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The E-City Program

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GAME CHANGER?
PLANNING FOR JUST AND SUSTAINABLE URBAN REGIONS

SciencesPo AESOP

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Track 01: Postgrowth

Postgrowth - Planning for other worlds and different development models

Chairs:

- Peter Ache, Faculteit der Managementwetenschappen (RU Nijmegen)
- Christelle Morel-Journel, Université Jean Monnet Saint-Etienne
- Yahya Shaker, Politecnico di Torino

Keywords: *risks, alternative visions, dreamscapes, development model, post-growth, post-growth economy, doughnut economy, common good economy*

The current IPCC report clarifies that the window for achieving the necessary transformation and transition towards a climate-resilient development closes. At the same time, doubts about the justice, sustainability and future viability of our growth model are growing in the IPCC and the current report 'Earth for All' for the Club of Rome (September 2022).

Attempts such as the Global Agenda 2030 or the EU's Green Deal to combine ecological and social aspects aim for appropriate economic growth while decoupling economic growth and environmental destruction.

The so-called post-growth economy, the doughnut economy, the common good economy and similar concepts attempt to show alternatives to the conventional growth model that can enrich urban and spatial planning.

We need climate-resilient development to achieve social sustainability goals and sustainable urban and regional development.

We welcome theoretical, methodological, and empirical contributions that address the following questions (and more):.

- How can ideas from the post-growth debate help to understand current crises and find answers?
- Which social and economic risks areassociated with this?

For this track, we invite – academic or practice - papers reflecting on related issues, mobilising facts and figures, bringing examples to the discussion, and tracing out potential future states of things from all corners of the globe.

In addition, we invite papers that start 'dreaming' again. It is not a dream that builds castles in the clouds, a leisurely and idle exercise of compensatory nature. The educated dreaming (docta spes, Ernst Bloch) is bound to "teach desire, to desire better, to desire more, and above all to desire differently" (Thompson, 1977, p. 330).

Such a dreamscape of desires may provide the disruptive force that breaks through cultured routines and establishes other worlds and different development models.

Urban planning in the post-growth era: insights from World Bank indicators

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Abstract

In the current era of IPCC reports emphasising the urgency of shifting to a climate-resilient development paradigm, there is still a theoretical gap in understanding the interplay between economic growth and economic sustainability. This study proposes a new economic growth model based on an extensive analysis of 921 indicators from the World Bank database, which identifies two main categories of growth drivers: "economic model dynamics" accounting for 73.9% of influence, and "environmental forces for development" contributing the remaining 26.1% of influence. "Urban planning plays a key role in harnessing these drivers to adapt and optimise economic growth. We advocate an integrated approach that combines rigorous data analysis with visionary planning, aiming to promote an urban renaissance of sustainable and inclusive growth.

Keywords: urban planning, post-growth era , economic growth modelling, World Bank indicators, sustainable development

1 Introduction

On 20 March 2023, the United Nations Intergovernmental Panel on Climate Change (IPCC) released the Synthesis Report of the Sixth Assessment Report: Climate Change 2023, which highlights an era of urgency for a paradigm shift towards climate-resilient development. This is despite the notable attention the topic has received in contemporary policy discourse, particularly in relation to the use of large-scale data for strategic urban planning. However, there is still a theoretical gap in understanding the interplay between economic growth, climate change, social justice and economic sustainability .

Economic growth is the most intuitive embodiment of economic dynamics, since Adam Smith(Smith, 1776) has become the core topic of economic research; but from classical economics to modern economic growth theory, the source of wealth growth is attributed to the growth of specific material factors, although the theoretical construction paradigm is intuitively simple, but in the face of the economic growth process of different development backgrounds, a serious lack of theoretical explanation occurs. Although such a theoretical paradigm is intuitive and simple, it has serious theoretical inadequacies when facing the economic growth process in different development contexts. Therefore, this study will establish a theoretical framework for the growth-driving category of economic dynamics that is more in line with the objective reality of the world's development practice on the basis of the existing economic theory research, with the help of the complexity system science theory . Based on the research goal of analysing the category of economic growth drivers from the perspective of the complexity system, this study has the following three core questions: (1) What are the categories of economic growth drivers from the perspective of the complexity system? (2) What are the role characteristics of economic growth driver categories in generating economic dynamics? (3) What is the catalytic role of urban planning in driving these forces?

The development of economic theory reflects both the stage of development of human society and the progress of human cognitive ability. Although the theoretical system of modern economics is complex, it is still possible to find the theoretical starting point based on the research lineage. Based on Solow's growth model, the growth theory model Solow(Solow, 1956), which analyses the three elements of capital, population, and technology, has gradually been formed, data as well as information has become the ultimate development element(Wu Zhiqiang et al., 2021), and the element of economic dynamics identified based on the concepts of complexity systems science is a composite element, and the factor analysis method in the field of statistics is widely used in the study of various fields of the economy.

Throughout the research history of economic power elements, so far there is no unified conclusion, and with the development of science and technology, the connotation of power elements is also constantly expanding; to Solow model based on the creation of a series of economic growth model is also a continuous iterative process, but the Solow model is limited by the logic of economic development in the era of industrialisation, has obvious theoretical shortcomings; the economic system has a number of components and there is a complex relationship between the various parts of the role. The economic system has multiple components and complex interactions between them. Therefore, system dynamics cannot be

analysed according to simple causal logic and reductionism, and it is necessary to identify the operating characteristics of system dynamics from the perspective of system evolution and development on the basis of complex simulation of the dynamical environment.

The aim of this study is to use the most comprehensive and complete set of economic statistical indicators in the World Bank database as a data base, apply the theory of complexity systems science, and build a new economic growth model for extensive analysis with the help of advanced statistical techniques. This will unravel the complex network of impacts of these indicators on economic growth, identify the main growth drivers and account for the weight of impacts of each driver; construct a model of the role of urban planning that can be developed to exploit these drivers in order to adjust and optimise economic growth; and study the complex relationship between urban planning, economic growth and sustainability.

The rest of this study is organised as follows, with Part 2 examining the theoretical lineage and related work. Part 3 discusses the theoretical framework, extraction steps, and indicators for extracting the elements of economic dynamics under the complexity perspective. Part 4 describes the data sources involved. Part 5 experiments the results of extracting economic power elements. Part 6 discusses the economic dynamics characteristics around the economic dynamics elements. Finally, in Part 7, the interactions between urban planning and economic growth, climate change, social justice and economic sustainability are derived.

2 Literature review

2.1 Significance of the study

Since the birth of modern economics, economic theory has appeared in the vein of five analytical perspectives on economic dynamics: 1) the earliest two theoretical perspectives come from the founder of classical economic theory, Adam Smith, published in 1776 in the Wealth of Nations Adam Smith proposed that there are two ways to grow the economy, namely, "increase the amount of productive labor" and "improve labor efficiency"; 2) the third theoretical perspective focuses on the growth model and the role of innovation, the core issue was first raised by Malthus in 1798, but the theoretical breakthrough until Schumpeter in 1912. "and" improve the efficiency of labor "; 2) the third theoretical analysis focus on the role of the growth model and innovation, its core issues were first raised in 1798 by Malthus, but the theoretical breakthrough until 1912 Schumpeter's theory of economic development appeared in a breakthrough in the framework of neoclassical economics, Schumpeter founded a new economic development theory. On the basis of Schumpeter's creation of the concept of "disruptive innovation"; to the end of the 20th century, after more than 200 years of continuous discussion in the economics community to form a relatively consistent view that economic growth comes from three main lines, namely, productive resource inputs, resource efficiency improvements, and disruptive innovations and progress; (3) the fourth theoretical perspective has been widely accepted Until the beginning of the 21st century, with the 2002 Nobel Prize in Economics awarded three times to behavioural economists, the psychological motivation of people as the driving force of economic development has also gradually entered the field of mainstream economics research.

The cognition of the elements of economic power has gone through the process from physical resources, to abstract resources, and then to abstract elements, reflecting the deepening of the cognition of economic theories on the laws of economic operation, as well as the differences in the laws of economic operation of human societies at different stages of development.1) The era of agrarian civilization: classical economic theories take money, labor, and land as the core; 2) The era of industrial civilization: modern growth theories take capital , population, and technology as the core; 3) the era of information civilisation: the era of information civilisation is strengthening on data resources, and data as well as information has become the ultimate development element(Wu Zhiqiang et al., 2021); 4) the era of ecological civilisation: the theoretical system with complexity system science as the core The biggest difference between the theory and the theory of the previous eras lies in the cognitive difference of the methodology of scientific research, and it is a philosophical difference about the worldview from the reductionism to the philosophical conceptual shift of holism(Zhiqiang and Xin, 2016). The basic characteristics of complex systems are that they have many components, multiple relationships or interactions between components, and interactions that produce emergent phenomena. Therefore, the elements of economic dynamics identified based on the scientific concept of complexity systems are a kind of composite elements(Sterman, 2012); it can be classified into positive and negative feedback elements according to their role on the system(Meadows and Meadows, 2007); according to the way of participation in the dynamics of the physical dimension of the economic system can be divided into the role of providing material dynamics, the role of providing energy dynamics, and the role of providing information dynamics(Andersen *et al.*, 2012).

2.2 Research Basis

2.2.1 Economic models

Modern economic growth theory is based on the Solow model, whose theoretical logic is that there is a basic growth model for economic growth, and under the framework of the basic growth model, factor inputs will directly generate the power of economic growth. The Solow growth model is built around two equations: one is the production function equation; the other is the capital accumulation equation. 1) Production function equation: the Solow model divides inputs into capital K and labour L two categories, the total output is Y and specifies the exogenous variable1 as technology A (2) Capital accumulation equation: it considers that the change in capital stock per capita $\dot{k}$ is equal to the amount of investment per capita sy minus depreciation of capital per capita in the production process $(n + g + \delta)k$ where s is the savings rate, n is the population growth rate g is the rate of technological change、δ is the rate of depreciation. The production function equation is usually expressed in Cobb-Douglas form as:

$$Y = F(K, L, A) = A \cdot K^{\alpha} \cdot L^{1-\alpha} \quad (1)$$

The usual expression for the capital accumulation equation is:

$$\dot{k} = sy - (n + g + \delta)k \quad (2)$$

[1] An exogenous variable (exogenous variable) is a variable that is influenced by external factors in an economic mechanism and is not determined by factors internal to the economic system. It only acts as an explanatory variable in the model or system and therefore only affects other variables in the model and is not affected by other variables.

2.2.2 Dynamic environment

(1) Characteristics of the dynamics of development stages. Regarding the dynamic role of capital, population and technology, by analyzing economic data(Acemoglu *et al.*, 2001; Kaldor, 1961; Maddison, 2006) , found a number of typical development facts: 1) The basic growth model underpins the efficiency of factor inputs. The poorest countries have less than 5 per cent of the per capita income of the richest countries(Summers and Heston, 1991)， This illustrates the huge difference in factor benefits of labor. 2) Factor inputs are most beneficial in the early stages of the formation of the basic growth model. The growth of the four little dragons of Asia, the newly industrialized countries, came mainly from factor growth Young(Young, 1995) (3) Factor inputs are gradually driven together at the end of the formation of the basic growth model. Empirical studies have shown a gradual convergence of the role of resource accumulation in high-income countries, which may be caused by technology transfer(Coe and Helpman, 1993).4) Simple factor inputs do not lead to changes in economic growth rates. The ratio of the contribution of labor and capital to per capita generation is approximately constant at 7 to 3(Jones and Dietrich, 2013) .

(2) Characteristics of the dynamic role of natural endowments. Natural resource endowment has a relatively limited role in the formation of economic dynamics, which is specifically manifested in two two aspects: 1) natural resource scarcity on the economic dynamics of the limit gradually reduced. In Clark's analysis of the United Kingdom found that land rent in national income from 1750 accounted for 20% to 1850 accounted for 8%, and then only 0.1% in 2010(Clark, 2010) .2) Natural resources have a greater impact on lagging economies. According to Nordhaus' calculations, per capita income growth in the U.S. declines by roughly 0.3% per year due to natural resource constraints(Nordhaus, 1969) ; while the upper limit for natural resources as a proportion of all resources used for production is about 20-25 per cent for poor countries; the lower limit for rich countries is about 5 per cent(Gylfason and Zoega, 2010; Spengler and Joseph, 1962).

(3) The dynamic role of external resources. Three distinct views on foreign trade have also developed: 1) The first view began with the classical theory that foreign trade contributes to the formation of economic dynamics. This includes Ricardo (1847), Heckscher-Ohlin (1933), Baumol (1967), Chinnery (1969), and Yujiro Speedwater (2005); 2) The second view is that foreign trade has a completely opposite effect on the formation of economic dynamics in different economies. Including Harold Dormer model, Solow model, etc., it is argued that foreign trade pushes the accumulation of resources towards higher rates of return, and due to the role of trade resources are more inclined to accumulate in areas with higher rates of return through mobility.3) The third viewpoint is put forward by the New Structural Economics, advocated by Zhang Peigang, Lin Yifu, and others. While agreeing on the importance of differences endogenous to the structure of factor endowments, they emphasise that developing countries should seek a path of industrial upgrading and economic growth that is different from that of developed countries, and that should be rooted in comparative advantages endogenously determined by the structure of their factor endowments.

2.2.3 Ternary composition

Compared to the study of information elements in the field of economics, system science provides another way of thinking. The modern idea of systems science, recognised by the scientific community, was first put forward by the Austrian biologist Bertalanffy in 1932, and was gradually and widely accepted by the scientific community in the 1950s. Based on the idea of system science, Wiener, an American applied mathematician, proposed in his epoch-making work Cybernetics, published in 1948, that matter, energy and information are the three elements that constitute the real world.(Wiener, 1961) During the same period, Qian Xuesen, in his monograph "Engineering cybernetics" published in 1954 in the United States, also explicitly proposed that, as an open complex giant system, the core elements of the physical world can be reduced to three types of elements: matter, energy and information. This idea of system theory perceives the core elements of the physical world from a higher dimension . Therefore, the elements of the economic model in economic growth theory can be more clearly identified from the perspective of system theory and can effectively resolve the debate on the relationship and role of the elements among different theoretical lines in modern economic growth theory(Zhiqiang, 2016).

2.3 Technical means

Factor analysis is a statistical method designed to reveal underlying structures and relationships in observed data, and the formal method of factor analysis was first proposed by the British statistician Karl Pearson in 1901(PEARSON, 1905). Famous mathematical statisticians such as Harold Hotelling(Hotelling, 1933b)and Steffen S. Seifert(Seifert *et al.*, 2004) have made important contributions to the mathematical theory of factor analysis. Common factor models include principal component analysis (PCA) and constant factor analysis (CFA). The American mathematical statistician Hertling extended this method to the situation group of random vectors in 1933, and Stone (stone) extracted three new variables from 17 elements of variables reflecting national income and expenditures by using Principal Component Analysis in his 1947 study on the national economy.

3 Research methodology

3.1 Research ideas

In order to address the core question of "what are the driving categories of economic growth from the perspective of complex systems", combined with the study of existing theoretical foundations, this study puts forward the "complex system dynamics hypothesis". Complex system dynamics refers to "the economic system has the characteristics of complex system, the operating mechanism of system dynamics has a high degree of complexity, and the elements of system dynamics are composed of complex dynamics factors containing complex indicators" (Figure 1). 1) System dynamics has the characteristics of complexity. According to the assumption that the economic system has multiple components and the complexity of the role of the relationship between the various parts; therefore, the system dynamics can not be analysed in accordance with simple causal logic and reductionism, and it is necessary to identify the operating characteristics of the system dynamics from the point of view of the system's evolution and development on the basis of the complexity of the dynamics of the simulation of the environment. 2) The dynamics of the elements of the complex factor composition. According to the assumption that the dynamics of the economic system should be composed of

multiple dynamics factors; and the dynamics factors also have complexity characteristics represented by multiple economic indicators.

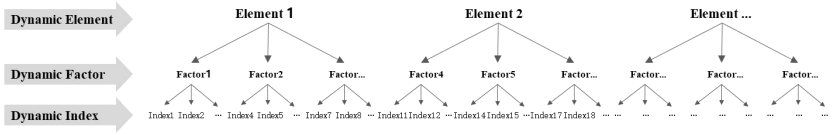


Figure 1 The way in which elements of the dynamics of the complexity economy are constituted (author's own drawing)

3.2 Data acquisition

Based on the theoretical ideas of complexity science and system dynamics, this study constructs multi-indicator constitutive factors as well as merges functional characteristic linkage factors to ultimately form the economic dynamics elements of physical dimensions that contain the characteristics of complex system dynamics. A total of 1,440 indicators in the World Bank database belong to 20 categories, including health, public sector, agriculture and rural development, urban development, infrastructure, external debt, gender, aid efficiency, education, climate change, environment, social protection and labour force, private sector, science and technology, economy and growth, energy and minerals, poverty, trade, financial sector and social development. Able to reflect the full range of socio-economic development.

3.3 Methods of analysis

Principal component analysis transforms random vectors whose components are correlated into random components whose components are uncorrelated with each other with the help of an orthogonal transformation, which geometrically manifests itself by transforming the original coordinate system into a new orthogonal coordinate system pointing in the n orthogonal directions with the widest dispersion of the sample points, and then downscaling the multidimensional variables. A few new variables with larger variance then combine the main information contained in the original multiple variables and also contain their own special meaning. The mathematical model is:

1) A coordinate transformation of the original variables gives:

$$F_1 = U_{11}X_1 + U_{12}X_2 + \cdots + U_{1n}X_n \quad (3)$$

$$F_2 = U_{21}X_1 + U_{22}X_2 + \cdots + U_{2n}X_n \quad (4)$$

$$\cdots$$

$$F_n = U_{n1}X_1 + U_{n2}X_2 + \cdots + U_{nn}X_n \quad (5)$$

2) Extract the principal components, which can be obtained:

$z_1$is called the first principal component, which satisfies the condition:

$$u_1'u_1 = 1 \quad (6)$$

$$\mathrm{var}(z_1) = \max \mathrm{var}(u'x') \quad (7)$$

$z_2$is called the second principal component, which satisfies the condition:

$$\mathrm{cov}(z_1, z_2) = 0 \quad (8)$$

$$u_2'u_2 = 1 \quad (9)$$

$$\mathrm{var}(z_2) = \max \mathrm{var}(u''x'') \quad (10)$$

The conditions satisfied by the remaining principal components are analogised one at a time.

4 Research data

4.1 Data sources

Data base construction. The steps include two processes, namely "data collection" and "data cleaning".1) Data collection. The world is regarded as a typical country in this study, and all 1440 indicators of the world in the World Bank's database and the statistical data from 1990 to 2018 are used as the data base of this study to ensure the comprehensiveness of the elements extracted.2) Data cleaning. The data were cleaned through data quality checking, and it was found that the number of indicators with valid data among the 1440 indicators was 921, that is, 519 indicators had the problem of missing data. Therefore, what was finally included in the subsequent data analysis was the 1990-2018 data of a total of 921 indicators with the world as the statistical calibre, which served as the data base for the study (Table 1).

Table 1 Classification of indicators in the World Bank database

Classification of economic indicators in the World Bank database[2]					
form	Number of indicators	Number of valid indicators	form	Number of indicators	Number of valid indicators
well-being	258	208	matrix	111	96
public sector	86	48	Social protection and the labour force	156	58
Agriculture and rural development	41	38	Private sector	161	123
urban development	18	16	science and technology	13	12
infrastructure	42	31	Economy and growth	239	132
external debt	69	18	Energy and minerals	48	42
distinguishing between the sexes	150	90	needy families	28	6
Aid effectiveness	58	52	(commercial) trade	119	110
educate	156	111	financial sector	64	35
climate change	74	65	social development	12	12

4.2 Data processing

4.2.1 Dynamic environment simulation

Steps of dynamic environment simulation through the economic development environment simulation to discover the economic dynamic environment with 871 indicators with complex system characteristics. The specific process is as follows: 1) System clustering. The data of 921 indicators with the world as the statistical calibre are subjected to "systematic

[2] World Bank database 873 indicators individually classified into a single category, 513 indicators classified into 2 or more categories, 52 indicators with no category, 2 indicators with incorrect information.

cluster analysis", forming 9 indicator clusters. 2) Cluster analysis. The first cluster group consists of 871 indicators, including economic development indicators, which constitutes the indicator system of this study to simulate the real economic dynamics environment. 3) Cluster exclusion. The 8 groups of clusters other than the first clusters mainly describe the indicators for the results of economic development, so they are not included in the power simulation environment.

From the simulation results (Fig. 2), 871 indicators related to economic development cover all 20 data categories, which fully demonstrates that: 1) the selection of indicators for simulating the environment of economic dynamics should not be limited to the 132 indicators in the category of "Economy and Growth", but should fully recognise that the formation of economic dynamics has a more complex and comprehensive mechanism; 2) the coverage of 20 data categories also indicates that this study has a more comprehensive feedback on economic dynamics based on the data, which has the basis for further research to address the Solow residual problem and endogenous growth. It should be fully recognised that the formation of economic dynamics has a more complex and comprehensive mechanism; 2) the coverage of 20 categories of data indicators also shows that this study has a more comprehensive feedback on economic dynamics on the basis of the data, and has the basis for solving the Solow residual problem and the endogenous growth problem in further research.

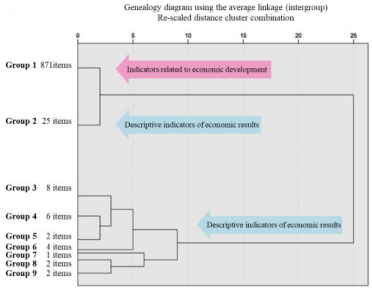


Figure 2 Tree diagram of the 921 indicators systematically clustered (author's own drawing)

4.2.2 Dynamic factor analysis

Through the economic power factor analysis, 19 economic power factors were obtained from 871 power environment simulation indicators, including 6 significant effect factors and 13 general effect factors. The steps of power factor analysis include two processes, namely "classification of effect characteristics" and "analysis of factor components". 1) Classification of effect characteristics. Bivariate correlation analysis is conducted between the 871 indicators generated by the dynamic environment simulation and the GDP, and three categories are obtained. Category 1 is "significant effect indicators", a total of 580 items, with significant positive correlation or significant inverse correlation with GDP; Category 2 is "double-edged effect indicators", a total of 265 items, which have insignificant correlation with GDP; Category 3 is unable to judge. (2) Factor component analysis. The main factors of "significant effect indicators" and "double-edged effect indicators" were extracted by the second factor analysis. From 580 items of "significant effect indicators", 6 significant effect principal factors were obtained, and according to the cumulative order of variance, F01 to F06 were used as the factor

codes (F is the first letter of the factor); from 265 items of "double-edged effect indicators", 13 double-edged effect principal factors were obtained, and according to the cumulative order of variance, F01 to F06 were used as the factor codes (F is the first letter of the factor). 13 double-edged effect main factors were obtained from the 265 "double-edged effect indicators", and C01 to C13 were used as the factor codes according to the cumulative order of variance (C is the initial letter of the common factor).

Table 2 Significant effect principal factor analysis

one-way factor analysis			quadratic factor analysis			factor nomenclature
Factor number	variance accumulation	Number of high-load indicators	Factor number	variance accumulation	Number of high-load indicators	
1	52.52 per cent	273 items	1	50.92 per cent	85 items	F01 Basic growth
			2	30.50 per cent	17 items	F02 Use of resources
2	23.36 per cent	65 items	3	33.42 per cent	20 items	F03 Public services
			4	25.11 per cent	7 items	F04 Outward Bound
			5	23.70 per cent	6 items	F05 Infrastructure
3	8.36 per cent	16 items	6	8.36 per cent	16 items	F06 Natural endowment

Table 3 Principal factor analysis of double-edged effects

one-way factor analysis			quadratic factor analysis			factor nomenclature
Factor number	variance accumulation	Number of high-load indicators	Factor number	variance accumulation	Number of high-load indicators	
1	14.88 per cent	24 items	1	59.21 per cent	14 items	C01 Public Policy
			2	35.42 per cent	5 items	C02 Private Environment
2	11.24 per cent	21 items	3	55.48	14 items	C03 Accidental death
			4	40.63 per cent	7 items	C04 Health expenditure
3	7.91 per cent	4 items	5	7.91 per cent	4 items	C05 Inefficient operations
4	7.56 per cent	9 items	6	7.56 per cent	9 items	C06 Level of Finance
5	7.43 per cent	13 items	7	7.43 per cent	13 items	C07 Foreign trade capacity
6	5.53 per cent	5 items	8	5.53 per cent	5 items	C08 Labour participation
7	4.32 per cent	5 items	9	4.32 per cent	5 items	C09 Public Education
8	3.68 per cent	5 items	10	3.68 per cent	5 items	C10 Environmental protection

9	3.65 per cent	6 items	11	3.65 per cent	6 items	C11 Land resources
10	3.57 per cent	2 items	12	3.57 per cent	2 items	C12 cost of funds
11	3.50 per cent	3 items	13	3.50 per cent	3 items	C13 Toughness Environment

5 Experimental results

5.1 Extraction results of dynamic elements

On the basis of 19 power factors, 9 economic power factors were found (Figure 3). The extraction of the power factors consists of two steps, namely: "factor independence calibration" and "power factor extraction".1) Factor independence calibration. Since the 19 power factors come from two groups of significant effect indicators and double-edged effect indicators, there may be correlation or covariance between the two groups of power factors, in order to test the independence of the factors, this study adopts two methods of "bivariate correlation analysis" and "multiple linear regression" to check. In order to test the independence of the factors, this study used "bivariate correlation analysis" and "multiple linear regression" to carry out calibration. It was found that there were significant correlation among 15 power factors and significant covariance among 14 power factors, so it was necessary to carry out "factor analysis" again for the 19 power factors. 2) Extraction of power factors. Nine independent dynamic factors were obtained, and the cumulative contribution rate of variance reached 84.42%. According to the cumulative order of variance, D1 to D9 were used as the codes of the factors (D is the initial letter of the dynamic element).

The naming of power factors and power elements follows three principles: 1) the principle of representativeness, i.e. the absolute value of the indicator loading coefficient representing the information contained in the main factor should be greater than 0.7, to reduce the interference of low loading indicators on the naming of the main factor. 2) the principle of comprehensiveness, i.e. a comprehensive analysis of the representative indicators selected through the principle of representativeness, and the naming based on the conclusions of theoretical basic research in the first section of this chapter. 3) the principle of directionality. That is, the naming of factors and elements seeks to highlight the direction of the role of power factors and elements in the formation of economic power, reflecting the power mechanism of power factors and elements. Through the classification of role characteristics as well as factor component analysis and naming principles, 6 significant effect factors, 13 double-edged effect factors and 9 economic power elements formed by the merger of power factors are finally identified.

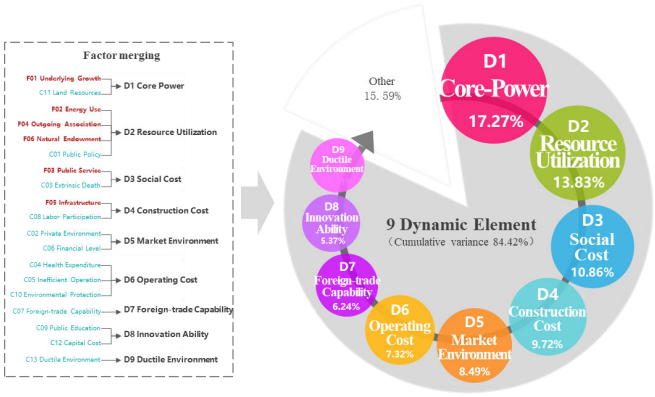


Figure 3 Compositional characteristics of the nine economic drivers (author's own drawing)

5.2 Characterisation of complex systems of dynamical elements

The nine economic drivers contain a total of 222 indicators covering 20 classifications in the World Bank database.The number of 222 indicators is very unevenly distributed among the 19 economic drivers (Figure 4). They can be broadly categorised into three levels according to the number of indicators: 1) over-indicator clustering: containing 73 indicators and only 1 factor (i.e. F01 Basic Growth); 2) more indicator clustering: containing 11 to 19 indicators and 5 factors; and 3) less indicator clustering: containing 3 to 8 indicators and 13 factors.

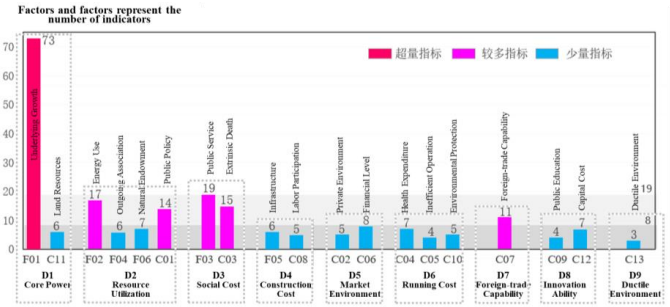


Figure 4 Complexity characteristics of the elements and factors containing indicators (authors' own drawing)

5.3 Characterisation of the economic dynamics of the power factor

(1) Factor D1: "Economic model". Reflects the dominant power model of economic growth; it consists of two power factors, F01 Basic Growth and C11 Land Resources. (1) F01 basic growth factor, as the main source of economic model contains 8 categories of economic indicators: education, population, land, labour, external resources, science and technology, health and infrastructure. (2) The "economic model" factor includes C11 land resources, which indicates that land resources are an important part of the "economic model", but its driving force plays a double-edged role.

(2) Factor D2: "Resource use". Reflects the use of various types of external resources; it consists of four driving factors: F02 energy use, F04 outward linkages, F06 natural endowments and C01 public policy. (1) Of the 17 statistical indicators represented by F02 Energy Use, 10 can be categorised as energy, including carbon dioxide emissions from electricity and heat production (as a percentage of total fuel combustion), etc.; one can be categorised as information technology, for fixed-line telephone subscriptions; one can be categorised as capital, for insurance and financial services (as a percentage of imports of business services); and five can be categorised as population, including insurance and financial services (as a percentage of imports of business services). indicators can be categorised as population, including children with HIV (0-14 years old), etc. (2) Two of the seven statistical indicators represented by the F04 outward linkages can be classified as capital, namely the unit value index of exports (2000=100) and the unit value index of imports (2000=100); three indicators can be classified as health, including domestic general government health expenditure (% of current health expenditure), etc.; and one indicator can be classified as information technology (IT). (2000=100); 1 indicator can be classified under the category of Information Technology (IT), which is Information and Communication Technology (ICT) product exports (% of total product exports); and 1 indicator can be classified under the category of Population, which is Low birth weight babies (% of births). (3) Four of the six statistical indicators represented by F06 Natural Endowments can be categorised as Energy, including Oil Rent (as a percentage of GDP), etc.; and two indicators can be categorised as Capital, Manufacturing Imports (as a percentage of Merchandise Imports) and International Tourism, Expenditures (as a percentage of Total Imports). (4) Eleven of the 14 statistical indicators represented by C01 Public Policy can be categorised as Public Policy, including the International Development Association (IDA) Resource Allocation Index (1=low, 6=high); and three can be categorised as Education, including Net Enrolment Ratio of First Year Students (as a percentage of the official school-age population), among others.

(3) Element D3: "Social costs". Reflects the maintenance costs of social development. It consists of two driving factors, F03 Public Services and C03 Accidental Deaths. (1) 19 of the 20 statistical indicators represented by F03 Public Services can be categorised as public services, including the rural population using safely managed drinking water services (% of rural population), etc.; and one indicator can be categorised as safety and health, which is the lifetime risk of maternal mortality (rates vary by country). (2) All 14 statistical indicators represented by C03 Unintentional deaths can be categorised as safety and health, including the female suicide mortality rate (per 100,000 female population).

(4) Factor D4: "Construction costs". Reflecting the costs of forming the basis for economic development, it consists of two driving factors, F05 Infrastructure and C08 Labour Participation. (1) Three of the six statistical indicators represented by F05 Infrastructure can be classified as infrastructure, including fixed broadband subscriptions), etc.; and three can be classified as safety and health, including antiretroviral treatment coverage (the proportion of people living with HIV)), etc. (2) All five statistical indicators represented by C08 Labour Participation can be classified under the Social Stability category, including Armed Forces Personnel, Total), etc.

(5) Factor D5: "Market environment". Reflects the role of marketisation level. It consists of two driving factors: C02 Private Environment and C06 Financial Level. (1) Six of the seven statistical indicators represented by C02 Private Environment can be categorised as Doing Business, including procedures for setting up warehouses (number), etc.; and one indicator can be categorised as Public Policy, with a rating of the National Policy and Institutions Assessment (CPIA) on Human Resource Development (1=low to 6=high). (2) All nine statistical indicators represented by the C06 financial level can be classified under the financial level category, including ownership of accounts in financial institutions or mobile money service providers (% of the population over 15 years of age that is female), etc.

(6) Element D6: "Running costs". Reflects the cost of normal operation of society. It consists of three driving factors: C04 Health Expenditure, C05 Inefficient Operation, and C10 Environmental Protection. (1) Of the seven statistical indicators represented by C04 Health Expenditure, six can be categorised as medical services, including the proportion of the population whose out-of-pocket medical expenditure results in the poverty line being below US$1.90 (2011 PPP) (%), etc.; and one can be categorised as education, which is the number of R&D researchers (per million people). (2) Of the 4 statistical indicators represented by C05 Inefficient Business, 2 indicators can be classified as Business Environment, including Enterprises Failing to File Full Tax Returns on Sales Revenues (% of Enterprises), etc.; 1 indicator can be classified as Health Care Services, as Causes of Death by Injury (% of total); and 1 indicator can be classified as Land, as Area of Rural Land (sq. km.). (3) One of the five statistical indicators represented by C10 Environmental protection can be categorised as environmental protection, as social contributions (% of income); one indicator can be categorised as education, as the percentage of male and female trained secondary school teachers (%); and three indicators can be categorised as land, including the area of terrestrial protected areas (% of the total area of land), etc.

(7) Factor D7: "Foreign trade capacity". Reflects the role of resources external to the economy. It consists of a power factor, C07 Foreign Trade Capacity. 10 of the 13 statistical indicators represented by C07 Foreign Trade Capacity can be categorised as International Trade, including Net Official Flows from United Nations Agencies, UNECE (in current US dollars), etc.; and 3 indicators can be categorised as Health and Safety, including Secure Internet Servers (per million people), etc.

(8) Element D8: "Innovative capacity". Reflects the conditions underlying the formation of innovation. It consists of two driving factors, C09 Public Education and C12 Capital Costs. (1) Four of the five statistical indicators represented by C09 Public Education can be categorised as education, including current expenditure on secondary education (% of total public institutional expenditure on secondary education), etc.; and one indicator can be categorised as money, which is commercial bank borrowers (per 100,000 adults). (2) All 2 statistical indicators represented by C12 cost of funds can be categorised as monetary, including interest payments (% of expenses) and interest payments (% of income).

(9) Element D9: "Resilient environment". Reflects an economy's confidence in its

development resilience. Consists of C13 Resilient Environment, a motivating factor.

One of the three statistical indicators represented by the C13 resilience environment is in the category of health services, the basic health services coverage index; two indicators can be classified as energy, including net energy imports (as a percentage of energy use)) and alternative and nuclear energy (as a percentage of total energy use), among others.

6 Analytical discussion

6.1 Validation of element extraction results

Through the extraction of economic drivers, this study obtained 19 economic drivers factors for 9 economic drivers and constituent elements. Following Owen et al. (2009) and others, the empirical model was tested using the regressions of the direct determinants of economic growth (Figure 5). The standard growth equation developed in this study is as follows:

$$GDP_i = \beta_1 \times D_1 + \cdots + \beta_i \times D_i + \varepsilon_i \quad (11)$$

where the dependent variableGDP is the gross domestic product (GDP).D_1 toD_i are the nine driving factors extracted from the factor analysis, theβ_1 toβ_i are the linear regression coefficients. The calculation results show that the regression test is superior, with a significance of 0.000, indicating that the nine economic power factors have good factor independence; the adjusted regression R-square of the model is 0.999, indicating that the model's explanatory ability is close to perfect.

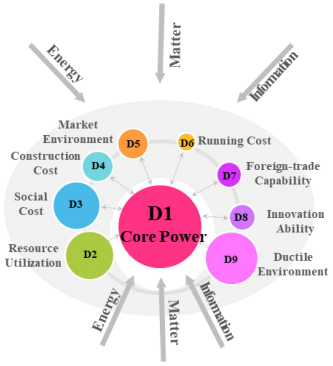


Figure 5 Theoretical modelling of the core dynamical environment hypothesis (authors' own drawing)

6.2 The dominant role of economic models in economic growth

(1) Contributing about 3/4 of world economic growth. Analysing the characteristics of the contribution of the nine power elements to economic growth, it can be found that: (1) world economic growth is mainly determined by the contribution of the economic power elements of the D1 economic model, which contributes 73.9 per cent to world economic growth, i.e., basically determines the formation of three-quarters of the world's economic growth; and (2)

the contribution of the remaining eight economic power elements to world economic growth is 26.1 per cent in the aggregate (Figure 6).

(2) Explaining about 2/5 of the economic operating mechanism. Standardised coefficients are applied to the world economic growth equation to analyse the degree of explanation of the 9 types of economic power elements to the overall model . It can be found that: 1) the D1 economic model has the highest degree of explanation of the model among the 9 economic dynamics elements, at 37.8%; 2) the degree of explanation of the model of the D1 economic model is 2.5 times to 25 times higher than that of the other 8 elements, and the range of the degree of explanation of the rest of the 8 economic dynamics elements is 1.5%-14.7%, with the total degree of explanation of the 8 elements being 62.2%.

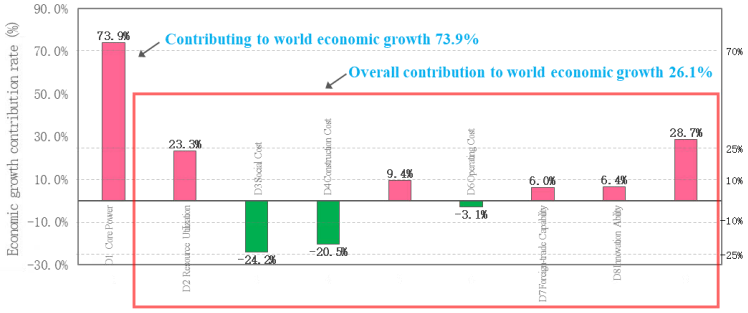


Figure 6 Contribution of the nine economic drivers to world economic growth (authors' own drawing)

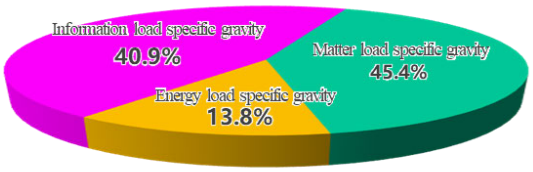
6.3 "Complexity" and "triadic character" of the economic model

The economic model element is an alternative upgrade to the Solow model. According to the world economic growth equation established in this study, the D1 economic model element contributes 73.9 per cent to economic growth and explains 37.8 per cent of the overall model; compared with the Solow model, which explains only 36.4 per cent-60.0 per cent of economic growth, the D1 economic model element has more theoretical and practical value. This is because the Solow model reduces the economic power mechanism to simple inputs of capital and labour under the total factor production constant, and this oversimplified treatment fully reflects the lack of knowledge of the complex economic growth mechanism, which is the product of a simple reductionist cognitive philosophy that lacks the concept of complexity system research.

(1) The complexity characteristics embodied in the eight types of indicators. In this section, we will analyse the driving mechanism of factor D1 from the perspective of complexity system theory, which consists of two factors, F01 basic growth and C11 land resources, and the 79 indicators belonging to it include eight new categories, namely, education, population, land, labour force, external resources, science and technology, health and sanitation, and infrastructure. The number of indicators of the eight categories is unevenly distributed, and can be classified into two levels according to the sum of the absolute values of the indicator loading coefficients. According to the absolute value of the indicator loading coefficients, the indicators

can be divided into two levels. (1) High-loading category: includes two categories, education and population, with loadings above 22 per cent; (2) Medium-loading category: includes two categories, labour force and external resources, with loadings between 10 and 20 per cent; and (3) Low-loading category: includes four categories, namely, land, science and technology, health and infrastructure, with loadings below 7 per cent.

(2) The triadic composition of matter-energy-information of the economic model. System science believes that matter, energy and information are the three elements of the physical world, which are composed of the ternary nature, and the same 79 indicators constituting the D1 elements can also be divided according to the three elements. The result of the division is that the total number of 32 indicators of information element, the absolute value of load 27.6; the total number of 36 indicators of material element, the absolute value of load 30.6; the total number of 11 indicators of energy element, the absolute value of load 9.3. By comparing the load value of material, information and energy elements, we get the proportion of the world's triad of nature, i.e., the proportion of matter: information: energy is 45.4%: 40.9%: 13.8%. From the ratio, we can get the following two conclusions: 1) matter and information are the main elements in the world's triad; 2) the weight of matter and information is close to each other, and slightly higher than that of information.



sFigure 7: Sum and proportion of world material information energy loads in years (author's own drawing)

6.4 Spatial relevance of land for economic modelling

The complementary role of land resources in the economic model. According to the composition of the D1 factor, the following correlation can be observed between the "F01 Basic growth" factor and the "C11 Land resources" factor.

(1) "F01 basic growth" is the driving core of the D1 factor. The F01 basic growth factor constituting the D1 factor consists of 73 indicators, with an absolute cumulative load factor of 91.9 per cent; while the C11 land resources factor consists of 6 indicators, with an absolute cumulative load factor of only 8.1 per cent.

(2) "C11 land resources" is a necessary component of the D1 factor. Firstly, the F01 basic growth factor and the C11 land resources factor are significantly positively correlated; secondly, the F01 basic growth factor and the C11 land resources factor are significantly covariant in the multiple linear regression; and lastly, the calculation result of the factor analysis method also combines the F01 basic growth factor and the C11 land resources factor into the D1 factor.

6.5 The "double-edged effect" of elements of the dynamic environment

The nine driving forces have a double-edged effect, and there is a wide variation in the direction of contribution of the nine driving forces to world economic growth, with six driving forces playing a positive role and three driving forces playing a negative role. Therefore, we set up economic growth equations with the nine driving forces as independent variables for each of the 84 case countries, and examine the direction of the contribution of the nine driving forces to economic growth. It can be found that there is a double-edged power effect of all nine factors.

7 Conclusion

7.1 Conclusions of the study

This study focuses on the discovery of categories of drivers of economic growth, understanding the interplay between economic growth, climate change, social justice and economic sustainability through the economic dynamics characterising the drivers, the key role of urban planning in harnessing these drivers in order to adjust and optimise the way in which economic growth occurs, quantifying the relative weights of these drivers and outlining intervention strategies.

7.2 Significance of the study

It provides ideas and research directions for the theoretical ideas of complexity science and system dynamics to study economic growth, explores the categories of economic growth drivers under big data analysis, discovers the interactive links between urban planning and the indicator system of economic growth drivers, and provides theoretical support for policy formulation and urban planning strategies.

7.3 Research limitations

The limitations of this study are as follows: (1) the limitations of data, some indicators in the World Bank database are more difficult to count, and the missing data cause 519 invalid indicators; (2) the limitations of time, although the current World Bank statistics began in 1960, the vast majority of indicators only began to be counted in 1990, which led to the time range of the data in this study from 1990 to 2018 years; (3) the complexity of the research field, as this study involves a number of fields such as urban planning, economic growth, sustainable development, etc., the study is complex and somewhat imperfect.

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Appendix

Figure 1 Table of basic information on indicators with significant effect factor loading coefficient of 0.7 or more in absolute value

F01 Basic growth factor (85 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
School enrolment, pre-primary, boys (per cent of total)	Education/ Gender	0.916	Women surviving to age 65 (% of cohort)	Health/Gender	0.835
School enrolment, pre-primary (per cent of total)	teach	0.914	Enrolment, secondary, boys (per cent of total)	Education/ Gender	0.834
School enrolment, pre-primary, girls (per cent of total)	Education/ Gender	0.913	Air traffic, registered carrier global departures	infrastructure	0.834
Enrolment, primary, private (% of total primary)	teach	0.909	Life expectancy at birth, women (years)	well-being	0.834
Intellectual property royalties, payments (balance of payments, current United States dollars)	Economy and growth/science and technology	0.909	Population aged 65 and over, male (per cent of male population)	well-being	0.831
Mobile cellular subscriptions (per 100 population)	infrastructure	0.908	GDP per capita (constant 2010 US$)	Economy and growth	0.831
Intellectual property royalties, receipts (balance of payments, current United States dollars)	Economy and growth/science and technology	0.905	Primary school completion rate for girls (percentage of relevant age group)	Education/ Gender	0.829
Labour remittances and employee compensation paid (in current United States dollars)	Economy and growth/financial sector	0.902	Life expectancy at birth, overall (years)	well-being	0.827
Air transport, passenger traffic	infrastructure	0.900	urban population	Urban development/climate change	0.827
Imports of services (BoP, in current dollars)	Economy and growth/trade	0.899	Urban population (% of total population)	Urban development/climate change	0.825
Imports of commercial services (current US$)	Trade/private sector	0.898	Life expectancy at birth, men (years)	Health/social development/gender	0.821

Exports of services (BoP, in current dollars)	Economy and growth/trade	0.894	Merchandise exports to developing economies in the region (per cent of total merchandise exports)	Trade/private sector	0.820
Exports of commercial services (current US$)	Trade/private sector	0.893	Men surviving to age 65 (% of cohort)	Health/Gender	0.820
Population aged 80 and over, female (per cent of female population)	well-being	0.893	Enrolment, secondary (per cent of total)	teach	0.819
Population aged 80 and over, male (per cent of male population)	well-being	0.892	Male employment in services (per cent of male employment)	Social protection and labour force/gender	0.819
Gross national income (GNI) per capita as measured by the Atlas method (current US$)	Economy and growth	0.879	Secondary education, teacher	teach	0.818
Merchandise imports from developing economies in the South Asia region (percentage of total merchandise imports)	Trade/private sector	0.878	Primary education, pupils (percentage of girls)	Education/ Gender	0.814
Net bilateral aid flows from DAC donors, UK (current US$)	Aid effectiveness	0.877	Trade in services (% of gross domestic product (GDP))	Economy and growth/trade/private sector	0.812
GDP per capita (current US$)	matrix	0.876	Net bilateral aid flows from DAC donors, EU institutions (current US$)	Aid effectiveness	0.809
GNI per capita, PPP (constant 2011 international dollars)	Economy and growth	0.875	Per capita final consumption expenditure per inhabitant (constant 2010 United States dollars)	Economy and growth	0.808
GDP per capita in purchasing power parity (PPP) (current international dollars)	Economy and growth	0.873	Enrolment, secondary, girls (per cent of total)	Education/ Gender	0.806
Gross national income (GNI) per capita at purchasing power parity (PPP) (current international dollars)	Economy and growth	0.873	Enrolment, primary (net per cent)	teach	0.803
Net adjusted national income per capita (current United States dollars)	Economy and growth	0.873	Secondary education, teacher, female	teach	0.802
Merchandise exports to developing economies in East Asia and the Pacific (percentage of	Trade/private sector	0.871	Merchandise imports from intraregional developing economies (per cent of total merchandise imports)	Trade/private sector/infrastructure	0.801

total merchandise exports)					
GDP per capita at purchasing power parity (PPP) (constant 2011 international dollars)	Economy and growth	0.868	Out-of-school children, male (% of male primary school age)	teach	-0.802
Agriculture, value added (constant 2010 United States dollars)	Economy and growth	0.866	Labour force participation rate, males (% of male population aged 15-64) (simulated ILO estimates)	Social protection and labour/social development	-0.803
Labour remittances received and compensation of employees (% of gross domestic product (GDP))	Economy and growth/financial sector	0.864	Mortality rate, under 5 years, female (per 1,000 live births)	well-being	-0.803
Enrolment, tertiary, female (% of total)	Education/ Gender	0.860	Employment rate of males aged 15-24 (percentage) (simulated ILO estimates)	Social protection and labour force/gender	-0.816
Merchandise exports to developing economies outside the region (per cent of total merchandise exports)	Trade/private sector	0.860	Labour force participation rate, males (% of male population aged 15+) (simulated ILO estimates)	Social protection and labour/social development/gender	-0.818
Female employed persons in services (per cent of female employment)	Social protection and labour force/gender	0.860	Labour force participation rate, males (% of male population aged 15-24) (simulated ILO estimates)	Social protection and labour/social development	-0.825
Enrolment, tertiary (% of total)	teach	0.858	Intentional homicide, female (per 100,000 females)	public sector	-0.825
Enrolment, tertiary, male (% of total)	Education/ Gender	0.856	Rural population (per cent of total population)	Agriculture and rural development	-0.825
Old-age dependency ratio (per cent of working-age population)	well-being	0.852	Ratio of total employed population aged 15 years and over (percentage) (simulated ILO estimates)	Social protection and the labour force	-0.832
Population aged 65 and over, female (per cent of female population)	well-being	0.848	Number of deaths among 15-19 year olds	teach	-0.840
Adjusted net national income per capita	Economy and growth	0.848	Merchandise imports from high-income economies (per	Trade/private sector	-0.846

(constant 2010 United States dollars)			cent of total merchandise exports)		
Total population aged 65 and over, women	well-being	0.843	Mortality rate, adult, male (per 1,000 males)	Health/Gender	-0.857
Total population aged 65 and over	well-being	0.841	Number of deaths among 10-14 year olds	well-being	-0.858
Overall primary school completion rate, (percentage of relevant age group)	Education/ aid effectiveness/climate change	0.840	Labour force participation rate, total (percentage of total population aged 15-64) (simulated ILO estimates)	Social protection and labour/social development	-0.860
Population aged 65 and over (per cent of total population)	well-being	0.840	Mortality rate, adult, female (per 1,000 adult females)	Health/Gender	-0.861
Population aged 65 and over, men	well-being	0.840	Contributing male domestic workers (per cent of male employment)	Social protection and labour force/gender	-0.865
Persons employed in services (per cent of total employment)	Social protection and the labour force	0.839	Probability of death among young people aged 20-24 (per 1,000)	well-being	-0.871
Primary education, teachers	teach	0.839	Labour force participation rate, total (% of total population aged 15+) (simulated ILO estimates)	Social protection and the labour force	-0.874
GNI per capita (constant 2010 US$)	Economy and growth	0.838	/	/	/
F02 Resource use factor 2 (17 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Landline Subscription	infrastructure	0.916	Electricity generation from oil (as a proportion of total electricity generation)	Energy and minerals/infrastructure/climate change	-0.803
CO2 emissions from electricity and heat production (per cent of total fuel combustion)	matrix	0.882	Prevalence of anaemia among pregnant women (%)	well-being	-0.825
HIV-infected children (0-14 years)	well-being	0.870	Hydroelectricity generation (% of total electricity generation)	Energy and minerals/climate change/infrastructure	-0.838

Electricity generation from oil, gas and coal energy sources (as a proportion of total electricity generation)	Energy and minerals/environment	0.866	CO2 emissions from other sectors, excluding residential buildings and commercial and public services (percentage of total fuel combustion)	matrix	-0.841
Livestock production index (2004-2001 = 100)	Agriculture and rural development	0.840	Energy use per $1,000 GDP (constant 20011 PPP) (kg oil equivalent)	Energy and minerals/climate change	-0.855
Energy consumption per unit of GDP (constant 2011 PPP US$/kg oil equivalent)	Energy and minerals	0.831	Prevalence of anaemia in non-pregnant women (% of women aged 15-49)	well-being	-0.880
Electricity generation from natural gas (share of total electricity generation)	Energy and minerals/climate change/infrastructure	0.829	Prevalence of anaemia among women of childbearing age (% of women aged 15-49)	well-being	-0.882
Insurance and financial services (per cent of imports of business services)	Trade/private sector	0.821	Energy intensity level of primary energy sources (MJ/2011 PPP GDP)	Environment/energy and minerals	-0.899
Effective transition rate from primary to lower secondary general education for both sexes (%)	teach	0.800	/	/	/
F03 Public service factor (20 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Rural population using safely managed drinking water services (per cent of rural population)	Health/Environment	0.775	Urban population using at least basic health services (per cent of urban population)	Health/Environment	0.730
People using safely managed drinking water services (per cent of the population)	Health/Environment	0.752	People using safely managed health services, urban population (% of urban population)	Health/Environment	0.729
Per capita out-of-pocket expenditures, purchasing power parity (current international dollars)	well-being	0.748	Rural population using at least basic health services (per cent of rural population)	Health/Environment	0.729
Domestic private health expenditure per capita, purchasing power parity (current international dollars)	well-being	0.747	Lifetime risk of maternal death (rates vary by country)	Health/Gender	0.723

Urban population using at least basic drinking water services (per cent of urban population)	Health/Environment	0.742	People using at least basic health services (per cent of the population)	Health/Environment	0.720
Current per capita health expenditure, PPP (current international dollars)	well-being	0.742	Rural population using at least basic drinking water services (per cent of rural population)	Health/Environment	0.717
Domestic per capita general government health expenditure, purchasing power parity (current international dollars)	well-being	0.738	People practising open defecation (% of population)	Health/Environment	-0.724
Rural population using safely managed health services (% of rural population)	Health/Environment	0.738	People practising open defecation in urban areas (% of urban population)	Health/Environment	-0.733
People using safely managed health services (per cent of population)	Health/Environment	0.732	Persons practising open defecation, rural (per cent of rural population)	Health/Environment	-0.737
Domestic general government health expenditure (% of GDP)	well-being	0.730	Urban population using safely managed drinking water services (% of urban population)	Health/Environment	-0.739
F04 Outward linkage factor (7 items)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Export unit value index (2000=100)	/	0.859	Information and communications technology (ICT) product exports (per cent of total product exports)	Trade/infrastructure/private sector	-0.719759847
Domestic general government health expenditure (% of current health expenditure)	well-being	0.831	Low birth weight babies (per cent of births)	well-being	-0.792
Import unit value index (2000=100)	/	0.798	Domestic private health expenditure (% of current health expenditure)	well-being	-0.830
External health expenditure (% of current health expenditure)	well-being	0.763	/	/	/
F05 Infrastructure factor (6 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation

Fixed Broadband Subscription	infrastructure	0.804	Antiretroviral treatment coverage (percentage of people living with HIV)	well-being	0.751
Rural electricity supply (% of rural population)	Energy and minerals/agriculture and rural development	0.798	Tuberculosis case detection rate (per cent, all forms)	well-being	0.711
Fixed broadband subscriptions (per 100 population)	infrastructure	0.796	Tuberculosis prevalence rate (per 100,000 population)	Health/aid effectiveness	-0.752
F06 Natural endowment factor (6 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Oil rent (per cent of GDP)	Environment/energy and minerals/climate change	0.872	Adjusted savings: depletion of natural resources (percentage of GNI)	Economy and growth/energy and minerals	0.831
Gross natural resource rents (per cent of GDP)	Environment/energy and minerals	0.856	Manufacturing imports (per cent of merchandise imports)	Trade/social development	-0.859
Adjusted savings: energy losses (% of GNI)	Economy and growth/energy and minerals/environment	0.849	International tourism, expenditures (per cent of total imports)	Trade/private sector	-0.863

Figure 2 Information table for indicators with an absolute value of 0.7 or more for the main factor loading coefficient of the double-edged effect

C01 Public Policy Factor 7 (14 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
International Development Association (IDA) Resource Allocation Index (1=low, 6=high)	public sector	0.930	Country Policy and Institutional Assessment (CPIA) Social Security Rating (1=low to 6=high)	public sector	0.864

Country Policy and Institutional Assessment (CPIA) Fiscal Policy Rating (1=low to 6=high)	public sector	0.911	Country Policy and Institutional Assessment (CPIA) Financial Sector Rating (1=low to 6=high)	public sector	0.823
Country Policy and Institutional Assessment (CPIA) Public Management Quality Rating (1=low to 6=high)	public sector	0.894	Country Policy and Institutional Assessment (CPIA) Business Regulatory Environment Rating (1=low to 6=high)	public sector	0.818
Country Policy and Institutional Assessment (CPIA) Economic Management Cluster Mean (1=low to 6=high)	public sector	0.890	Country Policy and Institutional Assessment (CPIA) Macroeconomic Management Rating (1=low to 6=high)	public sector	0.804
Country Policy and Institutional Assessment (CPIA) Debt Policy Rating (1=low to 6=high)	public sector	0.883	Net enrolment rate of first-grade students (per cent of official school-age population)	teach	-0.816
Country Policy and Institutional Assessment (CPIA) Structural Policy Cluster Mean (1=low to 6=high)	public sector	0.882	Net enrolment rate in grade 1, girls (per cent of officially defined school-age population)	Education/Gender	-0.823
Country Policy and Institutional Assessment (CPIA) Gender Equality Rating (1=low to 6=high)	public sector	0.866	Net enrolment rate in grade 1, boys (per cent of officially defined school-age population)	Education/Gender	-0.859
C02 Private environmental factors (5 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation

Procedures for establishing warehouses (number)	Private sector	0.900	Total tax rate (per cent of business profits)	Private/public sector	0.755
Property registration procedures (number)	Private sector	0.890	Country Policy and Institutional Assessment (CPIA) Human Resource Development Rating (1=low to 6=high)	public sector	-0.738
Time required for tax preparation (hours)	Public/private sector	0.871	/	/	/
C03 Accidental death factor (14 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Female suicide mortality rate (per 100,000 female population)	well-being	0.887	Female smoking prevalence (percentage of all adults who smoke)	well-being	0.851
Suicide mortality rate (per 100,000 population)	well-being	0.880	Mortality rate from CVD, cancer, diabetes or CRD between the exact ages of 30 and 70, men (%)	well-being	0.847
Male suicide mortality rate (per 100,000 male population)	well-being	0.870	Mortality rate from accidental poisoning, males (per 100,000 male population)	Health/Environment	0.838
Prevalence of smoking among men (percentage of all adults who smoke)	Health/Gender	0.864	Mortality rate from accidental poisoning, female (per 100,000 female population)	Health/Environment	0.832
Mortality rate from CVD, cancer, diabetes or CRD between the exact ages of	well-being	0.862	Mortality rate from accidental poisoning (per 100,000 population)	Health/Environment	0.826

30 and 70, women (%)					
Total smoking prevalence (15+)	/	0.861	Causes of death due to infectious diseases, maternal, prenatal and nutritional conditions (% of total)	well-being	0.802
Mortality rate from CVD, cancer, diabetes or CRD between the exact ages of 30 and 70 years (%)	well-being	0.857	Cause of death, non-communicable diseases (% of total)	well-being	-0.809
C04 Health expenditure factor (7 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Proportion of population with out-of-pocket medical expenditures resulting in a poverty line below $1.90 (2011 PPP) (%)	well-being	0.852	Proportion of population with out-of-pocket medical expenditure of more than 10 per cent of household consumption or income (%)	well-being	-0.874
Number of people with out-of-pocket medical expenditures resulting in a poverty line below $1.90 (2011 PPP)	well-being	0.831	Number of persons whose out-of-pocket medical expenditures account for more than 10 per cent of household consumption or income	well-being	-0.878
Proportion of population with out-of-pocket medical expenditure of more than 25 per cent of household	well-being	-0.867	Number of persons whose out-of-pocket medical expenditures account for more than 25 per cent of household	well-being	-0.880

consumption or income (%)			consumption or income		
R&D researchers (per million)	science and technology	-0.870			
C05 Inefficient operation factor (4 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Enterprises failing to file full tax returns on sales revenue (per cent of enterprises)	Private sector	-0.800	Cause of death, by injury (% of total)	well-being	-0.856
Logistics performance index: frequency with which goods reach the consignee within a predetermined or expected time (1 = very low to 5 = very high)	Private sector/trade	-0.819	Rural land area (square kilometres)	Agriculture and rural development/environment	-0.899
C06 Financial level main factor (9 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Ownership of accounts at financial institutions or mobile money service providers, females (% of population aged 15+)	/	0.967	Ownership of accounts at financial institutions or mobile money service providers, poorest 40 per cent (percentage of population aged 15+)	/	0.966
Ownership of accounts at financial institutions or mobile money service providers (% of population aged 15+)	/	0.967	Ownership of accounts at financial institutions or mobile money service providers, richest 60 per cent (percentage of population aged 15+)	/	0.965

Ownership of accounts at financial institutions or mobile money service providers, older persons (per cent of the population over 25 years of age)	/	0.967	Ownership of accounts at financial institutions or mobile money service providers, secondary education or higher (per cent of the population aged 15+)	/	0.963
Ownership of accounts at financial institutions or mobile money service providers, males (% of population aged 15+)	/	0.966	Ownership of accounts at financial institutions or mobile money service providers, young people (% of population aged 15-24)	/	0.956
Ownership of accounts at financial institutions or mobile money service providers, primary education or less (per cent of the population aged 15+)	/	0.966		/	
C07 Foreign trade capacity factor (13 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Net official flows from United Nations agencies, UNECE (current US$)	external debt	0.956	Export costs, documentary compliance (United States dollars)	Private sector/trade	0.838
Import time, border compliance (hours)	Private sector/trade	0.953	Import costs, border compliance (United States dollars)		0.836

Export time, border compliance (hours)	Private sector/trade	0.925	Import time, document compliance (hours)	Private sector/trade	0.801
Communications, computers, etc. (per cent of services exports, BoP)	Economy and growth/trade	0.904	Secure Internet servers (per million people)	infrastructure	-0.820
Cost of exports, border compliance (United States dollars)	Private sector/trade	0.900	Distance to frontier score (0 = minimum performance to 100 = frontier)	Private sector	-0.830
Communications, computers, etc. (per cent of imports of services, BoP)	Economy and growth/trade	0.882	Prevalence of severe food insecurity among the population (per cent)	well-being	-0.900
Export time, document compliance (hours)	Private sector/trade	0.875	/	/	/
C08 Labour participation factor 15 (5 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Armed forces personnel, total	(commercial) trade	0.841	Number of unemployed men (% of male labour force) (simulation of ILO estimates)	Social protection and labour/gender/education/social development	0.811
Female unemployment (% of female labour force) (simulation of ILO estimates)	Social protection and labour/gender/education/social development	0.840	Net official development assistance (ODA) received (per cent of GNI)	Aid effectiveness/economy and growth/external debt	-0.810
Total unemployment (% of total labour force) (simulation of ILO estimates)	Social protection and labour/education	0.833	/	/	/
C09 Public education factor (5 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation

Current expenditure on secondary education (% of total expenditure on secondary public institutions)	teach	0.883	Expenditure on secondary education as a percentage of government expenditure on education (%)	teach	-0.870
Current expenditure on primary education (% of total expenditure on primary public institutions)	teach	0.817	Commercial bank borrowers (per 100,000 adults)	financial sector	-0.902
Expenditure per capita in secondary schools (per cent of GDP per capita)	teach	-0.817	/	/	/
C10 Environmental protection factors (5 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Social contributions (% of income)	public sector	0.922	Area of terrestrial and marine protected areas (% of total territory)	Environment/climate change	0.820
Percentage of male and female secondary school teachers trained (%)	teach	0.897	Marine protected areas (per cent of occupied sea)	Environment/climate change	0.818
Area of terrestrial protected areas (% of total land area)	Climate change/environment	0.820	/	/	/
C11 Land resource factor (6 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
HIV prevalence, males (per cent of 15-24 year olds)	Health/social development/gender	0.959	Area of land below 5 metres above sea level	Climate change/environment	0.907

			(% of total land area)		
Urban land area below 5 metres above sea level (% of total land area)	Urban development/environment/climate change	0.908	Area of rural land below 5 metres above sea level (percentage of total land area)	Agriculture and rural development/climate change/environment	0.906
Urban population living below 5 metres above sea level (% of total population)	Urban development/environment/climate change	0.908	Rural population living below 5 metres above sea level (% of total population)	Agriculture and rural development/climate change/environment	-0.852
C12 cost of funds factor (2 indicators)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Interest payments (percentage of costs)	public sector	-0.907	Interest payments (percentage of income)	public sector	-0.920
C13 Resilient Environment Factor (3 fingerprints)					
Indicator name	World Bank Sub-Group	Load value after rotation	Indicator name	World Bank Sub-Group	Load value after rotation
Basic health services coverage index	well-being	0.817	Alternative and nuclear energy (per cent of total energy use)	Energy and minerals	-0.798
Net energy imports (per cent of energy use)	Energy and minerals/trade	-0.784	/	/	/

Planning beyond growth: a case study of wellbeing-oriented planning in Wales and Cornwall

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Abstract

Although an increasing research interest in the combination of post-growth ideas and planning, questions concerning the implementation of post-growth models and initiatives in real-world planning system remain underexplored.

This study explores two post-growth initiatives, the *doughnut economics* in Cornwall and the *wellbeing economy* in Wales, by the means of a qualitative content analysis of documents related to land-use and transport planning.

The study shows that there are traces of post-growth ideas in strategic documents and plans, as well as indications that these ideas also are forming concrete policies, although some documents are still clearly growth oriented. To analyse the implications of post-growth ideas in planning practice and culture, a deeper empirical analysis is needed.

Keywords: Post-growth; case studies; wellbeing; doughnut economics; planning

1. Introduction

Planning beyond growth, or post-growth planning, has been promoted as both a response to the ongoing sustainability crises (Barry, 2019), and as an adaptation strategy to a future where growth cannot be taken for granted (Crownshaw et al., 2019). Two post-growth initiatives that have been launched are *Doughnut Economy* – a model displaying the socio-ecologically safe space in which society can operate, defined by an 'ecological ceiling' and a 'social floor' (Raworth, 2017) – and *Wellbeing Economy* – an initiative aiming to reorientate the economy towards wellbeing rather than towards growth (Fioramonti et al., 2022).

Although an increasing interest in the combination of post-growth ideas and planning, questions concerning the implementation of post-growth models in real-world planning system remain underexplored (Lange et al., 2021). To date, most of these studies apply the post-growth concept either as an entry point for criticising the mainstream (e.g. Berglund & Julier, 2020; Næss et al., 2020; Xue, 2015, 2018; Xue et al., 2017), or as a tool for imagining alternative futures (e.g. Hagbert et al., 2021; Ruiz-Alejos & Prats, 2022; Svenfelt et al., 2019). Although this focus is motivated by the low number of real-world examples of post-growth planning implemented at scale, there is a growing number of post-growth initiatives from which lessons already can be learned. This study explores places where two of these initiatives are in use, Cornwall and Wales. Cornwall adopted the Doughnut economics model in 2020. Together with the public participatory process called 'The Cornwall We Want', the localised doughnut model formed the basis of the new local plan which was published the same year. Wales became in 2015 the first country to translate the principles of the UN Sustainable Development Goals into law in the Well-being of Future Generations (Wales) Act. Furthermore, Wales joined in 2018 the Wellbeing Economy Governments, which is a network of national governments with the ambition to rethink their economy to become more wellbeing-oriented and to replace GDP as a main goal for national economics.

This study constitutes an initial step of a larger case study which aims to understand how the application of post-growth initiatives in Cornwall and Wales has influenced the strategies, processes, practices, and culture of land-use planning and transport planning at each place. The aim of this initial study is to explore the influence of post-growth ideas on documents related to land-use planning and transport planning in the two places.

The study is structured in the following way. The next chapter (Chapter 2) offers a summary of previous research on post-growth planning. Chapter 3 presents a brief description of the study design. Thereafter, the findings from the document analysis are provided (Chapter 4). The final chapters (Chapter 5 and 6) discuss the document analysis in the light of previous literature and reflect on research questions of relevance for the planned in-depth study of post-growth initiatives in Cornwall and Wales.

2. Previous research on post-growth planning

2.1 Framing 'post-growth'

As a notion, 'post-growth' refers to an alternative to the current growth-oriented paradigm (Barry, 2019; Lange et al., 2021; Savini et al., 2022). Whereas the more widely used term 'degrowth' emphasise the need to downscaling the economy, post-growth has a more agnostic aura in relation to growth – the main point of criticism being the unreflective assumptions about growth and the growth-dependence of our economies (Barry, 2019), as well as the misleading use of quantitative indicators like GDP to measure progress (Savini et al., 2022). Since these are important points in degrowth research too, it is clear that there are many overlaps between degrowth and post-growth.

Thus, post-growth is about rethinking the way land, production systems, consumption patterns, and work are organised (Lange et al., 2021). It is motivated by the failure of growth-dependent economies to sufficiently decouple economic growth from material and energy use – partly due to rebound effects – with its corresponding ecological deterioration (Hickel & Kallis, 2020). In a time of accelerating ecological crises and in a world where millions of people still do not have opportunity to meet their basic needs (United Nations Department of Economic and Social Affairs, 2023), the necessity of societal transformations towards socioecological sustainability are imperative.

Growth-critical ideas are not new per se, but they have until recently been relatively absent from the field of planning research, which, according to Lange et al. is surprising given planning's interest for issues linked to land scarcity and spatial justice. However, as Barry explains, planning has in many places become a type of institutionalised pro-growth activity, although this does not have to be the case. Instead, he suggests that:

'Hence, planning in the 21st century should be oriented around the following: how to design urban forms that produce high levels of human wellbeing and flourishing while using less energy and resources and where growth is a potential by-product, not the goal of planning.' (Barry, 2019, p.8).

Similarly, Savini et al. (2022) argue that a post-growth logic 'needs to provide a realistic but utopian vision of urban prosperity, based on the principles of post-growth urbanisation' and that it 'also needs to be backed up by a matching toolkit of planning instruments' (Savini et al., 2022, p.5).

While post-growth predominantly has a positive connotation in the literature, the term is in some studies applied synonymously to 'end of growth'. This does not refer to a deliberate transition to a planning system more apt to provide human and planetary wellbeing, but rather to an unplanned societal change provoked by the collapse of economy when the growth-era comes to its inevitable end (Crownshaw et al., 2019). It is therefore important to make clear that a post-growth future may imply substantially different things depending on whether the transitions happen in a planned manner or if it occurs beyond our control. I will here use the term 'post-growth planning' as a deliberate action to plan differently, both in terms of the planning process and the planning outcome.

2.2 Real-world studies of post-growth planning

The emerging combination of post-growth ideas and planning has given rise to a variety of case studies with different focus. In the rest of the section, I will exemplify the most prevalent themes encountered in the post-growth planning literature: post-growth as a starting point for criticising the mainstream planning; post-growth as imaginaries of alternative futures; post-

growth as experimentation with the alternative; and post-growth as specific initiatives, including doughnut economics and wellbeing economy.

2.2.1 Post-growth planning as a critique of the mainstream

Several critical urban and regional studies have motivated the need of post-growth planning by analysing the effects of eco-modernist development in cities and regions. Taking Helsinki as a case, Berglund & Julier (2020) illustrate how urban development projects, branded as 'sustainable urban development', imply commodification of public land and exploitation of valuable natural environments. In Copenhagen, another city with explicit 'green' ambitions, Xue (2015, 2018) criticises the fact that no absolute decoupling between housing growth and environmental degradation, and between economic growth and traffic growth, is achieved, as the urban development is characterised by both suburbanisation and densification. Similarly, while Copenhagen can report progresses in active travelling and public transport, road traffic has also increased (*ibid.*). Using Oslo as an example, Næss et al. (2020) problematise the rationale of urban growth by exemplifying how urban sprawl constrains accessibility and risks exploitation of agricultural land, whereas densification drives exploitation of central green areas with potential negative effects on climate adaptation, public health, and wellbeing. Turning to the national level, Xue et al. (2017) compares the opportunities for Norway to meet the Paris Agreement with either an eco-modernist agenda or a degrowth agenda, with the conclusion that an eco-modernization is unlikely to be sufficient. Fauré et al. (2016) contributes with a similar insight regarding the Swedish performance on the topic of sustainability. This study applies the doughnut model to identify the socio-ecologically safe space for Sweden as a starting point for a backcasting scenario. Since Sweden performs relatively well at the parameters of social sustainability but is far from meeting the ecological targets, the study concludes that a radical decrease in ecological impact while not jeopardising the social parameters should be of key importance.

Targeting the regional level, Rydin (2022) emphasises the importance of differentiating between post-growth planning in high-growth areas contra low-growth areas, since the prerequisites for such places look fundamentally different. While post-growth planning in high-growth areas may imply minimising resource-use, re-using the existing built stock, and favouring affordable housing, post-growth planning in low-growth areas may instead include strategies for stimulating a sufficient level of endogenous growth to maintain provision of local services. Two important factors for this purpose are land ownership and collaboration with local stakeholders (Rydin, 2022). In other non-growing areas, growth stimulating measures are not expected to have effect, and then post-growth strategies may be motivated primarily for adaptation reasons as a response to a negative population trend. Dax & Fischer (2018) describe an Austrian area with these characteristics. The case study shed light on the uneven regional development that is visible in many parts of Europe, where peripheries are generated and reinforced at different scales due to changes in migration patterns and demographics. Post-growth as a planning strategy can in this context be to prioritise how to improve well-being and local attractiveness, targeting the existing population rather than external actors and capital. Durrant et al. (2023) challenge the predominant rationale of planning based on a polycentric structure consisting of growth-nodes and peripheries, arguing that this form of planning is detrimental for communities located in the periphery. Two suggested priorities for post-growth regional planning are to promote sufficient economic activity to support local livelihood in all parts of the region, and to ensure that new

infrastructure investments replace less sustainable mobility practice rather than being an addition to it.

2.2.2 Post-growth as an imaginary of something else

Research on post-growth planning has also explored attitudes to post-growth ideas among planning professionals. Hagbert et al. (2021) investigate how planning beyond growth is perceived by various planning actors, including professional planners, other civil servants, politicians, and grassroots. The study shows that 'growth' sometimes is perceived as a prerequisite and sometimes an obstacle for sustainability. It also attests a widespread concern that a shift to post-growth policies potentially could increase social risks and revolutionary instabilities. Ruiz-Alejos & Prats (2022) address the role of local planning practices in implementing degrowth ideas, using Södertälje as a case. The study reveals that many municipal planners experienced that they do not have the mandate to integrate overarching social and environmental goals in planning and that opportunities for more visionary scenarios are lacking. Instead, these planners perceived their role as facilitating a planning process driven by private actors and developers. However, if only they had the mandate to be more proactive, the believed municipal planning to have the potential to be an enabler of change. Svenfelt et al. (2019) develop four scenarios of a future beyond GDP growth in order to initiate a discussion about post-growth futures with planners in three Swedish municipalities. All scenarios are the result of a multi-target backcasting approach based on the fulfilment of four sustainability targets, including climate, land-use, participation, and resource security. The discussions reveal a general interest to discuss various imaginaries of the future more freely, although the opinions on what a desirable future naturally diverge between the participants. Svenfelt et al. conclude that backcasting scenarios are a useful method to explore alternative development paths than what is normally predicted.

2.2.3 Post-growth planning as experimentation with alternative futures

Apart from the abovementioned exploratory approaches to post-growth imaginaries, research on post-growth planning includes case studies on places with experience of experimenting with post-growth ideas in the planning process. Crowley et al. (2021) use examples from Spain and Portugal in which citizen participation in urban planning has contributed to stopping transformations of public land into private. In this example, both the planning process, i.e. promoting a more participatory approach, and the planning outcome, i.e. avoiding commodification of public land, are in line with post-growth ideals. However, as Crowley et al. observes, this type of bottom-up governance may be less effective in considering global impacts of local planning than it is to safeguard the interests of the local community. An alliance between urban planning and post-growth advocators can arguably contribute to balancing the interests of the local contra the global. Ferreira & von Schönfeld (2020) present a manifesto for such an alliance, pointing out commodification of commons as one central discussion point for the planning actors. This is motivated by its role as fuelling economic growth, on the one hand, and driving environmental degradation and social exploitation, on the other. In this way, post-growth-inspired planning is associated with simultaneous concerns for social welfare and ecological qualities. Ferreira & von Schönfeld (2020) observe, however, that post-growth strategies are no 'silver bullet' and that its success depends on how it is designed, what the underlying motives are, and the geographical context of the place. This is illustrated by real-world experiences in which various degrees of success have been reported (Ferreira & von Schönfeld, 2020).

2.2.4 Post-growth planning as initiatives: doughnut and wellbeing

There are also case studies on places which have committed to specific post-growth initiatives, including doughnut economics and wellbeing economy. Since studies on Cornwall and Wales are of greatest relevance for this literature review, these will constitute the main part. However, some comparative studies have also been included.

Addressing the Cornwall Doughnut, Turner et al. (2020). highlights the importance of downscaling and localising the model and, when possible, linking its socioecological domains to concrete policy goals and targets This downscaling process is not without challenges (R. A. Turner & Wills, 2022). One challenge is to handle interest conflicts related to scale, time and different domains, another is to alter the growth-imperative in which local institutions typically are embedded and the path dependencies caused by vested interests. Still another question concerns whether the ecological ceiling targets should be technocratically or democratically determined (*ibid*.). The case of the Cornwall doughnut is further analysed by Honeybun et al. (2024), who argue that both statutory bodies – in particular, the Council Leadership Board – and the participation of local stakeholders have been crucial to approach sustainability issues more holistically and to gain legitimacy in the local community. Hjelmskog et al. (2023) make a similar conclusion when analysing the case of Glasgow from a doughnut economics framework. The study concludes that the model is a good tool to get a shared understanding for connections, co-benefits and trade-offs between different domains but observes that it remains unclear whether it also leads to transformative action in practice.

Khmara & Kronenberg (2023) compares four different degrowth initiatives or phenomena in order to assess their respective transformative potential, including Copenhagen as a C40 city, Totnes as a Transition Town, Amsterdam as a doughnut city, and Detroit as a shrinking city. The cases were compared with respect to urban policy, land rent, housing policy and transport, and the study concludes that the Amsterdam doughnut performed best in relation to post-growth ideals. However, Khmara & Kronenberg remark that Amsterdam adopted the doughnut model as a result of also being a C40 city and that many post-growth-oriented policies were in place before the doughnut came into place.

Several studies have taken an interest in the implementation of the Wellbeing of Future Generations (Wales) Act. Having analysed key factors for the realisation of the Wellbeing Act, Messham & Sheard (2020) conclude that the engagement of individual politicians and the political context of the time played a particularly decisive role for the Wellbeing Act to be put in place. McKinlay (2019) compares the Welsh Wellbeing Act with New Zealand's wellbeing budget, pointing out the Welsh focus on localism as one key attribute to delivering wellbeing in practice, and the presence of a 'Future Generations Commissioner', as another. The role as commissioner, whose task is to review the policymaking of all public bodies with potential implications on the wellbeing goals, does not exist in New Zealand. Howe & Nutbeam (2023) presents an interview with the first person at this position in Wales, Sophie Howe. Key learnings that Howe mentions from her time as Commissioner include the importance of legislating the wellbeing mechanism, of supporting civil servants in transforming their working methods, and of finding appropriate indicators reflecting progress towards each goal without getting obsessed by them.

Other studies have analysed the implementation of the Wellbeing Act at national and local scale. Jones (2019) reminds that every scale at which the Wellbeing Act is implemented has

implications on the degree to which wellbeing and justice can be achieved. A challenge at national level is to ensure that city problems are not prioritised at the expense of rural problems, whereas a local scale challenge is that local priorities may reinforce unequal development of the progress of specific wellbeing goals. Nesom & MacKillop (2021) explores the experiences of local actors from implementing the Wellbeing Act and observe that there is a tension between the national and the local level. Local implementation is stressed, but many local actors express a lack of clarity regarding the national government's expectations and the local government's room for action. Nesom & MacKillop argue that support, resourcing, and time for local implementation are needed, as well as trust-building between different levels of governance. On a similar note, Carter & MacKillop (2023) identify a lack of both guidance and resources as the main obstacles for local implementation. There is a clear national-local divide in attitude to the Wellbeing Act, where the local governments are less positive than the national government. Although the Wellbeing Act theoretically is based on ideas of spatial justice given its place-based approach and emphasis on participatory processes, the delivery of spatial justice in practice proves to be insufficient (Carter & MacKillop, 2023).

3. Study design

The study was carried out focusing on two places in which post-growth models or initiatives have been applied, namely Wales and Cornwall, and consisted of a qualitative content analysis of a selection of planning documents. Each document was read with three questions in mind:

- What is the prime focus and main motivation of the suggested planning approaches of the text?
- Are post-growth ideals visible in the text, and if so, in what way?
- How is urban growth and economic growth framed in the text?

For Cornwall, the local plan and the transport plan were selected for analysis. In addition to these, the annual review of the local plan was included. For Wales, the national plan, the planning policy, and the transport strategy were chosen.

The choice of documents was motivated by its relevance for reflecting the land-use planning and the transport planning at the respective places. Since the analysis aims to explore the influence of post-growth initiatives on planning documents in Cornwall and Wales, only documents published after implementation of the doughnut model and the wellbeing economy were considered. In the case of Cornwall, the annual review was also included since it offered an additional perspective on the progress of the realisation of the plan.

4. Document analysis

4.1 Cornwall

4.1.1 Cornwall Local Plan 2020-2050

Cornwall Local Plan 2020-2050 has the slogan 'Together we can' (Cornwall and Isles of Scilly Leadership Board, 2023a). This emphasis on togetherness and the positive view of

future as an opportunity for a better way of living captures well the tone in plan. The plan begins with two quotes about the long-term concerns of the environment and health, and children's right, poverty, and equal chance. Together, the initial quotes and the positive slogan underline what is considered to be central challenges of today, while pointing out the approach that the Council suggests suitable to tackle them. While emphasising the multiple challenges that society is facing, positive experiences, including community kindness and successful implementation of local solutions, are also mentioned. The need for 'a new era' is emphasised.

The local plan expresses its ambition to build a greener, cleaner, fairer, and more inclusive Cornwall. This ambition is translated into six aims: a creative net zero economy; sustainable food, land, and sea; thriving places with decent, affordable homes; equality, education, and entrepreneurship; healthy, safe, and resilient communities; and digital revolution for sustainable living. The aims are said to be based on the present conditions, on the one hand, and on citizen visions collected through the campaign 'The Cornwall we want' in 2020, on the other. In the survey of the campaign, the main themes raised by citizens concerned a greener economy less reliant on tourism; a Cornwall with more space for nature; a fairer, more inclusive, and compassionate Cornwall, and more local decision-making regarding local issues. Worth mentioning is that a resident survey from 2023 presented affordable housing as the single most important issue for Cornish citizens (Cornwall Council, 2023).

The wellbeing goals of the doughnut run like a red thread throughout the local plan. Not only is the Cornwall doughnut explicitly demonstrated, but its ideals are also implicitly present in the six aims. Both local and global ecological concerns have a prominent role: the local considerations are mainly linked to natural environment and biodiversity, whereas the global considerations are mostly represented by the net zero 2030 climate goal. Regarding social concerns, aspects of health and wellbeing, inclusion, equal chances, safety, and 'the local' are all represented in various forms throughout the aims. The focus of the plan is the needs of the present population and of the future generations to come, rather than boosting Cornwall's attractivity in terms of external skills and capital. Despite visionary formulations like 'Cornwall's creative economy is growing' (p. 27) and 'Cornwall is well positioned to develop new businesses and support existing businesses to grow' (p.28), very little is written about economic growth explicitly, and when it is addressed, it is never framed as the ultimate goal of society nor as the most central means to achieve socioecological wellbeing. In this sense, the spirit of the doughnut is clearly present in the plan: it places the social needs and the ecological limitations at its heart instead of focusing on promoting economic growth. When discussing how the plan will be delivered, the need of partnership is emphasised, since 'state institutions, however powerful, cannot achieve this vision on their own' (p.33). Partnership with the residents is pointed out as the most crucial one, although an enhanced partnership with the UK government is also mentioned.

The Cornwall Plan Annual Review 2023 displays how the proceedings of implementing the plan are going to date, based on the 22 identified socioecological areas of the Cornwall Doughnut (Cornwall and Isles of Scilly Leadership Board, 2023). In 2023, the majority of the areas were classified as off-target. The five domains that were considered to be 'significantly off-target' were the areas of air quality, biodiversity, renewables, food provision, and housing. Based on this, three short-term actions were decided as priority for the work in 2024: further actions to tackle the increased cost-of-living, e.g. supporting housing security and preventing

people's debt; encouraging organisations to do a 'pledge for nature' to promote biodiversity actions; and to make the websites related to the local plan more accessible to children and young residents. Being a prioritised area also the previous year, actions for tackling the cost-of-living have been handled in a temporary work group, which, according to the review, has now become permanent. Hence, the review offers both a snapshot of the work towards goal-fulfilment and some concrete actions and processes that are on-going (*ibid.*).

Figure 1: Social foundation of the Cornwall Doughnut (R. Turner et al., 2020).

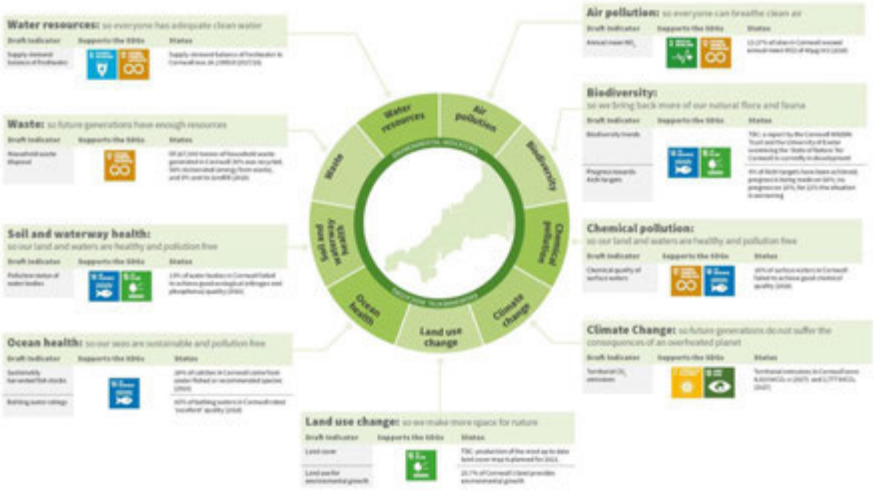

Figure 2: Ecological ceiling of the Cornwall Doughnut (R. Turner et al., 2020).

4.1.2 Cornwall Transport Plan

Turning to the Cornwall Transport Plan (Cornwall Council, 2021), the emphasis on climate change and wellbeing continues to be central. The vision declares that:

'Transport in Cornwall will be excellent and carbon neutral. Our transport system will connect people, communities, businesses and services in a way that enhances quality of life, is reliable, efficient, safe, healthy and inclusive. People will choose to travel in ways that will have low impact upon the environment and other people.' (p.2)

Key themes in the transport plan include a modal shift to more active travel and public transport, reduced speed limits for safer and more liveable streets, and replacing the predict-and-provide logic with a decide-and-provide approach. Like in the local plan, the need of 'a new era' is stressed. Furthermore, the importance of connecting the Transport Plan to other strategies and policy frameworks – locally as well as regionally and nationally – is explicitly stated.

Six transport goals are presented, including tackling climate change, supporting economic prosperity, respecting and enhancing the environment, supporting healthy active lifestyles and wellbeing, supporting community and road safety, and supporting equality of opportunity. Every goal is concretised in suggested policies and discussed in relation to the goal of carbon neutrality in 2030. In this sense, climate concerns appear to have a superior position to the other goals. There is also a red thread throughout the proposed solutions for the goals, with more active travel, reduced speeds, and less car use as examples of actions for several goals included those related to climate, health and safety. The co-benefits of more sustainable transport modes are hence emphasised. The plan also includes policies for land-use planning, as exemplified by suggestions to design for enhanced accessibility, connectivity, and inclusion, and to incorporate nature recovery in planning. For environmental reasons, the management of existing infrastructure is prioritised over construction of new roads. In order to achieve carbon neutrality in 2030, the plan highlights that travel behaviour ought to change – electrification is not sufficient. A backcasting scenario based on net zero 2030 suggests an increase in public transport travels by 50 percent and a replacement of 50 percent of the car trips to active transport modes by 2030, and a 15 percent shift to electric vehicles by 2025.

Although economic prosperity is one of the six transport goals, economic growth is not a central theme in the transport plan, which is mentioned as a difference from previous plans:

'During 2011-2019, scheme delivery focussed heavily on investment that supported economic and employment growth […] now is the right time to change course and steer investments towards road safety, locally important and green travel modes' (p.17).

Discussing economic prosperity, formulations like 'local and national transport connectivity is an important ingredient in a healthy economy' (p.12), 'lack of transport provision and poor connectivity can constrain the growth of our economy' (p. 33), and 'investment in sustainable transport connectivity is key in facilitating economic growth' (p.33) illustrate that economic growth is still considered. However, the economic concern is never discussed without emphasising the preferability of a modal shift and to sustainable freight options for climate and wellbeing related reasons. An example of this is: 'prioritising walking, cycling and public transport connectivity to and within our towns will help to support economic growth' (p.46). Other solutions to support economic prosperity are linked to improvements in connectivity,

accessibility and reliability. In this vein, economic growth is described as a potential outcome of an environment-friendly transport system rather than as the main means and end.

The transport plan is suggested to be delivered by a combination of specialised plans, working in partnerships, policy steering, bidding and lobbying. The biggest risks for failing to meet the net zero 2030 target are identified as changed national policies or local priorities, and lack of funding, of community or political support, of behaviour change and of devolved power to disincentivise car use.

4.2 Wales

4.2.1 Future Wales

Future Wales is Wales's spatial development plan which presents where long-term strategic development will be located, and which guides the planning decisions at all levels (Welsh Government, 2021a). The aim of the plan is to 'addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate resilience, developing strong eco-systems and improving the health and well-being of our communities' (p. 6). The introductory chapters take their starting point in the global challenges of climate change, biodiversity loss and the recent experience of the Covid-19 pandemic and highlights how a good planning practice can offer multiple co-benefits. An example provided concerns co-locating housing, workplaces, services, and amenities, which is not only beneficial for the climate but also for social, health, economic and cultural reasons.

'Sustainable growth' is a central concept since the plan is considered to have 'an important role in driving sustainable growth and combating climate change' (p.10). Two out of eleven outcomes that the plan aims to achieve concern growth explicitly: firstly, 'a Wales where people live in distinctive regions that tackle health and socio-economic inequalities through sustainable growth' (p.54), and secondly, 'a Wales where people live and work in towns and cities which are a focus and a springboard for sustainable growth' (p.55). In the former, growth appears as a means for achieving better health and equality, whereas in the latter, growth seems to be a goal in itself. The three last outcomes concern climate and environment explicitly.

Throughout the plan, growth is depicted as something unequivocally desirable, as exemplified in formulations like 'development plans will have a forward thinking positive attitude towards enabling economic development, investment and innovation […] promoting a culture of innovation, social partnership, entrepreneurialism and skills-development' (p.55). Formulations like this give rather associations to a conventional neoliberal approach to planning than to a radically different sustainability-oriented approach.

According to the plan, cities and large towns are prioritised as areas for strategic development, since 'growing urban areas across Wales will create concentrations of jobs, services, and amenities' (p.60). The choice is motivated by the ambition to avoid sprawl, while using existing infrastructure and promoting sustainable travel modes. Furthermore, it claims that 'areas outside the urban centres will benefit directly from the strength of our large towns and cities, though improved connectivity and additional investment in new homes, jobs

and services' (p.55). While not explicitly stated, this appears to be how the plan defines 'sustainable growth': the promotion of growth nodes whose benefits are expected to 'trickle down' to the periphery. This focus on urban growth is not further problematised from a spatial justice perspective. Another aspect which is not extensively discussed is how the new modes of remote working affect the structure of labour markets and commuting patterns.

In sum, the wellbeing goals are present throughout the plan, and it is clear that urban and economic growth are not the only important aspects. Still, the whole document relies on a growth agenda, and the other aspects seem to be secondary to the growth imperative.

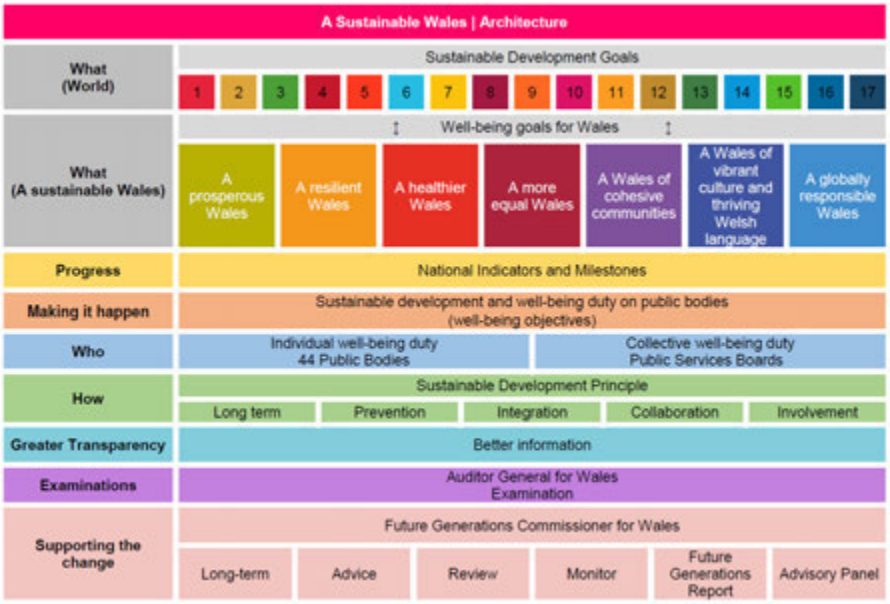

Figure 3: Wellbeing goals in Wales (Welsh Government, 2019).

4.2.2 Planning Policy Wales (PPW)

Planning Policy Wales (PPW) establishes the key principles of the planning system in Wales (Welsh Government, 2024). Although it is not part of the development plan, it is an important document in the process of planning decision-making. While pointing out 'sustainable places and wellbeing' as the goal, PPW identifies 'sustainable placemaking' as the process for goal-fulfilment. This is described as a process that involves all planning actors who need to collaborate to 'achieve sustainable economic benefits for all in line with the well-being goals' (p.17). Five outcomes of sustainable placemaking are presented with references to the social, environmental, economic and cultural wellbeing goals. The first outcome, 'growing economy in a sustainable manner', clearly reflect the idea of sustainable growth from the national plan.

In contrast to the national plan, PPW offers a definition of economic development: 'the development of land and buildings that generate sustainable long-term prosperity, jobs and

incomes.' (p. 86). Economic development is mentioned as one of the central ambitions of PPW, but the emphasis is put on increasing economic diversification and ensuring employment rather than on sole economic growth.

Many references are made to the Well-being Act and both the well-being goals and the well-being 'ways of working' – including collaboration, integration, long-term, prevention, and involvement – are present throughout PPW. However, there is no clarification on how conflicting interests linked to different well-being goals should be balanced against each other. As an example, one of the outcomes of sustainable placemaking is 'maximising environmental protection', but it is not clear how this outcome should be combined with other outcomes. Arguably, the maximal environmental protection would be to avoid exploitation overall – but since that is hardly the idea, it seems more likely that the concern for environmental protection enters the scene later in planning process, affecting the design of the plan at the margin rather than having the ability to question it more fundamentally.

4.2.3 Llwybr Newydd – The Wales Transport Strategy 2021

Llwybr Newydd, meaning 'a new path', refers to the ambition to rethink transport planning to better respond to the climate emergency and other pressing challenges of today while addressing aspects of health, poverty, inclusion, and accessibility (Welsh Government, 2021b). A three-step strategy is proposed, including bringing services to people, enabling sustainable, efficient and accessible transport, and encouraging sustainable transport choices. The strategy refers to the transport hierarchy in which the most sustainable travel modes are at the top and the most polluting are at the bottom. For infrastructure, road maintenance is prioritised over new constructions.

References to the Wellbeing Act and the wellbeing goals occur both in the aim of the strategy and in suggested priorities (Welsh Government, 2021b). The five ways of working permeate the strategy: it is long-term in that it reenforces the emphasis on the needs of future generations; it is preventive in terms of disincentivising unsustainable transport modes; it is integrative since it brings together many policy areas; it is collaborative in that it highlights the importance of partnerships for the delivery of outcomes; and it is involving in terms of encouraging increased participation of citizens and local stakeholders.

The transport strategy aims to address equality, health, climate, biodiversity, waste, economic cohesion, innovation, distribution of goods, affordability, Welsh language, art, sport, culture, and historic environment. The main economic concerns of the strategy – cohesion, innovation, distribution of goods and affordability – do not appear as superior to, or dictating the conditions of, the other goals. In this sense, the overall focus of the strategy seems to be providing a transport system that responds to the wellbeing-related needs of the residents rather than one that serves to attracting external financial or human capital.

The delivery of the strategy is suggested to occur through the National Transport Delivery Plan, mini-plans in which long-term and short-term strategies for the specific transport modes are presented, regional plans and transport commissions. Collaboration with various actors, including the UK Government, other policy areas within the Welsh Government, local authorities, regional partnerships, commercial operators, and transport users, are described as crucial for a successful implementation.

In sum, the transport strategy is clearly influenced by the ideals of wellbeing, both in its means and its ends. It is less growth-oriented than the national plan and PPW, since it appears to be less focused on sustainable growth and more on accessibility, sustainability and efficiency.

5. Discussion

The space for 'more visionary scenarios' that Ruiz-Alejos & Prats call out for (2022) undoubtedly exists in both Cornwall and Wales, which is manifested by formulations like 'a new era' and 'a new path'. None of the analysed documents define progress as measurable with GDP growth, but they differ in how growth-oriented they are. Comparing Welsh national plan and the Cornwall local plan, the former follows a logic of sustainable growth where growth seems to be both a means and an end in itself, whereas the latter discusses growth very little and never as the ultimate goal of planning. In the same vein, Cornwall transport plan depicts growth as a potential outcome rather than a means or an end. This resonates with Barry's description of growth as 'a potential by-product, not the goal of planning' (Barry, 2019). While a growth imperative to which the wellbeing goals are secondary characterises the Welsh national plan, the climate goal seems to have the superior position in the Cornwall transport plan, given how all policy areas are discussed in relation to it. Both the Cornwall doughnut and the Welsh wellbeing economy have clearly influenced the analysed planning documents – not least the two transport plans.

Despite the many references to the Welsh wellbeing goals, it is clear that the idea of sustainable growth is still prevalent in the key documents for national land-use planning in Wales. What 'sustainable growth' means is however not fully defined, nor is it clarified how conflicting interests should be weighed against each other. As both Berglund & Julier (2020) and Naess (2020) note, urban growth often implies exploitation of valuable environments – either through sprawl or though densification. How Wales will 'maximise environmental protection', which is one of the outcomes of PPW's sustainable placemaking, while promoting urban growth, is not discussed in the PPW. The Welsh transport strategy, in contrast, differ from the urban growth focus that Xue (2015: 2018) identifies in Copenhagen, in which the attention to the increase in active travelling and public transport are disguising a simultaneous rise in car travels. Welsh Government (2021b) acknowledges that growth of sustainable transport modes is not sufficient, unless they replace less sustainable transport modes. In this sense, the Welsh transport strategy is less growth-oriented than the Welsh documents for land-use planning.

Both the Welsh national plan and PPW contain traces of the post-growth planning ideas that Rydin (2022) suggests as suitable for high- and low-growth areas, in terms of using existing infrastructure in urban areas and focussing on place-based strategies to maintain provision of services in rural areas. However, the Welsh land-use documents build on a polycentric growth node-periphery structure with a conventional image of labour market and commuter patterns, which Durrant et al. (2023) describes as detrimental for communities located in the periphery. The risk is similar to what Jones (2019) and Carter & MacKillop (2023) highlight, that the urban focus of the Welsh national plan makes spatial justice difficult to achieve.

Regarding the process of post-growth planning, some observations can be made. Firstly, it is indeed difficult to fit a model or concept, like the doughnut or the wellbeing economy, into a local context, given its multiple considerations needed across both time and scale. In Wales, there is an emphasis on localism and the place-based approach – which is applauded by McKinlay (2019) – and still, several studies (Carter & MacKillop, 2023; Nesom & MacKillop, 2021) notes that there is a tension between the national and the local level in relation to the Wellbeing Act. This tension is difficult to capture only from analysing the national documents.

Secondly, there is a difference between planning documents and actual action. Although the Cornwall local plan is thoroughly influenced by the ideals of the Doughnut, the annual review shows that the majority of the sustainability targets are currently not fulfilled. However, the review also provides examples of on-going actions in the process towards the goals. In order to analyse the implications of these initiatives on planning practice – more than these glimpses that an annual review can offer – the implementation processes should be investigated separately through e.g. interviews with planning actors or analysis of policy documents and meeting minutes.

Thirdly, there are signs of a new post-growth-oriented way of planning based on backcasting in the documents. The clearest example is found in the Cornwall transport plan which explicitly refers to a shift from predict-and-provide to decide-and-provide, but a similar backcasting logic is present in the Welsh transport strategy where the net zero goal fundamentally determines the design of the strategy. Overall, the ‘safe and just space’ of the Cornwall doughnut and the Welsh wellbeing goals are examples of how the places formulate a vision which will dictate the conditions of planning.

6. Conclusions

The aim of this study was to explore the influence of post-growth ideas on documents related to land-use planning and transport planning in Cornwall and Wales. The study shows that there are traces of post-growth ideas in strategic documents and plans, as well as indications that these ideas also are forming concrete policies. The analysed documents are clearly influenced by the doughnut model and the wellbeing economy respectively, in terms of goals and ways of working. However, some documents show a more mixed picture where the growth imperative is still striking.

The post-growth ideas were generally more integrated in the transport plans than in the land-use plans. In both Cornwall and Wales, the transport plans exemplify a broader approach to planning which combines land-use and transport perspectives. In addition, both of the transport plans are characterised by a backcasting approach in which the climate goal plays a dominant role.

Given the focus on planning documents, the study was limited to concern the ‘talk’ rather than the ‘action’ of post-growth planning. To analyse the implications of post-growth ideas in planning practice and culture, a deeper empirical analysis is needed in which the specific implementation processes are followed. A suggestion for future research is to follow such a process through document analysis and interviews with planning professionals.

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Research on Rural Revitalization Planning from the Perspective of Ecological Capitalization: Taking Nuanshui Township as an Example

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Abstract
Balancing environmental protection and economic growth while promoting rural revitalization and coordinated urban-rural development is a crucial issue in China. With ecological capitalization as the starting point, this research proposes a rural revitalization planning model that is led by ecological principles, supported by population, industry, and land, and complemented by culture, based on the analytical framework of "ecological resources - ecological assets - ecological capital." Taking Nuanshui Township in Inner Mongolia as a typical case, the goal is to transform it into a comprehensive national forest park in the coal mining region of western Inner Mongolia and northern Shaanxi, exhibiting Chinese-style modernization, ecological, and geological characteristics. This approach provides valuable insights for exploring the promotion of rural revitalization through ecological capitalization.

Keywords
Ecological capitalization; Rural revitalization; Nuanshui Township; Sustainable development

1. Introduction

Against the backdrop of the long-term urban-rural dual system oriented towards urban growth, the issue of rural decline has become increasingly prominent. Coordinating urban-rural relations through rural revitalization to achieve Chinese-style modernization has become an important issue in China today. China's rural revitalization strategy points out that achieving rural revitalization requires efforts in five major aspects: industrial revitalization, talent revitalization, cultural revitalization, ecological revitalization, and organizational revitalization. Based on this, ecological construction leading rural revitalization, especially using "ecological value realization" as an incentive measure for ecological protection to guide rural revitalization, is attracting increasing attention from institutions and scholars. However, research on driving rural revitalization through the realization of ecological resources' value is still in the stage of fragmented prospects and assumptions, overlooking its potential as a sustainable, universal, and proactive force for driving urban-rural integration. This study systematically elaborates the basic logic of ecological capitalization driving rural revitalization, constructs an analytical framework based on the evolutionary process of "ecological resources - ecological assets - ecological capital," and proposes planning response strategies. Using Nuanshui Township as a typical case for empirical analysis, it attempts to avoid the resource curse phenomenon and mitigate the externalities of ecological resources. The aim is to provide possible pathways for protecting the ecological environment and realizing the economic value of ecological resources, and to provide references and support for exploring the path of rural revitalization under the theory of ecological capitalization.

2. The connotation and logic of ecological capitalization

2.1 The Conceptual Connotation of Ecological Capitalization

The concept of ecological capitalization has gained certain consensus in the academic community. Relevant research believes that ecological capitalization is a way to realize the value of ecological resources, which refers to the process of transforming ecological resources with scarcity and profitability into ecological assets through ecological confirmation, and then into ecological capital through the ecological market. Its value is mainly reflected in improving the efficiency of ecological resource allocation to mitigate ecological crises caused by rough

exploitation and utilization. Among them, ecological resources not only refer to natural resources but also include corresponding social resources, which are the combination of various natural and artificial elements with ecological carrying capacity and ecological service functions. Ecological assets refer to scarce ecological resources with clear ownership that can bring benefits to the owner under certain economic and technological conditions. Ecological capital is an ecological asset that can generate future cash flows, possessing three attributes: usefulness, appreciation, and tradability.

2.2 The Inner Logic of Ecological Capitalization

Based on the above concepts, the inherent evolutionary logic of ecological capitalization can be broadly divided into two stages: the capitalization of ecological resources and the capitalization of ecological assets. In the capitalization of ecological resources stage, first, we need to understand the natural attributes of ecological resources, identify ecological production factors that can be used for production, and determine their existence value. Second, given the scarcity of ecological resources, the primary task of capitalizing ecological resources is to clarify the ownership of property rights, thereby confirming the use value of ecological resources, and converting them into ecological assets through valuation. In the capitalization of ecological assets stage, first, we need to invest in production factors such as ecological technology to transform ecological assets into active ecological capital and confirm their factor value. Then, we need to transform ecological capital into ecological services and ecological products, and realize the monetization of ecological services through market operations to demonstrate their exchange value. Finally, part of the ecological benefits will be used in various forms for ecological construction, ecological resource protection, etc., forming a circular and sustainable utilization of value-added ecological resources.

3. Construction of Rural Revitalization Planning Model from the Perspective of Ecological Capitalization

To achieve the revitalization and development of various rural areas, it is necessary to adapt to local conditions and select development paths that are in line with the characteristics of each village based on the actual development situation of different townships and villages. For example, agricultural townships should prioritize agricultural development, while industrial townships should focus on developing township industries. Therefore, rural revitalization led by ecological capitalization is obviously more suitable for townships that have rich ecological resources and are more suitable for focusing on ecological construction. Against this backdrop, planning to support the promotion of rural revitalization driven by ecological capitalization needs to focus on considering various entities for achieving rural revitalization, value-added models, and the overall framework and implementation path for planning to realize the promotion of rural revitalization driven by ecological capitalization.

3.1 Various Entities Promoting Rural Revitalization through Ecological Capitalization

The main entities driving rural revitalization through ecological capitalization can be divided into three categories. The first category is the owners of ecological resource property rights. Generally speaking, the village collective owns the ownership of ecological resources, while individual villagers enjoy the right to use, manage, and operate these resources. Only when the property rights of the collective and individuals are clearly defined and their boundaries established can the enthusiasm of property right owners be mobilized, the liquidity of ecological resources be improved, and thus the capitalization of ecological resources be promoted.

The second category of entities is market operators. Market operators can be enterprises in related industries or individuals engaged in relevant industries. These entities possess sufficient funds, channels, and mature technological systems for utilizing ecological resources. They can

effectively tap into the value of ecological resources, put them into market operations, and thereby promote the capitalization of ecological assets.

The third category of entities is the grassroots government. The grassroots government plays a crucial role in coordinating market operators and property right owners. On one hand, it can effectively reduce communication costs between the two parties. On the other hand, it is familiar with the legal and management requirements of the region, and can play a significant role in promoting the capitalization of ecological resources and ecological assets.

3.2 The planning model of promoting rural revitalization through state capitalization

To fully operationalize ecological capitalization and maximize the inherent value of ecological resources to promote rural revitalization, effective guidance must be achieved through rural revitalization planning. The rural revitalization strategy points out that achieving rural revitalization requires efforts in five major areas: industrial revitalization, talent revitalization, cultural revitalization, ecological revitalization, and organizational revitalization. Therefore, the process of guiding rural revitalization with ecology cannot be separated from industrial development, talent support, cultural support, and organizational security. Furthermore, spatial resources, as crucial resources for industrial development and rural construction, are also significant supports for rural revitalization.

Based on the above analysis, to lead with ecological capitalization and formulate rural revitalization strategies through planning to support rural revitalization, it is necessary to build a rural revitalization planning implementation framework from five dimensions: ecology, industry, land, population, and culture. As previously mentioned, rural revitalization driven by ecological capitalization should form an "ecology + N" development model led by "greening the countryside," making ecological construction and ecological dividend realization the primary task of planning to promote rural revitalization. Planning needs to take ecology as the guide, comprehensively activate ecological vitality across the entire township, and lay the foundation for achieving common prosperity. On the basis of implementing ecological construction, based on subsequent development needs, it is necessary to simultaneously promote industrial revitalization, optimize land use and population structure, and propose paths and measures for ecological industry development, land use, talent introduction, and management. Finally, by activating cultural resources, further vitality can be injected into the ecological and industrial elements of rural revitalization, enhancing its attractiveness and influence.

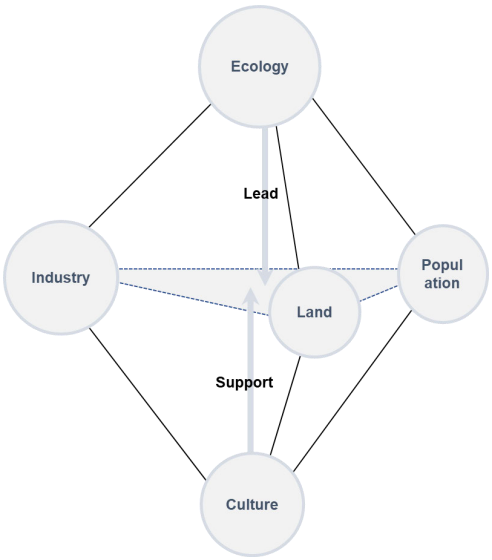


Figure 1: The "diamond" model of ecological capitalization driving rural revitalization planning

3.3 The planned action path for promoting rural revitalization through ecological capitalization

Overall, taking rural life, production, and ecological spaces as entry points, this study aims to provide guidance on the development strategies and paths for rural revitalization. Regarding the development of rural life, production, and ecological spaces, this study proposes the principles of total optimization and comprehensive planning. Total optimization involves enhancing the capacity of ecological spaces, activating the stock of production spaces, and controlling the increment of living spaces. Comprehensive planning prioritizes improving the pattern of ecological spaces, scientifically adjusting the layout of production spaces, and precisely planning the final layout of living spaces.

Specifically, for ecological spaces, continuous ecological management should be implemented to enhance their capacity, ensuring that the area of ecological spaces only increases and does not decrease, and that the types of spaces within the ecological protection red line remain unchanged. Meanwhile, four types of ecological spaces should be categorized based on actual conditions: conservation-oriented, integrated, cultivation-oriented, and restoration-oriented. Targeted measures should be formulated to increase the quantity and quality of different types of ecological spaces. For production spaces, abandoned farmland should be optimized and activated, and three agricultural production zones should be planned. Combining the results of dual evaluations, scattered and inefficient production spaces should be relocated to agricultural production zones or merged with large-scale and high-efficiency production areas through land reallocation, achieving the scale and systematization of production spaces. Scattered farmland that is not suitable for relocation can be converted to forests, while permanent basic farmland remains unchanged. For living spaces, a living space system should be precisely constructed for three types of people: those residing in the countryside, those living outside, and those returning to the countryside. Once the planning is determined, it should remain unchanged in principle. For returning villagers and tourists, characteristic stations should be planned and constructed in a scattered manner within the rural area, taking into account environmental conditions. Residents in the countryside and immigrants living outside should be concentrated

in existing settlements. Additionally, certain supporting facilities should be added based on the planned population.

In terms of ecological revitalization, corresponding governance objectives, frameworks, and implementation paths should be proposed, with a focus on implementing key ecological governance projects. For industrial revitalization, a comprehensive industrial system should be established, providing guidance on the development direction of key industries and planning for the introduction and further development of key industrial projects. In terms of land use, land use structures should be rationally regulated to ensure space for rural revitalization, and corresponding land management measures should be proposed to improve land use efficiency throughout the township. For population revitalization, predictions should be made on the size of various populations in the township, and guidance should be provided on the future development direction of different groups. In terms of cultural revitalization, strategies for the protection, inheritance, and utilization of historical and regional cultures, as well as approaches for promoting rural civilization, should be proposed. Finally, in terms of rural governance, corresponding governance strategies should be proposed for both ecological immigrants and rural residents, and innovative ideas should be put forward for the cultivation and construction of new-type collective economic organizations and social organizations.

4. Analysis of typical cases of rural revitalization from the perspective of ecological capitalization

4.1 The Development Background of Rural Revitalization in Nuanshui Township

Located in the west of Zhungeer Banner, Inner Mongolia Autonomous Region, China, and in the center of the Mengxi-Shaanbei coal mining area, which is an important coal source in China, Nuanshui Township is a typical resource-based region. Nuanshui Township belongs to severely exposed area of arsenic sandstone, a special geological structure that is one of the main factors leading to soil erosion and flood disasters in the Yellow River in China. Due to long-term coal mining and its special geological structure, Nuanshui Township has become an important area in China for promoting rural revitalization through ecological governance. Since 2009, Nuanshui Township has been designated by the Chinese government as a pilot township for the construction of an ecological natural restoration zone. By the end of 2021, the township's ecological afforestation area had reached 700,000 mu (about 46,667 hectares), with vegetation coverage exceeding 85%. However, while Nuanshui Township has achieved certain results in ecological governance, the spillover effect of ecological restoration dividends is not significant. The underdeveloped basic situation of the township has not been fundamentally changed, and some prominent issues such as the separation of people and production, as well as the separation of people and land, have not yet been resolved. How to activate the value of ecological resources to promote rural revitalization and economic development has become the main issue facing the township.

4.2 The Current Status of Rural Revitalization Development in Nuanshui Township

In 2009, the "Pilot Implementation Plan for the Promotion of Ecological Natural Restoration Area Construction in Nuanshui Township" was issued, requiring farmers who meet the conditions and are willing to relocate in the prohibited and restricted development zones of the township to do so in groups of entire communes or natural villages, adhering to a one-time planning and three-year relocation schedule, which meant withdrawing from agricultural and animal husbandry production in the same year and basically relocating the population within three years. Since the implementation of the ecological migration policy, the overall ecological condition of Nuanshui Township has improved significantly, and some ecological industries such as apricot and apple have been developed, initially realizing the transformation from lucid

waters and lush mountains to invaluable assets. In terms of ecological construction achievements, by 2010, the township had basically completed the ecological migration of the entire township, completed ecological afforestation of 208,054 mu (about 13,870 hectares), and achieved an ecological construction area of 256,300 mu (about 17,087 hectares). With the migration of villagers from various villages, comprehensive ecological improvement projects, including the treatment of arsenic sandstone, have gradually been implemented in full. By the end of 2021, the treatment of arsenic sandstone in Nuanshui Township had achieved remarkable results, with a significant increase in the vegetation coverage index (Figure 2-2-1). There were also significant improvements in agricultural product output and villager income levels, with the annual collective income of the village reaching 18,000 Yuan, per capita cultivated land area reaching 0.64 hectares per person, and the total output of economic crops reaching 7,549.9 tons. In addition to the treatment of arsenic sandstone, the township has also actively carried out ecological construction work such as soil and water conservation and returning farmland to forests, and established ecological governance platforms such as the Ordos City Soil and Water Conservation Science and Technology Demonstration Park.

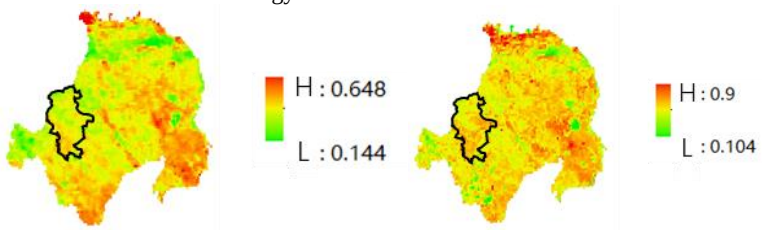


Figure 2: Vegetation Coverage Index of Nuanshui Township (Left: 2010; Right: 2021)
Data Source: Resource and Environmental Research Center of the Chinese Academy of Sciences

“Lucid waters and lush mountains are invaluable assets." The ecological construction efforts in Nuanshui Township have also generated a certain ecological dividend spillover effect, promoting rural revitalization and advancing common prosperity to a certain extent. Specifically, first, during the process of arsenic sandstone management, some arsenic sandstone resources have been fully utilized. On one hand, they have been used to develop seabuckthorn-related industries, and on the other hand, some areas have been transformed into arsenic sandstone geological parks, laying a foundation for the development of tourism in the township. Second, with the advancement of ecological restoration and returning farmland to forests, some green industries, including apricot, apple, forage, and traditional Chinese medicinal herbs, have developed effectively, providing new avenues for villagers to increase their income. Third, after the implementation of ecological migration, some homesteads and farmland have been converted into public welfare forests, and villagers can receive corresponding subsidies for public welfare forests.

However, even though the ecological construction in Nuanshui Township has promoted the pace of rural revitalization to a certain extent, there are still issues such as the monotony of tree species, small growth and yield of forest trees, and the lack of an ecological system and related industries relying on forest planting. Moreover, the ecological restoration in the township still relies primarily on natural recovery. Against this backdrop, how to improve the conversion rate of ecological construction achievements into "invaluable assets," how to promote the ecological development of Nuanshui Township from natural recovery to more proactive ecological cultivation, and further stimulate the ecological vitality and enhance the ecological value of the entire township, are the core issues that urgently need to be addressed for the future ecological revitalization of Nuanshui Township.

4.3 The Development Strategy for Rural Revitalization in Nuanshui Township

Since the implementation of the ecological migration policy, the ecological resources in Nuanshui Township have been in a state of "natural growth" without scientific and orderly management. On one hand, the township's ecological service value does not hold an advantage at the county level, and on the other hand, the value of the township's “lucid waters and lush mountains" has not been fully realized, resulting in insufficient ecological dividends. Additionally, Nuanshui Township is located at an important node for migratory birds and the Silk Road trade route, as well as the intersection of the northern and northwestern paths of sandstorms, making it an essential ecological "landing point" in the region.

To address the issues left behind by ecological migration, actively implement the "Two Mountains Theory," and fully leverage the ecological advantages of Nuanshui Township, it is necessary to actively guide and organize public participation in ecological construction. From the perspective of ecological capitalization and based on the analytical framework of "ecological resources - ecological assets - ecological capital," this plan proposes the development strategy for Nuanshui Township's Eco 2.0. This is both an inevitable choice for the current stage of development in Nuanshui Township and a necessary requirement for its development pattern.

The specific path for the Eco 2.0 construction in Nuanshui Township consists of three steps. The first step is to shape the foundation, relying on the existing ecological base to realize the capitalization of ecological resources in Nuanshui Township. Through the cultivation and construction of "three forests" - forests, fruit trees, and gardens, the basic pattern for ecological revitalization in Nuanshui Township will be formed. The second step is to release dividends, relying on Nuanshui Township's "lucid waters and lush mountains" to develop ecological industries and realize the capitalization of ecological resources, such as EOD-related industries, carbon sequestration-related industries, and others. This will transform "lucid waters and lush mountains" into "invaluable assets", allowing villagers to tangibly enjoy the dividends brought by ecological construction. The third step is proactive development, leveraging ecological dividends to attract and organize more villagers and market entities to participate in the construction of "three forests," promoting the ecological development of Nuanshui Township from natural restoration to more proactive ecological cultivation. This will further stimulate the ecological vitality of the entire township and enhance its ecological value. Ultimately, the goal is to transform Nuanshui Township into a national forest park.

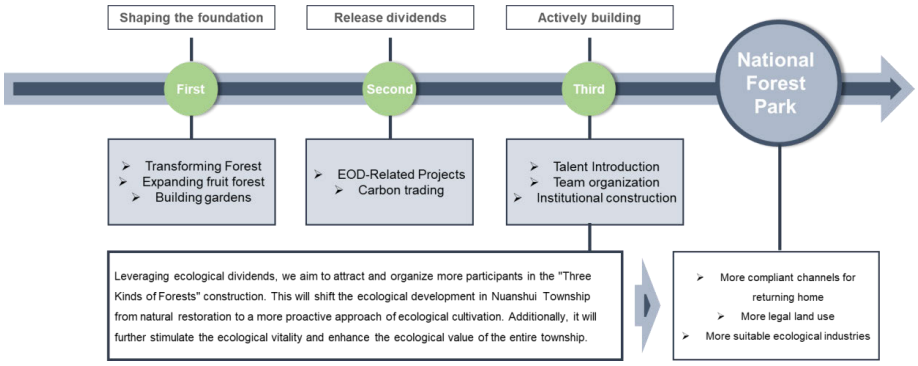


Figure 3: Action Framework

4.4 The Development Path for Rural Revitalization in Nuanshui Township

(1)Shaping the foundation

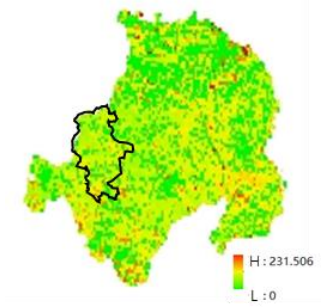
Through the cultivation and development of "forests, fruit forests, and gardens," the plan aims to enhance the integrity and biodiversity of the entire ecosystem in Nuanshui Township, thereby realizing the confirmation of ecological assets in the township and transforming them into ecological capital through valuation.

The scope of forest construction and cultivation covers the entire area of Nuanshui Township, encompassing three specific aspects. Firstly, "converting grassland to forestland" involves transforming natural grazing lands and other grasslands into arbor forests with a canopy density of no less than 0.2 through artificial afforestation. Secondly, "returning farmland to forestland" entails converting scattered and low-yield farmland into arbor forests. Thirdly, "rehabilitating mines and returning them to forestland" means planting trees in available land after mine reclamation. From the perspective of property rights, the village collectives will play a leading role in the management of this type of ecological resource, and relevant land will be collected through land transfer and other means to be consolidated and improved by the village collectives. Based on this, the plan selects six villages with relatively abundant resources in "grassland," "farmland," and "mines" - Deshengxi Village, Hanjiata Village, Kenmuken Village, Changhanbula Village, Geqiugou Village, and Shuiquangou Village - as the starting areas for artificial afforestation projects. Based on this foundation, the plan further categorizes the "forests" into three types: ecological forests, ornamental forests, and interactive forests. Ecological forests are primarily planted with arbor trees that possess water conservation and soil erosion control functions. They are located in the six administrative villages within the artificial afforestation starting areas, focusing primarily on ecological benefits and not participating in the development of the forest tourism system. In the future, they will be used primarily for the development of forest carbon sequestration. Ornamental forests are primarily planted with drought-tolerant and aesthetically pleasing ornamental arbor trees. They are primarily distributed in the four villages of Desheng Youliang, Shuiquangou, Nuanshui, and Yushuhao, often combined with fruit forests and along transit roads. These forests focus primarily on landscape benefits and have the potential to be integrated into the Nuanshui Township's forest tourism system in the future, enhancing the service value of forest tourism and ornamental aspects in Nuanshui. Interactive forests are primarily planted with tall and dense arbor trees, with some ornamental arbor trees interspersed appropriately. They are primarily distributed throughout the Nuanshui Township, combined with gardens, focusing primarily on economic benefits. In the future, they can be incorporated into the Nuanshui Township's forest tourism system, fostering a development pattern of harmonious coexistence between humans and nature.

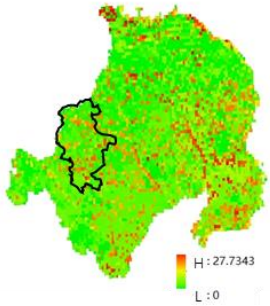
For the unique fruit forest resources in Nuanshui Township, on one hand, the plan proposes to promote the expansion of fruit tree planting areas, specifically by increasing the planting of mixed fruits in villages other than Desheng Youliang, and to moderately develop a courtyard economy. On the other hand, the plan believes that the scenic transformation of fruit forests should be implemented appropriately, meaning to transform the more extensive, profitable, and mature fruit forests into scenic spots, opening them to the public and introducing related tourism and appreciation projects.

In terms of "gardens", the construction and cultivation scope covers the entire area of Nuanshui Township. Specifically, it involves two aspects: first, developing and building small-scale village parks with an area of no more than 20 hectares, relying on the unique resources and endowments of each village. Simultaneously, drought-tolerant shrubs will be planted in every "garden" in a manner that fills in every available space to increase the vegetation coverage and ecological service value. Once completed, the vegetation coverage within each "garden" will reach at least 90%. It is expected that by 2025, a distribution pattern of "one garden per village" will be achieved. Second, the existing park green spaces and tourist landscapes in the central town area of Nuanshui will be renovated and upgraded, and 1-2 new street green spaces will be

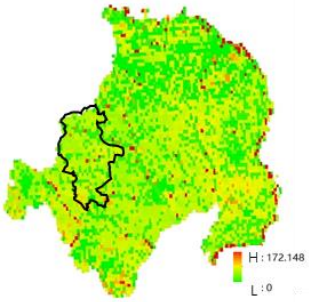
added. Furthermore, leisure stops can be established in conjunction with the "garden" layout to build a comprehensive leisure and recreational system throughout Nuanshui Township, enhancing the overall ecological vitality of the region.



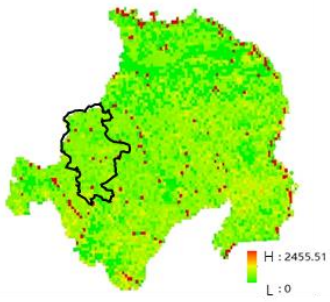
(a): Biodiversity value



(b): Food production value



(c): Purification of environmental value



(d): Total value

Figure 4: Evaluation of the Ecological Asset Value of Nuanshui Township
Data Source: Resource and Environmental Research Center of the Chinese Academy of Sciences

(2) Release dividends

Based on laying a good foundation for the ecological environment, it is necessary to establish corresponding mechanisms to realize the capitalization of ecological assets, thus guiding the transformation of the “lucid waters and lush mountains" in Nuanshui Township into “invaluable assets". To achieve this, this plan introduces the concept of "Two Mountains Bank" and recommends the establishment of a township-level "Two Mountains Bank" in the lead, consisting of five departments: Resource Storage Center, Value Assessment Center, Asset Trading Platform, Asset Operation Center, and Financial Service Center. Through the coordinated operation of these departments, various ecological resources in Nuanshui Township will be "monetized," opening up the transformation channel from "resources to assets, to capital, to funds." In summary, the main role of "Two Mountains Bank" is to provide channels for the transformation of ecological resources into assets and funds, such as green financial services, eco-industrial projects, carbon sequestration trading projects, etc., based on the quantification of the ecological foundation.

Specifically, the first step is for the township government to establish a comprehensive information management platform for the confirmation and registration of ecological resources in the township, including the registration and confirmation of ownership, location, and area of ecological resources within the entire area of Nuanshui Township. This requires all village collectives to conduct statistics on the physical quantity accounts of forest, fruit forest, garden, and other ecological-related assets in the village, calculate the township's ecological resource

assets and their changes, and report them to the township level. The township level will then uniformly input the data into the ecological resource information management platform and form a database for each village for future use. The village databases will be managed by the village secretaries, and the township-level management platform will be managed by dedicated personnel.

Next, relying on the Resource Storage Center of the Nuanshui Township's "Two Mountains Bank," various ecological resources included in the management platform will be stored and integrated, which can be further transformed into ecological assets through capital empowerment in the future.

Based on the overall integration of the township's ecological resources, this plan recommends collaborating with relevant professional institutions to develop the "Nuanshui Township Ecological Product and Asset Accounting Methods." With the support of the Value Assessment Center, the Nuanshui Township's GEP (Gross Ecosystem Product) will be calculated according to the relevant accounting methods, giving "value tags" to the green waters and lush mountains, and achieving coordinated growth in GDP and GEP scale. It is expected that by 2025, Nuanshui Township's GEP will reach 65.6 billion Yuan, and by 2035, it will reach 133.9 billion Yuan.

After determining the asset value of Nuanshui Township's ecological resources, it is necessary to "monetize" the asset value through appropriate channels. To this end, this plan recommends utilizing the Asset Operation Center of the "Two Mountains Bank" to release ecological dividends. The Asset Operation Center primarily achieves this by introducing the EOD (Ecological-Oriented Development) model, leveraging forest, fruit forest, and garden resources based on Nuanshui Township's ecological development needs to develop EOD-related industrial projects. Among them, the plan recommends setting the EOD-related project for the forest as the construction of Nuanshui National Forest Park, the EOD-related project for the fruit forest as the Desheng Youliang Village Rural Complex Project and the Shuiquanggou "Apricot Village" Agricultural, Cultural, and Tourism Integration Development Project, and the EOD-related project for the garden as large-scale garden engineering construction projects such as the Mine Park, Pisha Rock Geological Park, and Geqiugou Botanical Garden.

In addition, this plan proposes to build the asset trading platform of “Two Mountains Bank " in Nuanshui Township into a platform primarily used for forestry and agricultural carbon sequestration trading. In the near future, carbon trading pilot projects will be carried out within the township area, and in the long run, it can be promoted to the banner, city, and even the western Inner Mongolia and northern Shaanxi regions. Based on the estimated annual emission reduction of 0.7t per mu (1 mu ≈ 667 m²) and a price of 58 Yuan per ton for afforestation projects, and the estimated annual emission reduction of 0.43t per mu and a price of 10 Yuan per ton for agricultural carbon sequestration projects, it is expected that by 2025, the annual income of forestry carbon sequestration trading in Nuanshui Township can exceed 6 million Yuan, and the annual income of agricultural carbon sequestration trading can exceed 200,000 Yuan. To achieve this, villagers and village collectives need to be guided to declare woodland as carbon sequestration forests and farmland crops as agricultural carbon sequestration trading projects. Among them, for artificial arbor forests with a continuously distributed area of 0.67 hectares or more on villagers' individual land, villagers are encouraged to apply for carbon sequestration forests individually. Otherwise, villagers are encouraged to transfer their woodland to the village collective, and the village collective will apply for carbon sequestration forests uniformly.

The financial service center of “Two Mountains Bank " in Nuanshui Township primarily relies on the aforementioned ecological projects to provide certain economic support to enterprises, cooperatives, individuals, and others within the township. It is recommended that in the near term, it mainly provides GEP (Gross Ecosystem Product) ecological value loan services and carbon account services. The GEP ecological value loan service is a lending business based on

the assessed GEP value, which can effectively activate the economic value and financial attributes of ecological products. Priority can be given to select professional cooperatives and enterprises within Nuanshui Township that urgently need loans to carry out pilot projects. Carbon account services are divided into two categories: enterprise/cooperative carbon account services and villager/village collective carbon account services. The former is mainly aimed at enterprises and cooperatives in the township that conduct carbon trading to enhance their carbon account ratings and credit lines, while the latter allows villagers participating in carbon trading to deposit their carbon reserves into personal carbon accounts, which can be cashed out after trading.

(3) Actively building

To actively implement the "Two Mountains Theory," it is necessary to promote Nuanshui Township towards more proactive ecological cultivation and construction. Therefore, the plan proposes to leverage ecological dividends to attract and organize more local, expatriate, and returning Nuanshui residents to participate in ecological cultivation efforts such as afforestation, orchard expansion, and garden construction.

First, we can use new media, offline promotion, and other methods to promote Nuanshui Township's development goals, vision, and ecological dividends to attract public participation in ecological construction. Then, we can recruit relevant personnel through four channels: forest construction, national forest construction, garden construction, and "Two Mountains Bank" experience management.

For forest construction: 1).Organized by the township government, recruit 800-1000 afforestation workers.2).Organized jointly by enterprises and the township government, recruit 150-200 forest park construction and management personnel.3).Organized jointly by enterprises and the township government, recruit 200-300 forest rangers.4)

For orchard construction: 1).Organized by village collectives, recruit 80-100 fruit farmers. 2).Organized jointly by enterprises and village collectives, recruit 50-80 personnel for rural complex construction. 3).Organized jointly by village collectives and villagers, recruit 50-80 returning residents to operate the rural complex.

For garden construction: 1).Organized by village collectives, recruit 40-60 garden construction workers. 2).Organized jointly by enterprises and village collectives, recruit 30-50 garden maintenance personnel.

For "Two Mountains Bank" operation and management: 1).Organized by the township government, recruit 30-50 offline service personnel. 2).Organized jointly by enterprises and the township government, recruit 20-30 online platform development and maintenance personnel. 3).Organized jointly by enterprises and the township government, recruit 30-50 online service personnel.

Table 1: Description of the EOD-Related Projects in Nuanshui Township

	Forests	**Fruit forests**	**Gardens**
EOD-Related Projects	Nuanshui Township National Forest Park Project	Desheng Youliang Rural Complex Project; Shuiquangou Rural-Culture-Tourism Integrated Development Project	Mining park, arsenic sandstone geological park, and other landscape engineering construction projects.
Key Participants	A listed company + township government + villagers	Social capital + township government + village collective + fruit farmers	Social capital + township government + village collective
Source of Revenue	Operating income will be generated from carbon sequestration trading, development and operation of cultural tourism projects,	Operating income from future projects will come from carbon sequestration trading, fruit tree planting and operation, as well as the development and	Operating income mainly consists of the development and operation of cultural tourism projects, as well as the

	as well as the operation of parking lots in future projects.	operation of cultural tourism projects.	operation of supporting facilities.
Ecological Construction	By conducting artificial afforestation, we can further improve the ecological indicators in Nuanshui Township, including plant coverage, forest coverage, species richness, and water source conservation capacity.	By increasing the area of fruit forests, we can enhance the transpiration of the forest, improve the forest coverage rate, and at the same time enhance the ornamental value and tourism development value of ecological resources.	By promoting the diversity of the ecosystem in Nuanshui Township, we can revitalize brownfields and underutilized park green spaces, thereby enhancing the ecological vitality of the entire region.

5. Conclusion and Discussion

This study takes the planning perspective of ecological capitalization as an entry point, integrates the dual needs of ecological protection and economic development, analyzes the basic logic of ecological capitalization driving rural revitalization, and proposes a planning model led by ecology, supported by the revitalization of population, industry, and land, and enhanced by culture. It explores the planning path for rural revitalization from the perspective of ecological capitalization. Based on this, the study uses the case of Nuanshui Township in Inner Mongolia as a typical example, constructs a three-step planning action path from shaping the foundation, releasing dividends, to active construction, based on the analytical framework of "ecological resources - ecological assets - ecological capital" and combined with the needs of various entities in rural revitalization. The study also puts forward targeted planning and guiding measures for Nuanshui Township's characteristic resources such as "forests, orchards, and gardens," as well as an EOD development model centered on the "Two Mountains Bank." It clarifies the entire development system of Nuanshui Township's rural ecological resources from confirmation of ownership rights, to ecological asset valuation, to ecological capital operation, further confirming that the capitalization of ecological resources can bring value-added benefits in terms of ecology, society, and economy. Looking forward, the study will further refine the planning framework and implementation path for rural revitalization from the perspective of ecological capitalization, providing strong support and solid guarantees for supporting rural construction and coordinated urban-rural development.

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From Howard's Garden City Movement to Zero-Carbon New Towns in the postgrowth era: the case of New Town development in the context of carbon neutrality of Shanghai

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Abstract: Shanghai's urban development has transitioned from traditional New Towns to the emergence of zero-carbon New Towns, driven by a commitment to carbon neutrality by 2060. This transition reflects a broader shift towards sustainability and decarbonization in urban planning. Five major New Towns around Shanghai embody this shift, focusing on renewable energy, green infrastructure, and low-carbon living. Key indicators guide their development, emphasizing mixed land use, energy-efficient buildings, sustainable transportation, waste management, and climate resilience. Effective implementation mechanisms, supported by policy, finance, and community engagement, ensure the realization of low-carbon goals. Shanghai's journey towards zero-carbon New Towns highlights a proactive approach to address climate change while creating livable, resilient urban environments.
Key words: New Town development, carbon neutrality, sustainable development, carbon reduction

1. Introduction

From Howard's garden city movement, to Taylor's concept of satellite cities, and to Saarinen's organic dispersal theory, the development of New Towns has been affected by the background of the times (Aldridge, 2017). As the largest metropolis in China, Shanghai's New Towns have developed from first-generation bedroom towns to relatively independent satellite cities, and to new regional node towns (Shen et al., 2017). Nowadays, in the postgrowth era, sustainability and de-carbonization have become the new themes of urban development. The government announced that Shanghai will achieve carbon neutrality by 2060. At the same time, Shanghai is actively establishing its carbon financial market, trying to achieve carbon neutrality by linking the financial market with carbon resources.

Under these conditions, a new generation of New Towns emerged. Five New Towns built around the main city of Shanghai, namely Jiading New Town, Qingpu New Town, Songjiang New Town, Fengxian New Town, and Nanhui New Town, will serve as the first generation of zero-carbon New Towns in Shanghai in the postgrowth era (Shen et al., 2017). These five towns, while inheriting the functions of traditional New Towns also regard sustainable development and de-carbonization as the main themes of New Town development. That is, these five New Towns will take carbon neutrality and zero carbon output as their initial construction goals.

2. The development of New Town theory

The development of urban theory concerning "New Towns" has been a significant topic within urban planning and architecture over the past century (Fishman, 1990). The concept of New Towns, which are planned urban centers created to accommodate population growth or relieve housing shortages in established cities, has evolved through various stages, influenced by social, economic, and technological changes.

The idea of planned urban spaces dates back to ancient civilizations, but in a modern context, it was Sir Ebenezer Howard in the United Kingdom who laid the foundations for contemporary New Town theory with his publication of "Garden Cities of To-morrow" in 1898 (Aldridge,

2017). Howard proposed creating self-contained communities surrounded by "greenbelts," combining urban and rural benefits to combat the squalor of Victorian cities. His ideas led to the development of the first garden cities, Letchworth and Welwyn, designed to provide healthier living environments away from overcrowded urban centers.

The concept of New Towns gained significant momentum after World War II, particularly in the United Kingdom with the New Towns Act of 1946 (Barnett, 2018). This legislation aimed to systematically relieve overcrowding in London and other bombed cities by creating over 20 New Towns designed as self-sufficient communities with their industries, residential areas, and cultural facilities. The concept also included the development of satellite towns, smaller urban bodies orbiting larger cities, to help absorb the overflow of population and functions from urban centers without the same level of self-sufficiency as New Towns.

During the same era, Nikolaus Schärer, a Swiss architect and urban planner, proposed the concept of "organic dispersal." This theory suggested that urban expansion should mimic organic growth patterns, allowing cities to expand and contract fluidly in response to environmental and demographic changes, rather than enforcing rigid, pre-planned designs (Pringle, 2023). This approach aimed to integrate more flexibility and sustainability into urban development, influencing how New Towns and satellite cities were planned to better adapt to their natural and economic environments.

In the United States, the New Town development concept was incorporated into broader urban renewal efforts during the mid-20th century (Fishman, 1990). Notable projects such as Reston, Virginia, and Columbia, Maryland, were developed, emphasizing planned approaches to residential living, economic functions, and environmental concerns. Internationally, New Town development became part of national planning strategies in many countries, including Israel, South Korea, and Singapore, each adapting the basic principles to local needs and contexts.

The late 20th and early 21st centuries have seen new dimensions added to New Town theory, emphasizing sustainability and smart technology. The focus has shifted to creating eco-cities and smart cities that incorporate advanced technology to manage urban resources efficiently and minimize environmental impact. Examples include Masdar City in Abu Dhabi and Songdo International Business District in South Korea, which integrate information technology infrastructure and eco-friendly practices at a fundamental level (Zhou, 2019).

While New Towns have been lauded for their ability to plan and manage urban growth systematically, they have also faced criticism. Challenges include creating socio-economic divides, achieving a balanced community mix, and the risk of creating isolated urban pockets that do not integrate well with surrounding regions. Planners and developers continue to address these issues by fostering more inclusive planning processes and integrating New Towns more holistically with regional economic and transportation planning.

Overall, the theory and practice of developing New Towns have evolved from simple garden city concepts to sophisticated urban ecosystems that balance human needs with technological advancements and environmental stewardship. This evolution reflects broader changes in urban planning philosophies and the continuous search for sustainable urban development strategies.

3. The history of Shanghai's New Town development

Shanghai's New Town development can be traced back to the mid-20th century when the city began experiencing rapid urbanization (Shen et al., 2017). The government initiated the

construction of New Towns to accommodate the growing population and alleviate urban congestion. Over the decades, Shanghai's New Towns have evolved in response to changing urbanization patterns, economic development, and government policies. Initially conceived as bedroom communities, these New Towns have transformed into more self-sufficient urban centers with improved infrastructure, amenities, and employment opportunities.

Spatially, New Towns in Shanghai are strategically located in the city's periphery to balance regional development and relieve pressure on the central urban area. They are typically connected to the city center through transportation networks, such as highways, railways, and metro lines. Functionally, Shanghai's New Towns serve multiple functions, including residential, commercial, industrial, and recreational purposes. They are designed with modern urban planning principles, incorporating green spaces, pedestrian-friendly streets, and mixed-use developments to create livable and sustainable communities.

Fig.1 Spatial Distribution of Shanghai's Five New Towns

Shanghai has currently formed a spatial structure consisting of one main city and five New Towns, a configuration explicitly outlined in Shanghai's 2035 Spatial Plan. These five New Towns include Jiading, Qingpu, Songjiang, Fengxian, and Nanhui. They are strategically distributed across different regions of Shanghai, providing diversity and balance to the city's development landscape (Figure1). Jiading New Town, situated in the northwest, is renowned for its unique economic and cultural ambiance; Qingpu New Town, located in the west, attracts attention with its rich historical and natural resources; Songjiang New Town, positioned in the southwest, offers modern facilities and superior living conditions; Fengxian New Town, found in the south, captivates with its charming coastal scenery and modern urban construction; Nanhui New Town, nestled in the southeast outskirts, holds a strategic geographical position and rapidly growing economic strength.

In addition, the five major New Towns in Shanghai not only play pivotal roles in Shanghai's internal development but also serve as important links connecting the city with surrounding regions. By fostering collaboration and connectivity with neighboring cities, these New Towns contribute to regional integration, economic growth, and sustainable development in the broader Shanghai metropolitan area and beyond.

In the northwest, Jiading New Town maintains close ties with neighboring cities such as Suzhou and Kunshan, acting as a bridge linking Shanghai with the dynamic economies of the Yangtze River Delta region. Its strategic location along major transportation arteries facilitates seamless connectivity and collaboration in areas such as commerce, manufacturing, and research. Nestled in the western part of Shanghai, Qingpu New Town shares borders with cities like Jiaxing and Hangzhou in Zhejiang Province. Its proximity to these regional centers enhances cultural exchange, tourism, and economic cooperation, serving as a gateway connecting Shanghai with the cultural and economic vitality of neighboring cities, promoting mutual development and prosperity. Situated in the southwest, Songjiang New Town maintains strong connections with cities such as Suzhou, Jiaxing, and Hangzhou. Its well-developed transportation infrastructure, including highways and railways, facilitates the flow of goods, people, and ideas between Shanghai and its neighboring regions. Songjiang New Town plays a pivotal role in promoting regional collaboration in areas such as education, technology, and cultural exchange. Located in the southern part of Shanghai, Fengxian New Town shares borders with cities like Ningbo and Zhoushan. Its coastal location enhances its connectivity with neighboring coastal cities and ports, facilitating trade, tourism, and maritime cooperation. Fengxian New Town serves as a key link connecting Shanghai with the vibrant economies and scenic attractions of the coastal region, promoting mutual development and prosperity. Positioned in the southeast outskirts, Nanhui New Town maintains close connections with cities such as Ningbo and Wenzhou. Its strategic location near major ports and transportation hubs fosters trade, logistics, and economic cooperation, acting as a vital node in the regional logistics network. Nanhui New Town facilitates the efficient flow of goods and services between Shanghai and neighboring cities, driving economic growth and regional integration.

Guided by the Shanghai 2035 Spatial Plan, the development of these New Towns aims to create a livable, business-friendly, and leisure-oriented urban environment. They are envisioned as crucial hubs for future economic growth and population migration, integrating modern urban infrastructure, green ecological environments, and cultural leisure facilities. By offering diverse functions and convenient transportation networks, these New Towns will attract more residents and businesses, contributing to the sustainable development of Shanghai.

4. The Zero-Carbon New Towns

Shanghai, as China's economic hub and a densely populated metropolis, has been actively addressing the challenges of climate change and environmental protection. Firstly, Shanghai's carbon peak target aims to reach the peak of carbon dioxide emissions by 2030, followed by a gradual reduction. Additionally, Shanghai has set an ambitious target to achieve carbon neutrality by 2060 (Hua et al., 2019).

In the context of Shanghai's carbon neutrality goals and the background of New Town development, the emergence of zero-carbon New Towns has become a new construction objective. With Shanghai's commitment to achieving carbon neutrality and promoting sustainable development, the direction of New Town development is evolving. Traditionally, New Town development focused on population accommodation and relieving urban functions, but in the context of carbon neutrality, zero-carbon New Towns emphasize the reduction of carbon emissions and climate friendliness during the construction process. This implies that New Town planning will increasingly consider aspects such as renewable energy utilization, energy conservation, and green transportation to achieve zero carbon emissions.

Currently, the construction status of the five major New Towns in Shanghai demonstrates a diverse and comprehensive trend. In terms of industrial structure, these New Towns are no longer solely reliant on residential areas but are gradually achieving diversified industrial development. In addition to residential areas, they also boast modern commercial districts, industrial parks, and cultural and entertainment facilities, providing residents with a richer array of lifestyle choices. Regarding infrastructure, the transportation networks of the New Towns are becoming increasingly sophisticated, including highways, railways, and metro lines, facilitating convenient connections between residents and businesses. Moreover, environmental protection receives considerable attention, with an increase in green spaces, ongoing efforts in water resource conservation, and advancements in waste management.

The low-carbon construction objectives of the five major New Towns in Shanghai primarily focus on energy utilization, transportation systems, building energy efficiency, and carbon market development. In terms of energy utilization, the New Towns will vigorously develop clean energy sources, reduce reliance on traditional fossil fuels, and encourage the adoption of energy-saving technologies by residents and businesses. Regarding transportation systems, the New Towns will optimize public transportation layouts, promote electric vehicles and other new energy transportation options, and reduce emissions from motor vehicles. In terms of building energy efficiency, the New Towns will promote green building practices and energy-efficient renovations to improve building energy performance and reduce energy consumption. Additionally, the New Towns will actively participate in carbon market development, promoting carbon trading and the growth of the carbon market to facilitate the development of a low-carbon economy and further reduce carbon emissions.

For example, Jiading New Town, located in the northwest, has been actively promoting the development of new energy vehicles and supporting industries, aiming to become a model for sustainable transportation. Qingpu New Town, known for its historical and natural resources in the west, has implemented strict environmental protection measures during its development process, preserving its ecological integrity. Songjiang New Town, with its superior living conditions in the southwest, has focused on enhancing energy efficiency in its buildings and promoting green construction practices. Fengxian New Town, situated in the south with its charming coastal scenery, has prioritized the development of renewable energy and eco-friendly tourism. Lastly, Nanhui New Town, positioned in the southeast outskirts, has been at the forefront of carbon market development, actively participating in carbon trading and promoting low-carbon industrial transformation.

5. Interpretation of high-level policies

In fact, there are a series of upper-level policies and planning guidance for the low-carbon construction of Shanghai New Town. Taking Nanhui New Town as an example, there are policies and plans at the national, Shanghai municipal and district levels to guide its low-carbon development.

As a part of Pudong New Area in Shanghai, Nanhui New Town is supported by a series of top-level policies and planning documents at the national, municipal, and district levels. These documents provide crucial guidance and support for its low-carbon development. Understanding these top-level planning policies is essential for grasping the positioning and future direction of Nanhui New Town.

In the national-level policy document, "The Fourteenth Five-Year Plan for National Economic and Social Development of Pudong New Area and the Long-Range Goals for 2035," besides

emphasizing Pudong's aspiration to become a premier destination for global investment, trade, and entrepreneurship, it also highlights the comprehensive construction of a modern economic system. This system focuses on the coordinated development of the real economy, technological innovation, modern finance, and human resources, aiming to enhance the quality and efficiency of the supply system. This implies that in future development, Pudong will strengthen support for technological innovation and green industries, promoting the structural transformation of the economy towards low-carbon and environmentally friendly sectors. Additionally, the plan emphasizes the construction of modern urban areas, including optimizing urban spatial layout, developing rail transit, and establishing ecological networks. These measures will contribute to improving urban environmental quality and advancing the city towards green and low-carbon development.

In the Shanghai-level policy document, "The Fourteenth Five-Year Plan for the Development of China (Shanghai) Pilot Free Trade Zone Lingang New Area," besides outlining the goal of establishing Lingang New Area as a special economic functional zone, it also emphasizes enhancing innovation capability. The plan underscores the promotion of international collaborative innovation and the construction of a world-class, open, and modern industrial system. This indicates that in future development, Lingang New Area will strengthen support for green technology and environmental industries, driving industries towards a low-carbon, green direction. Additionally, the plan emphasizes the goal of building the most modern, eco-friendly, convenient, vibrant, and distinctive comprehensive node coastal city. This will help promote the construction and development of low-carbon new towns.

In the Pudong New Area (district level) policy document, "The Fourteenth Five-Year Plan for the Construction of Nanhui New Town," besides setting forth the goals of building a high-level open area, an integrated reform and innovation highland, and a high-energy industry highland, it also proposes the construction of an ecological New Town and a digital New Town. The plan emphasizes increasing the area of public park green space, forest coverage, and ecological space ratio to promote the city's development towards green and low-carbon. Additionally, the plan highlights the goals of constructing a digital New Town and smart communities. This will be achieved by improving urban management through smart technologies and information, promoting the city's development towards a low-carbon and smart direction. These measures will contribute to improving the city's ecological environment and advancing towards a low-carbon development model.

6. The Zero-Carbon New Towns' indicator system

The planning of low-carbon cities in Shanghai's five major new towns is a strategic response to the global imperative of mitigating climate change and transitioning towards a sustainable future. With the commitment to achieving carbon neutrality, Shanghai has embarked on comprehensive urban planning to guide the development of its burgeoning new towns, including Nanhui, Lingang, Fengxian, Chongming, and Jiading. These cities are envisioned as models of sustainable urban development, balancing economic growth with environmental stewardship.

The initiatives for low-carbon development in Shanghai's new towns are multifaceted and comprehensive, addressing various aspects of urban planning, infrastructure development, and community engagement. Aligned with international climate goals, these initiatives aim to reduce carbon emissions, enhance energy efficiency, promote renewable energy adoption, improve air and water quality, and create resilient urban environments. Central to these efforts is the integration of sustainability principles into urban planning and design, including measures

to promote compact, mixed-use development patterns and prioritize walking, cycling, and public transit over private vehicles. In building and transportation, the new towns prioritize energy-efficient construction practices and the adoption of low-carbon transportation modes. This includes incentivizing green building construction, implementing stringent energy efficiency standards, and expanding public transportation networks. Efforts to conserve energy and resources are integral, with a focus on waste reduction, recycling, and renewable energy utilization. Additionally, resilience and adaptation are emphasized, with measures to enhance flood resilience and integrate green infrastructure solutions.

Taking Nanhui New Town as an example, a set of development indicators has been established to guide its low-carbon development journey. These indicators span various dimensions, including urban form, transportation, energy efficiency, waste management, and climate resilience. Nanhui aims to achieve a balanced mix of land uses and green spaces, with indicators focusing on mixed-use development and ecological conservation. Energy-efficient construction practices and sustainable transportation solutions are prioritized, with targets for green building construction and public transportation coverage. Efforts in resource conservation and climate resilience are also highlighted, with indicators for waste utilization and flood management. Overall, these initiatives and indicators guide Nanhui New Town's journey towards low-carbon development, fostering a sustainable, resilient, and livable urban environment. By integrating sustainability principles into urban planning and development processes, Nanhui aims to become a model of sustainable urban development, showcasing the feasibility and benefits of a low-carbon, resilient, and inclusive urban future.

Table.1 Nanhui New Town's planning indicators towards Zero-Carbon New Town

No.	Aspects	Characteristic Indicator	Indicator Value
1	Healthy and Vibrant Layout and Environment	Proportion of mixed-function blocks on construction land	0.5
2		Per capita park green area	9.5 square meters per person
3		Proportion of ecological space	0.55
4		Proportion of affordable housing and market-oriented public rental housing area in new housing	≥40%
5		Proportion of livable renovation in old neighborhoods	0.5
6	Low-carbon and Convenient Building and Transportation	Proportion of newly built two-star green buildings	1
7		Proportion of healthy buildings or ultra-low energy buildings in total building area	≥25%
8		Proportion of prefabricated or assembled buildings with a prefabrication rate of 45% or an assembly rate of not less than 65%	≥5%
9		Coverage rate of construction land rail transit stations within 600 meters/bus stops within 500 meters	80%/100%
10		Proportion of new energy buses	1
11	Efficient Energy and Resource Conservation	Number of charging piles for new energy vehicles at new construction sites with an area of over 2400 square meters	45325
12		Construction of hydrogen refueling stations (oil-hydrogen co-construction)	4 items
13		Comprehensive management and control platform for energy facilities	1 item
14		Rate of garbage resource utilization	0.75
15		Rate of non-traditional water source utilization	≥3%
16		Average reduction in carbon emissions intensity of newly built residential and public buildings	8 kgCO2/(m2·a)
17	Resilient and Safe Sponge City and	Proportion of new sponge cities in newly built urban areas	1
18		Proportion of comprehensive corridors for four types of urban engineering pipelines under all new main roads in newly built urban areas	1

19	Municipal Infrastructure	Per capita road area	≥13 m2
20		Local woody plant index	≥0.7
21		Standard compliance rate of district flood defenses	100% (defensive standard of once-in-200-year)
22	Smart and Innovative Management and Humanities	Application scenarios of "One-network Management" in new towns	Over 30 newly built application scenarios
23		Proportion of application of BIM in design and construction stages of new buildings	1
24		Construction of demonstrative digital living communities	10

7. Achievement and implementation of low-carbon goals

The implementation of urban planning schemes is crucial for the sustainable development of cities. Through effective planning implementation, cities can enhance their functionality and livability, address development issues, and achieve long-term development goals. For example, London has devised the "London Plan," which, through planning implementation, has enhanced the city's transportation efficiency and environmental quality, thus improving the residents' quality of life. Similarly, Shenzhen, China, has formulated the "Shenzhen Urban Master Plan (2010-2020)" implementation guidelines, which have propelled industrial upgrading and enhanced the city's image, making it a pivotal city in China's reform and opening-up.

To ensure the implementation of urban planning schemes, governments need to employ various methods. Firstly, governments need to provide policy and regulatory support to ensure the legality and effectiveness of the plans. For example, the Japanese government has enacted laws such as the "Urban Renewal Law" to provide legal protection for urban planning. Secondly, sufficient financial support is crucial. The Guangzhou municipal government in China, when promoting urban planning implementation, has adopted the PPP model, attracting social capital to participate in urban infrastructure construction, thereby ensuring the smooth progress of projects. Additionally, establishing effective project management and supervision mechanisms is vital. The Singaporean government, when implementing the "Singapore Concept Plan," established strict project management and supervision mechanisms to ensure the timely and quality completion of planning projects. Lastly, strengthening social participation and communication is essential. The Amsterdam municipal government in the Netherlands extensively solicited public opinions during city development planning, enhancing the legitimacy and acceptability of the plans through democratic participation.

Fig.2 implementation system of Nanhui New Town

However, the implementation of low-carbon city goals differs from traditional urban planning objectives. Low-carbon city goals emphasize reducing carbon emissions and improving energy efficiency, requiring consideration of environmental protection and sustainable development factors in urban planning and construction. For example, Copenhagen, Denmark, serves as a model for low-carbon cities, achieving significant reductions in carbon emissions through measures such as optimizing urban layout and promoting renewable energy. Therefore, it is crucial to prioritize the integration and implementation of low-carbon city goals in urban planning to steer cities towards more environmentally friendly and sustainable development.

Taking Nanhui New Town as an example, the low-carbon target implementation system covers various aspects, aiming to ensure that low-carbon planning objectives are effectively realized. Firstly, adhering to green and low-carbon development strategies, a comprehensive management framework was established during the planning phase (Figure 2). This includes innovative management mechanisms, unified management standards, and consolidated management power, providing strong organizational support for the implementation of low-carbon planning objectives.

In terms of management mechanisms, Nanhui New Town has established a leadership group dedicated to promoting green ecology and low-carbon construction. This group plays a crucial role in coordinating all relevant departments and units to ensure the effective execution of various low-carbon measures.

Regarding management systems, Nanhui New Town has strengthened the approval management of development and construction projects within the area, in line with the guidelines for the New Town. It has developed and established an energy-saving and green ecological management model that covers the entire process from project initiation, design,

construction, to operation. This model systematically implements energy-saving and ecological protection standards across the full life cycle of construction projects, from design through to operation.

Technical support measures include the involvement of third-party professional consulting firms to assist the leadership group in implementing green ecological standards throughout the construction process. This not only enhances the professionalism of project implementation but also ensures the accurate application of ecological standards.

Furthermore, promoting standardized management among participating units is key to ensuring that construction, design, construction, and supervision units strictly adhere to the green ecological content in the construction design documents, organizing construction disclosures and management accordingly. This approach effectively ensures the implementation of environmental standards during construction.

The demonstration role of government investment is also crucial in financial arrangements. Funds are strategically allocated to ensure that the necessary finances for green ecological urban planning and control mechanisms are secured by district fiscal funds. For government-funded projects, the finance department actively provides support, ensuring sufficient funding for green and low-carbon construction of projects.

Through these comprehensive measures, Nanhui New Town can effectively promote the achievement of low-carbon objectives, providing a solid foundation for the sustainable development of the city. This not only reflects the foresight in urban planning and management but also demonstrates the city's commitment and effort on the path to low-carbon development.

8. Conclusion

In conclusion, Shanghai's evolution from traditional New Towns to the emergence of zero-carbon New Towns reflects a significant shift towards sustainability and decarbonization in urban development. The commitment to carbon neutrality by 2060 has spurred the development of new urban centers that prioritize renewable energy, green infrastructure, and low-carbon lifestyles. Key indicators guide the transition, emphasizing mixed land use, energy-efficient buildings, sustainable transportation, waste management, and climate resilience. Effective implementation mechanisms, backed by policy support, financial investment, and community engagement, ensure the realization of low-carbon goals. Shanghai's journey towards zero-carbon New Towns underscores a proactive approach to address climate change while fostering livable, resilient, and inclusive urban environments.

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The Internet as a Business Game Changer: A Study on Invisible Consumption Spaces in Nanjing Old City

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Abstract

With the recent development of online-to-offline (O2O) industries in China, the Internet has become a game-changer, facilitating the creation of new forms of spaces. Taking Nanjing old city as a case study, this paper identifies invisible consumption spaces that are not situated on the streets or in shopping malls but are primarily located inside high-rise buildings and rely on online platforms to operate. The distribution of invisible consumption spaces presents characteristics of central agglomeration and multi-polar clustering. Based on decision tree algorithms, an analysis of a typical area indicates that spatial costs, property rights, and building management and support are the primary influencing factors. Additionally, commercial-residential buildings play a crucial role as carriers of spatial clustering. This paper argues that the emergence and development of invisible consumption spaces is a manifestation of the diversification of old city consumption spaces and a significant bottom-up regeneration strategy in the Internet era.

Keywords

Invisible consumption space, O2O, distribution characteristics, spatial clustering, space regeneration

1 Introduction

Research on consumption spaces initially began in the field of commercial geography, with studies on spatial location primarily based on Christaller's central place theory. Subsequently, as cognitive and behavioural models were proposed, the research perspective expanded to consumption behaviour (Huff, 1963). With the emergence of the information age, the Internet has become a game changer, radically altering the pathways and efficiency of communication, and profoundly transforming urban everyday life spaces. The consumption space based on online-to-offline (O2O) is precisely a new type of urban space that reflects the interplay between the explicit and the implicit.

In recent years, the O2O consumption model has developed rapidly in China. Research on O2O consumption spaces, such as takeaway restaurants, Airbnb houses (Sun, Wang and Hu, 2022), and Internet-sensation shops, has yielded relatively rich results. This research has initially established a framework for studying new types of consumption spaces under the backdrop of Internet development. However, there is an *invisible* O2O in-store consumption type that has not yet attracted much attention. These stores, as physical consumption spaces in the city, do not have storefronts opening directly to urban public spaces (on streets or in shopping malls) but are concealed within urban buildings. They operate through online platforms, focusing on experiential consumption, which mainly includes life services, entertainment, leisure, sports, and other formats. This paper refers to this type of consumption space as *invisible consumption space*. The research in this paper mainly focuses on the distribution characteristics and influencing factors of invisible consumption spaces in the context of the Internet environment. By analysing the data of invisible consumption spaces in Nanjing old city, this study explores the macro-level spatial distribution characteristics. Through case studies of typical blocks and buildings, this study aims to identify and analyse the micro-level site selection factors. The

research findings are expected to enrich and improve the types and contents of old city space regeneration under the influence of the Internet.

2 Research Overview

As information communication technology (ICT) advances, there is a notable shift in the fundamental dimensions of human cognition within the network society. The *space of flows* and *timeless time* have become the new spatial-temporal foundations (Castells, 1996). The social fabric and daily routines are reorganised by electronic communication networks, leading to time-space compression or even the end of geography. The development of ICT has brought new changes to urban space and consumption spaces (Carpio-Pinedo and Gutiérrez, 2020).

Online shopping has impacts on physical consumption spaces through substitution, enhancement, modification, and neutrality (Farag et al., 2007). Corresponding to offline physical consumption spaces, online virtual consumption spaces have emerged (Farag, Krizek and Dijst, 2006), and some traditional shopping has shifted from offline to online, which can have positive or negative impacts on physical spaces (Puel and Fernandez, 2011). Similarly, in addition to the shift from offline to online, online consumption spaces are also expanding offline. This expansion includes new retail spaces and playscapes that host offline leisure activities organised by online communities. Overall, the online-merge-offline development, known as the *bricks-and-clicks* model, is a prevalent trend in the evolution of consumption spaces (Zhen et al., 2018).

The transition of consumption spaces from *visible* to *invisible* is a common feature in numerous studies focusing on spatial distribution influenced by the Internet. Regional-scale studies focus on various industrial spatial patterns and characteristics, as well as the influencing factors among cities. The studies of urban internal scale mainly address the industrial characteristics, influencing factors, and the impact on traditional commercial space. In terms of spatial distribution, O2O consumption spaces tend to extend into back alleys and the interior of blocks horizontally, while showing a concentration trend in high-rise buildings vertically (Lu et al., 2013).

With the increasing emphasis on the cultural significance of consumption, the consumption of space also encompasses the consumption of the *third space* constructed collectively by material, spiritual, and social aspects (Soja, 1996). Consumption spaces are no longer just places for buying goods, but also offer a wider range of experiential sensations. Compared to the traditional rational-functional approach to processing information in consumption, experiential consumption focuses on the symbolic, hedonistic, and aesthetic aspects of the act (Holbrook and Hirschman, 1982). In addition to traditional retail shops, more and more studies involve cultural and recreational places (Chatterton and Hollands, 2002), as well as leisure, festival activities and spaces (Demant and Landolt, 2013; Kidder, 2012). A significant number of retail spaces in cities that cater to in-store consumers are being influenced by online shopping trends and are aiming to transition into experiential shopping destinations, possibly evolving into tourist attractions (Gilli and Ferrari, 2017). Experience is a key value in the O2O consumption

process. In general, the consumption of consumption spaces is becoming increasingly important, while the importance of location is diminishing.

Overall, research on consumption spaces in the context of the Internet is mainly concentrated in the field of urban geography, focusing on consumption behaviour and meaning, with some involving location and distribution. However, research from the perspective of space regeneration is relatively weak, especially systematic research on invisible consumption spaces, which requires further in-depth exploration.

3 Macro Distribution Characteristics of Invisible Consumption Spaces

3.1 Data Source and Processing

The study utilises Point of Interest (POI) data for the consumption spaces in Nanjing old city, which was obtained through the Gaode Open Platform (an application of Amap.com, one of the most popular digital maps in China). Each POI represents a single store (consumption space). The Gaode Open Platform provides comprehensive and complete open-source data, and it covers both offline and O2O consumption spaces, facilitating comparative research. Additionally, the data is linked to Dianping.com, a popular review platform in China similar to Yelp in Europe. This link provides information such as online reviews and average consumption per person, which aids in collecting characteristics of O2O consumption.

The data for this study was collected on 28 November, 2019, a time when the data had not yet been affected by COVID-19. The data is categorised according to the 'National Economic Industry Classification (GB/T 4754-2017)' and the POI classification codes from the Gaode Open Platform. These categories are divided into seven major groups: catering services, shopping services, educational services, life services, entertainment services, sports and leisure services, and medical services(Table 1).

Table 1. Summary of data on consumption spaces (shops) in Nanjing old city

Shop name	Name
Location	Administrative districts, latitude and longitude coordinates, and address texts
Floor levels	Extracted from address texts
Categories	Seven categories, and several subcategories
Online reviews	Ratings, and consumption per person

Data source: The floor levels are extracted according to the address text, and the other information is obtained through the Gaode Open Platform.

The article extracts POI data based on the definition of invisible consumption spaces. Consumption spaces can be categorised into two types based on their environment: street shops and internal shops. Street shops are visible consumption spaces with storefronts facing the street. In contrast, internal shops are located within buildings and are further divided into shopping mall internal shops and other internal shops. Shopping mall internal shops are considered visible consumption spaces, while other internal shops that do not have storefronts connected to public spaces and primarily operate through online platforms are considered invisible consumption

spaces. Specifically, within the POI data, places that meet the three conditions of 'not being on the first floor,' 'not located within a shopping mall,' and 'having non-empty online reviews' are identified as invisible consumption spaces.

The floor level information is derived from the address text within the POI data. When the address contains floor level information, the corresponding floor level is determined by searching, extracting, and standardising specific format key fields. If the address does not contain this information, it suggests that there is no requirement to specify the floor level in people's perception, and therefore, the default floor level is considered to be 1. Consequently, a floor level attribute label can be assigned to all POI data. The screening of internal shops in the shopping mall is completed using ArcGIS. POI data located within the shopping mall area, with a floor level less than or equal to the total number of floors of the shopping mall building, are considered shopping mall internal shops and are excluded. In addition to the store POI data, the attribute data of the buildings where invisible consumption spaces are located mainly come from relevant websites and field surveys (Table 2).

Table 2. Summary of data on buildings

Basic attribute	Name, type (office/commercial/residential/hotel, etc.), age, number of floors, standard floor area, standard floor height
Economic attribute	Sale price (10,000 yuan/m^2), rent price (yuan/m^2/day), property fee (yuan/m^2/month)
Management attribute	Owner property rights, property management, access control
Facility attribute	Independent water supply

Data source: The basic attributes, economic attributes, and property information of office/commercial/residential buildings are obtained from Diandianzu.com, Fang.com, and Anjuke.com. Additional information is collected through field surveys.

3.2 Spatial Distribution Characteristics of Invisible Consumption Spaces in Nanjing Old City

After the aforementioned data processing, it was ultimately determined that there are a total of 1,919 invisible consumption spaces in Nanjing old city (Figure 1, Table 3). It can be observed that spaces in the categories of life services, educational services, and entertainment services constitute the main components of the invisible consumption spaces. Compared to traditional stores, these spaces, although smaller in scale, are characterised by more distinctive operations and offer more customised and experiential services. This enables them to compete differently from traditional business and appeal more strongly to their target demographic, which is mainly young people.

Table 3. List of types, representative shops, and classification statistics of invisible consumption space in Nanjing old city

Types	Representative shops	Numbers	Proportion (%)
Catering services	Cat cafe, handmade dessert shop, private bakery, etc.	74	4

Shopping services	Suit customisation studio, jewelry customisation studio, etc.	56	3
Educational services	Foreign language learning, after-school tutoring, art training institutions, etc.	452	24
Life services	Hair salon, nail art studio, photo studio, massage parlour, etc.	1062	55
Entertainment services	Escape game room, private cinema, board game bar, etc.	132	7
Sports and leisure services	Fitness studio, Yoga studio, Taekwondo studio, etc.	103	5
Medical services	Postpartum recovery centre, psychological counselling centre, oral clinic, etc.	40	2
Total		1919	100

Data source: The author collated the POI data obtained by the Gaode Open Platform.

Figure 1. Spatial distribution of invisible consumption space in Nanjing old city

3.2.1 Distribution Characteristics: Central Agglomeration and Multi-Polar Clustering

This article utilises the Kernel Density Estimation (KDE) method, based on ArcGIS, to analyse the distribution of invisible consumption spaces in Nanjing old city. KDE measures the density of features around any given grid cell, describing the spatial aggregation state of geographical objects (Shi, 2010), and is a common method in spatial analysis. In this study, the Natural Breaks (Jenks) classification method is used to divide the data into six classes, which are then utilised to analyse the levels of aggregation of different poles (Figure 2). Multi-ring buffer zones are established around the city centre at 600-metre intervals to count the number of invisible consumption spaces and to construct a Lorenz curve. This curve is utilised to assess the level of aggregation centred around the city centre (Figure 3, Figure 4).

Figure 2. Natural Breaks (Jenks) classification by KDE analysis of the invisible consumption spaces in Nanjing old city

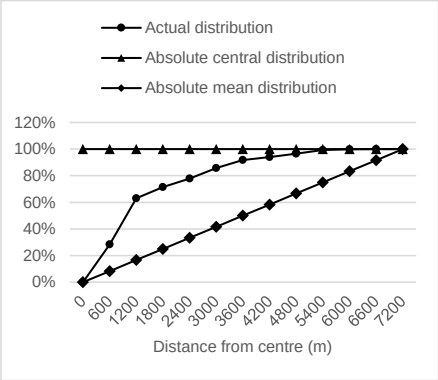

Figure 3. Lorenz curve for invisible consumption space in Nanjing old city

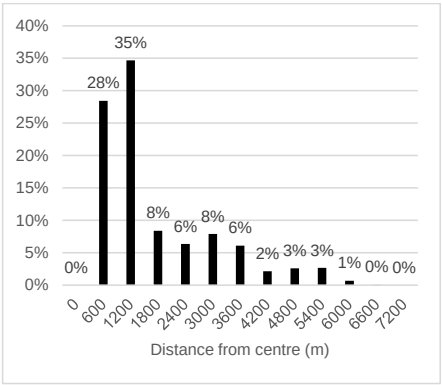

Figure 4. Statistics of invisible consumption spaces in Nanjing old city

Firstly, there is an overarching characteristic of central agglomeration. A distinct agglomeration is evident within the Xinjiekou CBD area, and the convex shape of the Lorenz curve further confirms this observation. More than 70% of the invisible consumption spaces are distributed within a 2000m radius around Xinjiekou. Additionally, secondary agglomerations can be observed in sub-centres such as Hunanlu and Daxinggong.

Secondly, on a local level, there is a characteristic of multi-polar clustering. Invisible consumption spaces are primarily located within buildings; hence, the agglomeration pattern shows a significant point aggregation. Within the Xinjiekou CBD area, they form multiple poles. The cost of operating a shop in high-rise buildings in the city centre area is much lower than that on streets and in shopping malls. As a type of microenterprise, invisible consumption

spaces are highly cost-sensitive. The multi-polar clustering formed by high-rise buildings is a result of spatial distribution driven by economic considerations.

3.2.2 Comparison of Invisible and Visible Consumption Space: Different in Proportion, Similar in Distribution

When comparing visible and invisible consumption spaces in the old city, it can be observed that there are a total of 6,561 visible consumption spaces corresponding to the categories of invisible consumption spaces, which is more than three times the number of invisible consumption spaces (Table 4). Among the visible consumption spaces, the number and proportion of shopping service spaces are much higher than those of invisible consumption spaces. These types of consumption spaces prioritise convenience and often rely on impulse buying, requiring increased visibility and accessibility. In contrast, invisible consumption spaces are mainly concentrated in experiential consumption types such as life services, entertainment, and sports and leisure.

Table 4. Numbers and Proportion of invisible and visible consumption spaces in Nanjing old city

Types	Invisible consumption spaces		Visible consumption spaces		Invisibility ratio
	Numbers	Proportion (%)	Numbers	Proportion (%)	
Catering services	74	4	789	12	0.094
Shopping services	56	3	1595	24	0.035
Educational services	452	24	713	11	0.634
Life services	1062	55	2682	41	0.396
Entertainment services	132	7	469	7	0.281
Sports and leisure services	103	5	150	2	0.687
Medical services	40	2	163	3	0.245
Total	1919	100	6561	100	0.292

Data source: The author collated the POI data obtained by the Gaode Open Platform.

Figure 5. Natural Breaks (Jenks) classification by KDE analysis of the visible consumption spaces in Nanjing old city

In terms of spatial distribution, a comparison of KDE analysis of visible and invisible spaces (Figure 2, Figure 5) shows that the overall distribution of both types of spaces is generally similar and does not exhibit significant spatial differentiation. The distribution of visible consumption spaces is relatively more extensive. In terms of density, the highest level of agglomeration for both visible and invisible consumption spaces is located in the Xinjiekou CBD area, with secondary agglomerations appearing in several sub-centres. The most apparent difference in the distribution of visible and invisible consumption spaces is observed in the Fuzimiao area. As a traditional commercial sub-centre of Nanjing, the number of invisible consumption spaces is very limited. This is mainly because the Fuzimiao area, being historical and cultural blocks, is characterised by low and multi-storey buildings, which lack the high-rise buildings required for invisible consumption spaces.

4 Micro Site Selection Influencing Factors of Invisible Consumption Spaces

4.1 Research Methods

This article selects invisible consumption spaces in the Xinjiekou and Daxinggong areas (Figure 6) to analyse the factors influencing site selection. The reasons for choosing this area are twofold. Firstly, the Xinjiekou and Daxinggong areas are the most concentrated and representative areas for the distribution of invisible consumption spaces. Secondly, as the central business area of the old city of Nanjing, it has a long history, a prosperous commercial environment, and a rich variety of spatial, functional, and economic attributes of buildings, which facilitates comparative research.

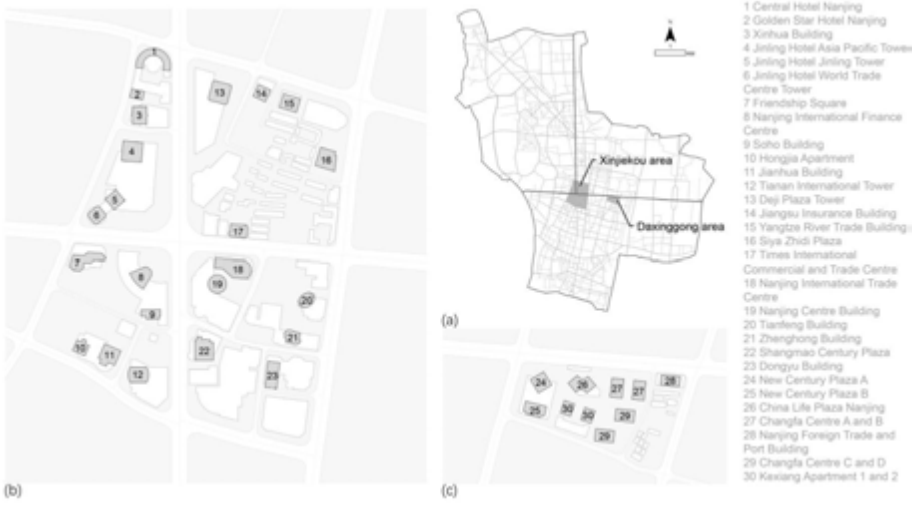

Figure 6. The research scope of Xinjiekou and Daxinggong areas
(a) Xinjiekou and Daxinggong areas in Nanjing old city
(b) Xinjiekou area and buildings
(c) Daxinggong area and buildings

The main analytical methods used in this study to research site selection factors are regression analysis and decision tree algorithms. The decision tree algorithms are inductive learning algorithms based on example data. It is commonly used to construct classification rules and form classifiers using example data. It is also used for predicting and mining unknown data and is widely applied in the fields of economic statistics and machine learning (Safavian and Landgrebe, 1991). It is also utilised in geographical space research, particularly in remote sensing information processing and urban address identification. The decision tree algorithms have the advantages of fast speed, high accuracy, easily understandable rules, and a relatively small computational load. They are suitable for both large and small sample sizes, as well as for continuous and discrete data. The basic idea is to use a hierarchical form, selecting different attribute conditions to make the most effective division of the set until significant category subsets are formed. Each path from the root to the leaf node corresponds to an extracted rule. The sample size, data characteristics, and the iterative and comprehensive relationship between the independent and dependent variables in this study fit well with the application conditions of the decision tree algorithms.

4.2 Analysis of Influencing Factors

Within the Xinjiekou and Daxinggong areas, there are 424 invisible consumption spaces spread across 30 buildings. Based on the number of stores within the building and the categories of store types (stores in a category are >= 5), buildings can be categorised into three types: first, buildings with almost no distribution of stores; second, buildings with some specific categories of stores; and third, buildings with a large number of various types of stores.

Before analysing the influencing factors, a single-factor screening is used to reduce irrelevant interference items. Based on the classification and quantification attributes of the variables, correlation, variance, chi-square, and linear regression are used to verify significance ($p <= 0.05$). The results of the single-factor screening preliminarily indicate that the site selection of invisible consumption spaces is related to building types, rental and property costs, building owner property rights, building access control, and building independent water supply, while the store floor levels, store categories, store ratings, consumption per person, and building age are irrelevant variables. Further regression analysis indicates that the clustering of invisible consumption spaces around commercial-residential buildings is the most effective factor in explaining the distribution of these spaces. In fact, in the Xinjiekou and Daxinggong areas, almost all buildings with a large number of invisible consumption spaces are commercial-residential buildings. The tendency for invisible consumption spaces to be concentrated in commercial-residential buildings is highly significant.

On this basis, the decision tree algorithms are further utilised to analyse the influencing factors through a hierarchical classification method. The dependent variable is the three situations of the buildings with invisible consumption space, with the growing method set to CRT. The results show (Figure 7) that rental and property costs, owner property rights, access control, and independent water supply have a significant impact on the site selection of invisible consumption spaces.

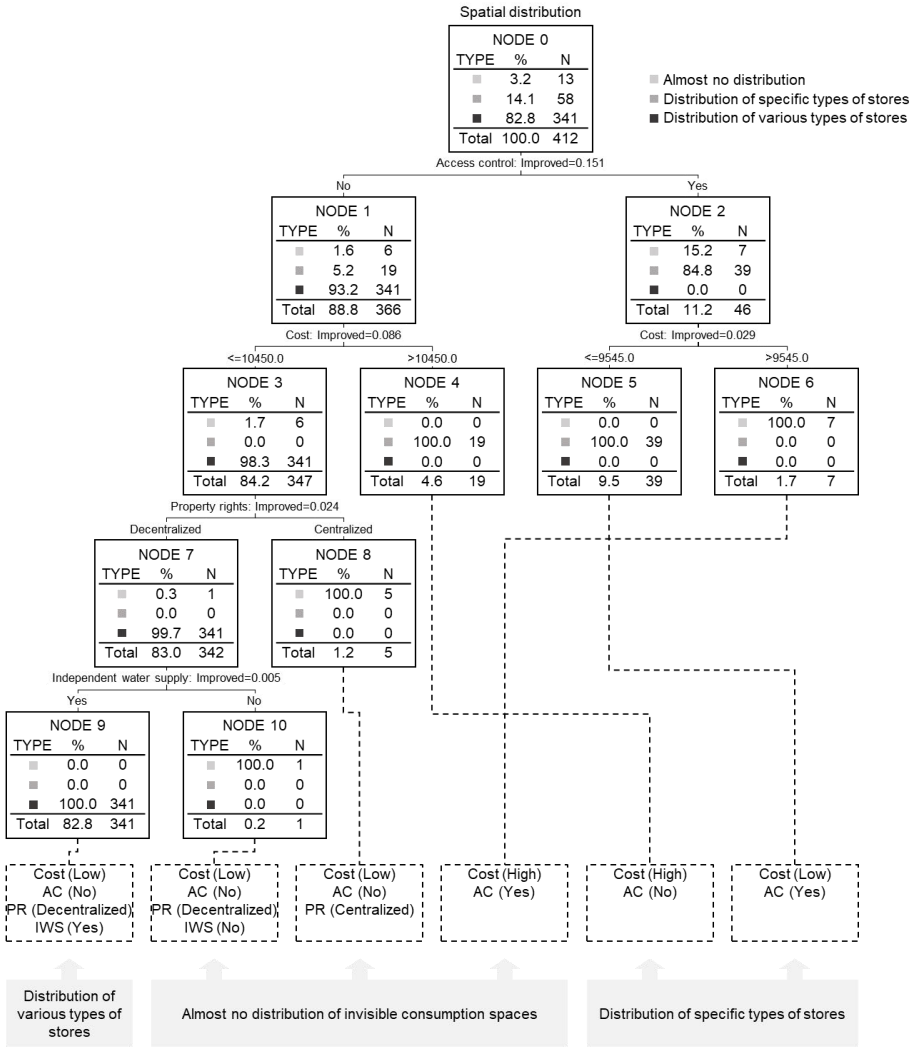

Figure 7. Process and results of decision tree algorithm

Specifically, the owner property rights, property management, and cost attributes of the buildings affect the numbers and types of invisible consumption spaces. Figure 7 shows that

the influencing factors of the three situations are different. Leaf node 1 indicates that when costs are low, owner property rights are decentralised, there is no strict access control, and there is an independent water supply, there are a large number of various types of stores present in the building. Leaf nodes 4 and 5 indicate that when costs are high or low but strict access control is in place, only specific types of stores are present in the building. Stores in buildings with strict access control are all appointment-based, membership-based life service spaces such as beauty salons and clubs. High-cost buildings only have a small number of language learning and study abroad institutions. Leaf nodes 2, 3, and 6 indicate that in cases where there is no independent water supply, property rights are consolidated, costs are high, and strict access control is enforced, there are almost no invisible consumption spaces within the building. This includes buildings with consolidated property rights that are not leased out, as well as high-end office buildings.

5 Conclusion and Discussion

5.1 Conclusion

Invisible consumption spaces, facilitated by the Internet and developed through O2O methods, represent a new form of consumption spaces in cities that has grown to a significant scale and cannot be ignored. In terms of spatial distribution, there is a macro characteristic of agglomeration towards central areas. This suggests that although invisible consumption spaces operate through the Internet, as physical consumption spaces they are still influenced by spatial elements in central areas. There is a micro characteristic of multi-polar clustering, with high-rise commercial-residential buildings serving as the main carriers for the clustering of invisible consumption spaces. This choice is based on multiple considerations, including cost, management, and support facilities.

5.1.1 The Spatial Distribution of Invisible Consumption Spaces Conforms to the Rule of General Consumption Space

As consumption spaces operate through O2O methods, traditional geographical theories still play a role in the site selection of invisible consumption spaces. The analysis in the previous text shows that the distribution of invisible consumption spaces is generally similar to that of visible consumption spaces. Firstly, on a macro level, the agglomeration centres of invisible consumption spaces are still the traditional business centres of Nanjing. Although the cognitive path of invisible consumption spaces is in cyberspace, they still need to complete the consumption in physical space. Therefore, factors such as traffic accessibility and commercial agglomeration effects, derived from geographical theories, still play an important role in their site selection. Secondly, compared with visible consumption spaces, invisible consumption spaces have a higher degree of agglomeration, showing characteristics of polar clustering in microform; that is, they are more concentrated in a particular building. Thirdly, there are significant differences in the composition and proportion of business formats between visible and invisible consumption spaces. The proportion of life services, entertainment, and sports and leisure in invisible consumption spaces is higher. This is related to the personalised and

experiential characteristics of these business formats and also reflects people's demand for diverse consumption spaces.

5.1.2 The Factor of Cost Leads to the Clustering of Invisible Consumption Spaces to Commercial-Residential Buildings in the City Centre

The commercial and service industry is cost-sensitive, and rent has a profound impact on the selection of commercial locations. This is also evident in the site selection of invisible consumption spaces. Firstly, by examining the cost factors, it is found that compared with other commercial spaces, the buildings where invisible consumption spaces are concentrated mostly have lower rent costs. Only business formats with stronger tenancy capabilities, such as foreign language training and study abroad counselling institutions, choose to locate in buildings with higher costs. Cost has become a determining factor for the types of businesses that can operate in these locations. Secondly, the analysis in the previous text revealed that invisible consumption spaces tend to favour commercial-residential buildings for their operations. Commercial-residential buildings emerged in the 1980s in some metropolises and have evolved to the present day. They are often criticised for their resource consumption, disaster prevention capabilities, environmental quality, and community atmosphere. This criticism has led to their rents being much lower than the average level in the same location. Against the backdrop of the internet era, the low rental costs of commercial-residential buildings happen to meet the needs of invisible consumption spaces, becoming a fertile ground for the development of invisible consumption spaces.

5.1.3 Management and Support Are Crucial Factors that Constrain the Distribution of Invisible Consumption Spaces

As consumption spaces within buildings, the spatial distribution of invisible consumption spaces is greatly constrained by the management and support of the buildings. Firstly, the impact of property rights on the distribution of invisible consumption spaces is mainly reflected in the differentiation between buildings with unified property rights and those with dispersed property rights in their approach to the emergence of invisible consumption spaces. High-end office buildings with integrated property rights, taking into account the overall environment and image, often carry out unified tenant recruitment, unintentionally excluding small and distinctive invisible consumption spaces. In contrast, commercial-residential buildings with dispersed property rights are controlled by different owners, and thus, under reasonable market prices and within the scope of legal use, owners typically do not impose additional requirements or restrictions on the entities that enter.

Secondly, building access control is also a factor that restricts the entry of invisible consumption spaces. The frequent movement of people in and out conflicts with strict access control measures. Therefore, under a strict access control management model, the invisible consumption spaces within are typically high-end service institutions that function based on appointments or memberships.

Thirdly, building support systems plays a crucial role in the establishment of certain types of business models, particularly independent water supply, which is essential for businesses like hair salons and catering services. Some buildings are unable to attract these types of business formats due to the lack of individual water supply systems. Thus, management and support determine the differentiation of invisible consumption spaces at the building level.

5.2 Discussion and Outlook

5.2.1 Invisible Consumption Spaces Are a Novel Form of Urban Space Regeneration in the Internet Era

With the Internet gradually becoming deeply integrated into people's everyday lives, the form of urban regeneration is also shifting from a focus on physical space renewal to a more comprehensive compound regeneration. The process of urban regeneration can be seen, to some extent, as a multi-dimensional and multi-element space production process involving entrepreneurship, employment, and business space. As a type of micro-entrepreneurial space, invisible consumption spaces have their own value. For the city, invisible consumption spaces can significantly enhance the efficiency and value of inefficient high-rise buildings, inject new vitality into a large number of vacant buildings such as commercial-residential buildings, effectively regulate the mismatch of land use and building functions, and serve as a bottom-up innovative driving force in the revitalisation of the old city. In addition, invisible consumption spaces facilitate job creation, foster innovation, diversify consumption options, support the structural reform of urban everyday life consumption, and address the increasing demand for an improved quality of life. Some invisible consumption spaces have potential cultural value because they reflect global and local dramatic unity. Through reproduction on the Internet, they have evolved into a subcultural phenomenon.

5.2.2 The Interaction between Physical Space and Cyberspace Will Generate New Forms of Urban Space

The Internet has partially replaced the functional roles of physical space, subsequently bringing about changes in everyday lifestyles and the logic of spatial distribution, enriching the forms of consumption spaces. Online and offline consumption spaces are not mutually exclusive but have interactive, complementary, and interconnected relationships. Invisible and visible consumption spaces are not in complete competition but rather promote each other through differentiated competition to meet diverse needs. With the continuous development of ICT and the advent of the Internet of Everything, new consumption spaces represented by invisible consumption spaces will face more diverse and complex changes. They have broad development potential and offer promising prospects for research.

This article presents empirical research on the old city of Nanjing, revealing the distribution characteristics and influencing factors of invisible consumption spaces to some extent. However, the study utilises POI data from a single platform, and the accuracy, comprehensiveness, and timeliness of the data still necessitate cross-verification with multiple data sources. The research

presented in this article is just a starting point, and there is a need for further exploration in areas such as the relationship between the distribution of invisible consumption spaces and urban structural elements, horizontal comparative studies between different cities, and longitudinal studies on historical evolution.

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Can Fast Urban Growth Be Low-carbon? Sub-Saharan Cities Towards New Territorial Strategies

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Abstract
Sub-Saharan Africa is now experiencing rapid urban growth. Considering that buildings account for most of the world's greenhouse gas emissions, guiding such an urban development towards low carbon is vital. With such an aim, this study focuses on the case of Lusaka, the capital of Zambia, which is subject to a rigid and partially outdated urban development system and lacks a deliberate policy addressing sustainable urban growth.
This study aims to demonstrate how, in the context of Lusaka, renewable technologies can contribute towards a net zero strategic territorial development. First, a systematic review of the integration of residential rooftop solar photovoltaics (RPVs) was undertaken; second, an in-depth purposive-sampled semi-structured interview with a local expert was conducted; third, the combination between renewable technologies and urban development was explored; finally, the systematic integration of RPVs based on the following four factors was proposed: (1) site coverage, (2) floor area ratio, (3) number of storeys, and (4) dwellers' density.
Results show a range of feasible hybrid solutions for addressing Lusaka's electricity needs. Furthermore, this study demonstrated that on-site energy production can influence both horizontal and vertical dimensions of buildings of energy self-sufficient energy communities: the maximum number of storeys, the maximum number of dwellers and, consequently, the floor area ratio. This study aims to pave the way towards regulated, strategic and sustainable territorial development by illustrating an easily replicable strategy.

Keywords: Fast urbanisation; Territorial strategies; On-site energy production; Sub-Saharan Africa; Lusaka

1. Background

Cities consume three-quarters of natural resources and generate equivalent greenhouse gas (GHG) emissions (Pardo Martínez et al., 2021). Today, one of the main challenges is reducing such consumption to tackle climate change. Climate resilience, energy performances of old and new buildings, and responsive urban planning—with well-defined and structured objectives—

have been identified as significant determinants of this challenge (IEA, 2022b). While spatial planning can facilitate climate actions (Hurlimann and March, 2012), 'a larger number of environmental crises take place in countries subject to high and rapid rates of urbanisation, fast urban sprawl, urban informality and weak urban governance' (Myers, 2011), often happening in developing regions of the world.

In 2020, despite hosting one-fifth of the world's population, Africa reported the lowest carbon emissions per capita (IEA, 2022b). This favoured condition, however, did not exempt the African metropolises—currently 'the epicentre of global urbanisation' (UN/ECA, 2017)—from being affected by the rampant consequences of global climate change and from facing global[ised] cities' challenges (Bini and d'Alessandro, 2017). In the period to 2050, the African continent is indeed forecasted to face the biggest floor area expansion in the world, with its building stock reaching about 50 billion square metres, doubling its current size (IEA, 2022b). The critical condition lies in the emergence of large cities despite low national income levels, leading to difficulties in providing essential services and infrastructures (Kriticos, 2019) and amplifying the already present effects of climate change, particularly in urban areas (IEA, 2022b).

1.1 . Zambia: climate change actions towards sustainable urban development.

Zambia, among other countries in the Sub-Saharan region, has been dealing with the sustainability of urban growth for a long time. In 1994, the nation embarked on a strategy of sustainable urban expansion to address the challenges of poverty, inequality, a declining economy and the government's limited capacity to provide essential public services (Makasa et al., 2010; UN-HABITAT and UNEP, 2009); during that period, the Ministry of Local Government and Housing (MLGH) developed the National Housing Policy, which called upon the private sector and local communities to engage in the planning and execution of 'sustainable human settlement projects' (UNDP, 1997). In subsequent years, the nation implemented various programmes, engaged in several initiatives, and developed new legislation to address the complexities of rapid urbanisation (Myers, 2011; UN-HABITAT and UNEP, 2009; Musonda, 2018). In 2015, the enactment of the Urban and Regional Planning Act No. 3 was expressly designed to provide additional guidance for implementing sustainable urban and rural planning and development (MNDP, 2020). In 2016, the nation amended its constitution to incorporate sustainable development as a fundamental national principle, aligning with the objectives outlined in the 2030 Agenda (MNDP, 2020). Therefore, the formulation of the National Urbanisation Policy in 2018 was driven by the need to tackle the challenges highlighted by the United Nations Sustainable Development Goal (SDG) 11: '(a) proliferation of informal settlements, (b) absence of supportive city form and functioning system of cities, (c) weak institutional and regulatory framework for urban development' (MNDP, 2020). As such, the National Housing Policy underwent revision in 2019, and an Implementation Plan was formulated to support 'sustainable, decent and affordable housing for all' (MNDP, 2020).

Notwithstanding persistent endeavours to address climate concerns via legislative measures and policy development, Zambia remained classified as a nation particularly susceptible to climate change in 2021 (COMESA, 2021). Consequently, the government presented a climate action plan to the United Nations Framework Convention on Climate Change (UNFCCC) in 2022, aiming to adapt to climate change and mitigate greenhouse gas emissions. This plan would then aim to decrease emissions resulting from future growth, as the International Energy Agency (IEA, 2022b) reported.

Even though institutional and regulatory processes are being used to introduce SDGs (MNDP, 2020), in Zambia the diversification of the energy mix should be improved in order to deal with the effects of climate change (McPherson et al., 2018; Ismail, Metcalfe, and McPherson, 2019;

MNDP, 2020; Imasiku, 2021; IEA, 2022b; Kapole, Mudenda, and Jain, 2023), such as drought and flood cycles, which show the limits of the over-reliance on hydropower (McPherson et al., 2018; Ismail, Metcalfe, and McPherson, 2019; IEA, 2022b; Kapole, Mudenda, and Jain, 2023). In 2019, the nation's reliance on hydropower accounted for 80.6 %; other energy sources were thermal (coal-powered) at 10.1 %, heavy fuel oil at 3.6 %, solar energy at 3 %, and gas, standby gas and diesel turbines at 2.8 % (MNDP, 2020). Although the country is indeed favoured by natural potentialities being abundant in hydropower and sunlight—it has the second-highest potential for solar power in the world (UNDP, 2014)—, which leads to excellent outputs both in hydroelectric and photovoltaic (IEA, 2022b), numerous hindrances to the full adoption of renewable energies were individuated: policy and regulatory barriers, as well as technical, institutional, financial and awareness-related issues (UNDP, 2014).

1.2 . Lusaka.

Materialising the dynamics mentioned above, the province of Lusaka boasts the highest urban population growth in the country (MNDP, 2020); it is considered one of the continent's fastest-growing cities (Ismail, Metcalfe, and McPherson, 2019), 'projected to at least double between 2020 and 2050' (UN-Habitat, 2022). The city's urban growth tends to follow an extensive model, expanding through new developments on the peripheries rather than within existing areas (USAID, 2018), leading to an urban sprawl which provokes overconsumption of resources (IRP, 2018), which in turn can not be guaranteed by institutions, often relying on outdated laws (Musonda, 2018). The rigid urban development system triggered several urban challenges, further amplified by the weaknesses of urban development institutions (Chigudu, 2021), showing the evident lack of a deliberate policy addressing urbanisation challenges and accompanying sustainable urban growth (Chigudu, 2021).
In line with the Zambia Vision 2030 (RoZ, 2006), Lusaka raised its policy profile on climate change adaptation and mitigation (LCC, 2016; IEA, 2022b). The effects of climate change, however, are hitting the city: low seasonal rainfall leads to load-sheddings (periods of planned energy supply disruption) lasting numerous hours per day (Jürisoo et al., 2019; Imasiku, 2021), a situation in some cases persisting more than one year (Jürisoo et al., 2019). This phenomenon triggers the users' demand for alternative and more reliable energy technologies, independent from the national grid, often fossil fuel-based (Jürisoo et al., 2019; Kapole, Mudenda, and Jain, 2023).

2. Research hypothesis and arguments

The previous section shows the efforts of local, national and international actors to face urban and climate challenges. However, the Zambian regulatory landscape does not keep pace with the evolving built environment (Chigudu, 2021), and *business-as-usual* can not cope with existing and future challenges. Climate change-aware regulations, as supported by the National Policy on Climate Change of the Republic of Zambia, must be prioritised (RoZ, 2016).

2.1 Hypothesis

Energy challenges and urban developments are strictly linked (Castán Broto and Baker, 2017; Perera, Coccolo, and Scartezzini, 2019; Bouzarovski, 2020). The paper hypothesises that the supply of energy from renewable sources can become a parameter to control Lusaka's urban morphology for a net zero territorial development.

2.2 Arguments

The urban form, the cradle of buildings' behaviours, can be a tool to face the challenge of cities' emissions. Different types of urban settlements have been demonstrated to be drivers of spatially contextualised combinations of carbon emissions (Baiocchi et al., 2015), and the study of urban-scale development strategies must be prioritised to reach net zero (Scognamiglio, Garde, and Røstvik, 2014). The physical texture of cities, once defined, is not flexible enough to allow future changes and creates long-lasting interdependencies among land use, transport, buildings, energy demand and carbon emissions (Güneralp et al., 2017); this condition calls for an urgent 're-direction of practised planning paradigms towards more sustainable spatial development' (Stoeglehner, Niemetz, and Kettl, 2011).
At present, spatial production is strictly related to the spatial dimension of energy challenges (Castán Broto and Baker, 2017), with cities across the globe significantly influenced by energy demand (Bouzarovski, 2020) and energy demand significantly influenced by cities' forms (Perera, Coccolo, and Scartezzini, 2019).
In Zambia, a country experiencing an insufficient national energy supply (fuelled by fast horizontal urban expansion and climate change effects), energy demand is expected to increase rapidly (McPherson et al., 2018; Ismail, Metcalfe, and McPherson, 2019). In such a context, integrating renewable energy technologies during urban development becomes of primary importance. In this regard, previous literature identified fundamental parameters: Salat (2010) proved that the urban form has the potential to halve the overall energy consumption and carbon emissions, while other studies reported that urban form, the density of building and population, envelopes' technology, systems' efficiency, inhabitants' behaviour and sources of energy impact energy performances (Strømann-Andersen and Sattrup, 2011; Yang et al., 2012; Stewart and Oke, 2012; Steadman, Hamilton, and Evans, 2013; Di Bernardino et al., 2015; Salvati, Coch Roura, and Cecere, 2015; Ignatius Wong, and Jusuf, 2016; Güneralp et al., 2017; Salvati et al., 2019; Hadavi and Pasdarshahri, 2020). Moreover, urban morphology parameters, such as land coverage and average building height, are found able to anticipate the urban energy performances (Salvati et al., 2019), and the urban form is found to impact the energy system in terms of cost, system autonomy and renewable energy integration (Perera, Coccolo, and Scartezzini, 2019).
Consistently, policymaking must ensure a radical reduction in greenhouse gas emissions, considering energy-related matters at the beginning of the urban planning process (Shi, Fonseca, and Schlueter, 2017). Improving the energy mix and generation from renewable sources can be the key to closing the gap in energy deficit in Lusaka (MNDP, 2020; Imasiku, 2021). In this regard, focusing on energy demand management (Grubler et al., 2012) would shift the interest from the national scale—often focusing on the supply— to the local management (Neves and Leal, 2010), following the trajectory of an energy chain already moving in the direction of decentralised and micro-scale infrastructures (Bouzarovski, 2020), levers for managing carbon emissions (McPherson et al., 2018).

2.3 Research questions

1. Is integrating residential RPVs with an urban-scale approach feasible in Lusaka?
2. How can on-site energy production be a tool to control urban expansion in both vertical and horizontal dimensions?

3. Methodology
Seeking answers to the research questions will contribute to developing a net zero strategic territorial development. In light of the observations made by previous literature, this study will: a) investigate the supply of energy from renewable sources in terms of rooftop-solar power

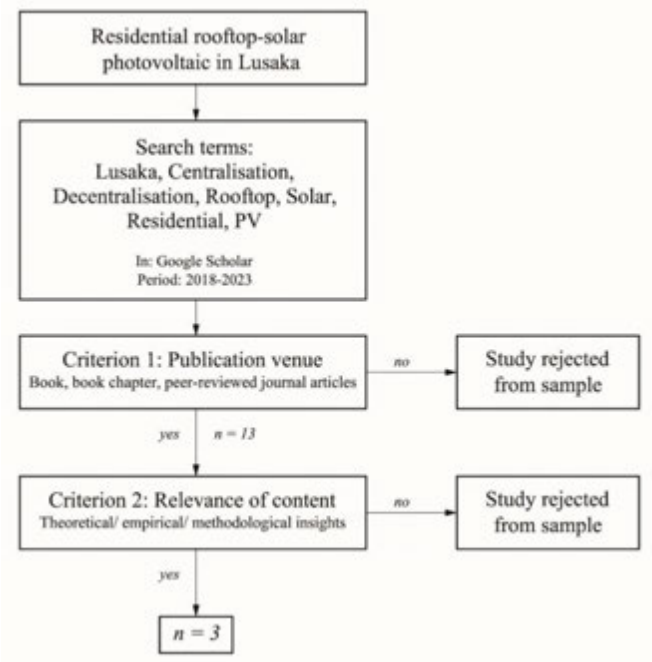
generation only; b) consider the supply of energy from renewable sources as a tool to face Lusaka's urban challenges.

This study investigates both centralised and decentralised RPV systems serving residential areas in Lusaka. Nevertheless, solar energy mini-grid systems have not been considered because of their previously verified unsustainability in the Zambian context (Stritzke and Jain, 2021; Kapole, Mudenda, and Jain, 2023). Stritzke and Jain (2021) investigated the solar mini-grids in Sinda and Mpanta, while Kapole, Mudenda, and Jain (2023) recently investigated a list of initiatives owned by both public and private institutions: Magodi mini-grid in Lundazi, Katamanda mini-grid in Chipangali, Chitandika mini-grid in Chipangali, Muhanya mini-grid in Sinda and Chibwika mini-grid in Mwinilunga. The studies observed that, although solar mini-grids are considered one of the most viable solutions to provide energy from renewables to the part of the population without access to electricity, they pose insurmountable sustainability-related limitations in the context of Zambia—in financial, environmental, and social perspectives. The public and private-owned projects were found to be financially unsustainable, especially in rural areas; in urban areas, their minimum financially sustainable residential tariff is estimated to be much above the one of the national utility ZESCO, and a lack of technical expertise hinders their implementation (Kapole, Mudenda, and Jain, 2023). The majority of the projects, however, have been defined socially—in terms of users' satisfaction and availability of electricity 24/7 (Stritzke and Jain, 2021)—and environmentally sustainable (Kapole, Mudenda, and Jain, 2023).

This premised, the study included a multiplicity of methods:

1) A systematic review (Grant and Booth, 2009) was conducted to comprehensively evaluate previous integrations of residential RPVs in Lusaka. Google Scholar was used to identify potentially relevant studies, and the terms 'Lusaka', 'PV', 'centralisation', 'decentralisation', 'rooftop', 'solar', and 'residential' were searched simultaneously. Only studies written in English from 2018 to 2023 have been selected due to the inner limitations of previous renewable technologies. The search yielded 24 works from various disciplines and venues: 12 articles, four reports, four theses, three book chapters, and one working paper. The selection was refined by including only books, book chapters and peer-reviewed journal articles, resulting in 13 pieces of work. A second refining criterion was adopted, excluding works that did not describe Lusaka's RPV strategies. Finally, the three relevant works meeting all the criteria were considered for further analysis (McPherson et al., 2018; Ismail, Metcalfe, and McPherson, 2019; Imasiku, 2021). This limited number shows an overall lack of consolidated literature on this topic.

Figure 1. Methodology adopted for the selection of articles.



2) Due to the minimal scientific work produced on the topic as of October 2023, one in-depth semi-structured interview was conducted the same month to compensate for the lack of scholarly information. The interviewee, selected by purposive sampling technique (Taherdoost, 2016) according to role and experience, was an expert in the development of renewable energy projects operating in Lusaka, holding previous experience in the development of solar projects and working for a Ministry from more than five years at the time of the interview. The interview was conducted remotely using the Google Meet tool. The respondent was requested to answer 14 open-ended questions. The interviewer encouraged free-flowing discussion; the interview lasted 1 hour and 10 minutes. Answers have been first recorded, upon explicit consent, and later transcribed. The generated transcript has been cross-checked with the recording to maintain data integrity. Finally, the RADaR technique (Watkins, 2017) was applied for qualitative data analysis.
3) Finally, the terms of combination between renewable technologies and urban development have been explored, delivering a framework for urban-integrated PV.

4. Analysis and findings

4.1 Reasons for a change

The free-flow discussion with the expert allowed the authors to gain a broad understanding. He reported that the severe load sheddings of 2014, 2015 and 2016 pushed national and international agencies not to over-rely on hydropower due to its evident limitations. Currently, the attention of the Ministry in which he operates is on the development of energy efficiency

guidelines; officials are conducting 'studies to learn how energy efficiency can be useful in urbanisation' in order to establish 'how to conserve energy at the point of use'. This understanding catalysed the authors' attention, *de facto* confirming the relevance of investigating the transitional—situated in a particular location and moment—interactions between renewable energies and urban strategies in Lusaka.

What emerged from this interview is the pivotal importance of costs and returns for the people for whom the energy systems are made: can they afford them? In this geographical and social context, future policies have to benefit everyone because 'people are part of the system as well'; in this light, activities 'to understand the social impact of grid extensions' are indeed promoted. The expert further confirmed that Lusaka is now subject to a fast increase in constructions, which follows a model of horizontal expansion moving in the direction of peri-urban areas; a higher electricity demand is consequent. Despite being 'one of the best system configurations, cost-effective', solar power generation was initially considered a non-competitive alternative due to the low tariffs of the national energy supply. 'Previously, the cost of energy was cheap, and people could afford to waste the energy. But now, as the cost of energy is slowly going up, people will be more interested in solar. We should talk about it now.' The Energy Regulation Board, in fact, lately promoted an increment of tariffs on a 5-year programme (ERB, 2023). Four incremental tariff bands are set to regulate consumption in the 'Residential' category: while the users subject to the lowest tariffs are typically not motivated to change energy sources, those subject to higher tariff bands are looking for cheaper alternatives. Accordingly, the implementation of RPVs in low-income communities would face a multiplicity of challenges—including the possibility of accessing the less expensive tariff band and the inadequacy of the building stock—; differently, middle- and high-income neighbourhoods are ideal targets for implementing RPV systems. Integrating solar power generation into users' buildings would contribute to a) demand for less energy from the national supplier and b) avoid the physical extension of the energy grid and the related challenges.

4.2 Centralisation or decentralisation in Lusaka?

Ismail, Metcalfe, and McPherson (2019) evaluated the feasibility of centralised and decentralised (both on-grid without battery-storage components and off-grid with battery-storage components) solar power generation, estimating the urban rooftop potential in Lusaka and rural Zambia, to address Zambia's electricity deficit 'attributable to climate disturbances and the nation's rapidly increasing electricity demand' (Ismail, Metcalfe, and McPherson, 2019). The study found that centralised solar generation can produce generation/cost ratios comparable with existing hydro generation ratios. In Lusaka, the study showed that a fully decentralised approach would be much more costly than the existing rate. Several hybrid generation scenarios were thus investigated, with the 70 % centralised and 30 % off-grid decentralised scenario best addressing the electricity shortages until 2030. In such a scenario, solar energy would provide affordable power and fast planning/implementation while offering autonomy to users. The study further highlighted the importance of collaboration between local and national institutions to develop long-term renewable energy legislation (Ismail, Metcalfe, and McPherson, 2019). McPherson et al. (2018) also showed that up to 50 % of total electricity demand could be met by decentralised solar photovoltaics—20 % more than what was found by Ismail, Metcalfe, and McPherson (2019)—if the energy generated is directly used. In this hybrid process, the system's low transmission expansion cost would outweigh the high storage costs (McPherson et al., 2018).

Imasiku (2021) tested the applicability of solar photovoltaic performance for grid-connected households in Lusaka (on-grid decentralised approach with battery-storage components). This hybrid model was demonstrated to alleviate the power load sheddings, meeting the demand

when hydroelectric could not, with users able to sell the excess power to the utility (configuration of a power purchase agreement). A two-bedroom house was considered for the load sizing, and the system included one residential RPV module of 1.6m^2 (China Sunergy-Nanjing CSUN285-60M), one inverter (Jiangyin HR-240P-AC/BbP)—both with low efficiency, chosen to mirror the availability on the Zambian market—and a storage battery connected to the direct current. Technical information on the model design (system design, losses, technical characteristics of photovoltaic module and inverter, system cost, etc.) is not relevant to the purpose of this study. Finally, Imasiku (2021) demonstrated that the two-bedroom household's nominal peak-hour energy consumption for middle-income earners in Zambia could be successfully met by on-site energy generation.
In summary, the feasibility of both centralised and decentralised (on-grid with/without batteries, off-grid) RPV energy generation in Lusaka was evaluated, showing that:

a) Hybrid solutions best address the need for electricity. The 70 % centralised and 30 % off-grid decentralised (with battery-storage components) scenario is the most favoured regarding costs and planning/implementation feasibility. The off-grid component was observed to be feasible up to 50 % if the solar power is directly supplied.
b) On-grid decentralised systems (with battery-storage components and commercial low-efficiency inverters and modules) have been demonstrated to meet the supply, allowing users to sell the energy surplus to the utility grid.
c) The interviewed expert confirmed that one system can not be chosen *a priori* over the other one. In the case of households using electricity only during the daytime, for example, a storage battery would not be necessary because of direct consumption. A battery would be necessary if a relevant percentage of the activities were to be operated at night. Operations to test the average loads would be thus needed before a realistic choice.

This study provided thus a range of feasible alternatives. It is important to note that the complex modelling of individual connections would have gone beyond the scope of the study, which is instead interested in understanding the feasibility of integrating residential PV with an urban scale approach.

4.3 Self-sustaining urbanisation: an approach towards net zero.

While the range of feasible renewable technology alternatives was investigated and reported in sections 4.1 and 4.2, the terms of combination with the urban development are presented below. Urban form factors have been previously recognised to have a pivotal role in urban planning and renewable energy integration and will thus be considered in this study section. The relevance of the urban form factors used in Perera, Coccolo, and Scartezzini (2019)—which investigated the influence of urban form on the grid integration of renewable energy technologies and energy systems design—has been cross-checked with other consolidated studies (Ratti, Baker, and Steemers, 2005; Salat, 2010; Strømann-Andersen and Sattrup, 2011; Yang et al., 2011; Stewart and Oke, 2012; Steadman, Hamilton, and Evans, 2013; Di Bernardino et al., 2015; Salvati, Coch Roura, and Cecere, 2015; Ignatius, Wong, and Jusuf, 2016; Güneralp et al., 2017; Salvati et al., 2019; Hadavi and Pasdarshahri, 2020; Ahmadian et al., 2021); the factors considered were: the Ground Floor Area [m^2], the number of storeys, the Treated Floor Area [m^2], the Sky View Factor (SVF), the Floor Area Ratio (FAR), the Site Coverage [%] and the Form Factor (FF). However,

a) a low-rise horizontal expansion characterises the context of Lusaka; for this reason, the authors evaluated the inclusion of the Sky View Factor as unnecessary for this study;

b) both the Treated Floor Area and the Form Factor are related to the thermal envelope (Perera, Coccolo, and Scartezzini, 2019), of which the investigation would go beyond the scope of the study;
c) in the cross-checked studies, particular importance was given to the density of people living in a given space, which is strictly related to land use and land surface; this factor has thus been considered in this study.

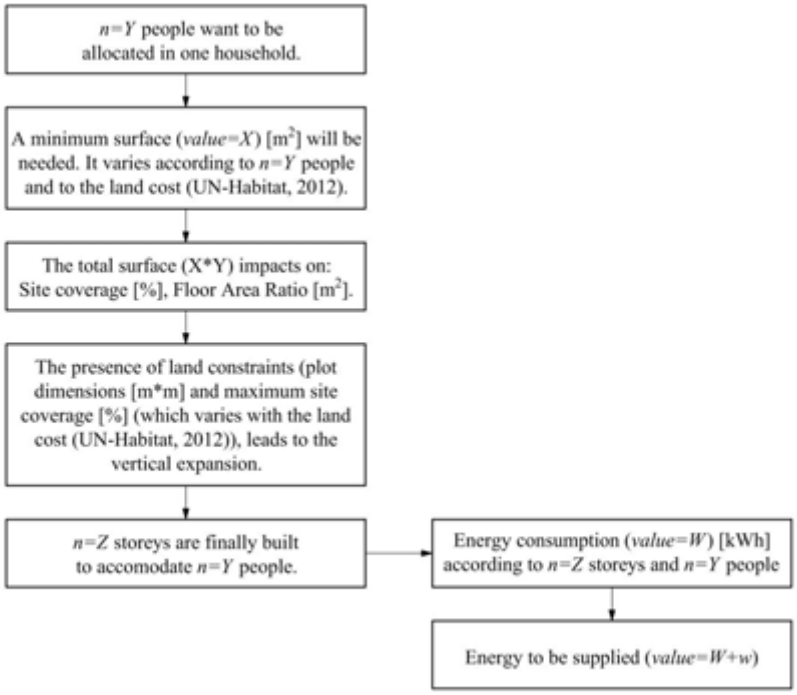
From an urban planning perspective, the following factors have been considered: Site Coverage [%], Floor Area Ratio (FAR), number of storeys, and dwellers' density. Regulations and standards related to:

i) land use and cost, plot size, site coverage, distances from boundaries and ratio area/population can be found in UN-Habitat (2012) and Chitengi (2015);
ii) the size of windows and habitable rooms can be found in the Public Health Act (GoZ, 1995);
iii) the height of buildings can be found in the Urban and Regional Planning Act, n. 3 of 2015 (GoZ, 2015);
iv) the installation of solar panels on buildings can be found in the Urban and Regional Planning Act, n. 3 of 2015 (GoZ, 2015), and on ERB website (2023).

4.4 Conceptualisation

Urban expansion, driven by housing demand, is here investigated in terms of horizontal and vertical growth, considering dimensional factors. Horizontal growth adds more ground floor space and directly relates to site coverage; vertical growth, in contrast, maintains the same ground floor space and site coverage but increases the number of storeys and the floor area ratio (Perera, Coccolo, and Scartezzini, 2019). These factors behave as variables, varying with the number of dwellers (constant) by following the minimum standards in the Public Health Act (GoZ, 1995). Finally, urban form and human behaviours lead to a specific energy consumption, which consequently suggests the amount of energy that should be supplied (Figure 2).

Figure 2. Logic representation of the process.



4.5 Upside-down perspective

This study aims to understand if on-site energy production can be a parameter to control and moderate urban expansion. The authors thus investigated the on-site energy generation as a constraint for horizontal and vertical expansion by capping the maximum energy consumption by a building to the maximum amount of energy produced. By a domino effect, this essential constraint can influence all the previously considered urban factors (Figure 3). Finally, the maximum on-site energy production could influence the maximum number of storeys, the maximum number of dwellers and, consequently, the floor area ratio. This approach shows how the number of storeys and the allowed floor area ratio increase by raising the maximum on-site energy production. The novelty of this system lies in relating often unrelated metrics towards a regulated and strategic territorial development.

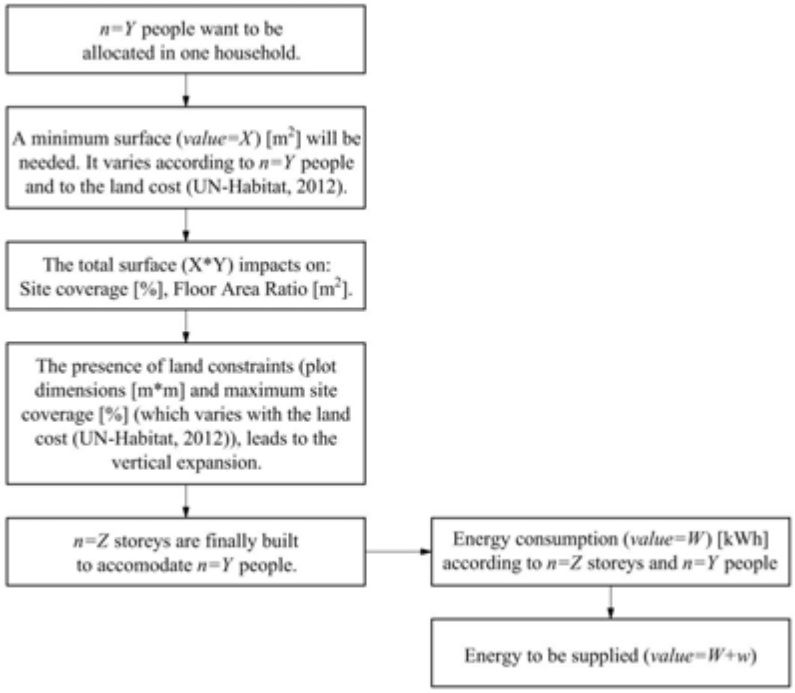


Figure 3. Theoretical prototype for urban-integrated photovoltaics.

4. Impact, significance and outputs

Can the current Zambian building regulatory landscape answer urban and climate challenges? Chigudu (2021) was critical: the rigid urban development system triggered over time several urban challenges, showing the evident lack of a deliberate policy addressing urbanisation challenges and accompanying sustainable urban growth; climate change-aware regulations, as supported by the National Policy on Climate Change of the Republic of Zambia, must be now prioritised (RoZ, 2016).

This study aimed not only at demonstrating that the implementation of renewable technologies can become a tool towards the development of urban strategies in the context of Lusaka but also at moving attention to the possibility of using the already ongoing horizontal expansion as the cradle for its own change (as explored in Fiacco and Talamini, 2021). The originally unfavoured condition was overturned: the fast horizontal expansion did not represent just an urban challenge but was exploited to ensure energetic independence for new urban developments. If applied at a large scale, this approach would address both urban and energy challenges by moderating horizontal and vertical growth through clean energy production. This urban-driven energy transition would limit the exposure to the risks deriving from fast urban development and climate change, further contributing to the development of pathways not yet investigated. The study demonstrated that the maximum on-site energy production can influence the maximum number of storeys, the maximum number of dwellers and, consequently, the floor area ratio; the on-site energy production could be linked to vertical and

horizontal growth. The novelty of this approach was indeed in the innovative relating of metrics and indicators towards a regulated and strategic territorial development.
This process can a) stimulate both private and public sector to invest in on-site energy generation, especially when in connection with residential land use, paid back by the increase in FAR, with the consequent possibility to build a higher number of units and allocate a higher number of dwellers; b) relieve the national energy utility, guaranteeing supply independence to users; c) represent a reference for a future easily-replicable self-sustaining urbanisation, avoiding a blind urban development leading to energy-hungry verticalism or horizontally hyper-extended and not well-managed spaces, which would ultimately risk becoming unlivable (Lall et al., 2021).
Urban scale strategies can only be pursued through policies that incentivise the systematic integration of renewable energy sources in new constructions, raising awareness among users and providing financial incentives and support (Ismail, Metcalfe, and McPherson, 2019). Bharwani et al. (2023) explained that locally-led and sustainable urban planning can be reached by supporting the diverse stakeholders (such as city councils and local universities) to co-create priorities, goals and knowledge around specific projects, considering the lived experience of local people alongside scientific inputs. A shift from 'government' to 'governance' (Scott, 2017) is necessary, where urban governance is meant as the 'multiple ways through which city governments, business, residents, and civil society organisations interact in managing the urban space' (Scott, 2017).

Author Contributions

Conceptualisation: FF, GT; Methodology: FF; Investigation: FF, KJ; Writing - Original draft preparation: FF; Writing - Review & Editing: FF, GT, KJ; Visualisation: FF; Supervision: GT; Project Administration: FF, GT.

Originality

The authors declare that the content of this research was presented at the "2023 Architecture Conference '*Development of Climate Sensitive Building Regulations for Zambia: the need for a collaborative effort by all stakeholders'* held by the Zambia Institute of Architects (ZIA) in Lusaka (Zambia), on November 22-24, 2023.

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Research on Strategies for Enhancing Urban Spatial Resilience in Shanghai Based on the Connotations and Characteristics of "Resilient Cities"

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Abstract: This paper explores the enhancement strategies for urban spatial resilience in Shanghai by defining, interpreting, and identifying the characteristics of "urban spatial resilience." Firstly, it analyses the relationship between resilient cities and urban spatial resilience. Secondly, it examines the systemic composition, organisational methods, and representation of resilient cities, revealing three essential contents—hierarchical structures, resilience mechanisms, and resilience representations—and four fundamental characteristics (13 attributes): capacity, structure, mechanism, and representation. Thirdly, it reviews the urban spatial planning, spatial expansion changes, and urban compactness variations in Shanghai since 1985. Finally, the paper identifies current issues in Shanghai's urban spatial development and proposes strategies to enhance its urban spatial resilience.

Keywords: Resilient Cities, Spatial Resilience, Shanghai, Construction Principles, Enhancement Strategies

1. Introduction

Urban areas today face many crises and challenges, including global warming, increased extreme weather events, and urban flooding, which render urban systems vulnerable and susceptible to disturbances. Since the inception of the "resilient city" concept, it has emerged as a new paradigm for addressing urban risks and uncertainties, garnering sustained interest from both the academic and political realms (Sharifi, 2019). Resilience thinking posits that cities are self-regulating complex systems (Holling et al., 2002), with resilient cities serving as tools to cope with uncertainty. Constructing resilient cities or enhancing urban resilience has become crucial for cities to face various challenges and achieve long-term sustainable development (UNDRR, 2013). This understanding has gradually evolved into a global consensus. The theory of resilient cities views urban areas as open, complex mega-systems, offering significant scientific guidance for urban planning and construction practices aimed at protecting the lives and properties of residents and enhancing urban functionality.

Since 2016, Shanghai has issued a series of policy documents aimed at enhancing urban spatial resilience, such as the "RISE" Vision Goals Framework for Shanghai's Urban Development over the Next 30 Years (2016), the Shanghai City Master Plan (2017-2035) (2018), and the Shanghai Urban Operation and Safety Development Report (2019-2020) Blue Book (2021). These documents repeatedly emphasise the importance of strengthening resilient city construction and achieving compact urban development and propose that by 2035, Shanghai will be fundamentally established as a "resilient city" capable of addressing various developmental risks and swiftly recovering from them. To counter issues such as continuous urban sprawl, population concentration in central urban areas, and the slow development of new cities, Shanghai advocates for a compact metropolitan spatial pattern and a transition from extensive expansion to baseline constraint and intrinsic development (Shaobo et al., 2019). Thus, constructing resilient cities and enhancing urban spatial resilience are among the critical planning objectives for current urban development in Shanghai.

Urban spatial resilience has emerged within the development and evolution of resilience, resilient cities, and urban resilience. Therefore, it is necessary to delineate and clarify the relationships among resilience, resilient cities, urban resilience, and urban spatial resilience. This paper is based on analysing the concepts, contents, and characteristics of resilience, resilient cities, urban resilience, and urban spatial resilience. It proposes a theoretical model for urban spatial resilience and examines the development trajectory, current issues, construction principles, and urban spatial resilience enhancement strategies in Shanghai. The research conclusions presented here are intended to deepen the understanding of urban spatial resilience among city managers and researchers. This deeper understanding facilitates a more thorough grasp of the concepts, contents, and characteristics essential for building resilient cities, providing valuable insights and references for urban development strategies.

2. Definitions, Connotations, and Characteristics of Resilient Cities

2.1 The Concept and Evolution of Resilient Cities

The concept of "resilience" has been extensively applied across multiple disciplinary fields such as engineering, psychology, disaster studies, economics, management, social sciences, and environmental science. Although descriptions of "resilience" vary among disciplines, they all emphasise its characteristics related to absorption, resistance, maintenance, self-organisation, adaptation, learning, and transformation. Following the perspective of Professor Shen Qingji, this paper defines "resilience" as the capacity of a system to maintain or restore its necessary functions in the face of disturbances, adapt to changes, and swiftly transform when its adaptive capacity is constrained.

Similar to other fields, the concepts of "Urban Resilience" and "Resilient City" emerged when applied to urban systems. The term "Resilient City" was first introduced by Local Governments for Sustainability (ICLEI) during the 2002 United Nations Summit on Sustainable Development. It emphasised a systemic construction process combining material aspects such as engineering improvements and facility enhancements with social dimensions, including public participation and institutional innovation, to enhance the overall resilience of urban systems. While there is no unified definition of a resilient city within the academic community to date, there is a consensus on its connotation and value: a resilient city possesses diverse disaster adaptation capabilities. Research varies from focusing on urban stability reconfiguration under environmental impacts, highlighting the rapid adaptive system characteristics of cities, to emphasising the adaptive capacity of cities and their residents to risks, yet all converge on the core notions of "stability," "resistance," and "adaptability." By analysing the interrelations among resilience, resilient cities, urban resilience, and urban spatial resilience, this paper further explicates the definition of a resilient city as a type of advanced urban form that possesses strong adaptive and learning capacities, effectively responds to significant urban disturbances such as climate change threats, ecological issues, public health incidents within a particular spatiotemporal scope, promptly restores structural and functional stability, and continues to evolve beneficially.

This paper classifies international research on resilient cities into four stages: nascent, initial, rapid, and reflection continued development (Figure 1). From the perspective of evolutionary trends, early research on resilient cities focused on human psychological resilience and ecosystem resilience, gradually transitioning to diverse studies targeting different components and processes within urban socio-ecological systems. The scope of the inquiry has shifted from

initially addressing common natural disasters and risks to increasingly dealing with emerging urban environmental and social issues, as well as derivative problems, thereby deepening integration with the discipline of urban planning.

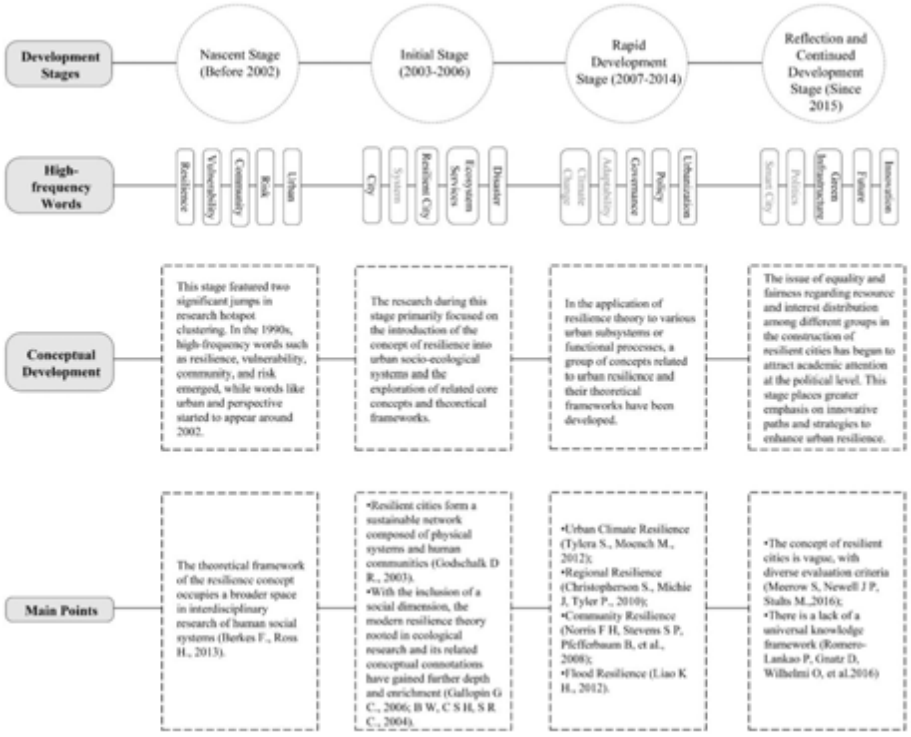

Figure 1: Evolutionary Stages of the "Resilient City" Concept

2.2 The Connotations of Resilient Cities

Based on an examination and analysis of the existing literature on "resilience," "urban resilience," and "resilient cities," this paper categorises the intrinsic connotations of resilient cities into three core components: hierarchical structures, resilience mechanisms, and resilience representations, covering the systemic composition, organisational methods, and representational forms of resilient cities (Figure 2).

Figure 2: Diagrammatic Representation of the Information Structure of Resilient Cities

(1) **Hierarchical Structure:** Refers to the stable structure formed by resilient cities' subsystems, system levels, and system elements under specific mechanisms. It represents resilient cities as complex systems.

(2) **Resilience Mechanisms:** Historical experiences indicate that urban development is long influenced and constrained by natural environments and human will, gradually evolving capabilities that maintain urban functions and structures and foster benign urban development. These capabilities are manifest in adaptive and learning abilities. The operational mechanisms of resilient cities serve as the analytical basis for examining the logical connections between their hierarchical structures and resilience representations. In integrating urban components and influencing factors, four resilience mechanisms have emerged to maintain urban structural stability—stability, sensitivity, resistance, and recovery—based on the two capability features (system organisational rules).

(3) **Resilience Representations**: From a psychological perspective, representation refers to the method by which segments of world information stored in the human mind are depicted or described, as well as how objects exist within individual psychology. Representation theory elucidates the connections between the representational information of objects and their physical or non-physical forms, linking information with people's perceptions of specific objects or events (Distin, 2005).

The representational forms of "resilient cities" are meant to express their intrinsic meanings, consisting of tangible and intangible urban characteristics. This study categorises the core connotations of "resilient cities" into four aspects based on urban components' material and non-material properties: urban spatial resilience, urban ecological resilience, urban social resilience, and urban economic resilience. These four cores are represented in different cities in varying proportions, resulting in distinctive, resilient city representations, including healthy, safe, resilient, low-carbon, ecological, and innovative resilient cities. Due to resilience

mechanisms being inherent attributes of all types of resilient cities, it is recommended to use "urban scale," "urban structure," "urban elements," and "resilience representations" as criteria for analysing city types. The classification of resilient city types should be based on assessments of their "complexity" and "connotative representations," and these criteria should be used in case studies to determine the specific type of resilient city.

(1) Based on evaluations of urban hierarchy, connectivity, and the number and types of urban elements, definitions of resilient city complexity are delineated as "ultra-high complexity (C1), high complexity (C2), medium complexity (C3), and low complexity (C4)."

(2) An evaluation system for resilient cities covering spatial resilience, ecological resilience, social resilience, and economic resilience is established. Definitions for the representational forms of resilient cities, such as health resilience, safety resilience, low-carbon resilience, ecological resilience, and intelligent resilience, are derived based on evaluation scores. In case studies, the most representative form of resilience representation can be selected as a keyword to determine the specific type of a city.

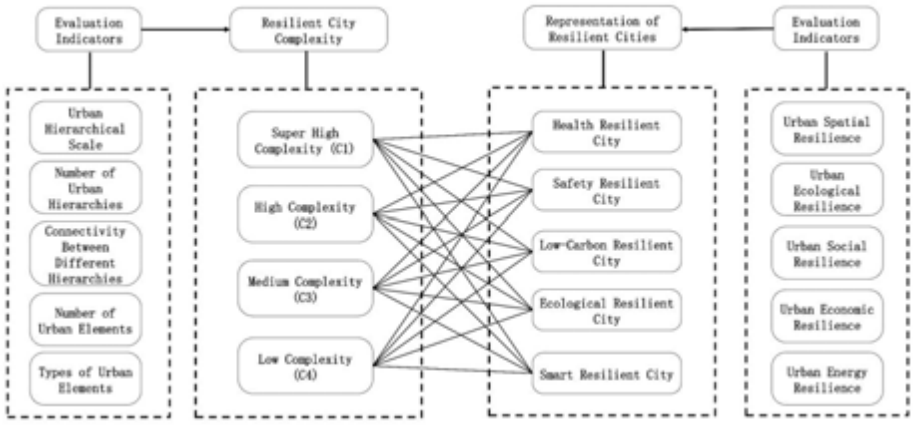

Figure 3: Classification of Resilient Cities

As shown in Figure 3, based on the results of evaluating the "complexity" and "connotative representations" of resilient cities in case studies, a combination of keywords from both categories yields 20 types of resilient cities across 4 complexity levels and 5 representational forms:

2.3 Characteristics of Resilient Cities

The characteristics of resilient cities are an extended expression of their concept and core connotations. This paper categorises the characteristics of resilient cities into four types with thirteen essential attributes (Table 1): capability characteristics, structural characteristics, mechanism characteristics, and representational characteristics.

(1) Capability Characteristics of resilient cities include adaptability and learning ability, which are the fundamental reasons behind the formation of resilience mechanisms in resilient cities.

(2) Structural and Elemental Characteristics refer to the system hierarchical structures formed under the influence of resilience mechanisms and the type and number of constituent elements of resilient cities.

(3) Mechanism Characteristics comprise stability, sensitivity, resistance, recovery, and resource redundancy. These are the system mechanisms that maintain resilient cities' functional and structural stability.

(4) Representational Characteristics include health resilience, safety resilience, low-carbon resilience, ecological resilience, and intelligent resilience. These human cognitive expressions abstract the capabilities, structures, and mechanisms of resilient cities into the most representative features.

Table 1: Classification and Analysis of Resilient City Characteristics

Characteristic Type	Characteristic Name	Characteristic Analysis
Capability Characteristics	Adaptive capacity Learning Ability	Based on historical experience, it is known that urban development is long influenced and constrained by natural environments and human will, gradually generating the ability to maintain urban functions and structures and promote benign urban development. It manifests as two capability characteristics: adaptability and learning ability.
Structural Characteristics	Hierarchical Features Elemental Features	As complex systems, cities' structural characteristics are inherent reflections of their functions and operational mechanisms. The structural features of resilient cities demonstrate the tangible or intangible urban hierarchical structures formed under the influence of resilience mechanisms, reflecting the core connotations of urban space, ecology, society, and economy and their energy and material flow characteristics.
Mechanism Characteristics	Stability Sensitivity Resistance Recovery	The operational mechanisms of resilient cities serve as the analytical basis for examining the logical connections between their hierarchical structures and resilience representations. Based on the two capability features in the integration process of urban components and influencing factors, four resilience mechanisms have emerged to maintain urban structural stability: stability, sensitivity, resistance, and recovery.
Representational Characteristics	Health Resilience	Representation theory elucidates the connections between the representational information of objects and their physical or non-physical forms, linking information with people's perceptions of specific objects or events (Distin, 2005). The representational characteristics of resilient cities are meant to express their most representative and abstracted urban features clearly.

3. Developing a Theoretical Model of Urban Spatial Resilience Based on the Connotations and Characteristics of Resilient Cities

Incorporating the definitions, connotations, and characteristics of resilience, resilient cities, urban resilience, and urban spatial resilience, this paper constructs a theoretical model for urban spatial resilience.

3.1 Urban Resilience and Urban Spatial Resilience

Urban "resilience" constitutes the core connotation of "resilient cities." Research from various countries indicates that the core information of urban "resilience" includes the constituent elements under hierarchical states, the reduction (or resistance) of disaster types, and the maintenance (or restoration) of a stable state, as well as adaptability to uncertain urban issues. Based on these core elements of urban "resilience" (Figure 4), this paper defines urban "resilience" from the perspectives of resilience capacity and system structure. Urban "resilience" is described as an inherent property of the city, manifested through a hierarchical structure organised from the bottom up by urban components. It exhibits stable characteristics that enable the city to maintain stability through rapid response capabilities, recovery capabilities in the event of sudden incidents, defence capabilities against similar events, and adaptability (or optimisation) capabilities.

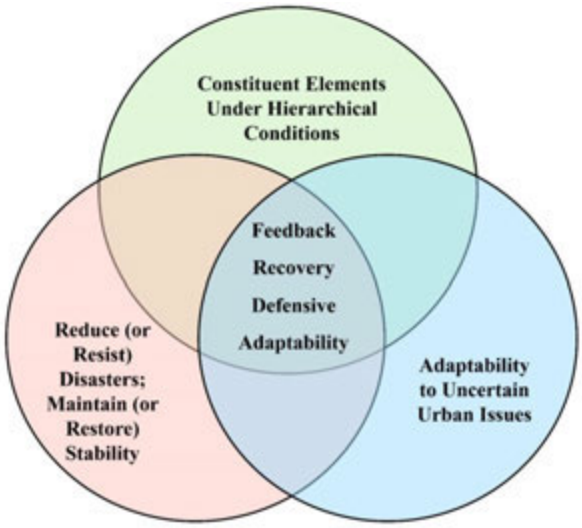

Figure 4: Core Information on Urban "Resilience"

This paper interprets urban spatial resilience as a subset of urban resilience, emphasising the state of resilience within the spatial dimension. The principal subject of the urban spatial resilience concept is urban space, with a focus on spatial attributes, representing the capacity for continuous development and operation of the urban spatial system. This capacity includes the ability to withstand disaster risks, absorb external shocks, and quickly recover essential functions. Resilient urban spaces can help maintain the integrity of urban system functionalities.

Urban spatial resilience is characterised by integrating the three elements of urban space: "scale, density, and form." Urban scale is evaluated based on ecological infrastructure and landscape safety patterns; urban density is assessed through ecological footprint and carrying capacity evaluations; urban form is measured using the "source-sink" landscape mean distance index (Xiu et al., 2018). Enhancing urban spatial resilience involves establishing redundant critical infrastructures, stable open spatial patterns, and modular, scalable spatial units across macro, meso, and micro urban scales to ensure sustainable urban development. Numerous researchers have explored urban spatial resilience from various perspectives. For instance, Liu (2014) defined "resilience planning" as the coordinated integration of rigid and flexible planning to maximise planning efficacy and defined morphological resilience as the characteristic of a spatial form that can sustain spatial development goals while fully accommodating diverse spatial usage demands (K. Liu, 2014). "Morphological resilience" planning techniques determine the material spatial elements that need rigid control according to spatial planning goals, using these rigid elements as the essential components of the spatial structure. Applying open, modular resilience planning techniques constructs an overall spatial structure closely linked with the spatial connotations of urban resilience. Famous urban models such as organic evacuation, cluster, and grid cities exemplify spatial resilience, characterised by stable, open spatial frameworks and modular, scalable spatial units. Xiu, Wei, and Wang (2018) developed a three-dimensional urban resilience research framework based on "scale—density—form" with clear spatial connotations (Xiu et al., 2018). In this framework, urban scale is evaluated based on ecological infrastructure and urban landscape safety patterns; urban density is assessed through ecological footprint and carrying capacity; urban form is evaluated using the "source-sink" landscape mean distance index. Shi (2016), using Shanghai as an example, explored the spatial requirements for enhancing resilience in mega-cities: (1) ensuring a safety baseline with life circles as the basic unit; (2) building disaster prevention systems with urban clusters as network groups; (3) coordinating the overall disaster prevention layout within the municipal area; (4) establishing regional strategic cooperation platforms (Shi, 2016).

This paper proposes that understanding urban spatial resilience should be approached from three critical perspectives:

(1) Transformation of Urban Spatial Resilience into Spatial Resilience Features: It is suggested to cognise and express "urban spatial resilience" as "spatial resilience features". It can be achieved by adopting a series of landscape indices from landscape ecology and representing the spatial resilience of different urban areas through a "Resilience Spatial Distribution Map".

(2) Relationship between Urban Spatial Resilience and Environmental Factors: Urban spatial resilience is closely linked to the natural environment, geological setting, hydrological conditions, wind environment, built environment, and spatial infrastructure factors of the city's location. Urban spatial resilience can be enhanced by expanding the spatial area under consideration.

(3) In-depth and Multi-dimensional Analysis of Urban Spatial Resilience: Efforts should be made to conduct a thorough and multifaceted analysis of urban spatial resilience. It could involve dividing urban areas into resilient and non-resilient spaces, resilient and non-resilient functions, and resilient and non-resilient structures.

3.2 Resilience" Theoretical Model

Based on the definition of "resilience," this paper establishes a "resilience" theoretical model based on its core information (Figure 5). The model specifies and describes the essential elements, operational characteristics, core information, and operational rules of the "resilience" theoretical model.

(1) Basic Elements: Includes both material entities and abstract objects.

(2) Operational Characteristics (Constraints): The "resilience" model is characterised by seven features during operation: "absorption," "resistance," "maintenance," "self-organisation," "adaptation," "learning," and "transformation."

(3) Core Information: The seven operational characteristics are simplified and categorised into four types of information, namely "recovery capability," "maintenance capability," "adaptability," and "transformation capability."

(4) Operational Rules (Also Known as Principles): These rules dictate how combinations of essential elements can form connections that represent the operational characteristics and core information of "resilience."

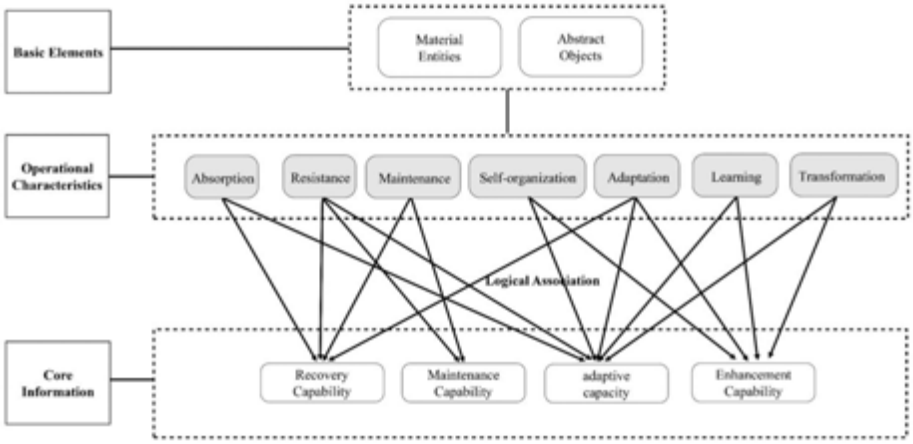

Figure 5: Theoretical Model of "Resilience"

3.3 Theoretical Model of Urban Spatial Resilience

Resilient cities are complex dynamic systems where closely interconnected subsystems create complex interactions that reflect the city’s political, economic, and social relationships. Therefore, resilient cities can be analysed through the relationships among subsystems and system elements (Yang M. et al., 2016; Zhou & Yuan, 2017). The urban spatial structure manifests the results of interactions among hierarchical structures, functions, and elements.

This study initially categorises urban spatial resilience into three systemic levels: macro, meso, and micro. Based on the physical and non-physical scale of system constituent elements, the meso and micro levels can be further subdivided, resulting in a hierarchical structure of single macro, multiple meso, and multiple micro levels (Figure 6).

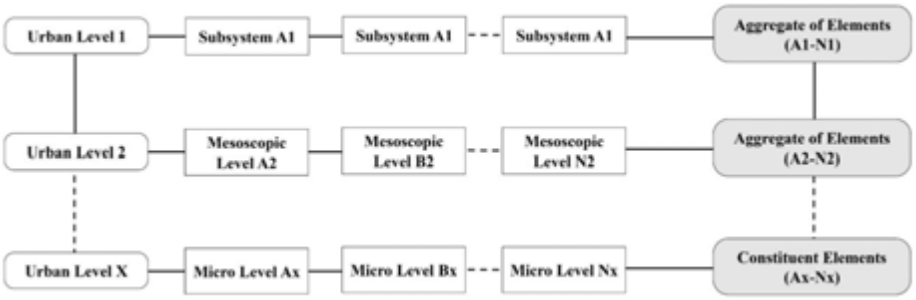

Figure 6: Schematic of Urban Spatial Hierarchical Structure

Based on the "resilience" theoretical model and the connotations and characteristics of resilient cities, this paper further proposes a theoretical model of "urban spatial resilience" (Figure 7). This model comprises operational mechanisms, influencing factors, hierarchical structures, organisational rules, intrinsic connotations and representational forms, and system capabilities.

(1) Operating Mechanisms: Adaptability and learning ability are the core operating mechanisms for urban spatial resilience. Individual cities and urban clusters optimise and reorganise their spatial resilience systems spontaneously by adapting to and learning from the impacts affecting their urban spatial resilience.

(2) Influencing Factors: These include a variety of factors such as the urban ecological environment, socio-economic factors, urban transportation, and land use. The operating mechanisms of the urban spatial resilience system are generated through adaptation to and learning from these factors affecting urban resilience spaces.

(3) Hierarchical Structure: The material and non-material essential components of cities form a stable hierarchical structure under the influence of two resilience mechanisms. From both physical and logical scales, this involves organising resilience components of urban spaces from the bottom up, forming a hierarchical structure with resilience and stability characteristics consisting of a single macro-level, multiple subsystems, multiple meso-levels, and multiple micro-levels, with individual forms varying based on specific case studies.

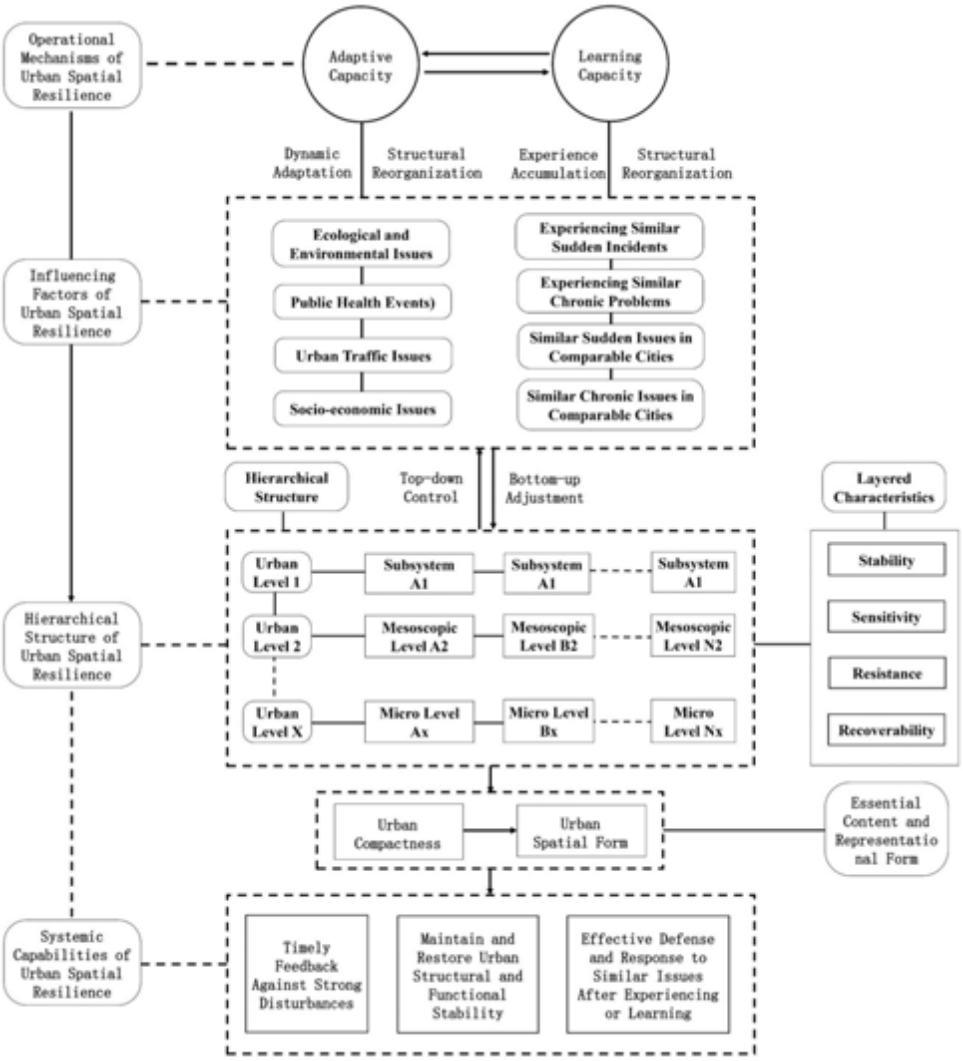

Figure 7: Theoretical Model of Urban Spatial Resilience

(4) Organisational Rules: Stability, sensitivity, resistance, and recovery serve as the organisational rules for urban spatial resilience at different hierarchical levels, forming a relatively stable structure at the system-wide level that can achieve and maintain specific functions. This stable structure can be continuously optimised through adaptation and learning concerning the types, quantities, and connections of the elements composing the different levels of urban spatial resilience.

(5) Intrinsic Connotations and Representational Forms: Urban compactness is the intrinsic connotation of urban spatial resilience, involving the economical and intensive use of land

resources, centralised layout of urban functional elements, enhanced management of urban spatial growth, promotion of high density and mixed-use of urban land, and strengthened urban planning management. The representational form of urban compactness is the urban spatial form.

(6) System Capabilities: Based on the influencing factors of urban spatial resilience, the operating mechanisms effectively organise the hierarchical structure of urban spatial resilience, fostering the generation of three system capability features of urban spatial resilience: "timely feedback against strong disturbances," "maintenance and recovery of urban structure and functional stability," and "effective defence and response to similar issues after experiencing or learning."

4. Shanghai Urban Spatial Resilience: Development Trajectory, Current Issues, and Enhancement Strategies

4.1 Urban Spatial Planning in Shanghai Since 1985

Shanghai's urban planning can be traced back to the "Greater Shanghai Plan" of 1929 (Figure 8), inspired by Ebenezer Howard's "Garden Cities of To-morrow" (1902). This plan employed a grid layout and designated a city centre in Yangpu district, encompassing government buildings, museums, and other public amenities. Although the onset of war in 1937 halted its implementation, this plan laid the foundational principles for subsequent urban planning (MacPherson, 1990). Post-war, multiple master plans were drafted, notably in 1946 and 1956, emphasising industrial development and population decentralisation to alleviate congestion in the central areas(Shanghai Local Chronicles Office, 2003). After the establishment of the People's Republic of China, Shanghai's planning ideology transitioned into the era of Soviet Planning Theory, focusing on industrial orientation and residential environment improvements (Soviet Planning Theory 1949-1958 · Shanghai: Urban Design and Planning, 2024). The 1959 plan significantly expanded Shanghai's administrative boundaries and envisioned transforming Shanghai into a leading beautiful city (Shanghai Urban Master Plan 1959 Edition, 2024). From 1984 onwards, Shanghai pivoted towards becoming a multifunctional economic hub. The 1986 plan further solidified Shanghai's status as a major international metropolis (The State Council’s Response to the Master Urban Planning Scheme for Shanghai, 1986). The plans from 1999 to 2001 established an urban spatial structure that facilitated harmonious development across various urban levels. The latest master plan (2017-2035) projects a longer-term vision, aiming to position Shanghai as a globally influential centre of technological innovation and a modernised international metropolis by 2035, introducing a spatial configuration of "one core, two axes, four wings; multiple corridors, multiple cores, multiple circles".

Figure 8 History of urban planning development in Shanghai

4.2 Urban Spatial Expansion in Shanghai Since 1985

To further analyse the urban spatial expansion of Shanghai since 1985, this study leverages data from (J. Yang & Huang, 2021), which utilises 335,709 Landsat images available on the Google Earth Engine. The methodology involves collecting training samples by combining stable samples extracted from the China Land Use/Cover Dataset (CLUD) with visual interpretation samples from satellite time series data, Google Earth, and Google Maps. The study employs multiple temporal indicators constructed from all available Landsat data, which are then input into a random forest classifier to obtain classification results, culminating in creating the China Annual Land Cover Dataset (CLCD) from 1985 onwards.

The results indicate that from 1985 to 2022, Shanghai's urban expansion predominantly exhibited a pattern of central aggregation and peripheral dispersion (Figure 9). This pattern reflects that the city's development extended beyond merely refilling old urban areas, expanding into peripheral regions and new districts. From 1985 to 1990, urban expansion was primarily concentrated in the city centre with minimal outlying growth. During this period, development focused on maximising the use of internal space and reconstructing key areas to accommodate the city's growing population and economic demands. Between 1990 and 2000, as the economy rapidly developed and urban policies adjusted, Shanghai's urban expansion began transitioning from the city centre to peripheral areas. The construction of major transport routes and new development zones catalysed swift expansion at the city's edges. After 2000, urban expansion entered a new peak period, reaching a nearly 40-year high, with the city centre area almost entirely urbanised. This trend continued until 2015. After 2015, urban growth began to slow, with expansion shifting towards suburbs and emerging satellite towns, characterised by "finger-like" growth patterns along major roadways and transit lines. By 2020, Shanghai's urban spatial expansion significantly slowed, indicating a transition into a more mature and stable development phase. The new urban development strategy emphasises ecological protection and sustainable development, aiming to improve residents' quality of life and environmental conditions while ensuring economic growth (Table 2, Table. 3).

Table 2 Changes in the area of built-up areas in Shanghai

Year	downtown area	Average annual growth	Extended strength	extension type
1985	631.45	/	/	/
1990	710.99	79.54	12.60	low speed
1995	1001.13	290.15	40.81	high speed
2000	1291.56	290.43	29.01	high speed
2005	1739.44	447.88	34.68	high speed
2010	2143.33	403.89	23.22	medium speed
2015	2355.34	212.00	9.89	low speed
2020	2489.10	133.77	5.68	low speed
2022	2537.84	48.74	1.96	low speed

Table 3 Changes in the area of downtown areas of Shanghai

Year	downtown area	Average annual growth	Extended strength	extension type
1985	358.90	/	/	
1990	416.95	58.05	16.17	low speed
1995	603.61	186.66	44.77	high speed
2000	788.56	184.95	30.64	high speed
2005	1029.50	240.94	30.55	high speed
2010	1374.12	344.62	33.47	high speed
2015	1483.85	109.74	7.99	low speed
2020	1545.64	61.79	4.16	low speed
2022	1568.33	22.69	1.47	low speed

Since 1985, Shanghai's urban area has expanded from 631.45 square kilometres to 2537.84 square kilometres in 2022, nearly quadrupling (Table 2). The pace of urban expansion has varied, generally following a 'reverse U' trend with initially slow, then rapid, and subsequently slowing growth rates. Between 1985 and 1990, urban expansion was relatively slow, focusing primarily on infilling the city centre and enhancing infrastructure. Since 1995, changes in domestic and international economic conditions and adjustments in urban policies have marked the beginning of a rapid development phase for Shanghai's urban space. During this period, large-scale developments in suburbs and new districts significantly accelerated the pace of urban expansion, with annual expansion reaching nearly 30 square kilometres. This rapid expansion continued until 2010. After that, as the availability of suitable land for development decreased and urban planning policies shifted, the pace of Shanghai's urban expansion began to slow. The focus of urban development shifted from quantity to quality, emphasising improvements in the urban living environment and economic efficiency. Since then, the rate of urban expansion has stabilised at about 10 square kilometres per year.

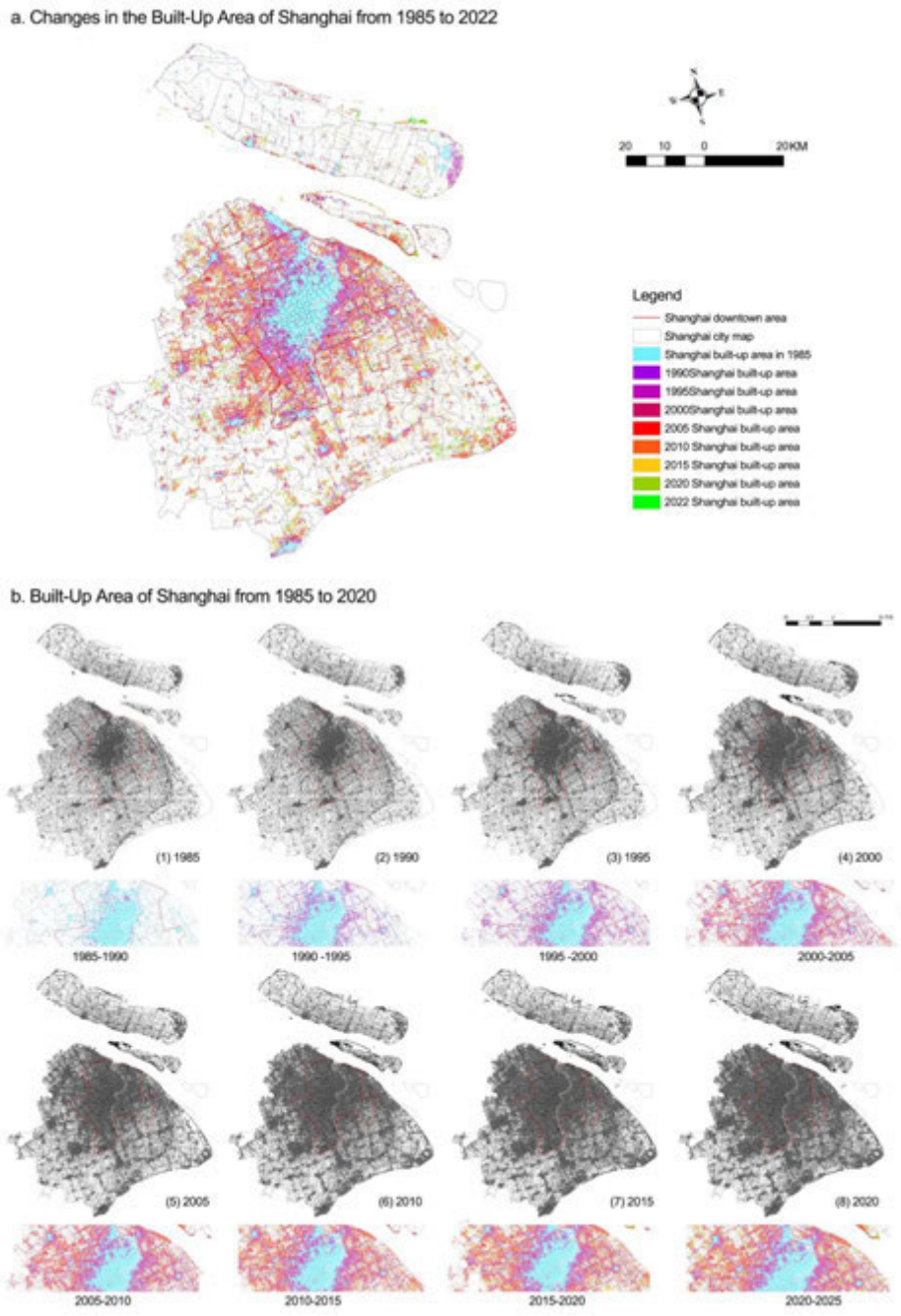

Figure 9 Changes in Shanghai's built-up area from 1985 to 2022

Since 2022, the pace of urban expansion in Shanghai has stabilised, indicating that the amount of land available for urban use in the city centre is nearing saturation. Urban development is increasingly focused on enhancing the efficiency of existing urban land use and improving the quality of urban life. The government and developers are actively seeking new urban development models, such as through urban renewal and the transformation of old districts to optimise urban spatial configuration and enhance city functions while also strengthening the construction of green infrastructure and public service facilities to support a sustainable urban future.

4.3 Current Issues in Shanghai's Urban Spatial Resilience Construction

The challenges posed by climate change and rapid urbanisation are particularly pronounced in the construction of urban spatial resilience in Shanghai. As global warming intensifies, Shanghai is increasingly subjected to extreme weather events such as floods and high temperatures. While significant progress has been made in enhancing flood defences, the measures in place to cope with high temperatures remain inadequate, especially regarding disaster monitoring and early warning systems that require further strengthening. Rapid urban expansion has exerted substantial pressure on the ecological environment, leading to a reduction in urban green spaces and wetlands and a decline in ecosystem functions. Reducing natural buffer zones and ecological barriers increases the city's vulnerability to natural disasters.

Moreover, the city's economic resilience is also being tested. Although Shanghai has become a central global commercial and financial hub, its economy is highly dependent on international markets and foreign investment, which may pose challenges during global economic instability. Additionally, Shanghai is continuously focusing on enhancing social resilience. City administrators are striving to improve public health services, the education system, and housing policies to enhance the quality of life for residents. Nevertheless, rapid urbanisation continues to cause uneven distribution of resources and social stratification. Urban planners and policymakers in Shanghai need to consider these complex factors to develop more effective strategies that promote sustainable development and strengthen urban resilience.

4.4 Analysis of the Relationship Between Urban Compactness and Urban Spatial Resilience

Urban compactness typically refers to a city's intensive and efficient spatial arrangement, encompassing high-density construction, multifunctional land use, and effective public transportation systems (Dantzig & Saaty, 1973; Lan et al., 2021). Urban spatial resilience, however, focuses on a city's ability to maintain critical functions, rapidly recover, and adapt to natural disasters, economic crises, or social changes. Both concepts are crucial topics in the field of sustainable urban development. These principles aim to enhance urban environments' liveability, sustainability, and adaptability, ensuring that cities can withstand and adapt to various challenges while continuing to thrive.

According to relevant theories of urban economics, Richardson et al. proved that the most efficient external space form of urban construction is circular. When the city is round, the compactness is 1. The larger the Richardson index, the more compact the spatial shape. This paper refers to relevant studies (Lan et al., 2021; Lv et al., 2022; Meng & Xing, 2019) and uses Richardson index to express the compactness of the block. Moreover, it is calculated as follows:

$$C = \frac{2\sqrt{\pi * A}}{P}$$

Where A is the area of the block, P is the block's perimeter.

The changes in the compactness of Shanghai city are shown in Figure 10. From 1990 to 2005, the increase in compactness was relatively stable, with an increment of approximately 0.02 every five years. It likely reflects the orderly advancement of urban planning and infrastructure development in Shanghai during this period, gradually enhancing the efficiency of urban operations and the quality of life for residents. The growth in compactness significantly accelerated between 2005 and 2010, increasing by 0.05. This change may be associated with accelerating urbanisation in Shanghai, such as hosting the 2010 Shanghai Expo. Much infrastructure construction and urban expansion likely occurred during this period. From 2010 to 2022, the growth in compactness returned to a stable state, with an increase of 0.01 every five years or two years. It indicates that urban development has entered a more mature and stable phase, where the optimisation and adjustment of urban space are more focused on details and quality, gradually enhancing urban spatial resilience.

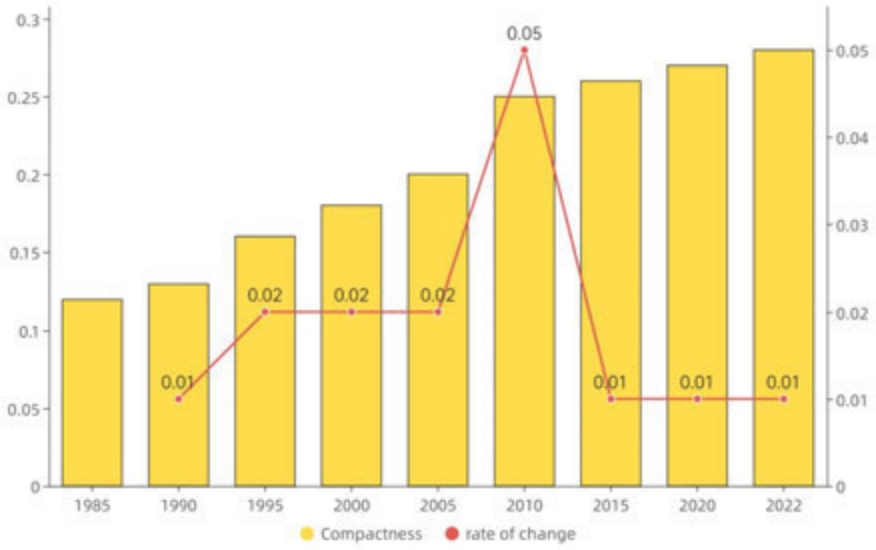

Figure 10 Changes in Shanghai's compactness from 1985 to 2022

The relationship between urban compactness and urban spatial resilience manifests in three critical aspects: ecological environment sustainability, economic vitality enhancement, and social and cultural dimensions resilience.

(1) Sustainability of the Ecological Environment: Compact cities contribute to protecting the natural environment and reducing ecological degradation by minimising land consumption and enhancing land use efficiency (Yao et al., 2022). For instance, by curbing urban sprawl and promoting the construction of high-density residential areas, more natural and semi-natural areas can be preserved, which are crucial for providing ecosystem services such as water retention, air purification, and biodiversity conservation. Furthermore, compact urban forms

help reduce commuting distances and, consequently, lower carbon emissions from transportation, thus mitigating the urban heat island effect and enhancing the overall ecological resilience of the city (Stevenson et al., 2016).

(2) Promotion of Economic Vitality: A concentrated urban layout facilitates the maximisation of resource utilisation and efficiency enhancement (B. Li, 2022). Compact cities can reduce transportation costs and time, enhance business synergies, and accelerate knowledge and technology dissemination. This environment not only attracts more businesses and talent but also fosters innovation and entrepreneurial activities, thereby strengthening the economic resilience of cities. It enables cities to recover and adapt quickly to economic fluctuations or external shocks.

(3) Resilience of Social and Cultural Dimensions: Compact urban environments promote interactions and communications among people from diverse backgrounds, enhancing cultural diversity and social inclusivity (Raman, 2010). This diversity and inclusivity are integral components of social resilience, which can reduce the risk of social fragmentation and conflict during times of change or crisis by strengthening community cohesion and mutual support.

In conclusion, the interconnectedness of urban compactness and spatial resilience spans multiple dimensions, including ecological, economic, and socio-cultural aspects. Urban planners, in their pursuit of urban compactness, should comprehensively consider its impact on the city's overall resilience to ensure more holistic and sustainable urban development.

4.5 Principles and Strategies for Building Shanghai's Urban Spatial Resilience Based on Compactness Elements

Based on the theoretical model of urban spatial resilience and the characteristics of compact urban development, this paper proposes a series of construction principles and enhancement strategies for building urban spatial resilience in Shanghai.

4.5.1 Construction Principles Proposed for Shanghai's Urban Spatial Resilience:

(1) Principle of Mixed Use: Encourage multifunctional land and space use in urban planning and construction, such as integrating commercial, residential, educational, and green spaces to form functionally integrated communities (Verdú-Vázquez et al., 2017). It reduces commuting distances and increases convenience and comfort in daily life (Gaigné et al., 2012). Developers and designers are encouraged to adopt flexible architectural designs, such as variable wall systems and multipurpose rooms, to accommodate future functional changes and diverse usage demands. It enhances the self-sufficiency of communities and provides additional support and buffering in the face of disasters or social upheavals.

(2) Ecological Priority Principle: Prioritise ecological protection and sustainable development in urban planning and expansion. Utilise natural infrastructure such as parks and wetlands to enhance the city's ecological resilience, protect biodiversity, and address urban heat island effects through microclimate regulation and flood risk reduction (Wu et al., 2020). Adopt renewable energy sources like geothermal and solar energy and promote using green building materials to reduce the environmental footprint of urban development and operations (Chel & Kaushik, 2018).

(3) Adaptive Flexibility Principle: Urban design and planning should exhibit high adaptability and flexibility, considering long-term environmental changes, social dynamics, and technological advancements (Jabareen, 2013). For example, the design of buildings and infrastructure should be adaptable to the impacts of climate change(Carter et al., 2015). Develop comprehensive strategies for natural disaster response, including constructing flood barriers, earthquake-safe building standards, and rapid-fire response systems, to effectively enhance the city’s resistance and recovery capabilities in the face of natural disasters.

4.5.2 Enhancement Strategies for Building Shanghai’s Urban Spatial Resilience:

(1) Strengthen Infrastructure Interconnectivity: Shanghai should continue to improve and strengthen its urban transportation network and public facilities to ensure rapid functional recovery after disasters (S.-C. Liu et al., 2021). Expand multimodal transportation systems, including public transit, bicycle lanes, and pedestrian paths, to reduce reliance on personal vehicles and enhance urban operational efficiency (Y. Li et al., 2024). These measures will enable the city to maintain continuity of operations and services in the face of public health emergencies or other urgent situations.

(2) Promote Green Building and Smart City Technologies: Utilise energy-efficient building materials and intelligent technologies, such as smart grids and automated management systems, to enhance the energy efficiency and operational flexibility of buildings and the city (Um-e-Habiba et al., 2024). Using energy-efficient materials, green roofs, smart grids, and automated systems reduces environmental pollution and increases the city's adaptability to various scenarios (Singh, 2024).

(3) Promote Socio-economic Diversification: Encourage industry diversification and innovation to enhance the city’s economic resilience and reduce dependence on single economic sectors. Support the development of small and medium-sized enterprises to improve the economic system’s resistance to external shocks. A diversified economic structure can help the city withstand global economic fluctuations and local economic crises(Sheng et al., 2024).

By implementing these principles and strategies, Shanghai can enhance its urban spatial resilience and ensure sustainability and high-quality living for its residents while pursuing compact urban development. These measures strengthen Shanghai’s resilience in facing future challenges, including natural disasters, economic fluctuations, and social changes.

5 Conclusion

Constructing resilient cities is one of the critical planning goals for Shanghai's urban development. Based on an interpretation of the definition, connotations, and characteristics of "resilient cities," this paper analyses current issues in Shanghai's urban spatial construction. It explores principles and strategies for enhancing urban spatial resilience in Shanghai, leading to the following six research conclusions.

(1) The Concept, Development, Connotations, and Characteristics of Resilient Cities:

A resilient city is a type of advanced urban form that possesses strong adaptive and learning capacities, effectively responds to significant urban disturbances such as climate change threats, ecological issues, and public health incidents within a particular spatiotemporal scope, promptly restores structural and functional stability, and continues to evolve beneficially. This paper

classifies international research on resilient cities into four stages: nascent, initial, rapid development and reflection of continued development. Analysing the systemic composition, organisational methods, and representational forms of resilient cities reveals that they encompass three essential connotations: urban structure, resilience mechanisms, and resilience representations. These cities also exhibit four categories (encompassing 13 specific characteristics) of essential features: capabilities, structures, mechanisms, and representations.

(2) Definition and Connotations of Urban Spatial Resilience:

Urban spatial resilience is characterised by integrating the three elements of "scale, density, and form" in urban spaces, allowing "urban spatial resilience" to be cognitively expressed as "spatial resilience features." The diversity of urban spatial resilience is evident in the variety of urban functions, choices during impact processes, socio-ecological environments, and multi-scale connections among urban components. The structural organisation of urban spatial resilience exhibits high adaptability and flexibility, manifested in the construction of hierarchical urban spatial structures at macro, meso, and micro levels and in the organisation of social functions.

(3) Theoretical Model of Urban Spatial Resilience:

Based on the connotations and characteristics of resilient cities, this paper has sequentially proposed theoretical models for "resilience" and "urban spatial resilience." The "resilience" theoretical model includes essential elements, operational characteristics, core information, and operational rules. The "urban spatial resilience" theoretical model comprises operational mechanisms, influencing factors, hierarchical structures, organisational rules, intrinsic connotations and representational forms, and system capabilities. The "urban spatial resilience" theoretical model can be applied to analyse the evolution phenomena, construction principles, and enhancement strategies of urban spatial resilience in Shanghai, realising system characteristics of urban spatial resilience that "respond timely to strong disturbances," "maintain and restore the stability of urban structure and functions," and "effectively defend against and address similar issues after experiences or learning."

(4) Evolution, Changes, and Current Issues of Urban Spatial Resilience in Shanghai since 1985:

Since 1985, urban expansion in Shanghai has predominantly displayed a pattern of central concentration with peripheral dispersion, marking a shift from mere rapid expansion to a focus on integrated quality and sustainable development. Urban spatial growth has gradually slowed, and urban compactness has progressively strengthened. Urban development has entered a more mature and stable phase, emphasising ecological protection and sustainable development, thus gradually enhancing urban spatial resilience. The city has moved from concentrated high-speed development in the city centre to more balanced development in the suburbs and new areas. During this process, Shanghai has gradually improved its urban compactness, driving the overall optimisation of transport, public services, and green infrastructure. However, as the city's scale has expanded, Shanghai faces multiple challenges, such as traffic congestion, environmental pollution, social inequality, and disaster response. Future urban planning needs to focus more on finding a new balance between developmental drive and environmental protection, strengthening community participation and technological innovation to build a more resilient and inclusive urban environment, and ensuring sustainable development strategies can effectively address upcoming social and environmental challenges.

(5) Principles and Strategies for Constructing Urban Spatial Resilience in Shanghai:

Based on the theoretical model of urban spatial resilience, the construction of Shanghai’s urban spatial resilience should adhere to the principles of multifunctional use, ecological priority and adaptive flexibility. By implementing strategies such as strengthening infrastructure connectivity, promoting green buildings and innovative city technologies, and fostering socio-economic diversification, the city’s overall resilience and capacity for sustainable development can be comprehensively enhanced. These strategies significantly improve Shanghai’s ability to respond and adapt to natural disasters, economic fluctuations, and social changes, as well as raise the overall standard of urban infrastructure and the quality of life for residents, ensuring a sense of community cohesion and security. Through these integrated measures, Shanghai can achieve a greener, more intelligent, and more humane urban development model, addressing immediate challenges while laying a solid foundation for future sustainable growth, ensuring a harmonious coexistence of urban environments and economic vitality, and thereby achieving comprehensive and enduring urban prosperity and resident well-being.

The current state of urban development across various countries indicates that traditional "safety-defense" disaster prevention concepts no longer meet the needs of contemporary urban risk management. Instead, resilience thinking, which originated in ecology, has come into focus. As an evolving concept, enhancing urban spatial resilience is an effective way to address the risks of urban climate change and follow sustainable development principles and a practical necessity to control chaotic urban sprawl and achieve compact development. The research conclusions of this paper are intended to aid urban managers and researchers in deeply understanding the concepts, connotations, and characteristics of resilient cities and urban spatial resilience. They clarify the principles for constructing urban spatial resilience, the methods for analysing it, and strategies for its enhancement, thereby enabling an appropriate response to the challenges and risks encountered in constructing resilient cities.

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Research on Strategies for Enhancing Urban Spatial Resilience in Shanghai Based on the Connotations and Characteristics of "Resilient Cities"

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Abstract: This paper explores the enhancement strategies for urban spatial resilience in Shanghai by defining, interpreting, and identifying the characteristics of "urban spatial resilience." Firstly, it analyses the relationship between resilient cities and urban spatial resilience. Secondly, it examines the systemic composition, organisational methods, and representation of resilient cities, revealing three essential contents—hierarchical structures, resilience mechanisms, and resilience representations—and four fundamental characteristics (13 attributes): capacity, structure, mechanism, and representation. Thirdly, it reviews the urban spatial planning, spatial expansion changes, and urban compactness variations in Shanghai since 1985. Finally, the paper identifies current issues in Shanghai's urban spatial development and proposes strategies to enhance its urban spatial resilience.

Keywords: Resilient Cities, Spatial Resilience, Shanghai, Construction Principles, Enhancement Strategies

1. Introduction

Urban areas today face many crises and challenges, including global warming, increased extreme weather events, and urban flooding, which render urban systems vulnerable and susceptible to disturbances. Since the inception of the "resilient city" concept, it has emerged as a new paradigm for addressing urban risks and uncertainties, garnering sustained interest from both the academic and political realms (Sharifi, 2019). Resilience thinking posits that cities are self-regulating complex systems (Holling et al., 2002), with resilient cities serving as tools to cope with uncertainty. Constructing resilient cities or enhancing urban resilience has become crucial for cities to face various challenges and achieve long-term sustainable development (UNDRR, 2013). This understanding has gradually evolved into a global consensus. The theory of resilient cities views urban areas as open, complex mega-systems, offering significant scientific guidance for urban planning and construction practices aimed at protecting the lives and properties of residents and enhancing urban functionality.

Since 2016, Shanghai has issued a series of policy documents aimed at enhancing urban spatial resilience, such as the "RISE" Vision Goals Framework for Shanghai's Urban Development over the Next 30 Years (2016), the Shanghai City Master Plan (2017-2035) (2018), and the Shanghai Urban Operation and Safety Development Report (2019-2020) Blue Book (2021). These documents repeatedly emphasise the importance of strengthening resilient city construction and achieving compact urban development and propose that by 2035, Shanghai will be fundamentally established as a "resilient city" capable of addressing various developmental risks and swiftly recovering from them. To counter issues such as continuous urban sprawl, population concentration in central urban areas, and the slow development of new cities, Shanghai advocates for a compact metropolitan spatial pattern and a transition from extensive expansion to baseline constraint and intrinsic development (Shaobo et al., 2019).

Thus, constructing resilient cities and enhancing urban spatial resilience are among the critical planning objectives for current urban development in Shanghai.

Urban spatial resilience has emerged within the development and evolution of resilience, resilient cities, and urban resilience. Therefore, it is necessary to delineate and clarify the relationships among resilience, resilient cities, urban resilience, and urban spatial resilience. This paper is based on analysing the concepts, contents, and characteristics of resilience, resilient cities, urban resilience, and urban spatial resilience. It proposes a theoretical model for urban spatial resilience and examines the development trajectory, current issues, construction principles, and urban spatial resilience enhancement strategies in Shanghai. The research conclusions presented here are intended to deepen the understanding of urban spatial resilience among city managers and researchers. This deeper understanding facilitates a more thorough grasp of the concepts, contents, and characteristics essential for building resilient cities, providing valuable insights and references for urban development strategies.

2. Definitions, Connotations, and Characteristics of Resilient Cities

2.1 The Concept and Evolution of Resilient Cities

The concept of "resilience" has been extensively applied across multiple disciplinary fields such as engineering, psychology, disaster studies, economics, management, social sciences, and environmental science. Although descriptions of "resilience" vary among disciplines, they all emphasise its characteristics related to absorption, resistance, maintenance, self-organisation, adaptation, learning, and transformation. Following the perspective of Professor Shen Qingji, this paper defines "resilience" as the capacity of a system to maintain or restore its necessary functions in the face of disturbances, adapt to changes, and swiftly transform when its adaptive capacity is constrained.

Similar to other fields, the concepts of "Urban Resilience" and "Resilient City" emerged when applied to urban systems. The term "Resilient City" was first introduced by Local Governments for Sustainability (ICLEI) during the 2002 United Nations Summit on Sustainable Development. It emphasised a systemic construction process combining material aspects such as engineering improvements and facility enhancements with social dimensions, including public participation and institutional innovation, to enhance the overall resilience of urban systems. While there is no unified definition of a resilient city within the academic community to date, there is a consensus on its connotation and value: a resilient city possesses diverse disaster adaptation capabilities. Research varies from focusing on urban stability reconfiguration under environmental impacts, highlighting the rapid adaptive system characteristics of cities, to emphasising the adaptive capacity of cities and their residents to risks, yet all converge on the core notions of "stability," "resistance," and "adaptability." By analysing the interrelations among resilience, resilient cities, urban resilience, and urban spatial resilience, this paper further explicates the definition of a resilient city as a type of advanced urban form that possesses strong adaptive and learning capacities, effectively responds to significant urban disturbances such as climate change threats, ecological issues, public health incidents within a particular spatiotemporal scope, promptly restores structural and functional stability, and continues to evolve beneficially.

This paper classifies international research on resilient cities into four stages: nascent, initial, rapid, and reflection continued development (Figure 1). From the perspective of evolutionary trends, early research on resilient cities focused on human psychological resilience and

ecosystem resilience, gradually transitioning to diverse studies targeting different components and processes within urban socio-ecological systems. The scope of the inquiry has shifted from initially addressing common natural disasters and risks to increasingly dealing with emerging urban environmental and social issues, as well as derivative problems, thereby deepening integration with the discipline of urban planning.

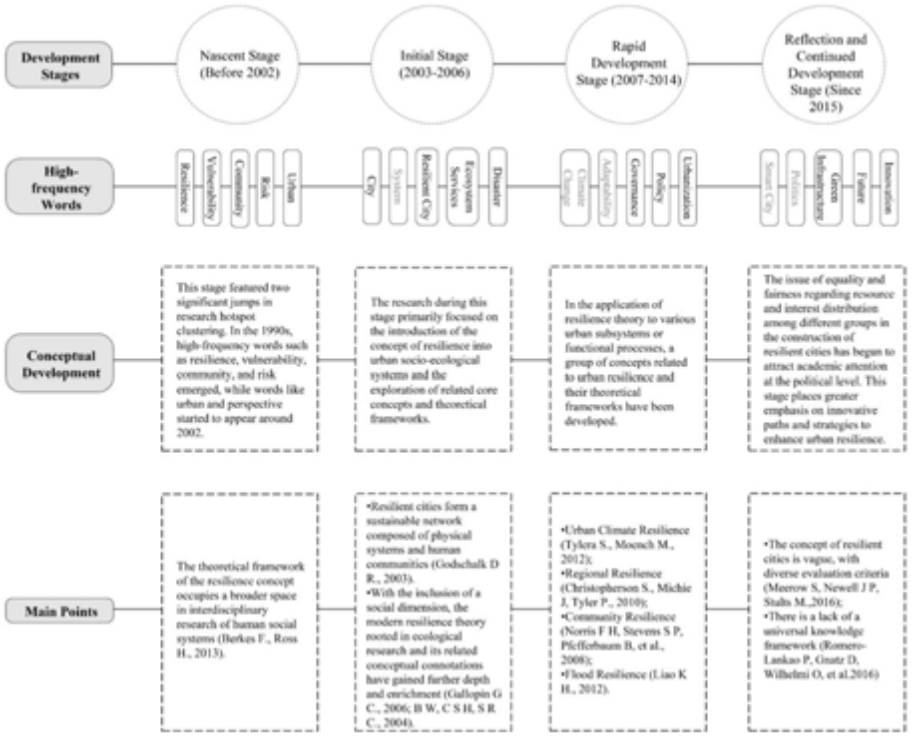

Figure 1: Evolutionary Stages of the "Resilient City" Concept

2.2 The Connotations of Resilient Cities

Based on an examination and analysis of the existing literature on "resilience," "urban resilience," and "resilient cities," this paper categorises the intrinsic connotations of resilient cities into three core components: hierarchical structures, resilience mechanisms, and resilience representations, covering the systemic composition, organisational methods, and representational forms of resilient cities (Figure 2).

Figure 2: Diagrammatic Representation of the Information Structure of Resilient Cities

(1) **Hierarchical Structure:** Refers to the stable structure formed by resilient cities' subsystems, system levels, and system elements under specific mechanisms. It represents resilient cities as complex systems.

(2) **Resilience Mechanisms:** Historical experiences indicate that urban development is long influenced and constrained by natural environments and human will, gradually evolving capabilities that maintain urban functions and structures and foster benign urban development. These capabilities are manifest in adaptive and learning abilities. The operational mechanisms of resilient cities serve as the analytical basis for examining the logical connections between their hierarchical structures and resilience representations. In integrating urban components and influencing factors, four resilience mechanisms have emerged to maintain urban structural stability—stability, sensitivity, resistance, and recovery—based on the two capability features (system organisational rules).

(3) **Resilience Representations**: From a psychological perspective, representation refers to the method by which segments of world information stored in the human mind are depicted or described, as well as how objects exist within individual psychology. Representation theory elucidates the connections between the representational information of objects and their physical or non-physical forms, linking information with people's perceptions of specific objects or events (Distin, 2005).

The representational forms of "resilient cities" are meant to express their intrinsic meanings, consisting of tangible and intangible urban characteristics. This study categorises the core connotations of "resilient cities" into four aspects based on urban components' material and non-material properties: urban spatial resilience, urban ecological resilience, urban social resilience, and urban economic resilience. These four cores are represented in different cities in varying proportions, resulting in distinctive, resilient city representations, including healthy, safe, resilient, low-carbon, ecological, and innovative resilient cities. Due to resilience

mechanisms being inherent attributes of all types of resilient cities, it is recommended to use "urban scale," "urban structure," "urban elements," and "resilience representations" as criteria for analysing city types. The classification of resilient city types should be based on assessments of their "complexity" and "connotative representations," and these criteria should be used in case studies to determine the specific type of resilient city.

(1) Based on evaluations of urban hierarchy, connectivity, and the number and types of urban elements, definitions of resilient city complexity are delineated as "ultra-high complexity (C1), high complexity (C2), medium complexity (C3), and low complexity (C4)."

(2) An evaluation system for resilient cities covering spatial resilience, ecological resilience, social resilience, and economic resilience is established. Definitions for the representational forms of resilient cities, such as health resilience, safety resilience, low-carbon resilience, ecological resilience, and intelligent resilience, are derived based on evaluation scores. In case studies, the most representative form of resilience representation can be selected as a keyword to determine the specific type of a city.

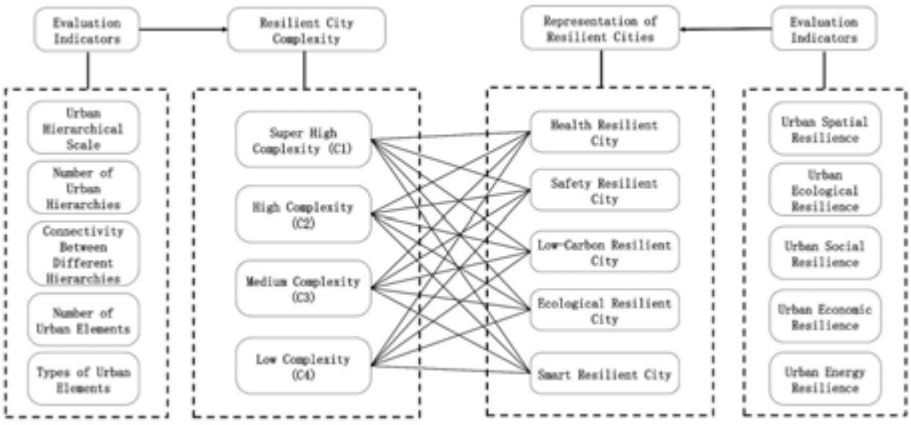

Figure 3: Classification of Resilient Cities

As shown in Figure 3, based on the results of evaluating the "complexity" and "connotative representations" of resilient cities in case studies, a combination of keywords from both categories yields 20 types of resilient cities across 4 complexity levels and 5 representational forms:

2.3 Characteristics of Resilient Cities

The characteristics of resilient cities are an extended expression of their concept and core connotations. This paper categorises the characteristics of resilient cities into four types with thirteen essential attributes (Table 1): capability characteristics, structural characteristics, mechanism characteristics, and representational characteristics.

(1) Capability Characteristics of resilient cities include adaptability and learning ability, which are the fundamental reasons behind the formation of resilience mechanisms in resilient cities.

(2) Structural and Elemental Characteristics refer to the system hierarchical structures formed under the influence of resilience mechanisms and the type and number of constituent elements of resilient cities.

(3) Mechanism Characteristics comprise stability, sensitivity, resistance, recovery, and resource redundancy. These are the system mechanisms that maintain resilient cities' functional and structural stability.

(4) Representational Characteristics include health resilience, safety resilience, low-carbon resilience, ecological resilience, and intelligent resilience. These human cognitive expressions abstract the capabilities, structures, and mechanisms of resilient cities into the most representative features.

Table 1: Classification and Analysis of Resilient City Characteristics

Characteristic Type	**Characteristic Name**	**Characteristic Analysis**
Capability Characteristics	Adaptive capacity Learning Ability	Based on historical experience, it is known that urban development is long influenced and constrained by natural environments and human will, gradually generating the ability to maintain urban functions and structures and promote benign urban development. It manifests as two capability characteristics: adaptability and learning ability.
Structural Characteristics	Hierarchical Features Elemental Features	As complex systems, cities' structural characteristics are inherent reflections of their functions and operational mechanisms. The structural features of resilient cities demonstrate the tangible or intangible urban hierarchical structures formed under the influence of resilience mechanisms, reflecting the core connotations of urban space, ecology, society, and economy and their energy and material flow characteristics.
Mechanism Characteristics	Stability Sensitivity Resistance Recovery	The operational mechanisms of resilient cities serve as the analytical basis for examining the logical connections between their hierarchical structures and resilience representations. Based on the two capability features in the integration process of urban components and influencing factors, four resilience mechanisms have emerged to maintain urban structural stability: stability, sensitivity, resistance, and recovery.
Representational Characteristics	Health Resilience	Representation theory elucidates the connections between the representational information of objects and their physical or non-physical forms, linking information with people’s perceptions of specific objects or events (Distin, 2005). The representational characteristics of resilient cities are meant to express their most representative and abstracted urban features clearly.

3. Developing a Theoretical Model of Urban Spatial Resilience Based on the Connotations and Characteristics of Resilient Cities

Incorporating the definitions, connotations, and characteristics of resilience, resilient cities, urban resilience, and urban spatial resilience, this paper constructs a theoretical model for urban spatial resilience.

3.1 Urban Resilience and Urban Spatial Resilience

Urban "resilience" constitutes the core connotation of "resilient cities." Research from various countries indicates that the core information of urban "resilience" includes the constituent elements under hierarchical states, the reduction (or resistance) of disaster types, and the maintenance (or restoration) of a stable state, as well as adaptability to uncertain urban issues. Based on these core elements of urban "resilience" (Figure 4), this paper defines urban "resilience" from the perspectives of resilience capacity and system structure. Urban "resilience" is described as an inherent property of the city, manifested through a hierarchical structure organised from the bottom up by urban components. It exhibits stable characteristics that enable the city to maintain stability through rapid response capabilities, recovery capabilities in the event of sudden incidents, defence capabilities against similar events, and adaptability (or optimisation) capabilities.

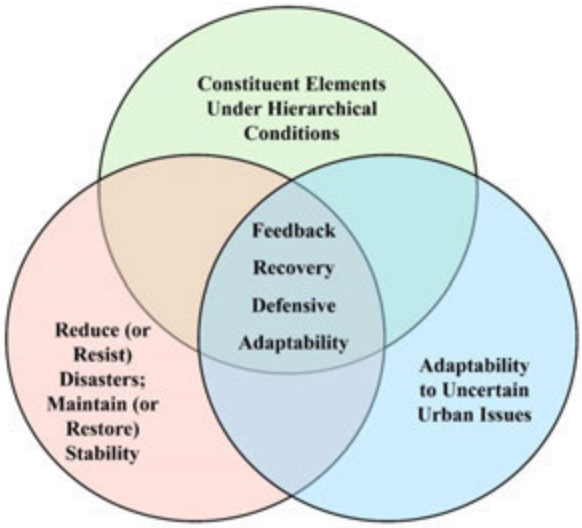

Figure 4: Core Information on Urban "Resilience"

This paper interprets urban spatial resilience as a subset of urban resilience, emphasising the state of resilience within the spatial dimension. The principal subject of the urban spatial resilience concept is urban space, with a focus on spatial attributes, representing the capacity for continuous development and operation of the urban spatial system. This capacity includes the ability to withstand disaster risks, absorb external shocks, and quickly recover essential functions. Resilient urban spaces can help maintain the integrity of urban system functionalities.

Urban spatial resilience is characterised by integrating the three elements of urban space: "scale, density, and form." Urban scale is evaluated based on ecological infrastructure and landscape safety patterns; urban density is assessed through ecological footprint and carrying capacity evaluations; urban form is measured using the "source-sink" landscape mean distance index (Xiu et al., 2018). Enhancing urban spatial resilience involves establishing redundant critical infrastructures, stable open spatial patterns, and modular, scalable spatial units across macro, meso, and micro urban scales to ensure sustainable urban development. Numerous researchers have explored urban spatial resilience from various perspectives. For instance, Liu (2014) defined "resilience planning" as the coordinated integration of rigid and flexible planning to maximise planning efficacy and defined morphological resilience as the characteristic of a spatial form that can sustain spatial development goals while fully accommodating diverse spatial usage demands (K. Liu, 2014). "Morphological resilience" planning techniques determine the material spatial elements that need rigid control according to spatial planning goals, using these rigid elements as the essential components of the spatial structure. Applying open, modular resilience planning techniques constructs an overall spatial structure closely linked with the spatial connotations of urban resilience. Famous urban models such as organic evacuation, cluster, and grid cities exemplify spatial resilience, characterised by stable, open spatial frameworks and modular, scalable spatial units. Xiu, Wei, and Wang (2018) developed a three-dimensional urban resilience research framework based on "scale—density—form" with clear spatial connotations (Xiu et al., 2018). In this framework, urban scale is evaluated based on ecological infrastructure and urban landscape safety patterns; urban density is assessed through ecological footprint and carrying capacity; urban form is evaluated using the "source-sink" landscape mean distance index. Shi (2016), using Shanghai as an example, explored the spatial requirements for enhancing resilience in mega-cities: (1) ensuring a safety baseline with life circles as the basic unit; (2) building disaster prevention systems with urban clusters as network groups; (3) coordinating the overall disaster prevention layout within the municipal area; (4) establishing regional strategic cooperation platforms (Shi, 2016).

This paper proposes that understanding urban spatial resilience should be approached from three critical perspectives:

(1) Transformation of Urban Spatial Resilience into Spatial Resilience Features: It is suggested to cognise and express "urban spatial resilience" as "spatial resilience features". It can be achieved by adopting a series of landscape indices from landscape ecology and representing the spatial resilience of different urban areas through a "Resilience Spatial Distribution Map".

(2) Relationship between Urban Spatial Resilience and Environmental Factors: Urban spatial resilience is closely linked to the natural environment, geological setting, hydrological conditions, wind environment, built environment, and spatial infrastructure factors of the city's location. Urban spatial resilience can be enhanced by expanding the spatial area under consideration.

(3) In-depth and Multi-dimensional Analysis of Urban Spatial Resilience: Efforts should be made to conduct a thorough and multifaceted analysis of urban spatial resilience. It could involve dividing urban areas into resilient and non-resilient spaces, resilient and non-resilient functions, and resilient and non-resilient structures.

3.2 Resilience" Theoretical Model

Based on the definition of "resilience," this paper establishes a "resilience" theoretical model based on its core information (Figure 5). The model specifies and describes the essential elements, operational characteristics, core information, and operational rules of the "resilience" theoretical model.

(1) Basic Elements: Includes both material entities and abstract objects.

(2) Operational Characteristics (Constraints): The "resilience" model is characterised by seven features during operation: "absorption," "resistance," "maintenance," "self-organisation," "adaptation," "learning," and "transformation."

(3) Core Information: The seven operational characteristics are simplified and categorised into four types of information, namely "recovery capability," "maintenance capability," "adaptability," and "transformation capability."

(4) Operational Rules (Also Known as Principles): These rules dictate how combinations of essential elements can form connections that represent the operational characteristics and core information of "resilience."

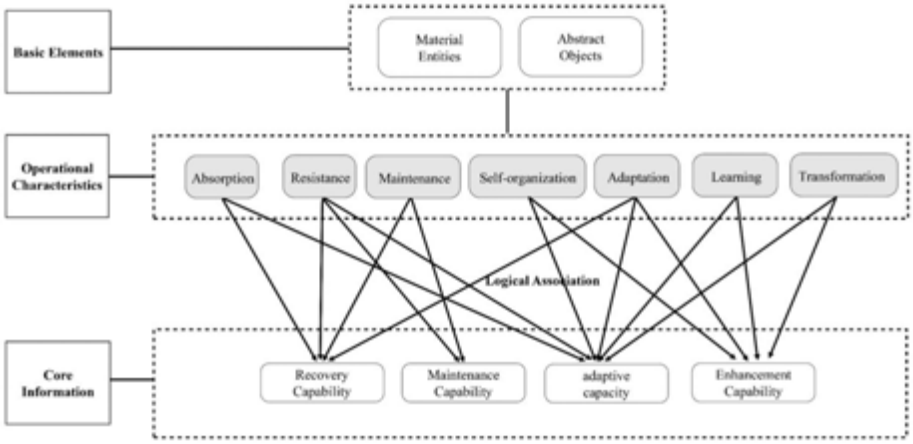

Figure 5: Theoretical Model of "Resilience"

3.3 Theoretical Model of Urban Spatial Resilience

Resilient cities are complex dynamic systems where closely interconnected subsystems create complex interactions that reflect the city’s political, economic, and social relationships. Therefore, resilient cities can be analysed through the relationships among subsystems and system elements (Yang M. et al., 2016; Zhou & Yuan, 2017). The urban spatial structure manifests the results of interactions among hierarchical structures, functions, and elements.

This study initially categorises urban spatial resilience into three systemic levels: macro, meso, and micro. Based on the physical and non-physical scale of system constituent elements, the meso and micro levels can be further subdivided, resulting in a hierarchical structure of single macro, multiple meso, and multiple micro levels (Figure 6).

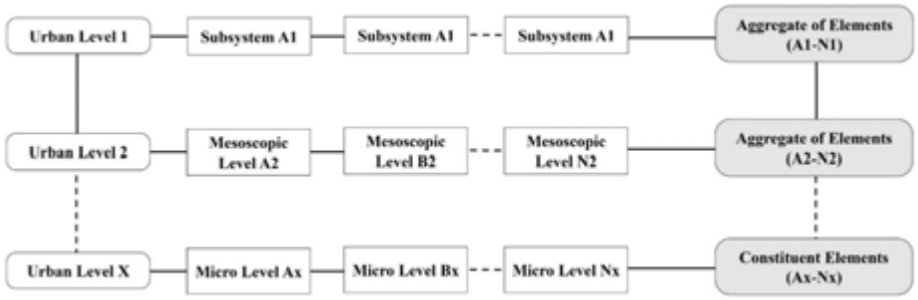

Figure 6: Schematic of Urban Spatial Hierarchical Structure

Based on the "resilience" theoretical model and the connotations and characteristics of resilient cities, this paper further proposes a theoretical model of "urban spatial resilience" (Figure 7). This model comprises operational mechanisms, influencing factors, hierarchical structures, organisational rules, intrinsic connotations and representational forms, and system capabilities.

(1) Operating Mechanisms: Adaptability and learning ability are the core operating mechanisms for urban spatial resilience. Individual cities and urban clusters optimise and reorganise their spatial resilience systems spontaneously by adapting to and learning from the impacts affecting their urban spatial resilience.

(2) Influencing Factors: These include a variety of factors such as the urban ecological environment, socio-economic factors, urban transportation, and land use. The operating mechanisms of the urban spatial resilience system are generated through adaptation to and learning from these factors affecting urban resilience spaces.

(3) Hierarchical Structure: The material and non-material essential components of cities form a stable hierarchical structure under the influence of two resilience mechanisms. From both physical and logical scales, this involves organising resilience components of urban spaces from the bottom up, forming a hierarchical structure with resilience and stability characteristics consisting of a single macro-level, multiple subsystems, multiple meso-levels, and multiple micro-levels, with individual forms varying based on specific case studies.

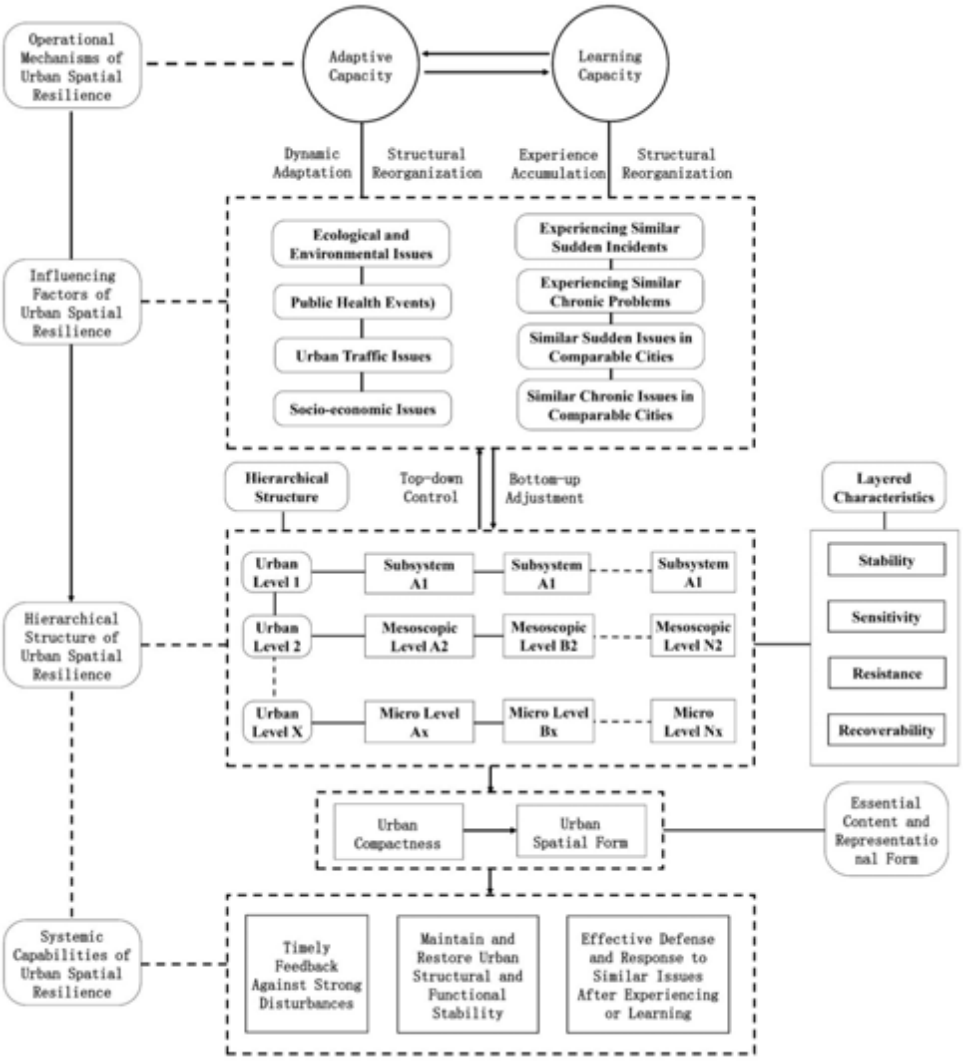

Figure 7: Theoretical Model of Urban Spatial Resilience

(4) Organisational Rules: Stability, sensitivity, resistance, and recovery serve as the organisational rules for urban spatial resilience at different hierarchical levels, forming a relatively stable structure at the system-wide level that can achieve and maintain specific functions. This stable structure can be continuously optimised through adaptation and learning concerning the types, quantities, and connections of the elements composing the different levels of urban spatial resilience.

(5) Intrinsic Connotations and Representational Forms: Urban compactness is the intrinsic connotation of urban spatial resilience, involving the economical and intensive use of land

resources, centralised layout of urban functional elements, enhanced management of urban spatial growth, promotion of high density and mixed-use of urban land, and strengthened urban planning management. The representational form of urban compactness is the urban spatial form.

(6) System Capabilities: Based on the influencing factors of urban spatial resilience, the operating mechanisms effectively organise the hierarchical structure of urban spatial resilience, fostering the generation of three system capability features of urban spatial resilience: "timely feedback against strong disturbances," "maintenance and recovery of urban structure and functional stability," and "effective defence and response to similar issues after experiencing or learning."

4. Shanghai Urban Spatial Resilience: Development Trajectory, Current Issues, and Enhancement Strategies

4.1 Urban Spatial Planning in Shanghai Since 1985

Shanghai's urban planning can be traced back to the "Greater Shanghai Plan" of 1929 (Figure 8), inspired by Ebenezer Howard's "Garden Cities of To-morrow" (1902). This plan employed a grid layout and designated a city centre in Yangpu district, encompassing government buildings, museums, and other public amenities. Although the onset of war in 1937 halted its implementation, this plan laid the foundational principles for subsequent urban planning (MacPherson, 1990). Post-war, multiple master plans were drafted, notably in 1946 and 1956, emphasising industrial development and population decentralisation to alleviate congestion in the central areas(Shanghai Local Chronicles Office, 2003). After the establishment of the People's Republic of China, Shanghai's planning ideology transitioned into the era of Soviet Planning Theory, focusing on industrial orientation and residential environment improvements (Soviet Planning Theory 1949-1958 · Shanghai: Urban Design and Planning, 2024). The 1959 plan significantly expanded Shanghai's administrative boundaries and envisioned transforming Shanghai into a leading beautiful city (Shanghai Urban Master Plan 1959 Edition, 2024). From 1984 onwards, Shanghai pivoted towards becoming a multifunctional economic hub. The 1986 plan further solidified Shanghai's status as a major international metropolis (The State Council’s Response to the Master Urban Planning Scheme for Shanghai, 1986). The plans from 1999 to 2001 established an urban spatial structure that facilitated harmonious development across various urban levels. The latest master plan (2017-2035) projects a longer-term vision, aiming to position Shanghai as a globally influential centre of technological innovation and a modernised international metropolis by 2035, introducing a spatial configuration of "one core, two axes, four wings; multiple corridors, multiple cores, multiple circles".

Figure 8 History of urban planning development in Shanghai

4.2 Urban Spatial Expansion in Shanghai Since 1985

To further analyse the urban spatial expansion of Shanghai since 1985, this study leverages data from (J. Yang & Huang, 2021), which utilises 335,709 Landsat images available on the Google Earth Engine. The methodology involves collecting training samples by combining stable samples extracted from the China Land Use/Cover Dataset (CLUD) with visual interpretation samples from satellite time series data, Google Earth, and Google Maps. The study employs multiple temporal indicators constructed from all available Landsat data, which are then input into a random forest classifier to obtain classification results, culminating in creating the China Annual Land Cover Dataset (CLCD) from 1985 onwards.

The results indicate that from 1985 to 2022, Shanghai's urban expansion predominantly exhibited a pattern of central aggregation and peripheral dispersion (Figure 9). This pattern reflects that the city's development extended beyond merely refilling old urban areas, expanding into peripheral regions and new districts. From 1985 to 1990, urban expansion was primarily concentrated in the city centre with minimal outlying growth. During this period, development focused on maximising the use of internal space and reconstructing key areas to accommodate the city's growing population and economic demands. Between 1990 and 2000, as the economy rapidly developed and urban policies adjusted, Shanghai's urban expansion began transitioning from the city centre to peripheral areas. The construction of major transport routes and new development zones catalysed swift expansion at the city's edges. After 2000, urban expansion entered a new peak period, reaching a nearly 40-year high, with the city centre area almost entirely urbanised. This trend continued until 2015. After 2015, urban growth began to slow, with expansion shifting towards suburbs and emerging satellite towns, characterised by "finger-like" growth patterns along major roadways and transit lines. By 2020, Shanghai's urban spatial expansion significantly slowed, indicating a transition into a more mature and stable development phase. The new urban development strategy emphasises ecological protection and sustainable development, aiming to improve residents' quality of life and environmental conditions while ensuring economic growth (Table 2, Table. 3).

Table 2 Changes in the area of built-up areas in Shanghai

Year	downtown area	Average annual growth	Extended strength	extension type
1985	631.45	/	/	/
1990	710.99	79.54	12.60	low speed
1995	1001.13	290.15	40.81	high speed
2000	1291.56	290.43	29.01	high speed
2005	1739.44	447.88	34.68	high speed
2010	2143.33	403.89	23.22	medium speed
2015	2355.34	212.00	9.89	low speed
2020	2489.10	133.77	5.68	low speed
2022	2537.84	48.74	1.96	low speed

Table 3 Changes in the area of downtown areas of Shanghai

Year	downtown area	Average annual growth	Extended strength	extension type
1985	358.90	/	/	
1990	416.95	58.05	16.17	low speed
1995	603.61	186.66	44.77	high speed
2000	788.56	184.95	30.64	high speed
2005	1029.50	240.94	30.55	high speed
2010	1374.12	344.62	33.47	high speed
2015	1483.85	109.74	7.99	low speed
2020	1545.64	61.79	4.16	low speed
2022	1568.33	22.69	1.47	low speed

Since 1985, Shanghai's urban area has expanded from 631.45 square kilometres to 2537.84 square kilometres in 2022, nearly quadrupling (Table 2). The pace of urban expansion has varied, generally following a 'reverse U' trend with initially slow, then rapid, and subsequently slowing growth rates. Between 1985 and 1990, urban expansion was relatively slow, focusing primarily on infilling the city centre and enhancing infrastructure. Since 1995, changes in domestic and international economic conditions and adjustments in urban policies have marked the beginning of a rapid development phase for Shanghai's urban space. During this period, large-scale developments in suburbs and new districts significantly accelerated the pace of urban expansion, with annual expansion reaching nearly 30 square kilometres. This rapid expansion continued until 2010. After that, as the availability of suitable land for development decreased and urban planning policies shifted, the pace of Shanghai's urban expansion began to slow. The focus of urban development shifted from quantity to quality, emphasising improvements in the urban living environment and economic efficiency. Since then, the rate of urban expansion has stabilised at about 10 square kilometres per year.

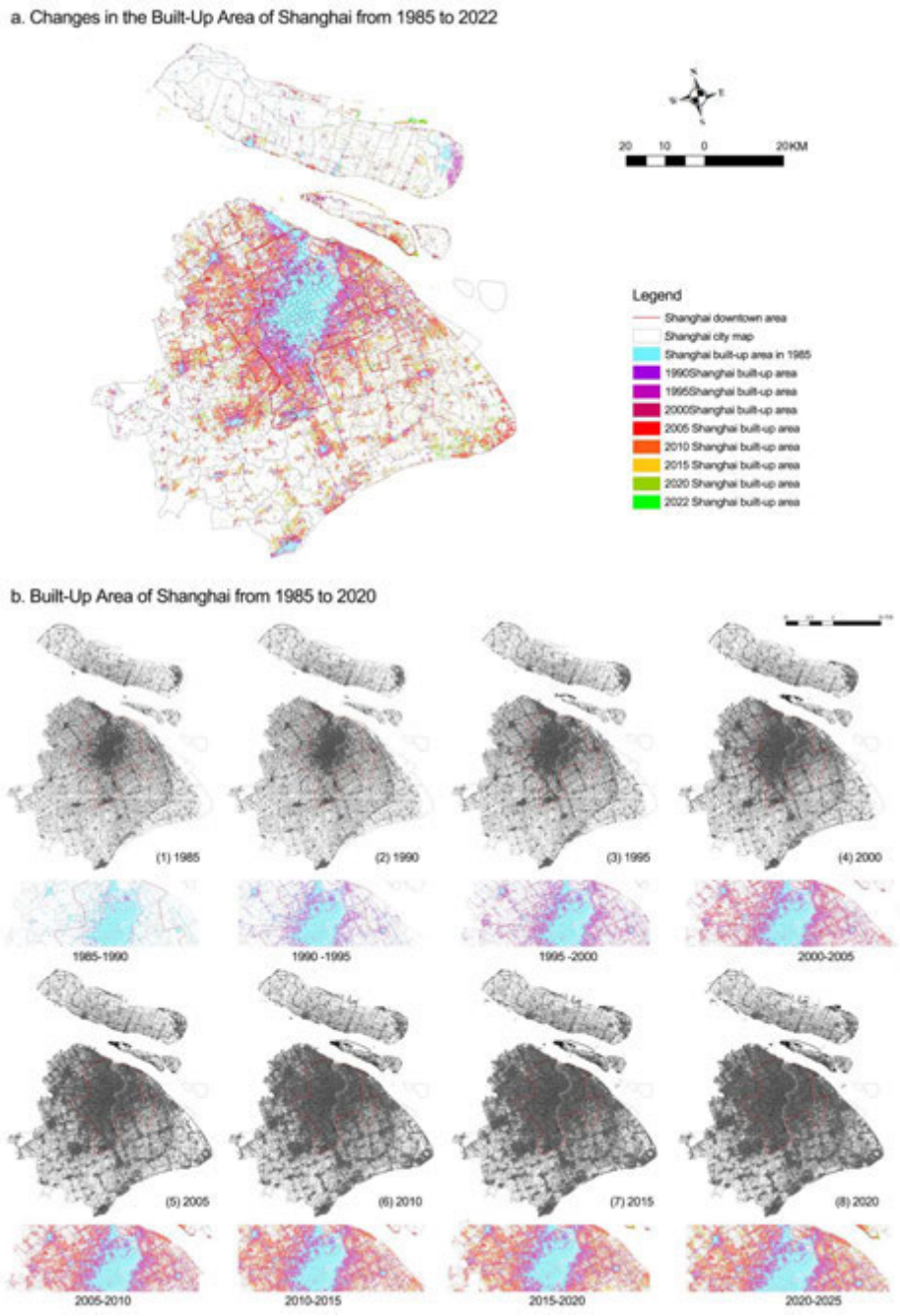

Figure 9 Changes in Shanghai's built-up area from 1985 to 2022

Since 2022, the pace of urban expansion in Shanghai has stabilised, indicating that the amount of land available for urban use in the city centre is nearing saturation. Urban development is increasingly focused on enhancing the efficiency of existing urban land use and improving the quality of urban life. The government and developers are actively seeking new urban development models, such as through urban renewal and the transformation of old districts to optimise urban spatial configuration and enhance city functions while also strengthening the construction of green infrastructure and public service facilities to support a sustainable urban future.

4.3 Current Issues in Shanghai’s Urban Spatial Resilience Construction

The challenges posed by climate change and rapid urbanisation are particularly pronounced in the construction of urban spatial resilience in Shanghai. As global warming intensifies, Shanghai is increasingly subjected to extreme weather events such as floods and high temperatures. While significant progress has been made in enhancing flood defences, the measures in place to cope with high temperatures remain inadequate, especially regarding disaster monitoring and early warning systems that require further strengthening. Rapid urban expansion has exerted substantial pressure on the ecological environment, leading to a reduction in urban green spaces and wetlands and a decline in ecosystem functions. Reducing natural buffer zones and ecological barriers increases the city's vulnerability to natural disasters.

Moreover, the city's economic resilience is also being tested. Although Shanghai has become a central global commercial and financial hub, its economy is highly dependent on international markets and foreign investment, which may pose challenges during global economic instability. Additionally, Shanghai is continuously focusing on enhancing social resilience. City administrators are striving to improve public health services, the education system, and housing policies to enhance the quality of life for residents. Nevertheless, rapid urbanisation continues to cause uneven distribution of resources and social stratification. Urban planners and policymakers in Shanghai need to consider these complex factors to develop more effective strategies that promote sustainable development and strengthen urban resilience.

4.4 Analysis of the Relationship Between Urban Compactness and Urban Spatial Resilience

Urban compactness typically refers to a city's intensive and efficient spatial arrangement, encompassing high-density construction, multifunctional land use, and effective public transportation systems (Dantzig & Saaty, 1973; Lan et al., 2021). Urban spatial resilience, however, focuses on a city's ability to maintain critical functions, rapidly recover, and adapt to natural disasters, economic crises, or social changes. Both concepts are crucial topics in the field of sustainable urban development. These principles aim to enhance urban environments' liveability, sustainability, and adaptability, ensuring that cities can withstand and adapt to various challenges while continuing to thrive.

According to relevant theories of urban economics, Richardson et al. proved that the most efficient external space form of urban construction is circular. When the city is round, the compactness is 1. The larger the Richardson index, the more compact the spatial shape. This paper refers to relevant studies (Lan et al., 2021; Lv et al., 2022; Meng & Xing, 2019) and uses Richardson index to express the compactness of the block. Moreover, it is calculated as follows:

$$C = \frac{2\sqrt{\pi * A}}{P}$$

Where A is the area of the block, P is the block's perimeter.

The changes in the compactness of Shanghai city are shown in Figure 10. From 1990 to 2005, the increase in compactness was relatively stable, with an increment of approximately 0.02 every five years. It likely reflects the orderly advancement of urban planning and infrastructure development in Shanghai during this period, gradually enhancing the efficiency of urban operations and the quality of life for residents. The growth in compactness significantly accelerated between 2005 and 2010, increasing by 0.05. This change may be associated with accelerating urbanisation in Shanghai, such as hosting the 2010 Shanghai Expo. Much infrastructure construction and urban expansion likely occurred during this period. From 2010 to 2022, the growth in compactness returned to a stable state, with an increase of 0.01 every five years or two years. It indicates that urban development has entered a more mature and stable phase, where the optimisation and adjustment of urban space are more focused on details and quality, gradually enhancing urban spatial resilience.

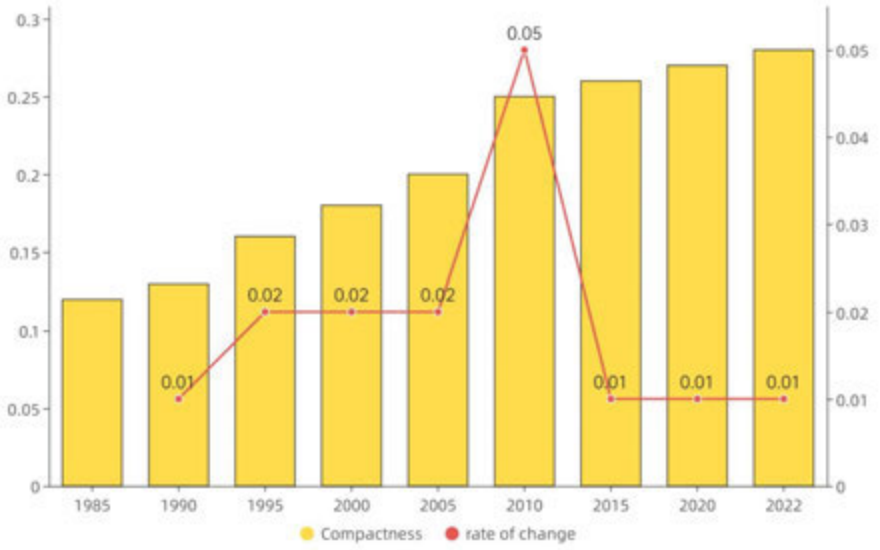

Figure 10 Changes in Shanghai's compactness from 1985 to 2022

The relationship between urban compactness and urban spatial resilience manifests in three critical aspects: ecological environment sustainability, economic vitality enhancement, and social and cultural dimensions resilience.

(1) Sustainability of the Ecological Environment: Compact cities contribute to protecting the natural environment and reducing ecological degradation by minimising land consumption and enhancing land use efficiency (Yao et al., 2022). For instance, by curbing urban sprawl and promoting the construction of high-density residential areas, more natural and semi-natural areas can be preserved, which are crucial for providing ecosystem services such as water retention, air purification, and biodiversity conservation. Furthermore, compact urban forms

help reduce commuting distances and, consequently, lower carbon emissions from transportation, thus mitigating the urban heat island effect and enhancing the overall ecological resilience of the city (Stevenson et al., 2016).

(2) Promotion of Economic Vitality: A concentrated urban layout facilitates the maximisation of resource utilisation and efficiency enhancement (B. Li, 2022). Compact cities can reduce transportation costs and time, enhance business synergies, and accelerate knowledge and technology dissemination. This environment not only attracts more businesses and talent but also fosters innovation and entrepreneurial activities, thereby strengthening the economic resilience of cities. It enables cities to recover and adapt quickly to economic fluctuations or external shocks.

(3) Resilience of Social and Cultural Dimensions: Compact urban environments promote interactions and communications among people from diverse backgrounds, enhancing cultural diversity and social inclusivity (Raman, 2010). This diversity and inclusivity are integral components of social resilience, which can reduce the risk of social fragmentation and conflict during times of change or crisis by strengthening community cohesion and mutual support.

In conclusion, the interconnectedness of urban compactness and spatial resilience spans multiple dimensions, including ecological, economic, and socio-cultural aspects. Urban planners, in their pursuit of urban compactness, should comprehensively consider its impact on the city's overall resilience to ensure more holistic and sustainable urban development.

4.5 Principles and Strategies for Building Shanghai's Urban Spatial Resilience Based on Compactness Elements

Based on the theoretical model of urban spatial resilience and the characteristics of compact urban development, this paper proposes a series of construction principles and enhancement strategies for building urban spatial resilience in Shanghai.

4.5.1 Construction Principles Proposed for Shanghai's Urban Spatial Resilience:

(1) Principle of Mixed Use: Encourage multifunctional land and space use in urban planning and construction, such as integrating commercial, residential, educational, and green spaces to form functionally integrated communities (Verdú-Vázquez et al., 2017). It reduces commuting distances and increases convenience and comfort in daily life (Gaigné et al., 2012). Developers and designers are encouraged to adopt flexible architectural designs, such as variable wall systems and multipurpose rooms, to accommodate future functional changes and diverse usage demands. It enhances the self-sufficiency of communities and provides additional support and buffering in the face of disasters or social upheavals.

(2) Ecological Priority Principle: Prioritise ecological protection and sustainable development in urban planning and expansion. Utilise natural infrastructure such as parks and wetlands to enhance the city's ecological resilience, protect biodiversity, and address urban heat island effects through microclimate regulation and flood risk reduction (Wu et al., 2020). Adopt renewable energy sources like geothermal and solar energy and promote using green building materials to reduce the environmental footprint of urban development and operations (Chel & Kaushik, 2018).

(3) Adaptive Flexibility Principle: Urban design and planning should exhibit high adaptability and flexibility, considering long-term environmental changes, social dynamics, and technological advancements (Jabareen, 2013). For example, the design of buildings and infrastructure should be adaptable to the impacts of climate change(Carter et al., 2015). Develop comprehensive strategies for natural disaster response, including constructing flood barriers, earthquake-safe building standards, and rapid-fire response systems, to effectively enhance the city's resistance and recovery capabilities in the face of natural disasters.

4.5.2 Enhancement Strategies for Building Shanghai's Urban Spatial Resilience:

(1) Strengthen Infrastructure Interconnectivity: Shanghai should continue to improve and strengthen its urban transportation network and public facilities to ensure rapid functional recovery after disasters (S.-C. Liu et al., 2021). Expand multimodal transportation systems, including public transit, bicycle lanes, and pedestrian paths, to reduce reliance on personal vehicles and enhance urban operational efficiency (Y. Li et al., 2024). These measures will enable the city to maintain continuity of operations and services in the face of public health emergencies or other urgent situations.

(2) Promote Green Building and Smart City Technologies: Utilise energy-efficient building materials and intelligent technologies, such as smart grids and automated management systems, to enhance the energy efficiency and operational flexibility of buildings and the city (Um-e-Habiba et al., 2024). Using energy-efficient materials, green roofs, smart grids, and automated systems reduces environmental pollution and increases the city's adaptability to various scenarios (Singh, 2024).

(3) Promote Socio-economic Diversification: Encourage industry diversification and innovation to enhance the city's economic resilience and reduce dependence on single economic sectors. Support the development of small and medium-sized enterprises to improve the economic system's resistance to external shocks. A diversified economic structure can help the city withstand global economic fluctuations and local economic crises(Sheng et al., 2024).

By implementing these principles and strategies, Shanghai can enhance its urban spatial resilience and ensure sustainability and high-quality living for its residents while pursuing compact urban development. These measures strengthen Shanghai's resilience in facing future challenges, including natural disasters, economic fluctuations, and social changes.

5 Conclusion

Constructing resilient cities is one of the critical planning goals for Shanghai's urban development. Based on an interpretation of the definition, connotations, and characteristics of "resilient cities," this paper analyses current issues in Shanghai's urban spatial construction. It explores principles and strategies for enhancing urban spatial resilience in Shanghai, leading to the following six research conclusions.

(1) The Concept, Development, Connotations, and Characteristics of Resilient Cities:

A resilient city is a type of advanced urban form that possesses strong adaptive and learning capacities, effectively responds to significant urban disturbances such as climate change threats, ecological issues, and public health incidents within a particular spatiotemporal scope, promptly restores structural and functional stability, and continues to evolve beneficially. This paper

classifies international research on resilient cities into four stages: nascent, initial, rapid development and reflection of continued development. Analysing the systemic composition, organisational methods, and representational forms of resilient cities reveals that they encompass three essential connotations: urban structure, resilience mechanisms, and resilience representations. These cities also exhibit four categories (encompassing 13 specific characteristics) of essential features: capabilities, structures, mechanisms, and representations.

(2) Definition and Connotations of Urban Spatial Resilience:

Urban spatial resilience is characterised by integrating the three elements of "scale, density, and form" in urban spaces, allowing "urban spatial resilience" to be cognitively expressed as "spatial resilience features." The diversity of urban spatial resilience is evident in the variety of urban functions, choices during impact processes, socio-ecological environments, and multi-scale connections among urban components. The structural organisation of urban spatial resilience exhibits high adaptability and flexibility, manifested in the construction of hierarchical urban spatial structures at macro, meso, and micro levels and in the organisation of social functions.

(3) Theoretical Model of Urban Spatial Resilience:

Based on the connotations and characteristics of resilient cities, this paper has sequentially proposed theoretical models for "resilience" and "urban spatial resilience." The "resilience" theoretical model includes essential elements, operational characteristics, core information, and operational rules. The "urban spatial resilience" theoretical model comprises operational mechanisms, influencing factors, hierarchical structures, organisational rules, intrinsic connotations and representational forms, and system capabilities. The "urban spatial resilience" theoretical model can be applied to analyse the evolution phenomena, construction principles, and enhancement strategies of urban spatial resilience in Shanghai, realising system characteristics of urban spatial resilience that "respond timely to strong disturbances," "maintain and restore the stability of urban structure and functions," and "effectively defend against and address similar issues after experiences or learning."

(4) Evolution, Changes, and Current Issues of Urban Spatial Resilience in Shanghai since 1985:

Since 1985, urban expansion in Shanghai has predominantly displayed a pattern of central concentration with peripheral dispersion, marking a shift from mere rapid expansion to a focus on integrated quality and sustainable development. Urban spatial growth has gradually slowed, and urban compactness has progressively strengthened. Urban development has entered a more mature and stable phase, emphasising ecological protection and sustainable development, thus gradually enhancing urban spatial resilience. The city has moved from concentrated high-speed development in the city centre to more balanced development in the suburbs and new areas. During this process, Shanghai has gradually improved its urban compactness, driving the overall optimisation of transport, public services, and green infrastructure. However, as the city's scale has expanded, Shanghai faces multiple challenges, such as traffic congestion, environmental pollution, social inequality, and disaster response. Future urban planning needs to focus more on finding a new balance between developmental drive and environmental protection, strengthening community participation and technological innovation to build a more resilient and inclusive urban environment, and ensuring sustainable development strategies can effectively address upcoming social and environmental challenges.

(5) Principles and Strategies for Constructing Urban Spatial Resilience in Shanghai:

Based on the theoretical model of urban spatial resilience, the construction of Shanghai’s urban spatial resilience should adhere to the principles of multifunctional use, ecological priority and adaptive flexibility. By implementing strategies such as strengthening infrastructure connectivity, promoting green buildings and innovative city technologies, and fostering socio-economic diversification, the city’s overall resilience and capacity for sustainable development can be comprehensively enhanced. These strategies significantly improve Shanghai’s ability to respond and adapt to natural disasters, economic fluctuations, and social changes, as well as raise the overall standard of urban infrastructure and the quality of life for residents, ensuring a sense of community cohesion and security. Through these integrated measures, Shanghai can achieve a greener, more intelligent, and more humane urban development model, addressing immediate challenges while laying a solid foundation for future sustainable growth, ensuring a harmonious coexistence of urban environments and economic vitality, and thereby achieving comprehensive and enduring urban prosperity and resident well-being.

The current state of urban development across various countries indicates that traditional "safety-defense" disaster prevention concepts no longer meet the needs of contemporary urban risk management. Instead, resilience thinking, which originated in ecology, has come into focus. As an evolving concept, enhancing urban spatial resilience is an effective way to address the risks of urban climate change and follow sustainable development principles and a practical necessity to control chaotic urban sprawl and achieve compact development. The research conclusions of this paper are intended to aid urban managers and researchers in deeply understanding the concepts, connotations, and characteristics of resilient cities and urban spatial resilience. They clarify the principles for constructing urban spatial resilience, the methods for analysing it, and strategies for its enhancement, thereby enabling an appropriate response to the challenges and risks encountered in constructing resilient cities.

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Nature is (not) democratic
Notes for a community-based approach to "natural resources"

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Abstract
The paper demonstrates how different understanding of what nature is and what socio-natural assemblages it forms can lead to strikingly contrasting environmental strategies and planning approaches, and argues for a reframing of nature and natural resources governance in the context of planning practices if a truly earthcaring model is to be achieved. Considerations and reflections developed on the current mainstream environmental policies and their understanding of nature, as well as on alternative framings of nature and politics of nature, aim at outlining a frame of reference for the co-management of nature in the perspective of the urban bioregion approach, by defining the conceptual basis and identifying research and practice gaps.

Keywords
natural resources, politics, local communities, urban bioregion

Full text

1. Setting the scene: the eco-crisis we are dwelling in

Sixty-two years ago, when Rachel Carson published her book *Silent Spring* (Carson, 1962), the environment was not a matter of public and political concern, and the outbreak of environmental awareness she started at the peak of the modern economic growth narrative was fiercely opposed. Since then, one could argue, environmentalism has come a long way: the green paradigm has now become an essential requirement and often a driving force for politics and policies all over the world. Nevertheless, unprecedented ecological disruption is harming territories more seriously than ever, with limitless soil consumption, chemical pollution, alteration of hydrological cycles, annihilation of ecosystems, irreparable loss of biodiversity, and so on. It seems the strategies adopted at a global level have failed to address the problem. It might even be that relocalising the global has ultimately become a necessity precisely because this excessive acting of nature makes it impossible to grab the Earth globally (Latour, 2015). Or that the practice of thinking globally, i.e. globalism, rides contrary to the interests of "people, polity and nature" (Olwig, 2011: 401).
This paper demonstrates how different understanding of what nature is and what socio-natural assemblages it forms can lead to strikingly contrasting environmental strategies and planning approaches, and argues for a reframing of nature and natural resources governance in the context of planning practices if a truly earthcaring model is to be achieved. The topic is of extreme relevance in times of uncontested consensus over environmental issues parallel to mounting ambivalence of institutional and corporate statements over nature and environmental policies. The following sections of the text outline the argument, first, by analysing the conceptual frame of reference for the

current mainstream environmental policies and their understanding of nature, based on an apocalyptic imaginary coupled with an ecological modernisation promise of redemption. Second, alternative framings of nature and politics of nature are explored, from the new materialist tradition to post-human perspectives and more recent critical approaches. Having uncovered the de-politicising/re-politicising gestures inherent to these dominant and alternative views of nature, the argument moves to consider how they influence current planning practices, outlining an articulation of anthropocentric, ecocentric, and relational attitudes in nature management and design. The final section argues that a bioregional approach could provide an alternative promising answer to the environmental problem in planning practice. It therefore identifies research trajectories and gaps to address for the development and implementation of appropriate bioregional planning tools for the community-based management of natural resources.

2. Diving into key concepts: nature as a resource

The ecological modernization theory has emerged since the Nineties as a mainstream response to the ecological crisis. The theory's supporters argue that no system shift is necessary in the economic model, as the best way to solve the current environmental problems lies in further advancing technological progress and industrialization. Fisher and Freudenburg (2001) explain the dual argument supporting such expectations.

> "First, the theory explicitly describes environmental improvements as being *economically feasible*; indeed, entrepreneurial agents and economic/market dynamics are seen as playing leading roles in bringing about needed ecological changes. Second, in the context of the expectation for continued economic development, ecological modernization depicts political actors as building new and different coalitions to make environmental protection *politically feasible*" (*ibidem*: 702).

The roots of such a perspective can be traced back to the "sustainable development" formula introduced by the Brundtland Commission (WCED, 1987), with its belief that ongoing economic growth could be achieved by better managing technology and society within the planet's ecological limits. Sustainability therefore results from the combination of a technological and a market fix, on one side decreasing the energy and material flows required by the economic growth, while on the other accounting for nature's contribution in the current economic system. By these means, the ecological modernisation paradigm ultimately promises to fix the unbalances and disruptions brought up by the limitless growth paradigm by decoupling wealth production and the use of natural resources.

Within this system of thought the notion of nature as a resource to be properly managed has even intensified the centuries-long process of objectification and de-politicisation of nature, in particular with the introduction and mainstreaming of concepts and frameworks such as the Natural Capital and the Ecosystem Services.

Born as an attempt to bridge ecology and economics, the concept of "natural capital", which emerged in the mid-Nineties, is presented as a move from traditional economics view of nature as a resource to be used in production to nature as capital to be preserved and renewed (Fenech et al., 2003). However, the idea that placing a market

value on nature is the right strategy to preserve its intrinsic value is highly contestable, for a number of reasons. As Monbiot (2018) points out, first, the name itself is misleading, since financial capital and nature are neither comparable nor interchangeable; second, it is meaningless to price something unless it is for sale; and third, it is even counterproductive. Indeed, it suggests that an intensification of the same logic that destroys nature will be able to save it, and that the existence of a market value is more effective to stir a desire to protect nature than its intrinsic value – an idea which has already been proven wrong (Crompton, 2010). On the contrary, "markets change the meaning of the things we discuss, replacing moral obligations with commercial relationships" (Monbiot, 2018).

The concept of "ecosystem services" was first formulated in the Seventies, but became popular in the same years when the ecological modernisation and the Natural Capital were gaining consensus. It was in the following decade, with the turn of the Millenium, that institutional mainstreaming projects were initiated: the Millenium Ecosystem Assessment (MEA), the Natural Capital Project, The Economics of Ecosystem Services (TEEB). Despite growing popularity, the framework is not exempt from criticism. Among other observations, Ernstson and Sörlin (2012) interpret the Ecosystem Services approach as a technology of globalisation which, by applying a set od standardised practices and procedures, achieves objectives of abstraction, universality and comparability, virtually disconnecting the benefits bestowed by the ecosystem from the place, the social realm, and the possibility of conflict – as well as from the ecosystem itself. The result is a de-politicising gesture, to be interpreted within a wider technomanagerial turn, since "what once was political is through the [Ecosystem Services] approach translated into a scripted set of non-political acts of management" (*ibidem*, p. 282).

Overall, the concepts and frameworks proposed within the ecological modernisation paradigm operate towards a general de-politicisation by means of invisibilisation and backgrounding. For Barca (2020) what is overshadowed in the dominant environmentalist narrative is the relevance of the "forces of reproduction", those subjects that reproduce humanity by taking care of the biophysical environment and that represent potential alternatives to the current order. For Ernstson and Sörlin (2012), from the specific standpoint of the ecological modernisation frameworks and procedures, alternative ways of knowing and valuing nature are silenced and delegitimised. For Swyngedouw and Ernstson (2018), on a more general level, the invisibilised is the "intra-human exteriority" or, in other words, the heterogeneity of humanity which provides the space of the political. The resulting post-political condition, in the end, further reproduces logics of hierarchy and domination, well represented by the city-countryside power balance or more general neocolonial attitudes, which are the root of the current extractive relation with nature.

No wonder that the ecological modernisation theory has been easily integrated in the framework of the Planetary Boundaries and the Sustainable Development Goals (Barca, 2020), with an emphasis on the concept of resilience. As observed by MacGregor (2017), 'the valorisation of climate resilience over human vulnerability removes expectations of citizen resistance to the root causes of ecological crisis, thereby casting it as an inevitable and therefore non-political *fait accompli*'.

Serving to frame the emerging environmental problems and the solutions put forward by the élites as respectively unquestionable and indispensable, the dominant

environmental imaginaries and policies are in fact seen by philosopher Alain Badiou as the "contemporary form of the opium for the people" (Badiou, 2008: 139).

3. Framing the alternatives: nature, the human, and liberation

Alternative conceptualisation of nature and the nature-society nexus may help shift from domination to cooperation logics. Much of the critical thought concerning nature and the ecology is indebted to the materialist tradition.

The ecoanarchist perspective of Murray Bookchin (2017 [1982]) builds on a multifaceted ecology-freedom nexus, starting from the premise that human domination of nature derives from human domination of human by human, and is therefore necessary to liberate the latter through a deconstruction of hierarchy and domination structures in order to emancipate the former. The quest for a free ecological society model involves a reflection on an appropriate, human-sized technology and the management of natural resources by de-centralised local communities, resulting in an argument in favour of direct democracy, municipal autonomy, and community self-determination.

Despite reciprocal criticism, almost contemporary ecoanarchist and ecofeminist perspectives share the idea of a nexus between the domination of nature and the domination of human subjects, and between the achievement of a truly ecological society and a project of double emancipation. The ecofeminist thought provides refined instruments to uncover the technoscientific governing apparatus which stands as the protagonist of ecomodernist thought, since its emergence in the Eighties from the women's movements' contestation of the relationship between science, female bodies, and nature. Carolyn Merchant in *The Death of Nature* (1980) first demonstrated how modern science, degrading the natural world from a living organism to a functional machine, realised its domination on nature and women. In the same decade, from the South of the world Vandana Shiva (1989) reproposed Gandhi's critique of modern science as a form of power, which causes "*male*development" through the imposition of violence, inequalities, domination.

Starting from these premises, ecofeminist thinkers then and now have been promoting an alternative perspective on the economy, where the idea of sufficiency replaces "wellbeing" as emerging from continuous growth. This shift is meant as an act of liberation of all the values denied by the market, including self-sufficiency, cooperation, an ethics of care, and results in a renewed interpretation of politics, which re-centres everyday needs and the living world, valuing - for instance - food sovereignty and the commons, and non-hierarchical practices (Bianchi, 2012). For Salleh (2009), for example, a principle of eco-sufficiency must replace the eco-efficiency endorsed by ecomodernist theories to address the ecological crisis from the perspective of life reproduction, where nature provides for human needs rather than profit.

Such a perspective implies a reconsideration of the non-human – as well as the sub-human – focused on multispecies entanglements and aimed at cooperation and commoning. Views on this point are evolving and are definitely not homogeneous. Perspectives focused on difference and relationality are complemented by a growing body of literature drawing on posthuman views (see Haraway, 2016). Barca (2020) discusses the tension between posthuman new materialist thought and traditional materialist ecofeminism in terms of a different vision of technology.

> "A major point of tension is provided by the different visions of agency (whether this should be extended to objects) and, related to this, of technology in general. New materialism tends to see human agency as inherently incorporating technology, which cannot be separated from it, but rather should be embraced in the more-than-human understanding of subjectivity. Materialist ecofeminism, however, tends to see technology as a dangerous and often violent social *dispositif* of control over human and nonhuman life" (*ibidem*: 39).

Pellizzoni (2017, 2023) develops an analysis of the intrinsic ambivalence of posthuman thought, and critiques in particular the assumption that the suppression of dualisms should automatically have emancipatory effects. Rather, he registers "evidence of a burgeoning governmentality of science and technology which builds precisely on nondualist standpoints" (Pellizzoni, 2017: 71): the conceptualisation of the world as inherently fluid, indeed, removes any boundary to the (human or non-human) agent's action and eradicates responsibility, making space for a radical experimentalism of the kind expressed in eco-pragmatist programs such as the *Ecomodernist Manifesto* (Asafu-Adjaye et al., 2015). A fundamental point he makes is the need to aknowledge that "runaway capitalism" employs new domination patterns and techniques, taking advantage of indeterminacy and chaos as governing instruments (Pellizzoni, 2023). Drawing on his reflections, Swyngedouw and Ernstson (2018) have clearly described the new ecomodernist argument.

> "The excessiveness or supernumerary acting of 'nature' becomes enfolded within capitalism itself. To save the world and ourselves, we need not less capitalism, but a deeper, more intense and radically reflexive form of capitalism, one that revolves around reconstructing DNA and genetic material, forces gas out of shale formations so it can be 'carbon-stored' elsewhere, mobilizes the power of the nuclear to drive the economy, and works to terraform earth in a mutually benign co-constitution.
> Much of this perspective is indebted to the consolidation of non-linear ecological complexity theory that cherishes 'emergence', 'resilience', continuous experimentation, the 'indeterminacy' of nature, and radical openness, but without explicit attention to capital, culture, and politics" (*ibidem*: 13).

4. Investigating planning practices: from dualisms to relationality

In the fields of planning and management of nature, practices and policies have been described as oscillating between two opposite poles: a dominant anthropocentric dissipative attitude, updated in its green version to a "sustainable management" model, and an ecocentric conservative attitude, rooted in radical deep ecologies, which aspires to the restoration of an ideal pristine nature (Luciani, 2022; Ventura, Ribas and Saurí, 2002; Magnaghi, 2001).
As an example, in the context of river management Ventura, Ribas and Saurí (2002) identify two opposite models, anthropocentric and ecocentric, to which they refer practical and theoretical approaches. From an anthropocentric standpoint, the river is a source of natural resources, and the aim of river management is to increase the material well-being of society. From the ecocentric perspective, the goal is to reach an ecological balance, with reference to an ideal natural status of the river, before any human interference. The different disciplines involved in the two management models

represent the river, on the one hand, as a de-contextualised object of control, and on the other, as the subject to a return to an original – though hypothetical – place and time. When conflicts arise – such as disruption caused by extreme weather events – each discourse attributes the responsibility to the opposite view, and propose to radicalise their own principles as a solution. According to the authors, it is the inflexible opposition between the two that prevents the resolution of conflicts. The way out, for them, is to adopt what they call an 'environmental' model, based on a dialogue between an 'anthropic view' and a complementary 'ecosystemic view'.

On a more general level, Alberto Magnaghi (2001) has described three different attitudes towards the territory: dissipative, typical of industrial modernity, of which ecomodernism is just the most up-to-date version; conservative, mostly typical of the ecological culture; and finally, a third attitude for which development results from the enhancement of the territorial heritage, through coevolutionary interaction between environmental, territorial and urban systems, society and local cultures.

The search for a third way, an alternative to the dominant polarisation, indicates the insufficiency of both extremes in that they are still based on a centre, while a relational focus, as suggested by the ecofeminist contribution to the environmental ethics (Proctor, 1998), would allow for a more balanced approach (Table 1).

Discourse	Anthropocentric	Ecocentric	Relational
Society-nature relationship	Demand/ consumption	Preservation and restoration	Democratic care and enhancement
Aim	Increase of material wellbeing	Natural balance	Natural and human coevolutionary balance
Reference	Fluxes	Pristine nature	Human environment
Scientific discipline(s)	Water regulation (quality and quantity forecast and control)	River ecology (natural values preservation and enhancement)	Territory / landscape sciences (human and natural values enhancement)
Time	Linear progress	Retrospective	Longue durée
Space	Anonymous	A (new) previous place	Identitarian, historical, relational place
Social aspects of the river	Economic-rational	Identitarian-emotional	Relational/ dialogical
Management model	Managerial (expert-led)	Impact minimisation / contemplation (expert-led)	Integrated, cooperative (expert and local knowledge)
Origin of conflicts	Ecocentric discourse	Anthropocentric discourse	Disconnection of the two realms

Table 1: The table summarises and confronts the main characteristics of the anthropocentric and ecocentric discourses, adapted from Ventura, Ribas and Saurí (2002), and those of a third discourse, named relational and derived from the territorialist approach that Magnaghi (2001) indicates as a neither dissipative nor conservative attitude towards the territory.

The three families of approaches are ideal-typical, but examples can be found in current planning and design practices that can be traced back to one or more of these categories.

Dominant planning practices tend to adopt a resource-based, techno-centred, and even technocratic approach that results in a radicalisation of the anthropocentric and ecocentric polarities. On the anthropocentric side, under the formula of sustainable management, which embraces the institutional and globalised view of 'the Anthropocene' (Barca, 2020; Swyngedouw and Ernstson, 2018), one can find the majority of the global-level approaches to address the environmental crisis, which follow development and progress objectives and consider nature as an asset to be handled wisely with the best available technology, on which they rely to turn the tide of environmental deterioration. They make wide reference to the Natural Capital and the Ecosystem Services frameworks, and point to the need of a global expert governance to address the environmental issues. Geoengineering is one of the technological strategies envisaged to "manage" the climate, which would require large-scale international research, governance and policy frameworks (The Royal Society, 2009).
On the ecocentric side, regenerative and biophilic approaches to the built environment, alongside with a conservationist paradigm, tend to dominate in planning practices. Emerging from a shift from a mechanistic understanding of the world to an ecological worldview (Mang and Reed, 2012), regenerative approaches target self-sustaining ecological design and make extensive use of nature-based solutions, 'letting nature do the work' (Lyle, 1994), while biophilic perspectives assume nature and its processes as the main reference to design the built environment as a human biological need. Regenerative design, however, can be understood in very different terms. Biomimicry, for instance, meant as "the emulation of strategies seen in the living world as a basis for design and innovation, […] the emulation of an organism, organism behavior, or an entire ecosystem, in terms of its form, material, construction method, process strategies, or function" (Pedersen Zari and Hecht, 2020: 3), is understood by its supporters as contributing to a regenerative framework. However, the practice of mimicking nature in the built environment on the premise that "humans are an indivisible aspect of multiple interacting ecologies" (*ibidem*: 2) seems to embody the warning (see the previous paragraph) that the indeterminacy of the human and the natural subsumed in the technological can result in ambivalent approaches. Indeed, biomimicry can be seen as aiming on one side to do without nature, since its services can be provided by an artificial environment, on the other to replace nature with a cyborg ecology, whereby the natural processes become themselves dependent on technological inputs.
Alternative views, however, can be envisaged by focusing on the intricated coevolutionary relationship between diverse ecological subjects, including humans and non-human entities, without dismissing the separation, foundation of the relational - therefore political - dimension. Otherwise, post-human cyborg hybridisation could reinforce the destruction of nature by riding the simultaneity and indeterminacy of ecocentric and anthropocentric attitudes.
One of the key points of a relational attitude, which at the operational level could well employ some kinds of regenerative methodologies, is the recentring of the political in nature stewardship. Table 1 shows how both anthropocentric and ecocentric approaches, despite opposite premises and aims, tend to see the principles of their respective disciplines as normative, and therefore adopt expert-led post-political management models. The third discourse, instead, acknowledges science, technology, and even culture, as political. The management of local "natural resources", in a

cooperative coevolutionary perspective, is not driven by top-down impositions of either sustainable-exploitation, conservation-without-use or indistinct hybridisation models, but is performed by self-organised communities whereby expert and local contributions complement each other as equally relevant.
Some grassroots initiatives can be observed that seem to point to this direction. For instance, they can be identified in the everyday practices of some environmental movement groups that focus on sustainable food, renewable energy, and making to restructure the fluxes that support their basic needs on a local rather than global basis, through re-localised, self-organised and non-hierarchical networks recognised as fully immersed in the natural systems (Schlosberg and Coles, 2016). Similarly, other examples may include the permaculture movement's practices which are inspired by principles of earth care, people care, and fair share, interpreted by Centemeri (2018) as pericapitalist experiences aimed at subsistence objectives and based on "multispecies comoning".

5. Outlining research trajectories: bioregional planning

The urban bioregion approach as developed by Alberto Magnaghi (2014) translates into a territorial planning framework his definition of a third attitude, neither dissipative nor conservative, towards the territory (2001). Drawing upon the regionalist and bioregional planning tradition, the urban bioregion is, in his view,

> "the appropriate conceptual reference for a territorial project which is designed to integrate the economic (referred to the local territorial system), political (self-government of inhabited areas and work places), environmental (territorial ecosystem) and living (functional and inhabited areas of a group of cities, towns and villages) components of a socio-territorial system that pursues a coevolutionary balance between human settlement and the environment, reestablishing new forms of the long-term relationships between city and countryside that tend "towards territorial fairness" (Madec 2012)" (Magnaghi, 2020: 35).

His concept of urban bioregion describes a local territorial system whose main elements are (a) a reticular settlement system characterised by synergistic rather than centre-periphery relations, (b) hydrogeomorphological and environmental systems that coevolve with the settlement and the agro-forestry systems, and (c) forms of self-government of the living environment by the local community, aimed at assuring the self-sustainability of the territorial ecosystem and the wellbeing of the inhabitants. Such wellbeing does not derive from the extraction of resources and profit but rather from a wealth-producing enhancement of territorial heritage and a tendency to the closure of the territorial metabolic cycles.
The natural environment, described as comprising hydrogeomorphological and environmental systems, plays the role of material precondition for the very existence of the urban bioregion, and is deeply tied to the third component, the participation institutions which guarantee the local community's active involvement in the reproduction of the life-producing matrices. Such an active involvement is not limited to common forms of participation, but takes the form of social co-production, a

precondition for the reactivation of a territorialising relationality between the settled community and the natural matrices.
It is worth stressing that the bioregional project of anchoring the settlements within the ecological networks to overcome a defensive attitude that frames nature as *a priori* threatened by the urban doesn't mean that the built environment should mimic or emulate the ecosystems to merge with them - as in the indeterminacy produced by biomimicry. Rather, it implies a *care*ful study of the reproducibility rules of the natural matrices; such rules become the foundational element of the territorial project, according to relationships of mutual acknowledgement, respect, and active care.
Self-government is also necessary to collectively outline and sustain local socio-economic systems. Contrary to the widespread model of hetero-directed territories that pursue exogenous economic objectives, the self-governed urban bioregion enhances its long-lasting heritage structures – including the coevolved natural environment – to achieve endogenous forms of development.
Nature is therefore understood within the wide notion of heritage proposed by the urban bioregion frame of reference, as precondition of the settlement and long-lasting heritage to preserve and enhance for durable local development. Centemeri (2018) provides a clue to the role of intentionality and actions in transforming something into good, resource, capital, or heritage, when she specifies that "goods and resources - be they private, public or common – do not exist as mere things. It is what we do with mere things, or through mere things, that accounts for their becoming «goods» or «resources»" (*ibidem*: 3). Or again:

> "Commodification is oriented not towards creating commonwealth but towards monetary surplus through selling the commodity on the market. Capitalisation can be defined as a value practice in which the monetary return on investment is the guiding principle (Muniesa *et al.* 2017). Capitalising on something entails either considering it to be an asset, or turning it into one so as to guarantee the production of monetary economic value in the future. Commonwealth can also be considered an asset but, unlike capital, the flows it generates possess different goals" (*ibidem*: 4).

Contrary to the ecomodernist view that interprets nature as a resource or as capital, therefore implying actions involving nature are meant to produce monetary value, within the bioregional approach nature can be framed as both heritage and common good, having intrinsic and relational value. Indeed, actions involving this heritage and common good are oriented towards the reactivation of care actions, a valorisation aimed at growing durable wealth (distinct from profit) and sustaining the conditions of life reproduction. Thus, the shift of meaning from resource and capital to heritage and common good recentres the local communities' role as protagonists in the management and design of nature. Local levels of governance, at the scale of the municipality, develop coherent actions of preservation, enhancement and valorisation through agreement tools that involve a plurality of actors gathered together by the existence of a common interest in the local territorial development project.

6. To conclude: future research/action challenges

The implementation and realisation of the bioregional project still poses considerable challenges, particularly related to economic and political aspects. For what concerns the topic of nature and democracy, a constellation of exemplary grassroots initiatives can be identified, mapped, and valued (Società dei Territorialisti, n.d.). However, a necessary further step is to effectively federate a network of initiatives – the network of networks – able to represent a more powerful collective actor in the dialogue and/or conflict with the institutions and the multiple corporate and particular interest groups that aspire to grab, extract, capitalise on the territorial and natural resources to the detriment of local communities and the resource itself. Addressing such powerful interests not only requires the existence of a strong – though not hierarchical - federated network, but also points to the need to develop effective counterbalancing strategies to be incorporated in the agreement governance tools and procedures, to prevent them from turning into instruments that further reproduce de-politicising, expropriating environments that operate beyond and below the State.
At the same time, it is important to assess, articulate, and improve the convergence of bottom-up and top-down processes, accounting for the reception of such emerging bioregional, self-organised practices at the institutional level.
Tracing a pattern is a difficult job, especially in times of cultural turmoil, with a growing variety of interpretations of the environmental crisis and openings of ambivalent scenarios of meaning. Overall, the urban bioregion project provides a powerful conceptual reference and operational framework to tackle the destruction of both nature and democracy prefigured by current tendencies in hegemonic environmental policies and practices, a project which explicitly links nature stewardship and direct democracy, that values relationality without ceding to morally annihilating non-dualisms. The challenge to embrace in the present and near future action/research is to define a governance model that departs from managerial attitudes and ultimately results in a bottom-up re-politicisation of nature and environmental stewardship.

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What practices to overcome the "cultural remoteness" of inner peripheries? A focus on Italian case studies

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Abstract
The contribution focuses on the role of culture in regeneration practices in inner peripheries. The few culture-based strategies promoted so far in these areas often consist of territorial marketing operations tailored to urban tourism, which risk of trivialising and flattening local culture and identities. Instead, the promotion of a contemporary cultural production, albeit based on local heritage, memories, traditions and identities could strengthen the ongoing socio-economic development strategies and offer alternatives to the prevailing urban cultural model.
The critical review of best practices, selected from Italian and European networks that bring together culture-led regeneration practices, allows to explore whether and how current practices in inner peripheries are contributing to generate new "cultural models", tailored to the peculiarities of these areas and alternative to the urban ones.

Introduction

According to Eurostat data, in 2021 most of the EU population lived in cities (38.9 %), towns and suburbs (35.9 %). The remaining 25.2% lived in rural areas and the number of people aged 65 years or older, living in the EU's predominantly rural regions, increased on average 1.8 % each year between 2015 and 2020. In addition, almost 9 out of the 10 predominantly rural regions in Europe recorded negative rates of natural population change over the same period (EUROSTAT, 2023). Issues related declining and aging population are intertwined with those related to fewer job opportunities, weaker infrastructure, poorer access to public services, and digital divide that largely contribute to the progressive abandonment of rural areas all over Europe.
The main consequences of rural abandonment concern the loss of the relevant tangible heritage, such as historical centres, natural resources and traditional landscapes, as well as of the intangible heritage such as memories, traditional agricultural or artisanal practices, which have for long contributed to preserving local identities and ecosystem services.
These aspects are exacerbated in the so-called "inner peripheries", which represent remote rural areas characterised by low economic potential, poor accessibility to centres of economic activity and public services, as well as by the disconnection from the centers of political power (ESPON 2017, 2022).

Since the 1990s, the rebalancing of territorial disparities based on the urban-rural dualism has been addressed by EU policies on sustainable development policies in order to counteract both urban congestion and rural depopulation. The European Spatial Development Perspective (European Commission, 1999) proposed an integrated strategic vision of territorial development, recognizing rural areas as key elements for the balanced functioning of the whole territory.

In order to pursue sustainable development and improve territorial cohesion, the "Long-term Vision for the EU's rural areas" aims to make inland rural areas stronger, by strengthening services and fostering social innovation; more prosperous by diversifying economic activities and sustainable production, more connected, by improving digital networks and favouring new forms of mobility and more resilient, by improving local capacity to cope with climate, social and environmental changes (European Commission, 2022).
In Italy, this theme has been addressed since 2014, trough the National Strategy for Inner Areas (NSIA) (Barca et al. 2014), based on the classification of Italian municipalities according to their degree of peripherality. In detail, the NSIA defined "inner areas" as municipalities that are at least 20 minutes far from the first municipality offering basic services (education, healthcare, mobility). In this way, two different typologies of territorial systems are defined: poles, consisting of large, medium and small urban centres and highly specialised coastal areas, which are the centres of economic and social activities; inner areas mainly composed of rural territory and small villages, which are increasingly exposed to depopulation and impoverishment of their economic and social fabric.

According to the 2020 update of the NSIA classification (Italian Agency for Territorial Cohesion, 2022), about half of the Italian municipalities can be defined as inner areas (1929 intermediate areas, 1524 peripheral areas, 382 ultra-peripheral areas), covering about 60% of the national territory and hosting about 23% of the population. For these areas the NSIA has been addressed to improve accessibility to essential services, while promoting economic development and social cohesion through place-based approaches and active stakeholders' involvement.
Although in the Italian experience the classification of inner areas has been essentially based on the notion of peripherality, intended as distance from the places where basic services are gathered, partially reflecting the approach adopted in the Espon Project (ESPON 2017), this notion can be also more broadly considered, referring not only to the physical distance of these areas from services but also to their marginality within the economic and political networks at different geographical scales (Bock, 2016). These areas generally appear to be far from urban ways of life, from social contexts full of interactions and activities (Membretti et al. 2022).

This broader idea of "peripherality" may include cultural aspects too: nevertheless, it has been so far firstly referred to the disparities in accessing cultural activities in some areas compared to the urban hubs of culture and creativity (Florida, 2002).
According to the report "The role of culture in non-urban areas of the European Union" (Johansen et al., 2020), the primary role of culture in peripheral areas is only recently gaining attention in academic and political debate, particularly due to the need of counteracting depopulation processes by fostering culturally driven innovation. However, cultural policies in these areas are lagging behind their urban counterparts (Lygard, 2016).
The role of culture in the development strategies carried out for inner peripheries has been for long neglected or related to urban-centred cultural models and policies, scarcely respondent to the peculiarities of these areas (Cruikshank, 2018). These models have typically emphasised the "access" to cultural services and infrastructure, such as museums, archaeological sites, cultural hubs, universities, often neglecting the need of enhancing local cultural capital, especially the intangible one, as a key tool for strengthening territorial identities and the sense of belonging of local communities.

On the opposite, the Faro Convention (COE, 2005) emphasized that cultural heritage consists of all the resources inherited from the past that populations identify as an expression of their values, beliefs, knowledge, and traditions. Moreover, some authors have clearly defined

"culture" as the intangible infrastructure of a territory, shaped by its human community (Magnaghi, 2010). Thus, culture is not only a fundamental right of people living in inner peripheries but should be intended as the result of the continuous interaction over time between population and places.

Based on these premises, this contribution aims at analysing "cultural remoteness" of inner peripheries, interpreted not only as accessibility to cultural services but, above all, as the capacity of local communities to recognize and re-shape their cultural capital, developing tailored to-the-site cultural models, alternative to the urban ones.

The cultural "remoteness" of inner peripheries

Some data provided by the Italian National Statistics Institute (ISTAT) on the accessibility to culture in inner peripheries are here analyzed to quantify the persisting gap between urban centers and inner peripheries: number and distribution of museums, monuments, archaeological areas, number of visitors, number of entertainment and sports events, number of libraries, and so on.
In 2022, out of a total of 4'416 museums, monuments and archaeological sites, both public and private, about 40% are in inner areas (853 in intermediate areas, 698 in peripheral areas, 189 in ultra-peripheral areas):

- on average there are 6.2 museums or similar sites per municipality classified as pole (A) and 0.4 museums or similar sites per municipality classified as inner area (D, E, F) (Figure 1);
- all the museums in the 182 municipalities classified as pole (A) attract more than 70% of the visitors; about 44% of them has less than 5'000 visitors and about 81% of the museums or similar sites of ultra-peripheral municipalities (F) has less than 5'000 visitors and about half of them has less than 1'000 visitors;
- the average number of employees per museum is 22 in the pole municipalities (A) and 5 in the ultra-peripheral municipalities (F).

Further disparities can be observed when complementary services offered by museums (educational workshops, thematic itineraries for children, conferences and seminars, live shows and cultural entertainment initiatives, permanent or temporary exhibitions) and digital services (online ticketing, social media accounts, online virtual tours, online educational workshops, online conferences and seminars, online digital catalogues) are considered.
In detail, as regards the complementary services, the average varies according to the type of offered service between 57% (museums with live shows and cultural entertainment initiatives) and 65% (museums with conferences and seminars) in the pole municipalities, and between 31% (museums equipped for thematic itineraries for children) and 42% (museums with live shows and cultural entertainment initiatives) in the ultra-peripheral municipalities.
As regards digital services, the average varies according to the type of digital service offered between 14% (museums equipped for online educational workshops) and 76% (museums with social media accounts) in the poles, and between 4% (museums equipped for online virtual tours and online educational workshops) and 56% (museums with social media accounts) in the ultra-peripheral municipalities.

Moreover, in 2022 out of 8'131 libraries in Italy, both public and private, only 33% are in inner areas (1'373 in intermediate areas, 1'050 in peripheral areas, 277 in ultra-peripheral areas).
Looking at the percentage of film, entertainment and sporting events, in 2022, almost 87% took place in poles (A), inter-municipal poles (B) or belt municipalities (C), reaching 75% of the

audience, while less than 13% took place in intermediate (D), peripheral (E) or ultraperipheral (D) municipalities, reaching the 25% of the audience.
Finally, only 2 of the Municipalities classified as inner areas (intermediate municipalities) host universities.

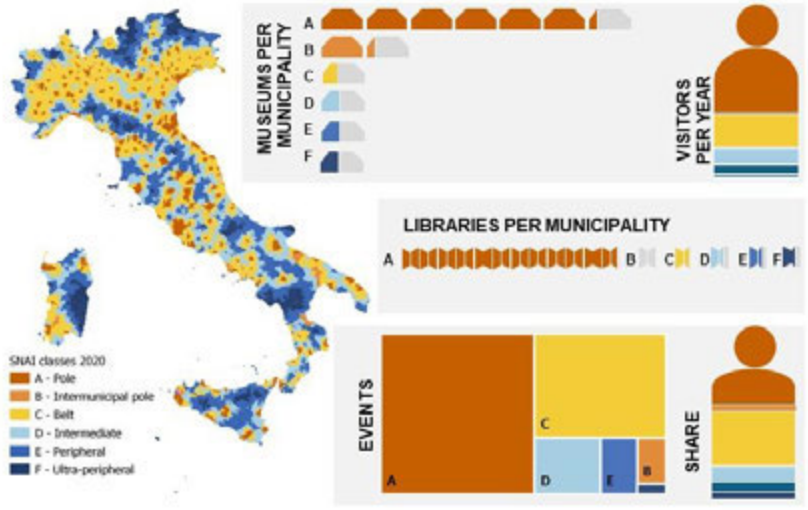

Figure 1. Distribution of museums, libraries, and events according to the SNAI classification (Source: Authors' elaboration from ISTAT data)

The concentration of museums, cultural hubs, events and universities in cities not only denies the fundamental right of inner peripheries' population to access cultural services, but also contributes to shape a concept of culture, capable of attracting a young and lively population, as a prerogative of urban areas.

Nevertheless, significant funding has been allocated on the topic "Culture and Tourism" in the inner peripheries selected as pilot areas by the first SNAI programming cycle 2014-2020, (about 16% of available funds for a total of 219 projects).
More than half of the funded projects have been addressed to relevant monuments' restoration or to promote tourism; others to the sustainable use of natural areas, promotion of festivals focused on rural traditions and creation of inter-municipal cycle and pedestrian paths (DPC, 2022).
These projects, although addressed to reduce 'cultural remoteness" of inner peripheries, due to the close link between "culture" and "tourism", may also induce negative effects, such as the museumization (Attili, 2018) of the historical villages or the loss of local identity (Sabatini, 2023): being "culture" the intangible infrastructure of a territory, shaped by its community, in fact, it is crucial to prioritize projects and initiatives capable of involving local communities in recognizing and reinterpreting legacies, practices and imaginaries to co-produce a contemporary local culture, linking ancestral and contemporary forms of knowledge, nature and technology, art and education.

According to this perspective, a kind of scouting has been carried out to identify bottom-up "culture-led" regeneration practices, capable of enhancing local resources in the field of production, maintenance, and care of places (Olcuire, 2023) in inner peripheries, starting from

the analysis of European and national networks that bring together culture-led regeneration practices, based on the peculiarities of territories, their memories, their historical landscape, local production, and new synergies between external resources and local communities (IETM, 2018).

Culture-led regeneration in the inner peripheries: from European and national networks to local practices.

To understand whether and how current practices in inner peripheries are contributing to create a new "cultural model", alternative to the urban one and tailored to the peculiarities of these areas, a methodological path based on a multiscale approach has been outlined (Figure 2).

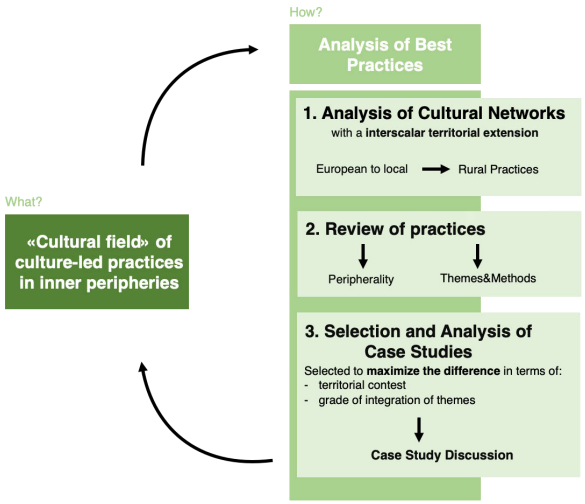

Figure 2. Methodological path for selecting of culture-led regeneration practices in inner peripheries (Source: Authors' elaboration).

This allows for a gradual focus on the local scale and the selection of practices that, being embedded in large-scale networks, benefit from the dialogue between heterogeneous actors and the possibility of exchanging knowledge and experiences developed in different contexts.
Specifically, a three-step analysis has been carried out to select culture-led regeneration practices in inner peripheries:

1. identification and selection of European networks focusing on culture-led regeneration practices developed in both urban and non-urban contexts.
2. identification and selection of national or regional networks focusing on practices carried out in non-urban and rural areas.
3. selection and analysis of culture-led regeneration practices developed at local level, and namely in inner peripheries.

The prevalence of culture-led practices carried out in urban areas compared to those developed in rural and marginal areas is evident in the first step of the analysis. Based on a systematic review of different sources, such as institutional documents (Murphy and Cameron, 2020; Arterial Network et al, 2022; Burgos et al., 2023) and institutional websites, six networks and research projects at European level that focus on urban and territorial regeneration with a

cultural and/or a community-led approach, in urban and non-urban areas have been identified (Table 1).

Table 1. European Networks

Network/Project	Description	Involved Actors
Culture Action Europe (CAE)	A European network promoting cooperation and development in the cultural sector. It advocates for the value of culture and arts in contemporary society through initiatives, advocacy, and transnational collaborations.	- Cultural organizations - Artists and cultural operators - Cultural activists - Professionals in the cultural sector
European Creative Hubs Network (ECHN)	A network bringing together creative hubs and organizations to support the creative sector in Europe. It aims to foster growth, innovation, and sustainability of creative hubs by promoting collaboration, knowledge exchange, and networking among members.	- Creative hubs - Support organizations - Professionals in the creative sector - Academic and research institutions
European Network of Cultural Centres (ENCC)	A network uniting cultural centers to promote culture and art in Europe. The ENCC aims to promote cultural diversity, access to culture for all citizens, and local and community cultural development. Through projects and initiatives, it promotes transnational cooperation and builds bridges between various European cultural communities.	- Cultural centers - Cultural organizations - Local and governmental authorities - Artists and cultural operators - Public and local community
Trans Europe Halles (TEH)	A network of independent cultural spaces promoting cultural collaboration in Europe. TEH supports cooperation among independent cultural centers and promotes cultural diversity, innovation, and the exchange of best practices in the European cultural sector.	- Independent cultural centers - Cultural organizations - Artists and cultural operators - Local and governmental authorities - Public and local community
European Land+Art Network	A network of organizations and individuals across Europe dedicated to promoting land-based art practices. It brings together artists, researchers, cultural institutions, and environmental organizations.	-Artists – researchers - cultural institutions - environmental organizations.
Ruritage	A project promoting sustainability and innovation in rural communities. Ruritage aims to enhance the cultural and natural heritage of rural areas, creating new opportunities for sustainable development through active citizen participation and engagement of various stakeholders.	- Local and regional authorities - Cultural and local development organizations - Universities and research institutions - Entrepreneurs and local businesses - Local communities

European networks play a crucial role in advocating different culture-led practices and provide a significant support to local and regional communities in developing cultural and creative practices: they act as drivers and promoters of a range of initiatives aimed at fostering cooperation, exchange and development in the European cultural field through innovative practices that address both social and environmental challenges.
Moreover, the networks/projects bring together a variety of actors engaged in different fields of cultural promotion at different scales, such as national or regional organizations, territorial cultural centers, creative centres, networks of cultural associations, foundations, NGOs, cultural enterprises, research centres (e.g. universities and research institutes).
Among these networks, only few (e.g. Ruritage) are specifically addressed to promote culture-led practices in rural areas. A number of national/regional networks that pay particular attention to local practices carried out in rural areas have been identified (Table 2).
The selected networks operate in different geographical contexts, above all in Southern and Eastern Europe, where the depopulation of rural areas appears more significant than in the rest of Europe.
These networks aim to promote cultural ecosystems, by involving a variety of local actors, such as cultural hubs, cultural associations, artists, cultural activists, researchers, entrepreneurs as well as local communities and public institutions. They aim to stimulate innovation, improve access to culture and encourage civic and community participation in the development of strategies for the social and economic growth of local communities through cooperation and exchange of resources and knowledge.

Table 2. National/regional Networks

I Level Network	II Level Network	Location	Description	Involved actors
Culture Action Europe	**Red de Espacios y Agentes de Cultura Comunitaria**	Spain	Network that promotes community culture and citizen participation in Spain, facilitating collaboration between cultural spaces and community actors to promote access to culture.	Cultural spaces, cultural associations, community organizations, public institutions, artists.
Culture Action Europe	**Clubture**	Croatia	Network that promotes independent culture in Croatia, facilitating the exchange of resources, knowledge, and best practices between independent cultural spaces and cultural operators.	Independent cultural spaces, cultural organizations, artists, cultural activists.
European Creative Hubs Network	**ARTERIA_LAB**	Portugal (Alentejo)	Network of 11 creative hubs operating in the Alentejo region of Portugal, engaging in architecture, visual arts, performing arts, design and crafts, literature, and new media.	Creative hubs, cultural organizations, artists, creative professionals, public institutions.
European Creative Hubs Network	**Matera Hub**	Italy	Innovation and culture hub located in Matera, Italy, promoting social, economic, and cultural innovation through projects, events, and collaborations.	Start-ups, entrepreneurs, artists, creative professionals, social activists.
ENCC, European Network of Cultural Centres	**Lo Stato dei Luoghi**	Italy	Platform dedicated to sustainable development and valorization of the territory, focusing on the analysis and promotion of local resources.	Local communities, local development organizations, public institutions, NGOs, research institutes.
Trans Europe Halles (TEH)	**Anténa – network for independent culture**	Slovakia	A network of cultural centres and organisations that operates in the field of independent arts and culture in Slovakia	Independent cultural spaces, cultural organizations, artists, cultural activists.

Among the selected European and national/regional networks, several culture-led practices focused on rural areas with varying degrees of peripherality have been identified (Table 3). These practices are mainly promoted by cultural organizations or associations working with artists, cultural institutions, environmental organizations, local communities, and activists. Overall, these organizations promote initiatives that bring together art, nature and local communities, to promote community development, environmental sustainability, education and enhancement of cultural heritage. The selected practices were further analyzed, focusing on both their degree of peripherality and the specific issues they address (Table 4).

The analysis of the selected practices allows some initial reflections on cultural regeneration practices in rural areas. First, most of them are bottom-up practices, linked to cultural activism organized in different legal forms, including cultural associations, social promotion associations, social enterprises, foundations; only in few cases practices are supported by public institutions. Second, all the selected practices are developed in mountain, rural, or island areas, although only some of these areas are classified as inner peripheries. Finally, these practices focus on recurring themes that can be classified into four macro-areas (Figure 3):

- sustainable local production and innovation;
- sustainable tourism;
- new ways of living and working in the territory;
- new narratives of the territory.

Table 3. Culture-led practices in rural areas

I Level Network	II Level Network	Practices	Location	Description
Culture Action Europe	Red de Espacios y Agentes de Cultura Comunitaria	**3piedras**	Spain – Ara, Alta Aragona	This organization focuses on art and ecology, promoting artistic and environmental projects.
Culture Action Europe	Clubture	**Silba Environment Art**	Croatia – Selva Island	This association focuses on environmental art and the island of Silba in Croatia, integrating art projects with the surrounding environment.
European Creative Hubs Network	Matera Hub	**Wonder Grottole**	Italiy –Grottole, Basilicata	This project involves the community of Grottole, Italy, aimed at enhancing cultural heritage and promoting local development through sustainable turism, local products and culture.
European Creative Hubs Network	ARTERIA_LAB	**Oficina do Convento**	Portogallo - Montemor-o-Novo, Alentejo	This organization acts as a multidisciplinary cultural center in Portugal, committed to promoting traditional artcraft, arts, culture, and education.
ENCC, European Network of Cultural Centres	Lo Stato dei Luoghi	**Interzona**	Italy - San Martino Valle Caudina, Campania	Interzona is an Italian cultural association, serving as a multidisciplinary center promoting culture and art through events, workshops, and projects.
ENCC, European Network of Cultural Centres	Lo Stato dei Luoghi	**Xfarm**	Italy – San Vito de Normanni, Puglia	Xfarm focuses on sustainable agriculture and art projects, integrating art with agriculture and the natural environment.
Trans Europe Halles (TEH)	Antena	**Periferne Centra**	Slovakia - Dúbravica	Perifernecentra is an organization dedicated to promoting cultural activities in peripheral rural areas related to artistic residence, ecology and art education at schools.
Trans Europe Halles (TEH)	-	**Plum Yard / Švestkový Dvůr**	Czech Republic - Malovice, South Boemia	Svestkovy Dvur is an organization focused on cultural programs and events based on theater and performing art.
Trans Europe Halles (TEH)	-	**Fundación Uxío Novoneyra**	Spagna – Lugo, Galicia	The Fundación Uxío Novoneyra is dedicated to promoting culture and the arts, particularly in Galicia, Spain.
Trans Europe Halles (TEH)	-	**Farm Cultural Park**	Italy – Favara, Sicily	Farm Cultural Park is a cultural center located in Favara, Italy, promoting contemporary art and culture through exhibitions, events, and cultural initiatives.
European Land+Art Network	-	**Arte Sella**	Italia - Borgo Valsugana, Trentino Alto Adige	Arte Sella integrates art, nature, and the environment throught outdoor art installations and environmental initiatives.
Ruritage	-	**Via Mariae**	Rumania, Harghita	Via Mariae Association supports and implements through the cooperation of the local stakeholders, the pilgrim route Via Mariae, also known as Maria's Way, that has been a connecting Western and Eastern Europe,
Ruritage	-	**Borgofuturo**	Italiy - Ripe San Ginesio, Marche	Borgofuturo promotes sustainable development and Communities-based rural regeneration in Marche region with culture-related projects and initiatives.

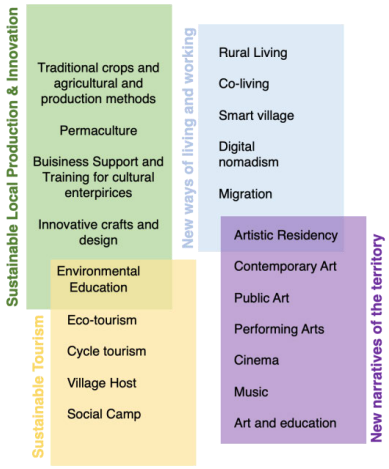

Figure 3. Thematic areas of cultural initiatives in rural areas. (Source: Authors' elaboration).

Table 4. Location and topics of the selected practices

Cataloguing Selected Pratices						
Pratices		A - Territorial Criteria			B- Thematic Criteria	
Name	Legal Form	Geographic Location	Typology of area	Inner Periphery (EPSON 2017)	Spaces	Themes of cultural initiatives
3piedras	Fundation	Spain – Ara, Alta Aragona	Mountain	yes	• Artistic Workshop • Guest House	• Environmental Education • Traditional farming and production methods • Artistic Residency, Cinema, Music • Rural Living
Silba Environment Art	Digital Platform by Fundation Kultura nova + Municipality of Zara	Croatia – Selva Island	Insular			• Enviromental Education • Artistic Residency
Wonder Grottole	Association for social promotion	Italy –Grottole, Basilicata	Rural	yes	• Guest House • Village Facilities • Territorial Paths	• Environmental Education • Village Host – Ecoturism • Traditional farming and production methods • Artistic Residency • Rural Living, Digital Nomands
Oficina do Convento	Cultural Association of Art and Communication	Portogallo - Montemor-o-Novo, Alentejo	Rural	yes	• Cultural Cente • Ceramic Workshop	• Innovative handcraft and design • Traditional production methods • Artistic Residency • Contemporary Art, Visual Art • Environmental Education
Interzona	Association for social promotion	Italy - San Martino Valle Caudina, Campania	Rural		• Cultural Center	• Contemporary Art • Artistic Residency • Rural Living
Xfarm	Project by Social Cooperative Qualcosa di diverso	Italy – San Vito de Normanni, Puglia	Rural		• Confiscated Agricultural Land	• Environmental Education • Traditional farming and production methods • Contemporary Art • Rural Living • Migration
Perifèrne Centrà	Civic Association	Slovakia - Dúbravica	Rural	yes	• Cultural Center	• Environmental Education • Traditional farming and production methods • Artistic Residency • Contemporary Art
Plum Yard / Švestkový Dvůr	Project by Theatre Group	Czech Republic - Malovice, South Boemia	Rural	yes	• Cultural Center	• Performative Arts • Artistic Residency • Art and Education
Fundación Uxío Novoneyra	Fundation	Spagna – Lugo, Galicia	Mountain	yes	• House-museum	• Artistic Residency • Rural Living
Farm Cultural Park	Cultural Association	Italy – Favara, Sicily	Rural		• Cultural Center • Guest Houses	• Artistic Residency • Contemporary Art • Public Art • Art and Education
Arte Sella	Social Enterprise	Italia - Borgo Valsugana, Trentino Alto Adige	Mountain		• Gardens • Territorial Paths	• Eco-turism • Artistic Residency • Contemporary Art • Public Art • Art and Education
Via Mariae	Cultural Association	Rumania, Harghita	Rural		• Territorial Paths • Guest House	• Eco-turism
Borgofuturo	Association for social promotion	Italy - Ripe San Ginesio, Marche	Mountain			• Social Camp • Environmental Education • Music and Festival

However, although the initiatives promoted by the selected practices may address a specific macro-area as well as individual themes, they often address a variety of themes, emphasizing interlinkages and mutual influences between both themes and areas.

A focus on Italy: examples of culture-led regeneration practices in inner peripheries

Although the selected culture-led regeneration practices are in different European countries, several factors make Italy an interesting case study.
First, about half of the selected practices are in Italy (6 out of 13). Second, Italy has been so far underrepresented in studies on cultural and creative practices (Duxbury, 2021). Third, Italian practices offer a variety of contexts, being located in rural and mountainous areas from the North to the South of the country.
Hence, three Italian practices characterized by different degrees of peripherality and starting dates and addressing different themes (Table 5).
All the selected case studies started a process aimed at generating a "new cultural model", where culture is directly shaped by local communities based on the recognition of local material and immaterial heritage. They also allow understanding how the initiatives addressing each theme, or more than one, can induce new territorial images and relevant impacts on the territory.

Table 5. The selected Italian practices

Name	Territorial Context	Foundation	Mission	Main Activities	Triggering Themes	Additional Cross-Cutting Themes	Governance and Innovation	Impacts
Wonder Grottole	Historical center of the village of Grottole, at 30km from Matera, Basilicata. Population of Grottole is 2,100 inhabitants.	Started in 2013 from the meeting of Casa Netural from Matera and a local inhabitant.	Facilitate the regeneration of the historic center through temporary living arrangements and the valorization of local resources.	Partnered with Airbnb for the Italian Sabbatical program, recovery of abandoned buildings, promotion of cultural initiatives and artist residencies.	Sustainable tourism, temporary living, architectural recovery, promotion of local territory.	Connection between local and global community, creation of training and skills growth opportunities.	Collaborations with local institutions, associations, and businesses to create collaboration networks and involve the local community.	Involvement of over 200 local community members, promotion on a national and international scale, attraction of tourists and "temporary inhabitants."
Arte Sella	Val di Sella, part of Borgo Valsugana in Bassa Valsugana, on the Trentino Alps. Population of Borgo Valsugana is 7.000 inhabitants.	Started in 1986 with an art exhibition in Villa Strobele in Val di Sella by the association «Frends of the Borgo»	Valorize the territory through artistic interventions integrated with the natural landscape.	Creation of artworks integrated into the landscape, educational projects like Arte Sella Education.	Collaboration with nature, integration of art and landscape, promotion of new models of cultural welfare.	Diversification of activities, partnerships with local and national cultural institutions.	Selection of artists with international perspective, financial and morale support from local and regional institutions.	Attraction of national and international visitors, creation of a network of cultural relations.
Interzona	San Martino Valle Caudina is an agricultural valley in the Appenine Mountains in the region of Campania. Population of 4.885 abitanti, inhabitants.	Founded in 2003 with the Interferenze festival, promoting indie and eletronic music in a rural area.	Revalorize rural territories through artistic residences and practices related to new media such as the deep listening of the territory.	Interferenze festival, artistic residences of Liminaria project, collaborations with schools and local communities.	Use of sound and new media arts, experimentation with hybrid formats, research and field studies.	Education, open hardware, international collaborations.	Weaving relationships between local and transnational levels, collaborations with urban cultural institutions.	Drafting of the Rural Futurism Manifesto, international exhibition, collaborations with urban cultural institutions.

WonderGrottole: the Italian Sabbatical

Wonder Grottole is an experimental project aimed at promoting the regeneration of the historic centre of Grottole, a village of 2,100 inhabitants located in the Basilicata region (southern Italy) and classified by the SNAI as peripheral area. The project aims at recoverying some abandoned houses and attracting of new temporary or permanent residents to encourage exchanges and relationships with the local population.

It is worth noting that in 2023 the Basilicata region, together with the Campania, has recorded the lowest negative migration balance in respect to all the Italian regions. The population trend in Basilicata shifted from -0.11% in 2002 to -0.66% in 2023. In terms of cultural statistics, Basilicata hosts less than 1% of all the registered Italian museums (or similar sites) and only 16,7% of them has more than 10,000 visitors per year.

In Grottole, the population trend moved from -0.65% in 2002 to -1.70% in 2022.

The historical center of Grottole has been characterized over the years by a progressive emigration, which has led to the gradual abandonment of the historical center where, currently, most of the buildings are abandoned. Today, the historical center hosts between 200 and 300 inhabitants, more than 70% of whom are over 70 years old.

The project started in 2013, following a walk (Netural Walk) organised by Casa Netural, a coworking space in Matera. Following this initiative, the first embryonic initiatives of the Wonder Grottole project were born from the exchange between Casa Netural and the Grottole's residents, and in particular with Silvio, the Municipal Culture Councilor.

The small village of Grottole was involved in the initiatives of the Matera Design Festival. In February 2018, the first crowdfunding campaign was promoted to launch the project and in September 2018, the social enterprise called WonderGrottole was established. The first

initiatives were related to the mapping of local resources to be involved in the project. They promoted an action for the participation of the community to map the abandoned buildings in the historical center. Using a game developed as an app, the local community mapped 629 abandoned buildings in the historic center. At the same time, a map of local knowledge, mapping and photo-storytelling of local producers was realized.
WonderGrottole focuses on sustainable slow tourism and temporary residence as a driver for the historic center’s regeneration. Specifically, the project aims at enhancing social innovation (Sacco, 2018), by favoring the exchanges between local community and temporary residents, such as tourists, researchers, artisans and artists, promoting meanwhile local resources.
A milestone of the WonderGrottole experience was the launch of the partnership with Airbnb in 2019 and the co-design of the Italian Sabbatical Programme: an international call for volunteers to host five "temporary residents" for three months, offering their skills to contribute to the revitalization of the village.
Meanwhile, the association has bought three abandoned buildings from private owners and renovated them to host WonderCasa, the association’s headquarters where guests and artists are hosted and WonderStudio, a workshop where artistic works are created. Also, Wonder Grottole launched touristic experiences in collaboration with local wine, honey and ceramic producers and promoted several cultural initiatives, such as international architectural competitions (e.g. Chiesa Diruta in collaboration with ReuseItaly), project exhibitions, the Living Culture Festival and the co-construction of the "Wonder Bee", a community apiary. The Institut Francais Nouveau Grand Tour has supported artist’ residencies, residential workshops for students and the Open School for Village Hosts hosted in Grottole.

Thus, WonderGrottole's initiatives have been aimed at promoting sustainable tourism and temporary living, with the aim of attracting energies and skills from all over the world and enhancing cultural exchange with the local community.
This is intertwined with the recovery of abandoned buildings in the historic centre, which are being transformed into accommodation and co-working spaces for the local and temporary community. The promotion of local products is also flanked by training opportunities, for both permanent and temporary inhabitants, to favor exchange and transmission of local skills. Hence, the different initiatives promoted by WonderGrottole have contributed to recovery historical heritage and promote local products and skills, renewing meanwhile the sense of belonging of inhabitants. Through collaborative projects with local institutions, associations and businesses, the project has promoted the exchange of knowledge and the empowerment of the local community that is currently more and more involved in political, social, and economic life.
Since the beginning of the project, WonderGrottole has involved more than 200 people from the local community. In 2018 and 2019, Grottole families opened their homes to students from all over Italy for the residential workshops of the Master in Relational Design of the Academy of Fine Arts of Catania, in Sicily.
The Italian Sabatic call for applications received over 280,000 applications in just one month, with over 3,000 national and international press articles on the Wonder Grottole project.
The international architectural competition for the Church of Diruta, promoted in collaboration with Reuse Italy Bcorp, collected 500 projects. The results of the competition were shown during the exhibition "La fragile bellezza" (The fragile beauty), hosted in the historical center thanks to the opening of some abandoned buildings.
In 2022, the activities of WonderGrottole brought around 2,000 tourists to the village. WonderCasa hosted 27 "temporary residents" from all over the world.

Arte Sella: the Contemporary Montain.

Arte Sella is a cultural association that plays an important role in the valorization and regeneration of the Bassa Valsugana, in the Trentino-Alto Adige region (North-eastern Italy), a vast mountainous and wooded area, characterized by a strong depopulation dynamic, especially in former industrial areas and less accessible areas. Val di Sella is located in the municipality of Borgo Valsugana with a population of about 7,000 and classified by the SNAI as an intermediate municipality.

The population trend in Trentino-Alto Adige has decreased from 1.06% in 2002 to 0.33% in 2022. In Borgo Valsugana, the population trend moved from 1.41% in 2002 to 0.82% in 2022. Looking at the statistics on culture, Trentino hosts 4% registered Italian museums (or similar sites) and 31% of them has more than 10,000 visitors per year.

Only a few dozen of people from Borgo Valsugana live in Val di Sella. For a long time, this area was an alpine pasture, and later the valley became a touristic area. Since the 1970s, Val di Sella has experienced a slow population decline, with the gradual abandonment of traditional pastoral activities and tourism.

Arte Sella was born in 1986 thanks to three inhabitants of Borgo Valsugana that organized an art exhibition in the garden of Villa Stobele, a private historic building located in the center of the Val di Sella, with the aim of combining contemporary art and nature. The exhibition was an unexpected success, attracting around 2,500 visitors. As a result, the organizers decided to repeat the experience through the creation of the Biennial Art in Nature, specialized in Land Art, where artists look to the natural landscape as an integral part of their work. This led to the creation of a four-kilometers artworks’ path called "Arte Natura": in 2002, the most famous artwork, the “Cattedrale Vegetale” by the artist Giuliano Mauri, attracted thousands of visitors and led other associations and local actors to join the project. Over the years, more than 300 artists from different parts of the world have contributed to the creation of three exhibition routes with artworks integrated into the surrounding natural landscape.

The success of the initiative led Arte Sella Association to formalize its initiative under the brand "Arte Sella. The Contemporary Mountain" and to broaden the scope of its initiatives.

The diversification of activities began in 1998, when the headquarter of ArteSella moved from Villa Strobele to another village in the valley, Malga Costa, which had lost its original rural character over time. Since 2002, Malga Costa has been enriched with numerous artworks and has become a pay-as-you-go place, hosting numerous cultural events, such as exibitions, concerts, theater performances and literary events. The original site, Villa Stobele, was reopened in 2016 to host an infopoint and educational workshops.

In 30 years of activity, the Arte Sella Association has promoted in situ artistic interventions and cultural initiatives that largely contributed to the enhancement of the territory and its natural heritage.

Today Arte Sella promotes different but complementary initiatives: in addition to artistic events and biennials, initiatives have been carried out to integrate landscape and sports activities or to promote innovative and ecological learning paths for students, teachers, and educators, training programs for social workers and teachers, focused on themes related to nature, art and care, placing viability, biodiversity, environment and quality of life at the center, have been carried out.

Furthermore, Arte Sella is now a permanent fixture in the area: a pole of cultural well-being, with a growing number of visitors: from around 15,000 in 2006 to around 80,000 in 2022. Today, the association counts not only on the close collaboration with the municipal and provincial authorities, which is essential to support Arte Sella's activities over time, on the numerous partnerships with other cultural institutions and regional museums, but also on a dense network of national and international relationships.

Interzona: Sound, arts and technoculture in rural areas.

The cultural association Interzona - APS is concerned with the revitalization of some rural and inner areas in Southern Italy through artistic practices related to the use of new media in sound art and technocultures, that are based on the relationship between art, culture and technology.
The association headquarter is in San Martino Valle Caudina, a mountain village of 4,885 inhabitants, in the Campania region. It has been classified by the SNAI as an intermediate municipality. Campania region is experiencing a significant decline in population: from 0.42% in 2002 to -0.26% in 2022. In San Martino Valle Caudina the population trend shifted from -0.40% in 2002 to -0.62% in 2022.
Interzona was founded in 2003 on the idea of Leandro Pisano, a researcher from San Martino Valle Caudina. He launched the first edition of the Interferenze festival, which included live events, performances, software art installations and digital experimentation in the rural area of Valle Caudina. Compared to other digital art festivals, Interferenze was the only one organized in a rural area, and it became a laboratory for experimentation and research in such territories. The 2005 edition of the festival took place in the historical center of San Martino Valle Caudina, which was transformed into a hybrid zone of meeting between locals, artists and tourists. The path of Interferenze continued until 2010, spreading to other rural areas of the Campania region. The last edition of the festival was held in Bisaccia, a village of the rural area of Irpinia, on the border between Campania and Basilicata regions. Then, a review process of the project and its sustainability, going beyond the Festival and its prevailing entertainment nature, was started. Hence, in 2014, Interzona launched Liminaria, a research project aimed at creating networks of cultural, social and economic actors from local communities and abroad.
The Liminaria project deployed different actions aimed at relating spaces, landscapes and inhabitants. In detail, it was addressed to re-launch marginal territories as privileged areas to promote cultural actions based on sound and new media.
The Project was tested over the years in several inner areas of southern Italy (Puglia, Molise, and Sicily), with hybrid formats in between of temporary residencies, laboratories, workshops and action-research projects. These actions converged in a research platform inspired by the concept of (neo)rurality, based on the exploration of the territory through a process of deep and immersive listening between artists and communities.
In 2019, Leandro Pisano, together with Beatrice Ferrara, drafted the Manifesto of Rural Futurism, a document in which the threads of the research carried out on the field during the first five years were pulled together, point by point, to share Liminaria's approach with other rural territories, both in Italy and at international level.
The Liminaria project was presented in exhibitions in Australia and New Zealand and, in 2022, landed in Japan with an exhibition of art related to sound and new media, as a conclusion of a three-year transnational cooperation project between Italy and Japan "Energies in the Rural", co-produced by Interzona and the public Aomori Contemporary Art Center (ACAC).

Hence, over the years the Interzona's field of action has extended from cultural and performance events, including a sound art residency program for international artists, to collaborative pathways with schools. The Interzona association has been involved in educational projects focused on land, communities and new technologies, developing open hardware projects with schools, cooperating with different village communities and weaving relationships between local and transnational levels, between exogenous and endogenous realities and actors.

Conclusions

The purpose of this contribution is to explore the “cultural remoteness” of the inner peripheries, interpreted not only as lack of access to cultural services but, above all, as the lack of bottom-up initiatives aimed at creating tailored to-the-site cultural models, based on the recognition and

reinterpretation of local cultural heritage and alternative to the dominant urban cultural models (Duxbury and Campbell, 2011).
To this aim, a set of culture-led regeneration practices carried out in peripheral areas have been selected within some European networks/projects focused on culture-led regeneration in both urban and non-urban areas.

Most of the examined practices highlight the importance of actively involving the local communities and developing networks of relationships going far beyond the local boundaries, while preserving their place-based identity. Most of the practices have been carried out thanks to partnerships between different actors, in the public-private and third sectors, and have dealt with different themes, trying to connect natural and cultural heritage, different artistic languages, new technologies and local traditions, innovative agricultural practices and local productions, permanent and temporary residents, environmental education and sustainable tourism.

In particular, the three Italian practices are based on the enhancement of tangible and intangible cultural assets through hybridisation, overlapping and encounters with external resources, where cultural initiatives are never exclusively aimed at entertainment and the consumption of cultural products coming from outside the territory, but are always closely linked to the local natural and cultural environment.

This is evident in the case of WonderGrottole, where the attraction of temporary residents allows the exchange of knowledge and skills creates mutually beneficial relationships between permanent and temporary residents, facilitating the communication between people with different cultural backgrounds through expressive storytelling, visual arts or physical interaction with inhabitants and places.
The Arte Sella initiatives, in Bassa Valsugana, have contributed significantly to the development of the Val di Sella, thanks to the symbiosis between art and nature, where one contributes to the definition of the other (Sechi, 2022). Here the artistic process is the result of the link established between nature and art, creating unique and non-reproducible products. Artistic practices favour the emergence of new territorial imaginaries and generate new forms of culture, strictly rooted in the local context. (Lowe, 2000)
The projects carried out by Interzona, such as the Liminaria project, directly engage with local communities through the artistic practice of deep listening, to create new perceptions of places and environmental resources. The aim is to create imaginaries that nourish the possibility of looking at their own places of living with different eyes (or, in the case of Liminaria, listening with 'different' ears), with particular reference to the natural resources of these territories (Pioselli and Pisano, 2020).

Moreover, in the investigated practices, culture seems to emerge as a key tool for opening up new spaces of participation, valorisation of resources, sharing between local and external actors, as well as for creating large-scale networks of collaboration and exchange networks, capable of amplifying and extending the impacts of individual practices well beyond the local context.
Finally, using both artistic and non-artistic forms, often integrated, these practices, although so far, they did not produce an impact in terms of population growth, have surely favoured the regeneration of local relational and cultural capital, nourished by exchange and hybridisation with external resources, which might represent a more fertile ground for attracting young and lively population.
They have contributed to activate dynamic development processes that, framed in wider relational networks, guarantee the continuity of the local initiatives, and provide relevant

examples of overcoming the cultural remoteness of inner peripheries through culture, social/creative innovation and collaborative governance (Ansell and Gash, 2008).

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Micro-Intervention as a New Approach for Urban Regeneration in Metropolises: A Case Study in Beijing

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Abstract

This study examines urban regeneration in Beijing through the lens of micro-intervention strategies, in alignment with the city's 2016-2035 Master Plan. As Beijing confronts challenges of its vast population and rapid urban growth, it has adopted a sustainable development model characterised by a growth cap and a strategic emphasis on minimalistic interventions. This paper examines three exemplary cases—No. 17 Guangminglou Residence, Wangjing Walk Business District, and Langyuan Vintage Factory—to illustrate how Beijing manages growth constraints while enhancing the quality of urban life. The micro-intervention projects are analysed to demonstrate their role in promoting cultural vitality and maintaining architectural integrity without the extensive construction typically associated with urban redevelopment. This research draws upon a longitudinal collaboration with the Beijing municipal government, incorporating insights from over 200 case studies since 2021. It reflects on the adaptability and effectiveness of Beijing's urban strategies. The findings suggest that Beijing's approach could serve as a model for sustainable urban transformation that other global cities facing similar developmental pressures might consider. This investigation offers a comprehensive insight into the potential of targeted, small-scale interventions to drive significant enhancements in urban sustainability and liveability.

Keywords

Urban regeneration, micro-intervention, sustainable development, Beijing urban planning

Introduction

Since the 1950s, the phenomenon of rapid urban expansion has prompted discussions on the effective management of urban development boundaries and the utilisation of city resources in a more efficient manner. The concepts of "smart growth" and "post-growth" have emerged as a means of achieving a balance between economic development and sustainable outcomes (Hess, 2010; Jackson, 2011). One method for reutilising urban resources is redevelopment, which has evolved from mere physical space reconstruction and beautification to focusing on sustained improvements to social environments and regeneration (Wu, Xu and Gar-On Yeh, 2007; Roberts, 2000). In the present era, this approach has become the dominant strategy employed by numerous cities in their pursuit of improvement and adaptive reuse.

Furthermore, China has increasingly prioritised sustainable development over purely economic gains since 2020. For instance, President Xi Jinping asserted that the ecological environment itself is the economy, thereby underscoring a shift towards environmental consideration in economic planning (Xinhua, 2020). The Ministry of Natural Resources has integrated urban development boundaries into national spatial planning, thereby providing guidance for this new direction (Government of China, 2019). The 2017 master plan for Beijing establishes a framework for the city's future growth, incorporating measures such as industrial permits, prohibited lists, and differentiated urban density controls (Beijing Municipal Bureau of Natural Resources and Planning, 2017). A notable aspect of this plan is the adoption of "micro-intervention" regeneration strategies, which replace large-scale demolitions with small-scale, gradual improvements. The approach to micro-intervention regeneration has already generated

a number of practices, which have in turn shaped a distinct model for the city's urban regeneration.

This paper examines three specific case studies that have been implemented under Beijing's micro-intervention strategy. The case studies include No. 17 Guangminglou Residence, Wangjing Walk Business District, and Langyuan Vintage Factory. This paper examines the operational principles of these initiatives, summarising their distinctive models and interpreting how such urban regeneration contributes to the sustainable development of metropolises. The following sections of this article are structured as follows: the next section reviews global literature on urban regeneration, followed by a methodology section. The fourth through sixth sections provide detailed accounts of each case study, while the final section discusses the significance of micro-intervention strategies for sustainable development.

Urban Regeneration: Global Perspectives and China's Strategic Approaches

In the mid-20th century, cities across the globe were confronted with the challenges posed by uncontrolled urban expansion. In response, various nations adopted sophisticated urban management policies with the objective of addressing inefficient land use, excessive dependence on automobiles, and environmental degradation. In the United States, the adoption of the "smart growth" philosophy facilitated the implementation of strategies such as "Urban Growth Boundaries" and "Transit-Oriented Developments" to effectively manage urban sprawl (Daniels, 2001). Similarly, the United Kingdom's "Green Belt" policy was instrumental in curtailing the unplanned expansion of urban areas (Hall, 2002). Japan concentrated on enhancing its public transportation systems to reduce reliance on personal vehicles (Hayashi et al., 2004). Singapore maintained urban order and efficient land utilisation through intensive spatial planning and stringent land development policies (Kempton et al., 2022). These initiatives were of great significance in controlling urban expansion, enhancing environmental protection, and promoting sustainable development.

As the 21st century commenced, particularly in the aftermath of the 2008 global financial crisis, there was a paradigm shift from a sole focus on GDP growth to an acknowledgement of the importance of ecological sustainability, social equity, and quality of life (Harris, 2010; Schneider et al., 2010). This shift gave rise to the "post-growth" theory, which advocates for economic activities to be harmonised with ecological capacities and societal well-being (Fritz and Koch, 2014; Kadekodi, 1992). Cities such as Amsterdam have implemented this theory by supporting circular economies and enhancing public transportation systems, thereby reducing reliance on conventional growth models (Flint and Danner, 2001).

In China, the rapid urbanisation that occurred between the late 20th and early 21st centuries initially prioritised economic growth and speed. However, as environmental concerns and resource pressures mounted, the Chinese government, during the second decade of the 21st century, redirected its urban planning strategies towards prioritising ecological protection and sustainable development. This strategic pivot involved the integration of the "Three Land Management Red Lines" into national spatial planning, which effectively balanced urban and rural growth (Liu et al., 2019). These red lines included ecological protection redlines, permanent basic farmland, and urban development boundaries. In response to the challenges posed by urbanisation, major cities such as Beijing and Shanghai developed urban master plans that regulated development space and population growth. These plans ensured the implementation of high-quality, sustainable urban development (Merics, 2021).

Following the enactment of the "14th Five-Year Plan" in 2020, China has actively promoted urban regeneration with the objective of transitioning towards high-quality development. The plan emphasises the implementation of intensive, green, and low-carbon development models, advocating a balanced "reserve-renovate-rebuild" strategy that prioritises the preservation and enhancement of existing structures (United Nations Development Programme, 2021). Furthermore, the State Council issued directives to avoid large-scale demolitions and constructions, promoting small-scale, incremental regeneration to ensure sustainability. (Asian Development Bank, 2021). The Beijing government developed the "Beijing Urban Regeneration Action Plan" (Beijing Municipal Government, 2021), which sets out specific objectives, tasks, and measures for urban regeneration during the "14th Five-Year" period. This plan provides a robust framework of policy and institutional support for these initiatives.

The urban regeneration strategy of Beijing has transitioned from a property-led approach of demolition and redevelopment to a more comprehensive strategy that prioritises functional transformation, quality enhancement, and cultural preservation. Notable projects include the renovation of Shougang Industrial Park (Wang, Duan and Zheng, 2023), the conservation project for Nanluoguxiang (Zhang, Kang and Koo, 2019; Min and Aili, 2015), and the revitalisation of Wangfujing pedestrian street (Zhou, 2012), which illustrate Beijing's strategic shift in urban regeneration. These initiatives not only preserve the city's historical heritage, but also improve the quality of life for residents, and stimulate economic growth through business upgrading. The projects illustrate the efficacy of applying urban regeneration principles to diverse local contexts.

Methodology

The methodology adopted in this study utilises a qualitative case approach, designed to provide an in-depth analysis of urban regeneration projects implemented in Beijing from 2020 to 2022. The research involved continuous investigation of over 200 urban regeneration initiatives during this three-year period.

The sources of these projects varied. Some of the projects were initiated by enterprises or local authorities seeking upgrades of their own properties. While others were initiated by district governments to enhance safety and environmental conditions within their jurisdictions. In collaboration with municipal and district governments, the research specifically targeted projects that were representative of broader trends or that demonstrated innovative practices within the sphere of urban regeneration. This selection process, conducted jointly by municipal and district governments along with researchers, ensured that each chosen project significantly aligned with the overarching goals of urban policy and practice.

Figure 1. The distribution of Beijing's urban regeneration projects from 2020-2022 (Source: author)

Primary data collection was conducted through organised interviews with a diverse array of stakeholders, including project developers, urban planners, architects, researchers, and government officials who were involved in the planning and reviewing phases of the projects. These interviews aimed to gather comprehensive insights into the project implementation process, the challenges faced, the strategies deployed, and the outcomes achieved. This methodology allowed for a multi-dimensional analysis of the projects, covering both the technical aspects of planning and design as well as the administrative and execution phases.

For projects identified as particularly significant, the research methodology included field visits. During these visits, interviews were conducted with a wide range of individuals, including local residents, visitors, sub-district and neighbourhood-level workers, and other local workers such as delivery riders. This method facilitated the collection of a broad spectrum of perspectives and experiences, providing a deep understanding of the community's interactions with and responses to the urban regeneration projects.

This study focuses on three key cases: No. 17 Guangminglou Residence, Wangjing Walk Business District, and Langyuan Vintage Factory. Each represents a distinctive approach to the micro-intervention regeneration of old residential buildings, commercial areas, and industrial facilities, respectively. The research involved comprehensive tracking of these projects from initiation and design through approval and operation. Extensive longitudinal monitoring and multiple site visits were conducted to ensure the accuracy and completeness of the data. This comprehensive examination provides critical insights into the challenges and innovations associated with micro-intervention strategies in urban regeneration.

No. 17 Guangminglou Residence

No. 17 Guangminglou Residence is a residential building located in Longtan Subdistrict, Dongcheng District, Beijing. Constructed in the 1960s, the three-storey building covers an area of 335.7 square metres with a floor area of 1007.1 square metres. Over time, the building has undergone significant deterioration, exhibiting a number of structural deficiencies, including partial cracking, which presents a significant risk to the safety of its occupants. The building's design and facilities are outdated and lack basic living conveniences, particularly the arrangement where every five households share a kitchen and bathroom, which severely compromises the quality of life and privacy of the residents and is in urgent need of improvement.

Figure 2. Before and after regeneration of No. 17 Guangminglou Residence
(Source: https://baijiahao.baidu.com/s?id=1751087758495236894&wfr=spider&for=pc)

Feature 1: Minimal increase for enhanced urban aesthetics and living conditions

In contrast to traditional large-scale demolition and rebuilding projects, the regeneration of No. 17 Guangminglou Residence employs a micro-intervention strategy. The objective of this approach is to preserve as much of the original architectural character and urban fabric as possible, while implementing necessary functional enhancements. The project entailed the addition of a single storey to the existing three-storey structure, resulting in a total height of 12.7 metres and an increase in floor area of 420.9 square metres. This approach, which could be described as prudent and incremental, was designed to ensure harmony with historical architecture and the adjacent older residential districts, thereby maintaining continuity of the urban facade and overall aesthetic coherence.

The renovation has provided each household with independent kitchen and bathroom facilities, thus transitioning from the previous non-self-contained units to fully equipped dwellings. This significant upgrade has enhanced the convenience and comfort of residents. Furthermore, the expanded living area has alleviated the previously cramped conditions, increasing the residential area from 35 to 46 square metres per household. This not only enhances the quality of life of residents but also significantly increases the private living space available to them.

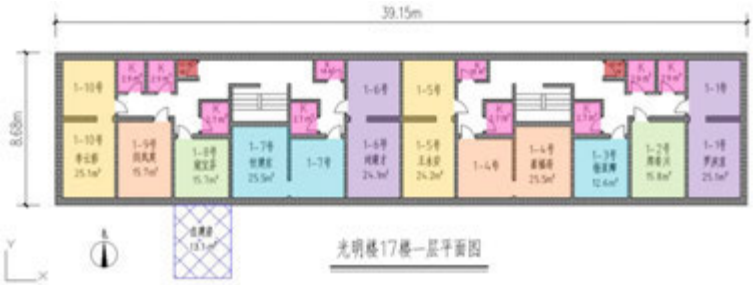

Figure 3. Floor plan before regeneration of No. 17 Guangminglou Residence
(Source: Beijing Tsinghua Tongheng Urban Planning & Design Institute)

Figure 4. Floor plan after regeneration of No. 17 Guangminglou Residence
(Source: Beijing Tsinghua Tongheng Urban Planning & Design Institute)

Feature 2: New Financial Framework for Collaborative Urban Regeneration

The No. 17 Guangminglou Residence, which was previously owned by the Dongcheng District government and designated as public housing, was occupied by tenants rather than homeowners. The regeneration project introduces an innovative funding model that involves residents, the property owner (Dongcheng District government), and both municipal and district governments in a collaborative financing arrangement. This model represents a departure from traditional funding models that are typically financed solely by the government or developers. It introduces a more diversified and sustainable funding source. The direct participation of residents not only alleviate the financial pressure on the government but also allows residents to engage actively in the regeneration process.

The total project cost is approximately 20 million RMB. The total government subsidies amount to approximately 5.8 million RMB, comprising municipal subsidies of 2630 RMB per square metre and district subsidies of 3156 RMB per square metre. The residents contributed approximately 4.2 million RMB, which represents a substantial level of involvement, accounting for 21% of the total cost. Meanwhile, the property owner, Dongcheng District government, invested approximately 10 million RMB, covering half of the total expenses. This financial structure ensures a balanced economic burden among all stakeholders, thereby reducing the dependence on a single financial source.

The residents primarily benefit from the considerable appreciation in housing value that occurs as a result of the regeneration process. The cost to residents was calculated using the original

housing area of 35 square metres at a renovation cost price of 1560 RMB per square metre, while the additional 11 square metres were calculated at a reconstruction cost price of 6564 RMB per square metre. Consequently, the average contribution cost for residents was calculated as (35 * 1560 + 11 * 6564) / 46, which equates to approximately 2800 RMB per square metre. This figure is considerably lower than the prevailing secondary market price of 100,000 RMB per square metre. By participating in the regeneration process, residents were able to transition from tenants to homeowners. This resulted in a notable increase in the value of their asset, with each household gaining an expansion in living space from 35 square metres to 46 square metres. This improvement in both living quality and financial feasibility represents a significant enhancement in the standard of living for the residents. This co-financing model offers a financially viable and socially responsible approach to urban regeneration, representing a sustainable method that benefits the entire community.

In conclusion, the regeneration of No. 17 Guangminlou Residence exemplifies a successful model for the regeneration of Beijing's aged residential buildings. The project demonstrated an effective balance between architectural preservation and the implementation of enhancements to living conditions. This was achieved through the adoption of a minimalistic design approach that aligns with the existing urban fabric. Moreover, the innovative financial model, which involved a collaborative investment strategy among residents, the property owner, and government agencies, demonstrated a sustainable and propagable approach to urban regeneration. This project not only enhanced the safety and functionality of the housing but also facilitated a significant shift in the residents' status from tenants to homeowners, thereby enhancing both their quality of life and financial stability. Therefore, No. 17 Guangminglou Residence represents a pivotal development in urban regeneration strategies, offering valuable insights for future projects in similar urban settings.

Wangjing Walk Business District

The Wangjing Walk Business District is situated in the Wangjing area of Beijing's Chaoyang District. It was previously a derelict zone characterised by a 380-metre road lined with commercial buildings, the majority of which were owned by Vanke and Fangheng. The district's regeneration was initiated with the objective of addressing a range of issues, including outdated environments, suboptimal business operations, and significant traffic congestion. The project aimed to enhance the commercial appeal and public spaces quality of the district, thereby improving inclusivity and accessibility to better serve the community's predominantly international demographics. The revitalisation has not only improved services but also significantly boosted urban vitality, transforming Wangjing Walk into a vibrant and dynamic business district.

The regeneration project of Wangjing Walk Business District represents a significant departure from traditional commercial complex renovations, which are typically developer-led and focus primarily on enhancing the commercial property itself through expansions, façade beautification, and interior refurbishment in order to attract more consumers. In these conventional models, the transformation of external public spaces is often relegated to a secondary role, usually addressed last in the renovation process with minimal investment.

In stark contrast, the Wangjing Walk Business District project commenced its transformation with a focus on the enhancement of public spaces, with a particular emphasis on the improvement of the central roadway environment within the commercial district. This initial step, spearheaded by the government and financially supported by them, demonstrated a strong

commitment to the revitalisation of regional development. The government's initial investment not only upgraded the infrastructure but also successfully encouraged private capital to participate in the renovation of adjacent commercial entities. This approach effectively mobilised resources and strengths from both the public and private sectors, collectively advancing the comprehensive regeneration of the area.

Furthermore, the Wangjing Walk Business District regeneration did not result in an increase in the scale of the buildings, thereby minimizing disruptions to the surrounding urban environment. Instead, the project substantially enhanced the area's aesthetic quality and functionality by upgrading environmental conditions and augmenting public services. This strategy, which places a core emphasis on the renovation of public spaces, not only improves the commercial viability of the area but also strengthens community cohesion and resident satisfaction. The Wangjing Walk Business District project offers a novel perspective and a practical example for sustainable development in urban commercial districts. It demonstrates how public space-focused regeneration can profoundly impact both economic vitality and social integration in urban settings.

Figure 5. Before and after regeneration of Wangjing Walk Business District
(Source: https://m.thepaper.cn/baijiahao_19131954;
https://export.shobserver.com/baijiahao/html/645866.html)

Feature 1: Government-Led, Corporate-Participated Regeneration Model

In the Wangjing Walk Business District regeneration project, the government, Vanke, and Fangheng played distinct financial roles and collaborated to drive the project's success. Both Vanke and Fangheng are prominent real estate developers in China, with substantial fixed assets on either side of Wangjing Walk.

At the outset, the government made an initial investment of 13 million RMB, which was focused on essential infrastructural renovations such as road repairs and lighting system upgrades. This funding constituted the initial stage of the broader district transformation.

Subsequently, Vanke, as a principal corporate entity, made a further investment of 35 million RMB. This expenditure was not only allocated to the development of recreational, artistic, and support facilities along the district, such as new commercial spaces, public art installations, and green projects, but also included substantial internal renovations and business model enhancements for Vanke-owned commercial buildings and offices along Wangjing Walk. The initiatives were designed to enhance the district's commercial appeal and public aesthetics, thereby improving the experience for residents and visitors and optimising Vanke's own asset value and operational efficiency.

Fangheng also provided financial support, albeit on a smaller scale, with a contribution of 5 million RMB. The investment was directed towards further enriching the district's recreational and artistic facilities, including the addition of art exhibitions and temporary event spaces, as well as other beautification projects. These enhancements served to enhance the overall cultural atmosphere and functionality of the district.

The layered financial contributions and their sequence ensured that the project's diverse needs were met, while also reflecting the spirit of collaboration and shared responsibility between the government and enterprises in urban regeneration efforts. This cooperative model effectively leveraged the strengths of each party, optimised resource allocation, and facilitated the transformation of Wangjing Walk from a traditional commercial street into a modern, international business and cultural district.

Feature 2: Strategic Business Alignment through Community Insights

In the preliminary phase of the Wangjing Walk Business District regeneration project, the project team conducted extensive and detailed market research and resident opinion collection to ensure that the regeneration plan comprehensively and accurately reflected the specific needs of the area. The research activities, which spanned several months, included roundtable discussions, questionnaire surveys, and door-to-door interviews. These covered 11,400 effective tax-paying enterprises out of 26,700 legal entities in the district, including 1,113 foreign-related enterprises. The substantial tax contributions from these foreign-related enterprises, accounting for 59.6% of the district's revenue, served to highlight Wangjing Walk's international business stature and its broad international consumer demand.

The resident surveys and interviews employed a multi-level and multi-dimensional approach, addressing satisfaction with the current living environment, expectations for the regeneration, and specific demands for new facilities. The residents expressed a strong need for improvements in infrastructure, including transportation and public spaces, as well as a desire for more recreational and cultural activities within the district. These insights enabled the project team to define the project's commercial positioning. This was to create a multifunctional commercial and cultural district that meets international standards, incorporating more outdoor recreational facilities and a diverse range of commercial and cultural amenities.

The preliminary research and opinion gathering conducted for this project were comprehensive and designed to align the modifications with the actual needs and expectations of the residents. This foundational work facilitated the development of a district that not only meets international standards but also addresses the specific requirements of the local community. The methodical approach to data collection and analysis was of great importance in guiding the regeneration and enhancement of the district's commercial and cultural environment. This approach reflecting a careful consideration of both broader objectives and detailed resident feedback.

The regeneration of Wangjing Walk Business District has significantly enhanced the area's commercial vitality and community environment, as evidenced by substantial increases in foot traffic and fiscal revenue following the regeneration. In particular, the average daily foot traffic increased from 4,784 on weekdays and 4,428 on weekends to 15,436 and 20,844, respectively. This increase not only demonstrated a significant boost in the district's appeal but also reflected an uptick in commercial activities.

In terms of economic impact, annual sales increased from approximately 800 million RMB prior to the regeneration to 1.2 billion RMB, representing a 50% increase. Moreover, fiscal tax revenue saw a significant rise, amounting to approximately 56 million RMB annually. This revenue growth not only provided the local government with increased fiscal income but also demonstrated the positive impact of enhanced public services and infrastructure investments on the prosperity of commercial activities.

In conclusion, the Wangjing Walk Business District regeneration project was implemented in a manner that avoided merely expanding the building area, thereby minimising disruptions to the surrounding community during construction. The investments made by each participating party were kept within reasonable bounds, ensuring a balanced contribution to the project. The project's outcomes were notably significant, yielding substantial economic benefits and enhancing social impact. This regeneration has established a new paradigm for the revitalisation of ageing urban commercial districts, demonstrating the efficacy of government-led improvements in public spaces. This approach effectively encourages local businesses and property owners to voluntarily participate in the upgrading of their properties on a voluntary basis. The project's collaborative funding model has been instrumental in fostering regional revitalisation, with subsequent economic growth and increased land values enriching the community. Ultimately, this has resulted in a mutually beneficial scenario for all stakeholders involved, thus establishing a replicable model for urban development.

Langyuan Vintage Factory

Langyuan Vintage represents a seminal example of industrial heritage micro-intervention. Strategically situated in the core of Beijing's Central Business District (CBD), the factory originally served as the Wan Dong medical equipment factory. As the CBD continues to evolve and urbanisation progresses, traditional industrial facilities are becoming increasingly incompatible with the modern urban landscape. In 2009, the Beijing Capital Group acquired the development rights to this site, launching a city regeneration project centred around cultural and creative industries. The project retained the industrial character of the area while introducing new cultural and public service functions to meet the diverse development needs of the city.

Figure 6. After regeneration of Langyuan Vintage Factory
(Source: https://www.xiaohongshu.com/explore/63073aaf000000001b02418c; https://175586960.b2b.11467.com/news/2885968.asp)

Feature 1: Preservation of Industrial Ambience and Provision of Diverse Spaces

The regeneration of Langyuan Vintage is characterised by a profound respect for the site's historical value. In contrast to the conventional demolition and reconstruction practices typically employed in such cases, the Beijing Capital Group opted to maintain the low-density characteristics of the industrial park and its industrial architectural appearance. This resulted in the transformation of the area into a "back garden" within the CBD. Although this strategy resulted in higher renovation and maintenance costs, the continued spatial quality and historical value it brought has endowed the area with a unique cultural atmosphere.

The project adhered to the principle of "repairing the old as old," thereby ensuring that the original structures and features of the factory were retained to the greatest extent possible. For instance, the site's original red brick walls and large industrial windows were meticulously restored and preserved. The spaces were redesigned with a variety of functions in mind, including bookstores, zen spaces, cafes, and co-working spaces catering to the culture and entertainment industries. This has made it the preferred relaxation destination for CBD employees after work.

In particular, some spacious industrial areas were transformed into venues suitable for theatre, art exhibitions, and other cultural events, such as the Lanjing Art Centre and Yu She Performance Space. This has enhanced Langyuan’s cultural atmosphere and provided unique interactive platforms for artists and audiences.

Feature 2: Cultivation of Culture and Community

Langyuan Vintage plays an instrumental role in enhancing the quality and scope of community public services by integrating a multitude of cultural activities and facilities. For example, the Liang Yue City Bookroom, which is accessible 24 hours a day, provides a shared space where reading and learning can be enjoyed, thereby enriching the cultural lives of the residents. Furthermore, the annual Langyuan Book Fair has become a significant event, attracting book enthusiasts and creative industry professionals alike, and fostering community cultural exchanges and the development of the creative industries.

The cultural facilities and activities not only enrich the residents' cultural lives but also gradually shape an attractive cultural community, enhancing the cohesiveness of the community.

In the process of regenerating Langyuan Vintage, the developer eschewed the profit-driven model typical of real estate developments, instead prioritising the enhancement of the spatial quality of the area and the continuous implantation and cultivation of a cultural atmosphere with the objective of creating a lasting impact. This strategy has demonstrably enhanced the value of the entire park. The protective transformation of the old industrial architecture and the careful planning of cultural content have enabled Langyuan Vintage to not only preserve valuable urban historical memories but also to foster new social value and business opportunities. The project exemplifies the profound potential of culture and creativity in regenerating urban spaces, offering new avenues for sustainable urban development and providing valuable insights and lessons for the regeneration of other industrial heritage sites in Beijing.

Conclusion

This paper examines the transformation of urban regeneration strategies in Beijing, providing a detailed analysis of three exemplary cases. This analysis reveals the core features of micro-intervention urban regeneration strategies. These strategies adhere to a minimalist approach to urban intervention, eschewing the mere expansion of building scales in favour of a focus on enhancing architectural quality, improving public spaces, addressing the needs of local residents and workers, and fostering high-quality cultural content. This regeneration approach offers a more sustainable path of development for metropolises in the global south, particularly those that have reached developmental limits and require refined management of urban construction.

The study is significantly supported by the Beijing municipal government, whose conception of a project repository in the Beijing Urban Regeneration Action Plan has provided a wealth of empirical data. Since 2020, the Beijing government has consistently updated its urban regeneration project repository, with over 80% of the 200-plus projects tracked from 2020 to 2022 employing micro-intervention strategies. This substantial corpus of data provides a robust foundation for the prominence of micro-intervention strategies in Beijing's urban regeneration efforts since 2020. In the future, Beijing will continue to pursue this strategy, with a focus on managing overall urban construction volumes and enhancing spatial quality, cultural significance, community care, and collaborative construction. This approach will be employed in order to gradually address the issues that have accumulated during periods of rapid urban expansion. As a representative megacity in the global south, Beijing's experiences and practices in urban regeneration could provide insights for other cities at similar stages of development.

It is important to note that this study is subject to certain methodological limitations. In the case of Wangjing Walk, the data on residents and businesses was obtain from the project constructors, rather than directly from the residents themselves. This approach may limit the comprehensive understanding of residents' negative feedback. In order to enhance the accuracy and depth of future research, this paper will, in subsequent studies, collect first-hand data through direct interviews with residents. This will further refine the research methodology in order to perfect the study's conclusions.

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Track 02: Markets

Markets - Planning for property markets, Financialization, and Private Actors

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- Tuna Tasan Kok, University of Amsterdam
- Petra Samaha, Sciences Po Paris

Keywords: *Financialisation, financial actors, adaptive planning strategies, property-led planning, property developers and investors, property-led urban development coalitions*

In the context of rising housing prices during the last decades, public actors found new ways to use planning to regulate property markets, for instance, by imposing affordable housing in new residential developments through inclusionary housing programs. At the same time, planning has been seen as a way to promote growth in property markets, notably by encouraging projects amenable to international capital or secure real estate values in increasingly volatile markets. With the growing interest of financial actors (such as sovereign wealth funds, pension funds, insurers, and investment trusts) for real estate, the regulatory capacity of planning is particularly under scrutiny as these actors' strategies have been linked to increasing rents, evictions, and rapid social change. The growing size of their portfolios also makes these actors central for implementing rehabilitation and urban renewal policies, which are essential to bringing carbon emissions to net zero. This track seeks to explore the intersections of planning, governance, and property studies, with a specific emphasis on critical perspectives that examine how planning systems, including regulations, grapple with the challenges posed by financialisation in contemporary urban environments. However, within planning scholarship, there is untapped potential for further exploration of property actors, their strategies, and their relative positions in relation to regulations. We welcome theoretical, methodological, and empirical contributions that address the following key themes.

Public Planning Mechanisms and Financialisation: Papers in this category should investigate how public planning mechanisms and institutions respond to cities' financialisation. We encourage critical examinations of regulatory frameworks, policy responses, and their implications for urban development.

Emerging Adaptive Planning Strategies: This theme seeks to explore the innovative and adaptive planning strategies that are emerging in response to the challenges posed by property-led planning and financialisation. Contributions should illuminate novel approaches, tools, and practices that planners employ.

Relational Dynamics among Public, Private, and Community Actors: While our primary goal is to shed light on lesser-known actors, such as property developers and investors, and their relational positions within urban planning coalitions, we also invite abstracts that delve into the

complex relationships among public sector actors, private developers, and local communities in the context of property-led urban developments. This theme encourages in-depth analyses of power dynamics, collaborative efforts, and conflicts among these key stakeholders.

Gender Balances in Property Coalitions: Specifically, we are interested in studies that investigate gender dynamics within property-led urban development coalitions. How do gender imbalances influence decision-making processes and outcomes in urban development projects?

Global Perspectives: We encourage submissions that offer insights from low and middle-income countries, exploring how they experience similar financialisation trends in urban development. Comparative studies and cross-cultural perspectives are particularly welcome.

Urban policy financialisation in mega-projects. The case of Milano Innovation District

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Abstract
Urban mega-projects are key policy instruments for connecting financial and real estate markets through the financialisation of strategic lands and the 'deterritorialisation' of actors, decisions, and strategies. Milano is currently characterised by multiple large-scale operations pursued by global developers and investors. This article problematises one of such projects, the Milano Innovation District, by reconstructing its spatial development through interviews, field observations and desk analysis, showing how financialised planning and policy measures generate deterritorialisation, and building on the financialisation literature intertwining real estate and spatial planning fields. Finally, this article discusses the role of state planning in underpinning spatial development, arguing that financialisation depowered the capacity of planning to recapture land value and rebalance urban rent. In essence, the financialisation techniques for collecting capital and delivering urban mega-projects have deterritorialised the governance of urban transformations, compromising the spatial government led by local, regional and central governments.

Keywords
deterritorialisation, financialisation, urban policies, urban mega-projects, Milano Innovation District

1. Introduction

Over the last decades, the financialisation of the economy (Epstein, 2005) has guided the change from a system of economies of scale spread over the territories to an increasingly globalised single economic system which clusters a significant part of the financial capital in the major cities. This change assumes the name of financialisation and, specifically in the sector of real estate, coincides with the transformation of real estate assets into tradable goods (Gotham, 2009) with the tendency to treat the built environment and landed areas as products exchanged on the financial market (Harvey, 2005; Savini and Aalbers, 2016; Van Loon and Aalbers, 2017).

Following this discourse, urban mega-projects (Fainstein, 2008; Flyvbjerg, 2014), represent the tipping point of such shift towards unpredicted financing methods, as ‘levers’ capable of welding the objectives of the financial market to the real estate industry and markets, particularly by (de)territorializing the land-value capital and converting it into financial capital following the logics of business plans tailored by property developers and their investors. In other words, urban mega-projects act as urban policies. The financialisation of such urban mega-projects implies ‘deterritorialism’ perspectives, reflected in deterritorialised urban policy measures which enable ‘world governance visions’ in financial schemes linked to property urban development (Medeiros et al., 2021: 965).

Through the category of ‘deterritorialisation’, I refer to the practice of progressively abstracting and dematerialising the essence of (urban) public policies, although these continue to affect territories, land and built environment, within a reshaping process of deterritorialisation & reterritorialisation (Cocco, 2007). Such category is intertwined with the concept of ‘territorial

deterritorialism' which «is an approach under which bounded spaces – territories – are the objects of policymaking and planning» (Faludi, 2018, p. 73). Even though several authors (Agnew, 1994; Capello et al., 2018) argued that 'deterritorialism governance' would represent a «concrete policy action to reduce the negative effects posed by the presence of national boundaries» (Medeiros et al., 2021, p. 965), this article suggests that the deterritorialisation (through financialisation) of urban mega-projects depowers the government's capacity to shape the same projects through strategic planning. Nonetheless, this process interacts with David Harvey's 'uneven geographic development' theory which lighted a crucial contradiction between territorial and financial logics of power in capital accumulation regimes (Harvey, 2005, p. 107).

Thus, deterritorialisation shifts the governance of urban mega-projects from a local public-led perspective to a global private-led one and requires a step-by-step process to prevent governance 'traps' (Medeiros et al., 2021). To some extent, the privatisation of leading actors, which occurs through deterritorialisation in large-scale operations, could potentially be predicted and interpreted before its massive expansion through conceiving urban mega-projects as exemplary cases of financialised 'collective apparatus' (Foucault, 1984), in other words as territorialities alienated by public collective power which historically guided apparatus (Foucault, 1984). Thus, such projects are what Harvey's theory defined as «innumerable points for the extraction of value and surplus value» (Harvey, 2005, p. 97). In this sense, financialisation interacts with spatial planning, urban policies, and strategic projects especially due to its role in shifting the societal spatialisation from political to economic – and financial – power (Foucault, 1982).

The financialisation of urban policies and projects is caused by the financialisation of real estate, which deterritorialise and treat properties as commodities within a shift from a traditionally non-financial sector to a financial one (Mosciaro, 2021; Aalbers et al., 2017). The shift towards the financialisation of urban policy architectures occurs in all the geographic spaces in which urban land and built environment are treated as financial assets/products/commodities (Aalbers, 2017; Van Loon et al., 2018). Within this global context, local financialised major projects, specifically in Milan, «are seen as both tools to revitalise real estate markets and key arenas in which political and economic actors bargain» (Conte and Anselmi, 2022, p. 2); in fact, according to Aalbers (2017, p. 3) financialisation may be defined as «the increasing dominance of financial actors, markets, practices, measurements and narrative», encompassing both an economic and political dimension.

Milano is an emergent 'middle-range' metropolis massively characterised by high-speed globalising and financialised tendencies that are forged by the site development of multiple urban mega-projects delivered by several global developers. Among the majors, the Australian property developer Lendlease is currently managing two of the three largest Milanese brownfields: the Milano Innovation District (MIND), over 1.000.000 m^2 located along the north-western axis and laying in the former EXPO 2015 site and Santa Giulia large-scale development project, 1.200.000 m^2 located on the cross-border district between Milano and San Donato Milanese municipalities along with the south-eastern railway line. This article aims to problematise the MIND case study by analysing how this exemplary urban mega-project financialised spatial planning and policies, (de)territorializing investments and enabling

financial instruments for bridging financial and property markets. In other words, the present article answers the following two research questions: How does financialisation interact with the real estate development of urban mega-projects? What financial and planning techniques govern the deterritorialisation of such projects? Thus, this contribution places the deterritorialisation of real estate assets and markets because of financialisation, presenting MIND as a case study for generalising a shift towards abstract models of large-scale spatial planning and project financing.

The argument for the deterritorialisation of urban policy financialisation will be built along with the following five paragraphs. Firstly, I will discuss the methodology and materials employed in this article. Secondly, I will frame the urban policy financialisation by examining its techniques linked to the deterritorialisation of property assets. Thirdly, I will introduce and problematise the Milanese planning system in the challenge of urban renewal. Fourthly, I will present and case of Milano Innovation Districting, considering case research as relevant in this field of analysis since, according to Harvey (2005, p.120), «case study work should internalise theorising practices in uneven geographical development».

2. Method and Materials

This case research is based on the study of one single urban mega-project, which is exemplary of financial and planning techniques linking the Milanese planning system to the financialisation of property techniques shaping such large-scale operation, as the article is revealing. Thus, the discussion proposed in this article comes from an empirical study of the Milano Innovation District (MIND) urban development project. In this sense, I argue that such a case is not a deviant or an extreme one; on the contrary, the in-depth analysis of the MIND mega-project demonstrates its similarity in terms of formulation, implementation and results of other European large-scale developments underpinned by a valorisation of public lands and assets. In fact, even though Italy overall, is a country with a limited level of real estate financialisation (Mosciaro, 2021), Milano represents an exemption since particularly its economic system is closer to other major European cities rather than other large Italian urban nodes.

This case analysis lights the de-territorialisation of urban development and policies through financialised real estate mechanisms affecting urban mega-projects, which I conceive as urban policies themselves following the urban policy theory of Dente, Bobbio, Fareri and Morisi (1990), even though there is no unique definition of urban policy (Briata and Raco, 2022). I decided to frame the result of built environment financialisation as ‘deterritorialisation’ instead of ‘decontextualisation’ since the evident majority of recent urban development projects are decontextualised in architecture and urban design terms, but only some of them are activated and managed through deterritorialised techniques delivered by financial (abstract) rationalities.

Regarding the case selection, MIND was chosen due to its relevant position in the context of large-scale development projects currently under development in the city of Milano. This case is underpinned by a structured public-private partnership in one of the largest strategic areas, as pointed out above. Its (semi)public nature maximises the availability and utility of information deciphered mainly from press articles, academic essays, official documents and semi-structured interviews that were essentials for validating these contents. In particular, the case selection of

MIND has taken into account its relevancy and exemplarity in planning traditions, cultures and motives, which are similar to other European experiences, a variety of territorial governance arrangements, institutional settings and planning techniques present in the site development, and a significant range of representations of planning intentions pursued by Lendlease as the main property developer.

3. The urban policy financialisation driving MIND's deterritorialisation

The processes of formulation and implementation of urban mega-projects are based on the principle of multiplying their land value in the financial market, thus exploiting financial leverage techniques on bonds issued by 'vehicle companies' named Special-Purpose Vehicles (SPVs), which are controlled by single property developers, joint ventures among them and investors or public-private-partnerships (Guironnet et al., 2016). Nowadays, vehicle companies constitute the main method for the financialisation of urban mega-projects through the so-called financial technique named 'securitisation' by which the (local) real estate assets are transformed into tradable bonds emitted by the SPV on the (global) financial market.

The realisation of urban mega-projects through SPVs is intertwined to the use of special planning devices (e.g., Key Opportunity Areas, Zone d'Aménagement Concerté, Programmi Integrati di Intervento, Accordi di Programma etc.), which combine aspects of land alienation with the planning flexibility that underpins complex phases of formulation, implementation and especially negotiation in public-private partnerships, which tend to be underpinned by public goods. It is relevant to notice that, in parallel with the introduction of such planning devices, local governments of major world countries have established legal & financial devices to deliver and leverage an increasing number of financialised urban mega-projects, such as Tax Incremented Financings (TIFs) in the United States, or CEPACs in Brazil, or the Dipiaio in China (Mosciaro, 2021).

In this sense, planning mechanisms delivered within the framework of public-private negotiations generally do not guarantee adequate transparency, so the profitability of urban mega-project operations underpins opacity in decision-making which often underlines forms of 'empathy' of local governments towards investors and developers (Raco et al., 2018, p. 13). The circumstances led to an 'enabling attitude' (Tasan-Kok and Ozogul, 2021) which massively increased the capacity of urban mega-projects to extract land value capture and trade it among national and international investors through the exchange financial products, especially to intuitional funds and trusts. At the same time, issues related to 'bureaucratic slowness' are assumed by investors and developers as a 'calculated risk' in pro-growth urban contexts in which local governments attempt to favour property development and, in general, the real estate industry (Raco et al., 2018: 13).

This recent phase of property financialisation has maximised the capacity to mobilize real estate assets as securities, bonds, shares, and equity in the financial market, hence the shift from the extensive use of financial grants (Fainstein and Gray, 1996, p. 31) to flexible spatial planning aimed at supporting financial allocations. In these unprecedented circumstances, the real estate industry is able to generate urban mega-projects such as MIND, which entails a more sophisticated set of socio-legal and socio-technical rules, policies, values, and frameworks

defined by the corporate ownership structure of vehicles (as dedicated funds) led by the property developer (Adisson, 2018, p. 374).

In essence, the financialisation of the MIND urban mega-project enables not only the decontextualisation of the area from the built environment, as it happened in other Milanese key opportunity areas – Grandi Funzioni Urbane (GFU) – recognised by the structural plan – Piano di Governo del Territorio (PGT) – but also the deterritorialisation of planning and policy techniques which are alienated from local real estate market cycles since the business plan logics relay only on long-term investing schedules managing times, operations and narratives. As mentioned, such deterritorialisation is already conceptualised by the Program Agreement – Accordo di Programma (AdP) – which anticipated the MIND Integrated Action Plan – Programma Integrato di Intervento (PII) – framing program agreements both as strategic strategies and planning tools. Particularly, PII is a planning tool established in the 1990s to develop large-scale urban projects, according to a project-led mindset which, since that period, has been guiding the Milanese urban policy *per project*, reflecting the finance-led dynamics of the business plan following 'diversification' logics.

Finally, flagship urban mega-projects encompass local development, regional cohesion and national/international promotion making such type of urban development, as the MIND case, political projects and urban policy themselves (Albrechts et al., 2003; Altshuler and Luberoff, 2003); I argue that the increasing financialisation of real estate assets which is affecting property development is maximised in financialised urban mega-projects in which planning techniques and urban policies are progressively dependent by deterritorialisation according to financial investment schemes which tend to be tailored and abstracted from legal and planning systems.

4. The financialisation of the Milanese planning system

The Milanese urban policy has undergone a series of structural shifts towards financialised spatial planning underpinned by a project-led mindset. As pointed out above, financialisation affects the methods by which local governments deliver strategic spatial planning and urban policies according to structural plans. Particularly, the municipal government of private and public funding to pursue large-scale development projects is increasingly relying on financial investments provided by the property industry, so several authors argue that financialisation is nowadays institutionally intrinsic in framing public-private partnerships which underpin urban mega-projects (Fainstein, 2016; Aalbers, 2020; Van Loon et al., 2018; Savini and Aalbers, 2016), seeing finance shaping planning systems and their urban policies. In this sense, despite the case of Milano is not encompassed by debt-issuing practices to receive banking loans for financing urban mega-projects (as in the TIFs), according to several interviews, I argue that its planning system appears to be financialised in cultural, political, and organisational terms.

The result of such a financialisation is a Milanese planning system highly characterised by project-led logics which are guiding the major urban mega-projects as the cases of Porta Nuova (Anselmi and Vicari, 2020), Bicocca (Kaika and Ruggiero, 2016) and Sesto (Savini & Aalbers, 2016) show.

Thus, based on the Milanese experience, which is similar to the ones of other European cities, it could be argued that urban mega-projects formally conceived as state strategies are increasingly framed as financialised policy devices. According to Lake (2015), urban policies (e.g., urban mega-projects) are becoming financial devices following the securitisation of

property bonds through Real Estate Investment Funds (REIFs) or marketisation of property shares through Real Estate Investment Trusts (REITs) – in which equity (i.e., REIT's shares) may be traded also in order to acquire property assets – and such processes have been progressively specialised in several Western cities, among Europe and America. Thus, this process is not unique, and it is always characterised by a determinant role of the state in fostering financialised strategies (Tasan-Kok, 2010).

Although the Milanese planning system does not prescribe any specific financial measure to invest in key opportunity areas selected by its structural plan, such areas are normally developed through public-private partnerships between public and private companies or joint ventures among private operators in which financial viability is roughly checked by the local government. So, the Milanese planning system appeared to be relevantly financialised, particularly in routing global investments into local government plans (Anselmi and Vicari, 2020) and governing such operations through public procurement techniques and legal contracts which enhance new codes of capital and market dependence (Raco and Brill, 2022). To some extent, the socio-spatial effects of such a 'financial attracting regime' establish a potential equation between the expansion in the financialisation of real estate assets and the gentrification of peripheral districts affected by renewal projects since urbanisation drives accumulation through the financialisation of such real estate products.

5. The financialised urban mega-project of MIND towards deterritorialisation

The Milano Innovation District (MIND) is one of the major Italian urban mega-projects. Located in the former EXPO 2015 area, MIND occupies a total gross floor area of 1,044,102.00 m^2 to be developed according to a building index of 0.52 m^2/m^2 (Comune di Milano, Arexpo & Lendlease, 2020). It is an urban mega-project pursued through sised financialisation techniques, aiming to become the pivot for driving the Milanese northwest quadrant urbanisation by intertwining this large-scale project with the greenfield operation of Cascina Merlata, and the Rho Fair complex. In this sense, the renewal project of such a large-scale public area in the post-EXPO years represents not only the urban regeneration of a key opportunity area for Milano, Lombardy, and Italy but also an attempt to establish a solid public-private partnership between the (landlord) national public company Arexpo and the (tenant/leasing) international property development company Lendlease.

The urban context in which the redevelopment project is located appears as a peri-urban enclave surrounded by railway and motorway infrastructures. Thus, the MIND urban mega-project links the renewed district to the layout of a new Milanese urban growth within a political environment in favour of fast changes during the last decade (Di Vita and Morandi, 2018). Following this perspective, the MIND area, over 1 million m^2 belonging to Arexpo, is becoming a strategic district for attracting science, knowledge, and innovation with the aim of creating an open incubator, enabling territorial excellence through the enhancement of investments already placed and the legacy of Expo 2015 (Comune di Milano, Arexpo and Lendlease, 2020). This urban concept reminds the 'TechnoCity' delivered by the Pirelli family for the Bicocca renewal project, the first Milanese large-scale operations in which land was mobilised as a financial asset, thus financialising such brownfield (Kaika and Ruggiero, 2016).

However, the MIND urban mega-project holds a long history that started in 2002 when the Fiera Milano Foundation acquired 520.000 m2 (more than half part of the entire greenfield) from the Milanese-based property development companies Bastogi & Brioschi Sviluppo

Immobiliare, owned by the Cabassi family. Consequently, the area remained 'frozen' until 2006, when Fiera Milano Foundation and Cabassi's groups presented a masterplan designed by the architecture office 5+1AA to call for an Integrated Action Plan – Programma Integrato di Intervento (PII). Almost parallelly, in 2007, the Municipality of Milano submitted its candidature to host the World Expo 2015, selecting that area to cluster the international pavilions. Although the City of Milano won the competition for hosting the mega-event already in 2008 and albeit the approval of the Program Agreement – Accordo di Programma (AdP) – was fast, the following implementation phases remained suspended until 2011 when the Municipality of Milano and Lombardy Region (the two major investors together with Municipality of Rho, former Province of Milano and Fiera Milano Foundation), acquired the entire area assigning its ownership and management to the new public-controlled company Arexpo Spa (2011-active). Consequently, the election of the centre-leftist Mayor, Giuliano Pisapia, in 2011, contributed to unlocking such political stalemate (Gaeta and Di Vita, 2021: 4). Within this municipal leadership, there was a restart of the implementation phase (2011-2015), which has seen the execution of the new masterplan called 'Planetary Garden' proposed by the Architectural Advisory Board for EXPO 2015 (Jacques Herzog, Stefano Boeri, Ricky Burdett, and William McDonough), and the government tender for management and construction.

At the end of the mega-event, after more than a year of inactivity, a period which can be interpreted as a planning disaster (Gaeta and Di Vita, 2021: 4), the Expo 2015 site was relaunched through two national government actions: the proposal of the Human Technopole research centre as a driver for capturing global financial and knowledge capitals, and the acquiring of 39,28% of Arexpo Spa shares by the Ministry of Economics and Finance (MEF) (Arexpo, 2016). Within this operation, the new governance of the public company is composed of 39,28% owned by MEF, 21,05% by Lombardy Region, 21,05% by Municipality of Milano, 16,80% by Fiera Milano Foundation, 1,21% by the Metropolitan City of Milano, and 0,61% by Municipality of Rho. In this management framework, important decisions are guaranteed only whether is reached a quorum of 71% of share capital (Arexpo, 2016). Meanwhile, the other two main shareholders Municipality of Milano and Lombardy Region, pushed San Donato Group and the University of Milano to move into the Expo site, respectively, the new IRCCS Galeazzi Hospital and a new Campus for Scientific Sciences.

It is necessary to remark that before this governance reconstruction of Arexpo Spa, there was an auction for selling the area, which failed since any bid was submitted. Thus, such government action catalysed unpredicted financial interests through the selection of public functions (e.g., 'public anchors'), which worked as drivers (Gaeta and Di Vita, 2021: 5) for attracting global capital since it guaranteed potential public-private partnerships. Between 2017 and 2019, there was the formulation phase of the urban mega-project, in which the global Australian property developer Lendlease successfully won the competition to manage the redevelopment of the former EXPO area within a Leasing Agreement - 'Concessione', in Italian legal terms – of 99 years through an initial investment and signing a Framework Contract with Arexpo, Lombardy Region, Municipality of Milano and other institutional actors, delivering the Integrated Action Plan – Programma Integrato di Intervento (PII) – for the area latterly. This new urban mega-project has been called Milano Innovation District (MIND). Particularly, in 2018, Lendlease and Carlo Ratti Associates (CRA), in cooperation with Arexpo, Systematica and Land (see Fig. 1), submitted a masterplan, for providing such PII, and, subsequently, since 2020, the construction phases of Human Technopole, University of Milano campus and Galeazzi Hospital have been started.

The MIND masterplan follows the 'pro-growth approach' launched with EXPO 2015, seeing its site development as a gateway for enhancing the competitiveness of Milano in the global city network and capturing growth potentialities (Bolocan Goldstein, 2015). In fact, such an approach, as in other major European cities, is intrinsically intertwined with urban mega-projects, which are fundamental for underpinning financialised urban narratives (Raco and Brill, 2022). In this sense, the development of the EXPO 2015 mega-event and the redevelopment of the MIND mega-project are two connected episodes within a longer-term process of the city's transformation and repositioning (Gaeta and Di Vita, 2021: 13). Also, EXPO 2015 and MIND can be seen as two «Siamese twin projects, which are inseparably tied together span over alternate periods of crisis and recovery, stagnation and acceleration, disorientation and confidence» (Gaeta and Di Vita, 2021: 3).

Such masterplan keeps the previous longitudinal division marked by two orthogonal axes called *cardus* and *decumanus* which are referred to the ancient Roman Empire practice of measuring agricultural land. Nevertheless, the masterplan presented by Lendlease and Carlo Ratti Associates (CRA) modifies the axes' meaning (Gaeta and Di Vita, 2021: 9) in a scheme north-south instead of east-west since all of the three 'public anchors' – IRCCS Galeazzi Hospital, the Human Technopole, University of Milano Campus, for a total 316.000 m^2 of gross floor area – are located on the northern side, while the private settlements directly managed by Lendlease will be built in the southern side. Moreover, each catalyst function is linked to a specific sub-district (deploying three sub-masterplans): West Gate & Galeazzi Hospital, Green Heart and Human Technopole, and Knowledge Hub & University Campus (see Fig. 2). Subsequently, the general planning of the area had two relevant changes with the design of two new masterplans, one designed by the London-based planning office Allies & Morrison, which shaped MIND as an 'American city' linked to concentrate urbanisation (see Fig. 3), while the following one designed by the Bologna-based firm Mario Cucinella displayed, especially for 'West Gate', an architectural morphology linked the Milanese pattern of avenues and courtyard buildings (see Fig. 4). Concerning the planning practice of the implementation phases, it could be argued that the financialised attitude pursued by Lendlease in driving the decisional process following organised planning and financially-driven advanced governance of the mega-project, in terms of business plans, functional programs and urban design solutions, despite the lack of public transportation and access to the private side of site development.

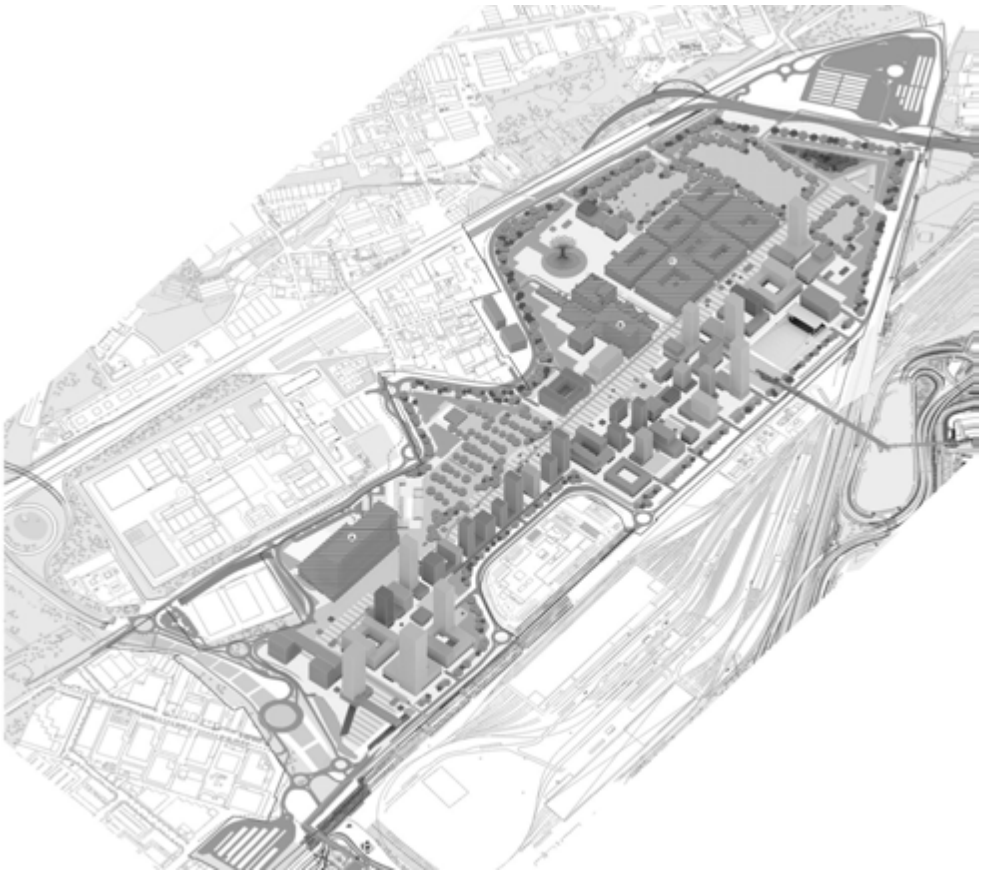

Fig. 1 MIND PII (Lendlease, Arexpo, Carlo Ratti Associati, Municipality of Milano, 2020)

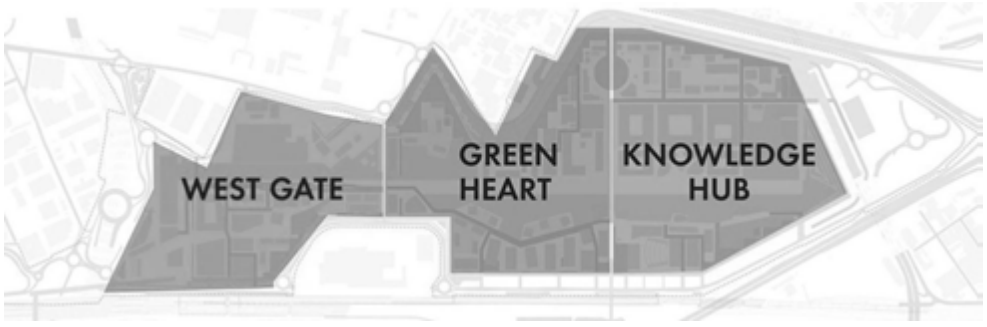

Fig. 2 Subdistricts (Lendlease, 2020)

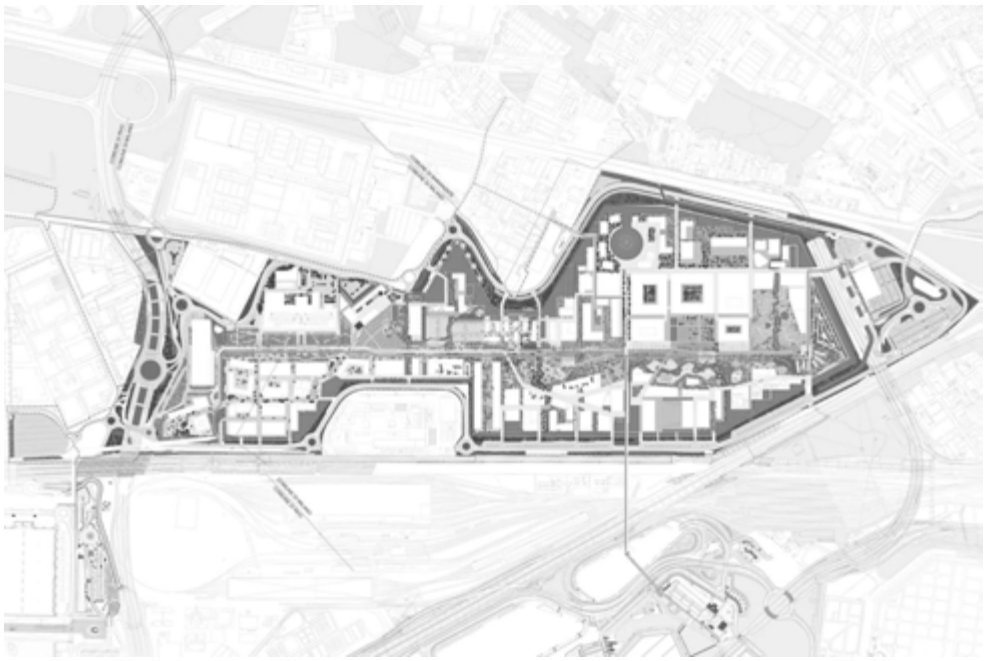

Fig. 3 Allies & Morrison MIND Masterplan (A&M, 2021)

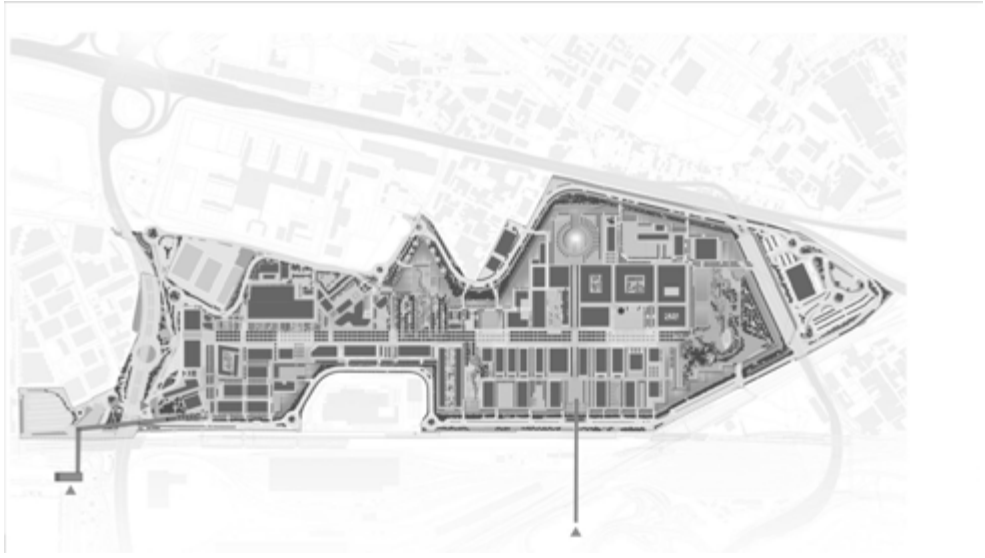

Fig. 4 Mario Cucinella MIND Masterplan (MCA, 2022)

In addition to the three 'public anchors' that MIND is hosting, in compliance with the PII, new accommodation, leisure, and free time functions will be directly developed by Lendlease following environmental and sustainable values of living and working (317,000 m^2 of gross floor area, 103,000 m^2 of services such as commercial and neighbourhoods businesses, 90,000 m^2 residential units, 30,000 m^2 of production activities such as laboratories, 305,000 m^2 of offices), for hosting approximately 70.000 people in total. Moreover, Lendlease established a joint venture with Ream Sgr Spa (a Turin-based property developer and manager) to provide about 30,000 m^2 of social housing residences and office units used by the university campus through the multi-division alternative REIF named 'Cervino'.

The site development of MIND is intrinsically linked both to the new real estate financing techniques and to active real estate management in the specialisation of the business plan that Lendlease is applying to the property valorisation of the area. Using Lendlease Global Commercial Italy Fund, the beginning phase of the investment program was confirmed in 2021, framing a long-term spatial plan which combines a joint venture with an institutional investor in the 'West Gate' district and the public-private partnership with the University of Milano in the 'Knowledge Hub' district. Subsequently, it has been established the alternative investment fund 'Lendlease Renaissance I' as an SPV managed by Lendlease for underpinning the joint venture with the Canada Pension Plan (CPP) investment board for a value of about 400 million euros of equity acting in the 'West Gate' district with a predicted ending value of about 800 million euros. Such investment is affecting only the 'West Gate' district, 11 plots 'Stralci Funzionali' for different destinations of use (office, retail, hotels, residential and ancillary spaces) and a total of 164.000 m^2. However, according to press declarations by Arexpo Spa officials, the estimation of the entire MIND redevelopment project is roughly 4,5 billion euros (Gervasoni et al., 2024).

In this sense, the active real estate management approach pursued by Lendlease as a specialised property developer combining high expertise in both corporate and project management marked a shift in the Italian real estate sector beyond the 2007 subprime mortgage financial crisis. Such a shift has occurred, not only due to an internationalisation of the professional figure of the property developer but also due to the transformation of the technical-financial instruments suitable for the urban development of large public areas, which historically was strongly linked to real estate cycles, therefore with constrained choices to profit maximisation in the short run. In fact, the management of the area for 99 years implies, for the property developer, the strategic programming of a long-term business plan capable of contemplating a return value shaped over time. In other words, this temporal dimension configures multiple and integrated design choices, generating repercussions of spatial order, for example, inherent in the use of high-performance, sustainable, and replaceable materials, or construction technologies that allow the re-functionalisation and transformation of individual properties for adaptation to the required property market demand.

Overall, the financialisation of the MIND urban mega-project deploys several financial interventions, planning instruments and policy tools, which are tailored and fragmented among the 24 'functional excerpts' (sub-lands) – 'Stralci Funzionali' – and in consideration of the articulated and complex levels of risk regarding each property asset class which is connected indeed to such function (e.g., commercial and housing real estate assets hold a lower investment risk rather than large multifunctional assets). Each 'function excerpt' clusters an independent settlement since the financialisation of the real estate assets lying on a specific sub-land need

to be specialised and managed based on diversified investors' demand. Thus, in such excerpts, financialisation affects spatial planning, urban design and architectural design implications addressed by the investors' (tenants) business plan (e.g., retail, timeline, arrangements etc.) in reshaping the built environment over time. The consequence of such fragmentation in sub-lands (through financialisation) is the deterritorialisation of funding and spatial devices treating built constructions and objects, and this process affects the entire MIND masterplan. In other words, from an urban design angle, the masterplan appears unitarian, while from the financialisation angle, it can change according to the spatial planning flexibility defined by the PII.

6. Discussion

The nexus between property financialisation and cities' urbanisation has massively increased capital accumulation in urban mega-projects, clearly demonstrating how urban policies underpinning such projects have often become policy & financial instruments to pursue financialisation (Salet, 2008; Haila, 2008). As Lake (2015) pointed out, such a process has been delivered by the silent predominance of economic policy to social and urban policies (and partially spatial planning), which have been treated as subordinate, and thus financialised over the last decade. Following this discourse, urban policy financialisation seems to be reflected in flagship (political) projects both in financial and cultural terms (Briata and Raco, 2022).

To some extent, notable similarities with Milano in financial and spatial techniques used for delivering large-scale projects over other major European cities such as London (Raco and Brill, 2022), Amsterdam (Tasan-kok and Ozogul, 2021) & Paris (Guironnet et al., 2016), let me argue that the planning systems delivering urban policies have been increasingly and systematically reshaped towards financialisation, through enabling financialised property development (Salet, 2008). In fact, as in such cases, Milano uses «transnational capital and large-scale regeneration projects to promote its international reputation» (Conte and Anselmi, 2022), conceiving urban mega-projects as 'catalysts of urban and political change' (Swyngedouw et al, 2002, p. 546) for empowering local real estate markets and political arenas in global power configurations.

As I showed in the MIND case, particularly urban policy tools and (partially) spatial planning techniques are increasingly affected by financialisation through the standardisation of (global) real estate parameters enabling local project financing and underpinning the negotiating conditions of urban mega-projects, implying unprecedented uses of financial indicators linked to property investment, profitability and building permits (Raco and Brill, 2022; Edwards, 2020). Indeed, such financialised techniques used by global investors for delivering urban mega-projects are reflected in the local market-led orientation of planning systems in which specialised property developers are currently key players, representing such investors' interests and delivering a deterritorialisation of real estate narratives, motives, and techniques (Haila, 2021; Cocco, 2007). Finance has always been there, but such financialisation practices and instruments have multiplied its importance, making real estate one of the leading global asset classes.

Moreover, urban policy financialisation exercises increasing 'pressure' on land interests, dampening the thrust of radical reforms on land value recapture in European countries (Edwards, 2020). Thus, the urban policy program of large-scale projects set by the Milanese local government, and often affected by regional and central governments on some key opportunity areas, as in the MIND case, tend to prepare suitable sites for enabling public-private

partnerships, joint ventures and planning agreements, facilitating viability-based arrangements (Colenutt et al., 2015) which follow deterritorialisation criteria. This shift towards viability-based planning, conceived as an extension of financialisation into (state) strategic spatial planning, which I argue coincides with the deterritorialisation of urban policies (e.g., urban mega-projects) and a loss of solid planning principles, is practically traduced as a bundle of financialised metrics and reasoning used into spaces and situations (Briata and Raco, 2022; Chiapello, 2015) addressed to embed financial capital into real estate operations.

Also, the MIND case demonstrates that, due to the financialisation of property development, urban-mega projects and, in general, large-scale operations are increasingly shaped by the knowledge and know-how held by property developers, and investors who manage large datasets and operate with corporate structures capable of spatializing financial techniques underpinning the deterritorialisation of urban policies (and projects). This configuration has, paradoxically, made central, regional and especially local governments increasingly dependent on the information provided by property developers and investors, making the latter able to move easily between building regulations and planning permissions (Raco et al., 2018). Consequently, today a 'heavy' vision of statutory plans and masterplans diverges from the site development managing structures of urban mega-projects, which, on the contrary, as in the case of MIND, are based on a principle of long-term planning flexibility. Such a 'flexible attitude' addressed by planning systems has been spread over Europe (World Bank, 2020), and it represents another relevant effect of the urban policy deterritorialisation since the constant reshaping of strategic areas disjunct their planning from statutory plans. Nonetheless, the urban policy financialisation has promoted the affirmation of new foreign social leading groups and the attraction of capital in selected incumbent major European cities together with gentrification effects.

The direct consequence of such planning flexibility is the 'project-led mindset' (Secchi, 1986) enabled by *ad hoc* instruments, as the PIIs in Milano, which guides the concept of a deterritorialised and financialised city (Tasan-Kok and Ozogul, 2021). Thus, the governance of the planning system is re-centred to what has been called 'devolved localism' (Briata and Raco, 2022) by which local governments, property developers and investors select suitable sites for financialised large-scale operations determining the such project-led layout of the city, thus a viability-based planning (Colenutt et al., 2015; Chiapello, 2015). Within this scenario, urban mega-projects address a 'stimulus' condition' for financially leverage local property markets, projecting land rent as essential drivers (Haila, 2021) to foster Milan in the global investment arena.

6. Conclusions

Financialisation has an ever-stronger impact on determining what needs to be planned (Halbert and Attuyer, 2016) and in which phases, following unpredicted deterritorialised methods. Thus, the constitutive conditions driving the financialisation of urban mega-projects have seen an overall alienation of the methods of activation, implementation, and management as they decrease the state planning power to deliver such projects.

According to this scenario, property investors and developers are taking a leading role due to their capacity to impress financial calculations over investment allocations, disassociating (e.g.,

deterritorialising) them from their impacts on local economies and actors and, instead, following the fluctuation regimes of capital (Briata and Raco, 2022; Chiodelli, 2012).

In conclusion, the viability-based and financialised urban policies reversed the *raison d'être* of (state) strategic spatial planning, which in the past addressed urban mega-projects based on planning & political principles, along with a trend which sees a massive rise of trans-scalar 'policy territorial integration approaches' (Medeiros et al., 2020), combined with multi-level and multi-actor governance (Faludi, 2018).

Thus, financialisation is deterritorialising planning practices and motives in parallel with the increasing complexity of land investment strategies and the rise of market-led property operations, inverting the ethos of the planning system (Briata and Raco, 2022). In other words, although spatial planning continues to keep a fundamental role in land use policy, the deterritorialisation of planning aims affects their endeavour towards recapturing land value, depowering the major lever for rebalancing urban rent. Nonetheless, I argue that strategic planning is still the key to counterbalancing the effects of urban policy financialisation, and the State should not abdicate its leading role in arranging spatial configurations.

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Large-scale urban development projects as a dilemma affecting the housing crisis. The case of Milano Porta Romana

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Abstract
This paper explores the linkages between housing studies and large-scale urban development projects through the lens of financialisation. Especially over the last three decades, global real estate finance massively hit local real estate markets, thus generating segregation, exclusion, and densification by commodifying housing as a financial asset class. Particularly, property financialisation has routed major projects into catalysts to extract capital gains from land value rather than levers to foster the right to housing and plan a 'just city'. Through the case of Milano Porta Romana, this paper shows how financialised schemes which are shaping such a large-scale urban regeneration project represent a dilemma for scholars, practitioners and politicians since, on the one hand, they produce home provision but, on the other hand, they rise up the housing costs without really tackling the housing unaffordability issue and these conditions affect the 'right to the city' for students, middle-class workers, and migrants.

Keywords
financialisation, large-scale urban development projects, housing crisis; densification; Milano Porta Romana

1. Introduction

This paper investigates the linkages among property financialisation, grand planning operations and urban policy from the housing crisis angle. In this contribution, I argue that the financialisation of large-scale urban development projects (Salet, 2008) massively hit the 'right to housing' for students, middle-class workers, and migrants (Arbaci, 2019), along with global investment trends intertwined with housing commodification and marketisation. Particularly, through the generalisation of the Milano Porta Romana case, I frame the financialisation practices and techniques affecting plan-making by showing the interactions between the real estate markets, in which the assets are developed and managed, and the financial market, in which the same assets are treated and traded as financial products (securities, bonds, shares, equities, loans etcetera).

This process generated significant insights on how private equity, but especially institutional investors (Holm et al., 2023), as occurred in the Porta Romana case, established joint ventures and public-private partnerships for 'financialising' large-scale projects (Savini & Aalbers, 2016; Aalbers & Christophers, 2014). Such dynamics affected the policy- and plan-making of local governments and massively decreased the housing affordability for middle- and low-income classes (Adisson et al., 2022; Aalbers et al., 2020; Aalbers, 2019; Van Loon & Aalbers, 2017). In other words, the nexus between property financialisation, which globally enabled real estate as one of the major asset classes, and the austerity reforms which locally reduced the state capital transfers, severely harmed the 'right to housing' in both Global North and South countries (Mazzuccato & Farha, 2023; Waldron, 2018; Aalbers, 2016; Sassen, 2015).

I organised this paper as follows: in the first section, I illustrated the housing unaffordability of Milano; in the second section, I introduced the project-led attitudes affecting the city-making; in the third section I explained the financialisation of Milano Porta Romana as an exemplary case of the interactions between finance and planning in delivering urban regeneration pursued by relevant property developers and institutional investors; in the fourth section, I discuss the case findings in relation to the planning and policy measures introduced by the Milanese local government to reframe major projects (Fareri, 2009) over the last decades, explaining why the financialisation of such projects represents a dilemma affecting the housing crisis. In conclusion, I tackle the impact of property financialisation on Milano's planning and affordable housing system by delivering a few policy recommendations on potential ways to revamp the social and public housing provision.

This paper's methodology encompasses a literature review of the main academic contributions related to urban development and housing financialisation; a desk analysis of the Milanese planning and policy frames and regulations; the use of semi-structured interviews of several key actors; the case study analysis of Porta Romana railyard; and field observations of the plan-making collected during meetings, interviews, readings, conferences.

Finally, the case of Porta Romana shows that the bundle of financialised practices and instruments mobilised by institutional investors and their development partners generated a collapse of publicly driven plan-making towards privatisation, alienation, decontextualisation and deterritorialisation of large-scale urban development projects, which tend to marginalise the 'right to housing'. The dilemma between valorising the provision of affordable housing or enabling the packaging of property investments over the major projects challenges the role of (state) spatial planning in shaping the housing demand.

2. Framing the Milanese housing unaffordability

Milano is a middle-range metropolis with nearly 1.4 million residents nestled within a metropolitan area of 3.2 million people, garners recognition as one of Europe's leading unaffordable cities. This reputation stems from escalating homelessness, a prevalence of low-wage jobs, and limited public and social housing offerings (Bricocoli and Peverini, 2024; Holm et al., 2023).

Following the Expo 2015 mega-event, Milano firmly established itself among the world's major cities (Pasqui, 2018). Evolving from a traditional regional hub to a middle-range metropolis (Bassetti et al., 2005), Milano has adeptly navigated global interdependencies and investments (Bolocan Goldstein, 2017), diversifying major projects to meet financial demands. Prior indications of this 'city globalisation' were highlighted by Taylor & Derudder (2004) for connectivity and by Dente et al. (1990) for administrative capabilities. This trend is exemplified by Milano's participation in the 'C40 Cities' network and its 'Reinventing Cities' program, aimed at urban renewal in key locations like Piazzale Loreto, the Ex Macello, and Scalo Lambrate. Additionally, global developers Lendlease and Hines are spearheading three major urban transformations: the Milano Innovation District in the Expo area, Milano Santa Giulia, and Milano Sesto (ex-Falck's industries areas).

Like many Southern European capitals, Milano currently operates with a limited welfare model (Allen et al., 2004), resulting in scant state housing provisions, particularly in affordable rentals. This situation contrasts sharply with the expansive homeownership facilitated by the post-war 'Fanfani Plan' (Coppola, 2012), leaving approximately 70% of Milanese citizens as landlords (Holm et al., 2023). However, Milano stands out from other Italian cities with its substantial public housing developments dating back to the 1950s through the 1980s, which now accommodate 10% of the city's population (Comune di Milano, 2023).

Over the past decade, Milano's real estate market has experienced significant growth, with a 41% increase in property values and a 22% rise in rental prices (OCA Report 2023; Assolombarda, 2021). This market is predominantly driven by equity investments via non-listed Real Estate Investment Funds (REIFs), particularly 'Fondi Chiusi', which saw a nearly €1 billion market capitalisation in 2022 (Holm et al., 2023).

Among these financial instruments, the Fondo Investimenti Abitare (FIA), managed by Cassa Depositi e Prestiti (CDP) Real Asset and supported by institutional investors like Generali life-insurances and Cariplo Foundation, focuses on affordable housing. Meanwhile, the Municipality of Milano has privatised a significant portion of social housing/quasi-market dwellings owned by the municipal-controlled company MM (Nomisma, 2022; Comune di Milano, 2023).

This privatisation coincided with state neoliberalisation and financialisation efforts (Lake, 2015), leading to the dismantling of public property assets through actions such as establishing the 'Agenzia del Demanio' and introducing legislation on REIMFs and Special-Purpose Vehicles (Caudo, 2004).

In terms of policy regulation, real estate actors in Milano, akin to counterparts globally, have pursued urban regeneration by aligning financial business plans with flexible masterplans. This approach was facilitated by liberalised planning authorisation, exemplified by initiatives like the 'Segnalazione Certificata Inizio Attività' (SCIA) and the repeal of fair rental fees (Legislative Decree 222/2016; Law 431/1998), as well as specific qualifications for REIFs and related Special-Purpose Vehicles (SPVs), often managed by Savings Management Companies (SGR) (Legislative Decree 228/1999).

3. A project-led scenario

In parallel with the legislative engines enacted to fuel the State property financialisation, which alienated numerous public residences, the Lombardy Region and the City of Milano implemented significant planning adjustments through Regional Law 9/1999 and Regional Law 12/2005. This led to the inception of Integrated Action Plans, known as Piani Integrati di Intervento (PII), and the revision of structural plans via Piani di Governo del Territorio (PGT), facilitating a range of large-scale transformative projects alongside the restructuring of major state enterprises and the hosting of Expo 2015 mega-event. Notable among these projects were Porta Nuova-Garibaldi and CityLife, designed as catalysts for urban renewal to attract financial investments (Anselmi and Vicari, 2020; Conte and Anselmi, 2022).

The latest structural plan, PGT 'Milano 2030', ratified in 2019, redefined major regeneration initiatives as 'Grandi Urbane Funzioni' (GFUs), aiming to integrate these projects into the

surrounding urban fabric. However, this attempt to guide large-scale project planning coincided with urban densification (Salet, 2008), resulting in substantial increases in building volumes within the GFUs, subway stations, railway stations, and main thoroughfares (up to 1 m^2/m^2 building index) (Comune di Milano, 2019), maximising returns for investors and developers, particularly in semi-central districts.

In essence, akin to trends observed in other globalised cities (Swyngedouw et al., 2002; Salet, 2008), since the late 1990s (Bolocan Goldstein and Bonfantini, 2007), successive administrations in Milano pursued urban policies intertwining real estate financialisation with regeneration efforts, facilitating the extraction of urban rents to be exchanged as financial products, *project by project*.

In Milano, significant public lands have undergone financialisation over recent decades through sales, leases, or sale & lease-back arrangements, including projects such as 'Ex Macello' near Argonne Avenue, 'Green Between – Tessiture Urbane' initiative in Crescenzago, the ex-railyards regeneration of Scalo Greco' and decommissioned military barracks in the western part of the city. Within these processes, social housing has been utilised for the first time as a catalyst for urban development and capital accumulation, involving state, state-controlled, or state-funded entities such as the national railways authority and company (Ferrovie dello Stato FS, Rete Ferroviaria Italiana RFI), the Ministry of Defense, and InvestiRE/Redo Sgr (Holm et al., 2023).

Various scholars (Ponzini and Vani, 2012; Gastaldi and Baiocco, 2013; Gastaldi and Camerin, 2015; Artioli, 2016) argue that the financialisation of public assets (such as ex-barracks and yards) stems from shifts in strategic and logistical frameworks within these sectors, compounded by a lack of state capacity in planning large brownfield sites. The austerity measures governing the provision of public assets by local governments, particularly in land renovation projects, have been exacerbated by complex reforms and legislation, leading to fragmented institutional settings. This has prompted local governments to primarily pursue land sales through financialisation and alienation techniques (Artioli, 2016), despite the considerable value of Italian public real estate assets, estimated at approximately 450 billion euros (Gastaldi and Camerin, 2015).

In summary, it can be argued that the urban policies implemented by past PGTs, as well as the mentioned operations of land alienation and financialisation (Kaika and Ruggiero, 2016), have exacerbated spatial and socioeconomic disparities, particularly in peripheral neighbourhoods while fueling property speculation and densification in residential settlements and delivering plan-making within a project-led perspective.

4. The case of Milano Porta Romana between urban densification and housing provision

The redevelopment of the decommissioned Porta Romana ex-railyard, known as the Milano Porta Romana large-scale project, highlights emerging trends in the affordable housing crisis due to property financialisation's impact on Milanese urban planning. These large-scale projects exemplify how the State, particularly the Milanese local government, facilitated significant property developments to stimulate Milano's real estate market.

The history of Port Romana regeneration is intertwined with the negotiations among the Municipality of Milano, Lombardy Region and Ferrovie dello Stato (FS) in 2007-2016 aimed at redeveloping all the seven decommissioned former Milanese railyards, in total covering approximately 1.290.384 m^2 (see Fig. 2; Fig. 4). This negotiation process led to the adoption of an Area Development Plan (AdP) integrated into the city's structural plan (Piano di Governo del Territorio PGT). The AdP is a planning instrument which was conceived to orchestrate further yard densification and approved in 2016 after initial setbacks in 2015. The approved AdP (Comune di Milano, 2016) outlined parameters such as a building index of 0.65 m^2/m^2, with a 65% allocation for green spaces and 35% for built-up areas, along with provisions for affordable social housing in each yard (see Fig. 1; Fig. 3).

The initial AdP draft was established by the Municipality of Milano, Lombardy Region, FS and the latter's property company - Sistemi Urbani - during Letizia Moratti's right-wing local government (2006-2011). Within the following centre-leftist mayor Giuliano Pisapia the AdP was subsequently endorsed in 2012, affirming the previous decisions made by Moratti's administration. Pisapia's administration sought to validate the AdP by fostering a participatory process, culminating in a strategic document in 2013 outlining guidelines for the master planning of the seven sites. However, the scope of this participatory process was limited, primarily focused on consensus-building objectives. In 2015, an initial version of the AdP failed to gain approval from the city council but was eventually approved in 2016 with slight revisions (Pasqui, 2018). Shortly thereafter, Savills, a relevant REIT and institutional investor associated with the Milanese property developer Coima, acquired a portion of the Farini ex-railyard, one of the seven sites, from Sistemi Urbani, thereby entering the de facto governance sphere previously dominated by state and state-controlled entities.

In its final iteration, the AdP was controversially negotiated by the City of Milano, the Lombardy Region (due to its involvement in the Circle Line mobility project), FS, and two other FS-controlled companies (FS Sistemi Urbani, focusing on real estate, and RFI, focusing on the rail network), along with Savills. Within the AdP's approval, FS Sistemi Urbani initiated a master plan design competition in 2017 to allocate development rights, with participation from five international architecture firms. Later, in 2021, the Municipality of Milano and FS Sistemi Urbani commenced a new participatory process aimed at 'enhancing citizen involvement' although the fundamental aspects of the master plans had already been established (Pasqui, 2018).

Throughout the entire process, various conflicts arose, leading to four separate lawsuits filed by residents, environmental associations, and FS itself against the city regarding the failed approval of the AdP in 2015. Key controversies included the recognition of FS as the rightful landowner and recipient of development rights, which had been granted in the early 20th century for railyard services without building rights; the legitimacy of using the AdP, originally intended for state actors, to organise what essentially amounted to a public-private partnership; the determination of development fees owed by FS to the city and the applicability of national legislation on 'extraordinary development rights'; and the proportion of green areas in the overall functional mix. However, the lawsuits ultimately favoured FS and the city, with the one initiated by FS being resolved upon the approval of the new AdP (Holm et al., 2023; Montedoro, 2018).

Following the procedures set by the AdP, in November 2020, the 'Porta Romana Fund' – a close-end REIF promoted and managed by Coima Sgr and subscribed by Covivio, Prada Holding and the 'COIMA ESG City Impact fund' (CECIF), the largest Italian REIF with an

investment capacity of 500 million euros – purchased the Scalo di Porta Romana, one of the 7 former railyards, for 180 million euros. Coima Sgr is the richest Milanese property development company (Coima, 2023), and it is owned by the entrepreneur Manfredi Catella, who established a joint venture with Hines Italy before the Expo 2015 for developing the Porta Nuova Garibaldi large-scale project.

After winning the auction, the three main actors managing Porta Romana Fund signed a 'value chart' for splitting the plots according to specific asset classes defined per 'functional areas' that they will directly develop and manage, within a total area of roughly 200.000 m^2 (see Fig. 5). The agreement assigned all the housing provisions to CECIF (thus Coima) and most of the office and retail units to Covivio to avoid internal competition among the operators which undesigned the Porta Romana REIF. The Municipality of Milano agreed to obtain development fees for roughly 50 million euros plus a range of planning gains, including social housing provision (Holm et al., 2023).

Coima, as the site owner and under AdP's provisions, directly organised and oversaw a design competition for the masterplan, won by the American firm Diller Scofidio+Refro. As per the PGT, the area later gained recognition as a 'special zone' (Zona Speciale Scalo Romana) through a PII approved by the Municipality in May 2022 (Comune di Milano, 2023) (see Fig. 2). The comprehensive plan allocates 112,150 sqm for urban purposes (retail, productive, hospitality, private non-residential services), 53,575 sqm for residences (market rate, social and public housing), and 95,397 sqm of green spaces. In total, 68% of the development is earmarked for housing, with 44% designated for residential social housing, including 11% for public housing and 22% for moderate rent (see figure below).

Following Milano & Cortina's successful bid for the 2026 Winter Olympics, the project gained renewed significance as Porta Romana was designated as the site for the Olympic Village. Currently, Coima is developing it with a project by Skidmore, Owings & Merril, the runners-up in the masterplanning competition (see Fig. 2).

Three functional areas were delineated based on the referenced 'value chart', each corresponding to distinct development stakeholders: the western quadrant encompasses a mixed-use area housing the Olympic Village developed by Coima, with Covivio developing the eastern part; the central section forms a network of connections expanding the existing Prada Foundation managed by Prada (see Fig. 5). Coima SGR will oversee the development of both market-rate and social housing, including the Olympic Village, which will be repurposed into student housing with 1,000 beds post-Olympics. In March 2023, Coima entered into an agreement with Consorzio Cooperative Lavoratori CLL – a consortium of housing cooperatives primarily involved in quasi-market/social housing production alongside other public and private entities. Coima hailed the new partnership as "a groundbreaking development in the Italian landscape (…)" introducing a novel model for social and subsidised housing development, a sector historically dominated by the public sector (…) 'COIMA Housing' aims to address up to 25% of Milano's current social housing demand, equating to approximately 40,000 residences (Coima, 2023).

The ultimate goal is to establish a national investment platform for social housing initiatives with a multiplier effect." Additionally, Coima established the 'COIMA Housing' Fund (COIMA Housing), a closed-end real estate fund focusing on various types of social housing development, targeting a size exceeding 400 million euros, with an initial closing planned for about 300 million euros. The principal investor and sponsor of 'The COIMA Housing Fund' is

the ‘COIMA ESG City Impact Fund’ (CECIF). With an investment leverage of 800 million euros and capacity of 500 million euros, CECIF stands as Italy's largest closed-end alternative fund, with Porta Romana being its flagship project, supported by a consortium of institutional investors, including professional social security organisations, funds, banks, and banking foundations (ENPAM Foundation, Cassa Forense, Cassa Dottori Commercialisti, Inarcassa, BCC Credito Cooperativo, Foundation CARIPARO, Compagnia di San Paolo, and Coima) (Coima, 2023).

Intesa Sanpaolo is also joining ‘COIMA Housing’ as part of "its commitment to fostering the development of 8,000 social housing units for youth and seniors". ‘COIMA Housing Fund’ participated in the inaugural call of a newly established fund promoted by CDP, the ‘Fondo Nazionale Abitare Sostenibile’ (National Fund for Sustainable Housing), aimed at financing new projects for senior, student, and social housing.

However, despite the relevant provision of social and student housing in the Porta Romana redevelopment project, which is developed in a moment of deep need for the ‘right to housing’ for students, middle-class workers, and migrants in the city of Milano (Bricocoli and Peverini, 2024), several rumours already reported the high rental fees for those settlements (Maggioni, 2024). In that sense, the financialisation of this large-scale project with forward-looking ESG targets and housing affordability does not allow the achievement of equal benefits for the working class housing demand nor a recapture of land surplus value extracted through such property operation.

Overall, the Porta Romana large-scale redevelopment project reflects a complex interplay of public and private actors, urban planning strategies, and socioeconomic dynamics, emphasising the evolving nature of the Milanese property densification towards financialization.

5. Discussion. Porta Romana densification and ‘all-you-can-eat urbanism’

In the chapters above, I explained the interactions between housing financialisation and planning-enabling attitudes in Milano. Second, I unpacked the urban development financialisation of the Porta Romana ex-railyard, which clearly demonstrates the nexus between finance and planning and, especially, how property financialisation is harming the right to housing.

Moreover, the implementation process faced challenges, including legal disputes and conflicts over property ownership and governance tools' use. Despite these challenges, the project progressed, attracting investments from entities like Savills and the establishment of the 'Porta Romana Fund' by Coima Sgr and partners in 2020.

Coima plays a pivotal role in both formulating and executing large-scale development endeavors, acting as facilitators and managers of financial aspects. Their ascent in Milano's property development scene is supported by political and financial ties with national and international funds like Cassa Depositi e Prestiti and Qatar Investment Authority, notably seen in the Porta Nuova project.

Coima's involvement extended to the development of the former Scalo di Porta Romana, allocating housing provisions to ‘COIMA ESG City Impact Fund’ (CECIF) and other assets to Covivio Spa. Additionally, Coima initiated partnerships for social housing development,

emphasising a shift towards professionalised property developers supported by institutional capital.

Thus, the Porta Romana initiative signifies a further progression, where mainstream financial actors engage in social housing within governance agreements alongside state entities overseeing spatial planning. ‘COIMA Housing Fund's launch and agreement with CCL cooperatives demonstrate an intent to enter the social residential housing market, enhancing capital and expertise directly and through partnerships. This shift marks a significant change in Milano's social housing governance, potentially embraced by city elites, warranting further examination.

Amidst promoting urban regeneration and real estate investment, Milano pursues public objectives through planning gains like green spaces, cycling lanes, and rail projects. Social housing provision gains prominence, reflecting the looming housing crisis, yet predominantly caters to middle-class demographics, sidelining traditional public housing. Despite this, low development fees persist, attracting institutional capital aligned with ESG targets, crucial for urban regeneration projects involving major investors, mirroring trends in Europe and the USA.

While the 2026 Olympics saw less central government involvement compared to Expo 2015, state-supported mechanisms like CDP remain prominent (Muller, 2011; Raco, 2013; Raco et al., 2018). Developers like Coima now spearhead state-backed projects with institutional investors' backing, reshaping affordable housing financialisation norms.

Thus, Porta Romana exemplifies the convergence of large-scale projects driving property financialisation (Anselmi & Vicari, 2020; Conte & Anselmi, 2022), the packaging of long-term investments from institutional backers (Van Loon et al., 2017), and a state-enabling attitude facilitating land value extraction (Tasan-Kok & Ozogul, 2021; Fainstein, 2012; Tasan-Kok, 2010), densification and alienation through spatial planning. Milano's recent structural plans facilitate a flexible built environment where developers and investors manoeuvre capital, fostering real estate market financialisation amidst a global trend of housing rights dismantlement (Mazzuccato & Farha, 2023). In other words, the bundle of policy, planning and financial measures reflected in the recent PGTs, AdPs, and PIIs, frame a sort of ‘all-you-can-eat urbanism’ able to satisfy every ‘investing-risk appetite’ and each property developer/investor’s demand by easily transform and circulate financial and land capital over Milano.

6. Conclusions

The exacerbation of financialisation on real estate, spatial planning, and urban policies, alongside the expansion of neoliberal politics (Lake, 2015), led to a failure to introduce countermeasures for rebalancing inequalities in several 'globalised cities' (Swyngedouw et al., 2002). As highlighted by Raco & Tasan-Kok (2023), spatial planning scarcely negotiates planning gains, even when large-scale projects yield substantial financial profits for property investors and developers.

The financialisation of urban policies (Lake, 2015) caused strategic planning to nearly vanish in the practices of many Western cities, depriving redistributive principles of urban rent,

especially in large-scale densification processes. Consequently, this significantly contributed to the housing crisis through expulsion, eviction, and gentrification phenomena.

The Municipality of Milano initially facilitated the financialisation of large-scale projects and brownfield densification, only recently partially recognizing their associated issues. Urban development financialisation poses a dilemma for planning decisions between urban regeneration and profit redistribution linked to inequalities, particularly for the current and previous centre-leftist local governments under Giuseppe Sala and Giuliano Pisapia.

In conclusion, while the Milanese planning policy framework demonstrated an unexpected ability to handle multiple large-scale projects simultaneously, it struggled to recapture land value surplus (Fainstein, 2012) through planning and financial tools, which could prevent market distortions and socio-spatial polarisation between 'city of the rich' and 'city of the poor' towards project-led mindsets (Secchi, 2013). Instead, recent urban politics and planning instruments fostered an 'all-you-can-eat urbanism' mindset, in which the planning & policy frames fit all types of densification projects, enabling the extraction and marketisation of urban rent while harming the housing rights of students, middle-class workers, and migrants.

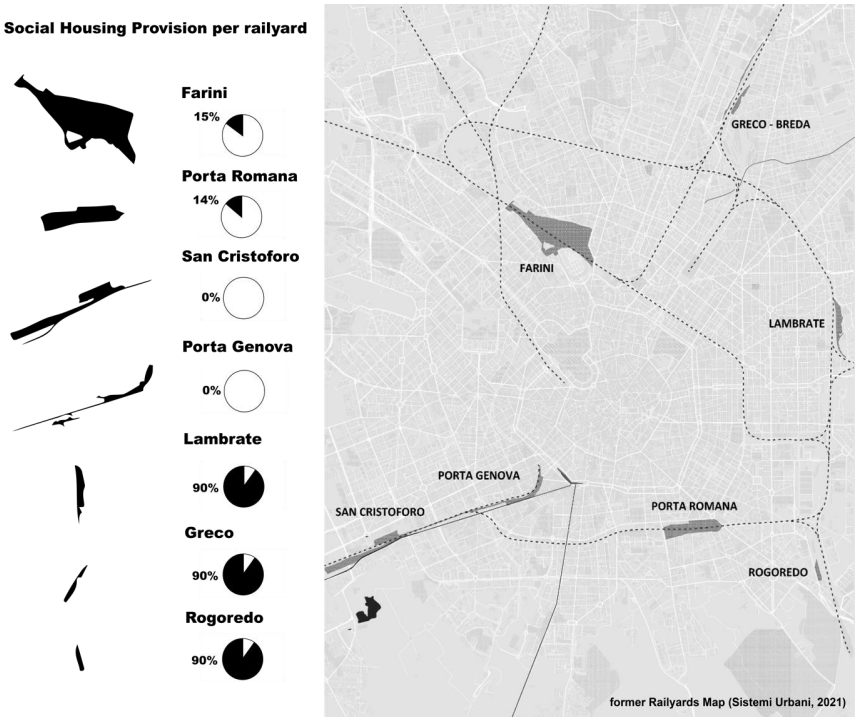

Figure 1 | Social housing provision per railyard (Holm et al., 2023)

Figure 2 | Milano Porta Romana PII (Comune di Milano, 2023)

Railyard	Surface	Surface to built	Build. index (UT)	Functions	Total social housing (ERS)			Subsidized sale (tip. A)		Moderate rent (tip. B)		Social housing rent (tip. C)	
	square meters (sm)	sm	sm/sm		sm	residentia	%	sm	%	sm	%	sm	%
Farini	618,733	402,460	0,86	mixed urban functions	60,705	1,013	15%	43,712	11%	2,925	1%	14,068	3,5%
Greco-Breda	73,526	28,000	0,65	social housing	25,200	420	90%	10,028	36%	14,186	51%	986	3,5%
Lambrate	70,187	34,000	0,45	social housing	30,600	510	90%	12,177	35%	17,226	51%	1,197	3,5%
Rogoredo	21,132	20,000	0,80	social housing	18,000	300	90%	7,163	36%	10,133	51%	704	3,5%
Porta Romana	216,614	150,000	0,48	mixed urban functions	21,140	352	14%	15,859	11%	0	0,0%	5,280	3,5%
Porta Genova	89,137	40,000	0,95	fashion retail functions and residentials	0	0	0%	0	0,0%	0	0,0%	0	0,0%
San Cristoforo	158,276	0	0,45	park	0	0	0%	0	0,0%	0	0,0%	0	0,0%
Total Program Agreement (AdP)	1.247.605	674,460	0,65		155,645	2,595	23%	89,940	13,2%	44.470 6,6%		22.235	3,3%

Figure 3 | Planned functions and housing supply for the 7 ex-railyards targeted by the AdP (Alessandro Balducci's elaboration, 2016).

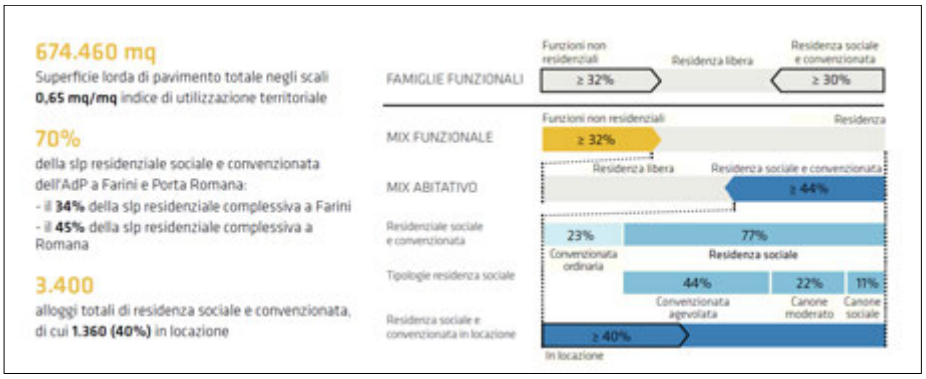

Figure 4 | Distribution of functions and housing supply in Porta Romana's redevelopment project (Comune di Milano, 2016)

Figure 5 | Value chart distribution among Prada (Offices, museum), Coima (Residences, offices, mix) and Covivio (Offices) (Covivio, 2022)

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AESOP Congress 2024 – Approaching urban renewal through the lens of urban rent theory.

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Abstract

A major urban renewal policy has been implemented in France since the 2000s, bringing about extensive urban and social changes in vast social housing complexes built during the post-war period of massive construction. Drawing on an urban political economy framework, this paper analyses two French urban renewal projects as a commodification and a privatization of neighbourhoods that have been characterized for decades by a public or quasi-public land ownership and by non-market-oriented forms of management. I argue that under certain conditions, urban renewal may produce different types of urban rents, which are mostly appropriated by private stakeholders. This paper investigates the role of state and local governments in these processes to underline the existence of public strategies favouring the profitability of private housing development and the production of urban rents in these areas.

Keywords : Rents, Urban Renewal, Social Housing, Commodification, France

1 Introduction: Land Rents, Urban Renewal, and Public Action

Since the early 2000s, in France, many social housing neighbourhoods, mostly built between the 1950s and the 1970s, have been the target of a substantial urban renewal policy, led by a state agency. While the spatial and social effects of this urban renewal program have been studied by many authors (Gilbert 2014; Kipfer 2016; Lelévrier 2023), as well as its political consequences at a macro-level (Beal, Epstein, and Pinson 2018; Epstein 2013), the way it changes the urban production mode of these social housing neighbourhoods deserves further explorations, in the field of urban political economy. This presentation, based on ongoing PhD research, will offer an approach of urban renewal in France through the lens of urban rent theory. This paper argue that French urban renewal projects can be considered as a commodification and privatization process of social housing neighbourhoods and can lead to the formation of different urban rents, depending on the dynamics of each local property market. It also insists on the role of public action in the very concrete processes which realize the commodification of land and enable the formation of urban rents.

Since a seminal article by Neil Smith (1979), the *rent gap* question has been addressed by an abundant literature. The rent gap hypothesis can be considered not only as an explanation for social changes, such as gentrification, but also as an interpretation, through the prism of markets and urban rents, of certain types of spatial transformations and built environment changes, within the perspective of uneven development (Smith 1982). The starting point of the rent gap hypothesis can be found in the multidimensional devalorisation processes experienced by some private housing neighbourhoods, leading to a gap between the rent captured under the current use of land and the rent which could be extracted from higher and better uses of the land, if the area was redeveloped (López-Morales et al. 2019). Smith's first formulations of the rent gap theory were quite silent about the role of the State in such processes (Boulay 2022).

Nevertheless, numerous authors since then have emphasized the part played by the state, both by national and local governments, in the rent gap formation (Badcock 1989): public infrastructure investment, as well as the adaptation of construction guidelines and urban renewal legislation have a strong effect on the potential rents which can be created through a redevelopment project and appropriated by private developers (Lan and Lee 2021; López-Morales et al. 2019). Neil Smith himself (1996) has afterwards studied the role of a quasi-public organization, the Redevelopment Authority, in the urban renewal of Society Hill in Philadelphia.

Focusing on the processes of devalorisation and revalorisation of the capital invested in some urban areas as driving urban renewal, Rachel Weber (2002) highlights the participation of the state in the "creative destruction of the built environment". She pays a particular attention to the way in which urban redevelopment operations are justified and organized by federal and local governments. The local and federal states are involved in the selective devaluation process that occurs in some neighbourhoods, which get stigmatized by local governments through a "discourse of blight" and depicted as obsolescent. Processes of devalorisation and revalorisation cannot be considered as "purely market-determined" (Weber 2002), as the state also contributes to the redevelopment of these urban areas, by authorising and even sometimes leading demolitions, and more broadly, by setting all the conditions for private capital to be safely and successfully invested and able to extract value from redevelopment sectors.

Approaching French urban renewal policy as neoliberal redevelopment and rent extraction strategies implies a comprehension of how land rents are produced within the urban space. This problem was tackled by the French Marxist urban sociology, and particularly by Christian Topalov, whose work provides a useful insight into the mechanisms of urban rents' formation. Christian Topalov analyses urban changes as the product of a "spatial competition of land uses", resulting in the elimination of "inferior", from a capitalist point of view, land uses by "superior" ones, that is which generate more profit, partly appropriated by landowners (Topalov 1984). Urban development leads to the formation of rents, understood as the "fixation and transformation of localized surpluses generated by the development of capital for a given activity and a given place" (*ibid.*: 13). The state can intervene at various levels in this process. On the one hand, public land ownership can hinder the development of capitalist land uses. First, it forms "land easements of obsolete large public facilities" or "land reserves" and there is no guarantee that they will be exploited "to produce maximum land rent" (Topalov 1984:47–48). As a consequence, public land or infrastructure may embody some of the barriers which hamper the continuous geographical expansion of capital (Harvey 1982) and further accumulation within the built environment. Second, some of these properties are subject to "social" management by the state or local authorities, leading to "distract land from more profitable private uses and to allocate it to public operations of social housing or social facilities" (Topalov 1984:47–48). However, on the other hand, the state can support the development of the most profitable capitalist land uses and promote the formation of urban rents and their appropriation, as part of the urban development process, by capitalist actors, notably by developers. Selling public land can constitute a "direct aid to the accumulation of real estate capital" through sales "at cost price" rather than market price (*ibid.*). Furthermore, infrastructure and development costs are often borne by the local and national governments, especially in "urban restructuring operations" (*ibid*: 101). Through these means, the state attempts to influence a crucial element in the formation of urban rents, namely the production of use values. Stemming from social processes and agglomeration effects, use values are vital

for the development of capital within the urban space, however private capital is never able to control these processes and to create use values on his own. Conversely, according to Christian Topalov, the state plays an important role in the production of use values in the urban space and can mobilize this political and economic resource for the benefit of urban rents. Yet, public authorities are only partly in control of the emergence of use values. Hence the pursuit of "greater security in creating localized conditions of private surplus profit" is not always successful (*ibid*: 31-32). The French urban renewal policy can provide concrete case studies to explore the conditions in which urban rents can be produced and to analyse the effective role of the state in these processes.

2 The Urban Renewal Policy in France since the early 2000s: Privatization and Commodification of Devalued Social Housing Neighbourhoods

Since the early 2000s, the French state has launched a vast urban renewal policy, targeting over 600 high-rise social housing estates inherited from a post-war period of massive construction. This legacy of the Fordist period experienced a difficult transition towards a flexible accumulation regime and new urban production modes (Bidou-Zachariasen 1995). Large social housing complexes known as "*grands ensembles*" have undergone profound transformations in their spatial organization and population dynamics in the post-Fordist era. Concentrations of poor and racialized inhabitants progressively emerged in these peripheral social housing estates, because of socio-economic and urban mutations, but also under the influence of public policies and management by social landlords. Starting from the 1980s, these social housing complexes began to be considered as a national public problem (Tissot 2007) and targeted with specific policies (Bonneville 2005), because of their urban decay and of their social and racial composition, in relation to the increasing political demand for mix-tenure urban development, in France (Blanc 2010) like in other European countries (Kleinhans 2004).

The National Urban Renewal Program (PNRU) is launched in 2003 in this political and social context. It is implemented by local authorities and social landlords at local scale. They benefit from special funding that they obtain by signing urban renewal contracts with a state Agency, the National Agency for Urban Renewal (ANRU), which was established on purpose in 2004. The ANRU defines a national doctrine of urban renewal, following the cardinal objective of creating tenure mix in large social housing estates (Epstein 2013). Operationally speaking, the aim of changing the population of these poor neighbourhoods is supposed to be achieved by significant demolition and rebuilding, exemplifying the domination of a "strong 'physicist' approach" in the current urban policies (Moulaert, Swyngedouw, and Rodriguez 2001). Targeting mostly social housing estates, demolition first aims to disperse, through relocation, concentrations of poor and racialized populations (Lelévrier 2010). This urban intervention should then enable wealthier households to come and live in these areas, by the means of property development, in place of demolished social housing buildings. I will focus on this dimension of the French urban renewal policy: the state-initiated *rénovation urbaine* is not only a form of social engineering (Desage, Morel Journel, and Sala Pala 2014) but can also be interpreted as a process of commodification and privatization of large social housing estates (Lelévrier 2023). Within an urban political economy framework, the objective of incorporating private housing, mostly dedicated to future homeowners, in these neighbourhoods can be understood to integrate new urban areas into property markets and to open them to real estate development and private capital (Dormois, Pinson, and Reignier 2005).

French *grands ensembles* were mainly built between 1953 and 1973, thanks to public and quasi-public capital (Préteceille 1973), resulting in the creation of a mass social housing supply, with an administrative rent-setting system, instead of a market-oriented management (Topalov 1987; Kemeny 1995). The ANRU breaks a form of path dependency which followed from a mostly public or quasi-public land ownership and from the inclusion of these neighbourhoods in financing circuits based on long-term semi-public loans (45 years). Therefore, for the most part, large social housing estates have not undergone significant changes since their construction, neither in land ownership nor in their housing supply structure. They thus embody the barrier that public ownership and "social management" of land can represent for the development of capitalist land uses (Topalov 1984): large social housing neighbourhoods were not land to buy, available for property development, nor urban areas which could be transformed depending on the only initiative of private capital. Urban renewal programs can be seen as a state action aiming at removing land barriers that blocked private capital's access to social housing complexes, which get integrated into land and real estate valorisation processes that play out in other parts of the city, and sometimes at their borders, at least in some urban contexts. Considered as "fossilized[1]" by this public monopoly on land, residential social housing neighbourhoods produced, for social landlords, a limited land rent, as they could not extract a high rental income from mature dwellings with low and regulated rents (Kemeny 1995). Furthermore, in some large social housing complexes, high vacancy rates and a difficult management of decayed buildings, for both technical and social reasons, also contributed to reduce the land rent perceived by social landlords. Therefore, within certain urban contexts, these devalued and deprived neighbourhoods were far from being an optimal land use from a capitalist perspective, in comparison with the potential land rent that could have been capitalized under another land use. Exhibiting all the characteristics of an "inferior" land use, large social housing estates can thus constitute a specific situation of rent gap. Although it would be an application of the rent gap hypothesis to public housing estates rather than to private homeownership neighbourhoods, the situation of the *grands ensembles* seems to fulfil most of the criteria that G. Boulay (2022) suggests controlling to test the rent gap hypothesis. Thus, through the ANRU and an urban renewal doctrine promoting housing diversification, the state enables and organizes the filling of rent gaps and the replacement of a low land rent based on degraded and mature social housing dwellings by “superior” residential or economic land uses.

In addition, urban renewal policies have to be understood in a broader context of neoliberalization of housing markets and especially of the social housing sector, which is increasingly dominated by the “residual model” depicted by M. Harloe (1995). Dynamics of privatization (Aalbers and Holm 2008; Bernt, Colini, and Förste 2017), commodification (Forrest and Murie 1995) and even financialization (Aalbers, Loon, and Fernandez 2017; Byrne and Norris 2022) of social housing supply have been evidenced in many European countries, partly in relation to urban renewal projects.

3 Issues and Research Method

This paper explores how housing diversification is implemented and how private housing is incorporated in two large social housing estates located in property markets with contrasting dynamics. On the one hand, the Chantereine district is situated in the city of Alfortville, in the inner suburbs of Paris. The municipality of Alfortville has been, since its creation in the 19th century, a working-class area, under a socialist local government since 1945. In recent times, it

[1] Interview with a member of the ANRU staff, in charge of the Alfortville project, June 2021.

has been experiencing an increasing pressure on land and real estate prices, like many working-class municipalities of the core of the Paris region. On the other hand, the Southeastern Districts of Saint-Etienne, in the South-East of France, are situated in a former mining and industrial town, which has gone through a strong demographic decline and a situation which can be considered as urban shrinkage. Saint-Etienne's property market is characterized by high vacancy rates and low housing sell and rental prices.

This paper aims at analysing the concrete conditions in which unfolds the state-initiated process of privatization and commodification of land in social housing estates targeted by the French urban renewal program. It raises the tangible question of the production of urban rents in former devalued and poor urban areas, within two different property market contexts. This paper suggests that the French urban renewal program is an active commodification and marketization policy, led by national and local governments, on public land which was formerly assigned to non-market-oriented forms of management. Even in a slack housing market context, public authorities endeavour to stimulate private property investment and to create urban rents through urban renewal projects.

The argument is based on provisional results from my PhD work and on material collected since my master's thesis. I will draw on semi-structured interviews (8 for Alfortville, 20 for Saint-Etienne) conducted between April 2021 and March 2024 with people involved in the design and implementation of urban renewal projects in the two areas under study. I principally met local government officers of different municipality departments, civil servants of the national state and of the urban renewal state agency, members of social landlords' staff and elective representants. As I sought to understand how urban redevelopment projects had been designed and developed starting from the late 1990s, I interviewed both people in activity and retired persons. Since I study processes which date back to more than 20 years ago, it was necessary to contrast the output of the interviews with written documents, which I collected in part during the interviews and mostly through an archive research. I gathered a vast range of documents, among which planning documents, project design studies, internal administrative memos, and meeting reports.

4 Alfortville and the Strength of the Market: Housing Diversification of a Social Housing Complex and Production of Urban Rents in the Near Suburbs of Paris

Located around ten kilometres from Paris, Alfortville is connected to the mass transit system and easily reachable from the city centre. The Chantereine district is located at the southern end of the municipality (Figure 1), in a working-class residential area. Chantereine consists of a complex of seven tower blocks[2] containing 1,250 housing units built between 1970 and 1973. This social housing estate was constructed on municipally owned land, provided to the local social landlord through a long-term lease. This area has experienced a process of deterioration and devaluation leading it to be perceived as the "stigmatised district of Alfortville[3]", characterized by very low rents and hosting a disadvantaged population. Since 2009, Chantereine has been undergoing urban renewal initiatives, as part of the National Programme of Urban Renewal (PNRU) and the New National Programme of Urban Renewal (NPNRU) since 2014. Following the national guidelines of urban renewal, the municipality of Alfortville and the other local stakeholders have opted for a massive urban change, as the project involves

[2] There were more exactly six tower blocks and one "*barre*", that is a long horizontal building.
[3] Interview with an ex-local government officer of the municipality of Alfortville, June 2021.

extensive demolitions: at the end of the two urban renewal programmes, upon completion of the NPNRU, 72 percent of the neighbourhood's initial housing units will have been demolished. On the plots freed up by demolition, a new housing supply is constructed, providing different residential tenures. New social housing units (271 homes under the PNRU) built by the local social landlord contribute to renew and diversify the social housing supply in the neighbourhood. In compliance with the ANRU principles of housing diversification, private housing is also incorporated in the area: as part of the first program, 174 market-rate housing units sold mostly to homebuyers have been delivered in 2016 and 2017 by private developers that operate at national scale. In addition, 31 "affordable" housing units[4] have been produced by the local social landlord and sold below market rates. This housing construction programme has been elaborated by the municipality, which is designated as the project leader within the ANRU doctrine, and by a quasi-public development corporation, named Grand Paris Aménagement, which has been chosen by the municipality to oversee urban renewal operations. Even though urban renewal projects aim at fostering private development in social housing complexes, the intervention of real estate companies often unfold under a strong public and quasi-public control (Dormois et al. 2005).

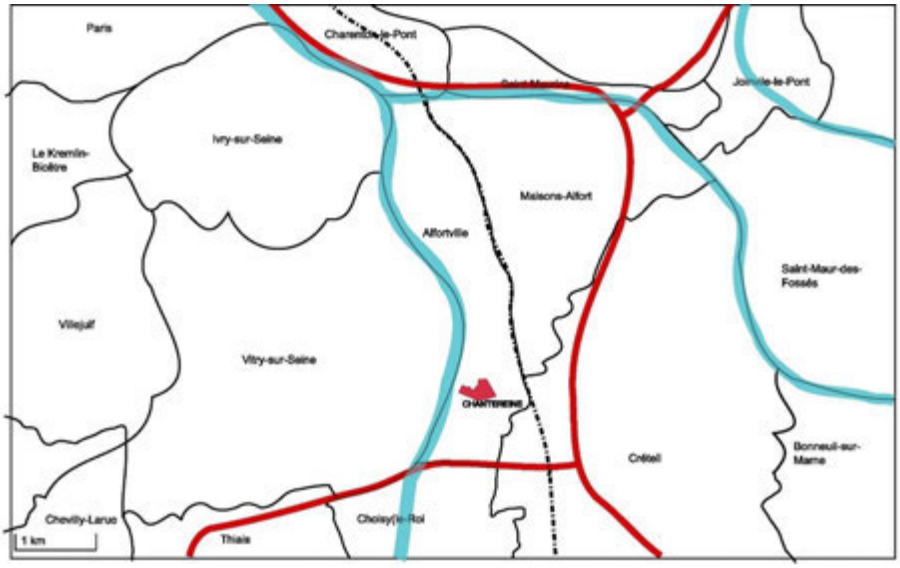

Figure 1. Location map of Chantereine in Alfortville (Pauline Gali, 2023)

Contrary to what has been observed in other urban renewal projects characterized with a lack of private initiative and a weak attractiveness (Bonneville 2005; Saint-Macary 2011), attracting private operators in Chantereine seems to have been less difficult than in many vast social housing estates. Due to the increasing tightness of the local real estate market, the municipality, assisted by the quasi-public development corporation, Grand Paris Aménagement, "had more to select developers than to seek after them[5]". The attractiveness of Alfortville and Chantereine

[4] I refer to housing units in programmes of "*accession sociale à la propriété*" developed by a social landlord.
[5] Interview with an ex-local government officer of the municipality of Alfortville, June 2021.

for real estate development put the municipality in a relative position of strength: an ex-member of the municipal staff considers that the municipal authority, in its relationship to property developers, was like an "oil magnate[6]". On the one hand, this favourable position enabled the municipality and Grand Paris Aménagement to control developers' operations and to impose them many demands on the characteristics of the new constructions. On the other hand, the construction of private housing in Chantereine is far from being the result of a spontaneous influx of private capital into the neighbourhood: it is the fruit of a national policy, funded by the ANRU, and of strategies implemented by a local government to secure developers' operations and "promote private capital investment by creating conditions for its profitability" (Faudry-Brenac and Moreau 1973). The existence of public investment and strategies aimed at attracting and securing private development, expected to come over a second phase of the project, has been highlighted in many urban renewal areas, and more broadly within redevelopment operations, in France (Arab and Miot 2021) and in other countries characterized by some forms of neoliberalization of urban development (Weber 2002; Bernt et al. 2017; Robinson and Attuyer 2021).

From the case of urban renewal in France, I propose to understand the public policies aiming at guaranteeing the profitability of private development operations as practices that organize the production of urban rents. Urban renewal integrates to property market neighbourhoods which were not part of valorisation processes and in which land had no exchange value. By the progressive construction of exchanges values through the different steps of commodification implied by the urban renewal process, several waves of urban rents can be produced. Public action is likely to influence indeed the possibility of urban rents' formation, but also their level and their repartition among the urban renewal projects' stakeholders. A concept of the French Marxist urban sociologist Jean Lojkine can be used to describe and analyse this process: Jean Lojkine created the idea of "*rentes en cascade*" (1971), that is "successive rents", to describe the urbanisation of lands during the post-war massive construction period and the building of the *grands ensembles.* On the basis of the Chantereine project, it is possible to establish that urban renewal produces "successive rents" through different processes of valorisation of capital.

Firstly, demolition encouraged by the ANRU and executed by local stakeholders removes the obstacle to the geographical expansion of capital that constituted high-rise social housing residential areas. These public and quasi-public owned land generated, for the reasons described above, a degraded rental income, which was appropriated by a local social landlord (stage 1, Figure 2). Some of the land freed up by demolition is dedicated to the construction of a new market-rate housing supply for homeownership. At this step of the process, the plot of land gets both commodified and privatized, and thus integrated in market exchanges and circulations (stage 2). The municipality or the public development corporation, which acquires the land from social landlords at a price set by the ANRU (30 euros/sqm)[7], sells the land to a private property developer. This sell of former publicly owned land is likely to generate a land rent appropriable by the municipality. The level of this rent depends on the strategies implemented by the local government, which is led to reflect both on the future value the land should have (Weber 2021) and on the room for manoeuvre it should keep to control the housing supply's characteristics and the future population to whom the homes will be sold. The municipality may choose to give a high price to its land and to set a value close to market rates, so as to receive a higher rent. In

[6] *Ibid.*

[7] Or for free, in the case of Alfortville, as the land belonged to the municipality and was provided to the social landlord by an emphyteutic lease.

Alfortville, the municipality, assisted by Grand Paris Aménagement, set a quite high price for the plots sold to private developers for an urban renewal project: 560 euro per square meter of completed floor area, which is 30 percent higher than the price planned at the beginning of the project in 2011 (430 euro per square meter)[8]. However, the municipality chose not to set the land price at the highest market rates, in order to give itself more negotiating leverage with developers and to impose more easily its requirements on the private housing future features, price and inhabitants.

The third stage of the process of commodification of land freed up by demolition lies in the sale of housing units by the developer through which it realizes and appropriates a portion of the land rent created by the production of the housing units. The requirements defended by the municipality regarding the selling prices and characteristics of the housing units tend to lower the rent captured by developers, by limiting the profits from the sale of housing units and potentially increasing their production costs. The housing estates built in Chantereine were sold at prices on average 30 percent lower than those observed for new housing units in the rest of the municipality[9], which goes well beyond the expected effect of a reduced VAT rate (5.5% instead of the normal 20%[10]) applied, at a national scale, to housing units built in urban renewal projects. Furthermore, the municipality of Alfortville imposed quality criteria for every housing unit and favoured the production of family apartments by asking operators to include more two and three-bedroom units in their programs. Implemented thanks to diverse planning documents, more informal instruments and direct negotiation with developers, this public control on developers aimed to guarantee an adaptation of the new private housing supply to the population the municipality is willing to attract in Chantereine through the urban renewal project.

Other dimensions of local and national public action rather favour and tend to increase the urban rent appropriated by developers. First, the subsidization of demolitions and development costs by the ANRU allows developers to acquire plots on which they can operate without incurring additional expenses. Second, the Alfortville municipality has granted several adaptations of the urban project to limit the risks borne by private capitals. In anticipations of the developers' preferences, the local government, and Grand Paris Aménagement reorganized the overall plan of the project, relocating the plots dedicated to private housing to the area that benefited first from urban interventions. The construction of new social housing and the creation of a vast public space were intended for forming a "new screen[11]" to facilitate the arrival of private operators, which often only intervene in the later stages of urban renewal projects. At developers' request, the municipality also allowed a higher construction density: market-rate housing residences (as some social housing ones) reach significant heights (up to eight floors). This high density contributes to the profitability of private housing programmes, which have already benefited, as seen before, from land selling prices that were not totally set at market rates.

[8] Traité de concession d'aménagement entre la Ville d'Alfortville et l'Agence Foncière et Technique de la Région Parisienne (which has become Grand Paris Aménagement), 2011.

[9] 3700 € per square meter on average for the two market-rate property development programmes of Chantereine, instead of 5200 €/sq on average in 2016-2017 in Alfortville.

[10] Created by a law in 2006, this tax benefit applies to most of housing units built in urban renewal districts, bought for homeownership and under certain income conditions.

[11] Interview with an ex-local government officer of the municipality of Alfortville, June 2021.

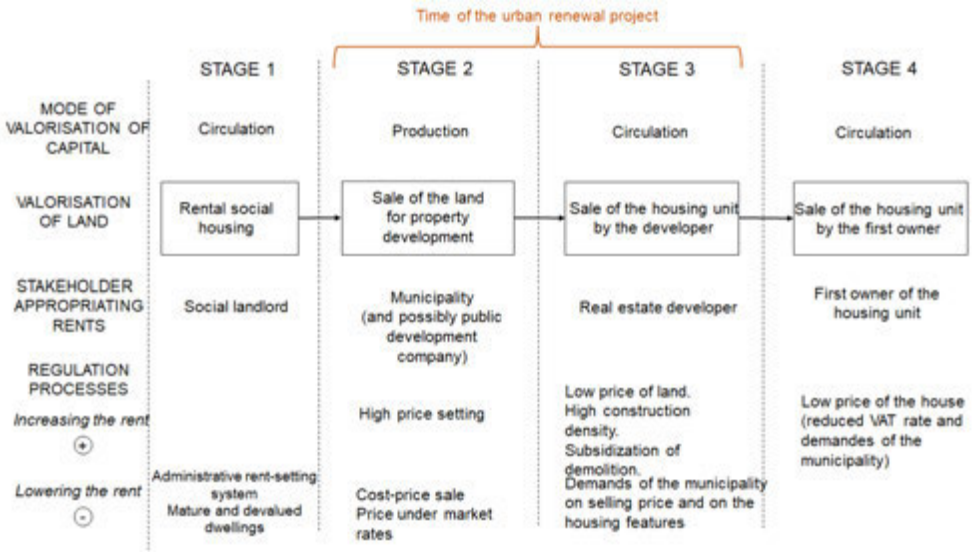

Figure 2.The "successive rents" model based on the urban renewal project of Alfortville (Pauline Gali, 2024).

Finally, the resale of the housing unit by the first buyer appears as the fourth moment in the formation of an urban rent. In the case of Alfortville, thanks to the local government strategies to produce "affordable" housing and to the state subsidization of urban renewal, the first purchaser of the apartment bought it at a low initial price, quite inferior at market rates. If the first buyer, in the second-hand housing market, adjusts the selling price of his home to market rates, the difference between the "affordable" initial price and the market value corresponds to a rent appropriated by the first owner of the apartment. As a consequence, public action in favour of the production of affordable housing in urban renewal projects results in the privatization of a rent by a few households. In Alfortville, it is noted that for housing units built by developers, resale prices are on average 33 percent higher than the purchase price.

Urban renewal therefore organizes the production of "successive rents" through the valorisation of an urban space which was not integrated to market-led urban development dynamics. Public action, by the state and by local governments, influences not only the conditions that enable the formation of rent but also the extent of the urban rent and how it is distributed. These rents are mostly appropriated by private actors, notably by the developers and the first buyer, although the municipality may also benefit from part of the land rent for its fiscal resources. This pattern (Figure 2), based on the Alfortville's case, is likely to apply to metropolitan tight and highly valued markets. Nevertheless, in the words of Christian Topalov, the State enables and promotes urban rents but does not create them directly (Topalov 1984:199; Périlleux 2023:67). It raises the question of the effectiveness of public action in terms of rent production within large public housing estates undergoing urban renewal located in slack and less valued market contexts.

5 The Southeastern Districts (*Quartiers Sud-Est*) of Saint-Etienne, the Commodification without the Rent? Privatization of a Social Housing Complex within a Weak Property Market

The Southeastern Districts of Saint-Etienne embody the reality of an urban renewal project conducted in a context of a weak property market, in a city that has undergone urban shrinkage for many years (Cunningham-Sabot and Roth 2013). Local actors describe a city where "there is no market[12]" for new private housing and where "land rent is negative[13]". Attracting developers to Saint-Etienne is no easy task, even in some central neighbourhoods of the city, some of which are included in the PNRU and NPNRU. In the peripheral social housing estates, such as the Southeastern Districts, according to local public actors, the task is even more challenging due to the lack of residential attractiveness, both for inhabitants and developers. In terms of land uses, these areas remain specialized in accommodating modest households within vast social housing complexes, partly renewed as part of the urban renewal programmes. Although social mixing was a principle promoted by the ANRU, it has never been the central focus of the urban renewal project in the Southeastern Districts. Housing diversification was considered as a way to enable some of the neighbourhood's inhabitants to become property owners where they already lived. In that respect, the aim was also to build a new housing supply adapted to families with children who tend to leave the city centre for its suburban outskirts, an objective also promoted across Saint-Etienne as a whole (Morel Journel and Sala Pala 2011; Miot 2012). Finally, housing diversification was also intended to contribute to urban change in vast social housing complexes that have been largely demolished, in a logic of reducing the social housing stock subject to high vacancy rates and de-densifying the neighbourhood.

Composed of five sectors built successively between 1953 and 1970, the Southeast Districts initially included over 4,500 housing units, of which 689 were demolished between 1989 and 2000 and approximately 700 as part of the PNRU. In the initial urban project, established in the mid-2000s, 226 new housing units were to be built, including 65 market-rate housing units that have never been constructed[14]. Among this ambitious construction programme, only operation of housing diversification has been concretely planned: the local social landlord, with the support of the municipality, attempted between 2009 and 2012 to develop affordable housing for sale, by the means of an operation of 25 units as part of a mixed-tenure estate[15]. After two failed attempts to launch the operation, because of a lack of potential clients, the "Sisley" residence was eventually entirely developed as social housing by the local social landlord. Local actors first attribute this commercial failure to the narrowness of the local housing market, which makes very delicate to complete an operation of 25 apartments led with quasi-public capital and to find households interested to buy flats sold at 1940 euro per square meter[16], in a neighbourhood considered though as not attractive (figure 3). The local social landlord has taken a risk and the responsibility for the initiative of a first housing diversification operation in the neighbourhood and has been confronted with the difficulties of Saint-Etienne's housing market, in which the production of urban rents is not so easy to engage. The municipality and the social landlord learnt lessons from this failed experience, which encouraged them to pay a particular attention to the selling price of the homes, to their architectural form, which cannot be as dense as the "Sisley" building was, and at the timing in which the operation is implemented: the "Sisley" programme has been planned at a relatively early stage of the urban

[12] Interview with a former civil servant of a state local administration, January 2024.
[13] Interview with a current civil servant of a state local administration, January 2024.
[14] GIP-GPV de Saint-Etienne, Planning documents for the reconversion of "la Grande Marandinière" site, January 2006, Municipal Archive of Saint-Etienne (6985 W 6).
[15] Selling documents of the programme "Les Prés de Sisley", Métropole Habitat Saint-Etienne (social landlord), Municipal Archive of Saint-Etienne (6985 W 6).
[16] Lettre of the head of the local social landlord to the mayor, December 2010, Municipal Archive of Saint-Etienne (6985 W 6).

project, even before the demolition of a large high-rise block nearby. Nevertheless, the municipality experienced another setback on a piece of land also located in the central part of the urban renewal project and of the neighbourhood: on this plot, it planned to develop a mixed-use project including shops and housing. After having failed to convince a developer to build a housing programme on this site, the municipality eventually accepted the construction of a small shopping area, without residential units on the upper floors.

Figure 3: Sales brochure for the "Sisley" Programme of the local social landlord, attached to a letter addressed by the Director of the social landlord to the Mayor of Saint-Etienne, December 2010 (Municipal Archive of Saint-Etienne (6985 W 6).

Despite the injunction for housing diversification promoted by the ANRU and all the efforts of local government to establish favourable conditions for private residential investment, there is no guarantee to realize the construction of market-rate housing and thus to set off the production of urban rents. If private initiative does not follow public investment strategies and does not take over from them, the formation of rents, although theoretically enabled by urban renewal,

remains a potentiality. In Saint-Étienne, this is even a very uncertain prospect: in a context of overall devaluation of the local housing market, characterized by significant vacancy rates and an overabundant supply of older housing units, it is not certain that there is a rent gap to fill between the peripheral social housing neighbourhoods and the rest of the urban space. At the scale of Saint-Étienne, property market does not lead to valuation differentials significant enough for a large social housing neighbourhood to offer private developers prospects for creating and appropriating any land rent.

Nonetheless, the municipality of Saint-Etienne attempts, by leveraging small publicly owned land plots on the outskirts of the neighbourhood, to inject a market dynamic into it by adopting a role of "market leader[17]." Following a call for projects, the municipality sold a 5,300 m² parcel where a former school was located to a local architect, Julien Rivat, for 150,000 euros[18]. This sale allowed for the construction of 13 houses, benefiting from the Passivhaus environmental label. These homes, each around 100 square meters, have been sold within two months for around 1,950 euro per square meter excluding taxes, a price set in consultation with the municipality. Another disused school, also on the outskirts of the urban renewal perimeter, was sold in 2022 for 600,000 euros to a local developer to create a student residence with 201 studios sold separately[19]. A call for proposals had been organized to attract private real estate operators' attention after an initial failed attempt to implement a building programme with a property developer in 2012.

Despite the setbacks encountered on the most central parcels of the urban renewal project, the municipality manages, on the outskirts rather than in heart of the Southeastern Districts, to anchor the neighbourhood to housing markets and to property-led development by betting on specific real estate products. Despite the weakness of the housing market in Saint-Etienne, the municipality tries to arouse private initiatives by privatizing publicly owned land. Furthermore, in the Southeastern Districts, the choice of the municipality to develop economic activities on some pieces of land freed up by demolitions deploy commodification logics even where housing diversification was deemed impossible or not desirable. Thus, even when market context makes uncertain or difficult the prospect of “successive rents” within the field of property development, the aim of normalising, from all points of view, large social housing estates keeps driving publicly led processes of privatization and commodification of land in these neighbourhoods. Urban renewal projects are consequently part of the geographical extension of the capital and of market-oriented land uses, with the support of local and national governments.

6 Conclusion

This paper offered an analysis of French urban renewal projects drawing on an urban political economy framework. It focused on the formation of land rents in the field of property development in large social housing estates. Urban renewal appears as a policy paving the way to produce urban rents by promoting "higher" land uses in social housing complexes which were characterized by a public or quasi-public land ownership and by a non-market-oriented management. Public authorities, whether the central state through an Agency or local governments, play a major role in creating the conditions for the formation of such rents by seeking to ensure the profitability of real estate development operations and minimizing associated risks. However, the comparison drawn between the urban renewal projects of

[17] Interview with a local government officer of the municipality of Saint-Etienne, February 2024.
[18] City Council report, 1 February 2016, Municipal Archive of Saint-Etienne.
[19] City Council report, 24 January 20222, Municipal Archive of Saint-Etienne.

Alfortville and Saint-Etienne underlines that public action on its own cannot directly trigger the formation of urban rents: as C. Topalov wrote, "the State does not create rent, it is construction that will enable the effective realization of the rents potentially inscribed in the urban plan" (Topalov 1984:199).

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Public-private dialogue in the cultural reuse of historical and architectural heritage: the example of the Carmine Monastery in Italy

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Abstract

The paper analyses the restoration process of the former Monastero del Carmine, a complex structure of historical value located in the city of Bergamo (Italy). Built after the 14th century, the Monastery experienced a long period of abandonment from the 18th century until the second half of the 20th century when the property was transferred to the Municipality. In the gradual recovery, the theatre company Teatro Tascabile di Bergamo (TTB) played a significant role. Important for the reuse process was the Special Public Private Partnership activated between the TTB and the Municipality, thanks to which a complex process of material and immaterial regeneration began. The paper presents a public heritage regeneration process highlighting the role of the actors involved and the technical-administrative tool adopted.

keywords
Public-private Partnership; Abandoned place; Cultural Heritage; Restoration; Common good

Introduction

The unused building heritage, whether privately or publicly owned, represents a significant presence in the Italian territory (Garda, 2018). To define appropriate strategies and actions for reuse, it is necessary to consider both its quantitative conditions and the different approaches.
In Italy, private buildings are divided into: 50% second homes/vacation homes, 10% dwellings occupied by non-residents or rented on the "informal market," and approximately 40% of homes are completely unused (Gentili and Hoekstra, 2018). Abandoned private buildings, which make up 30% of the total heritage, amount to 10 million properties (Istat, 2019). Various approaches can be recognized concerning reuse methods: (i) coercive by the public authority; (ii) enabling to promote the reuse of properties; (iii) incentivizing, particularly at the economic level (Moroni, 2020).
Conversely, public buildings in Italy amount to more than one million two hundred thousand units (MEF, 2021). About 70% (over 800 thousand buildings) are owned by local administrations (municipalities), corresponding to 82% of the total surface area. The rest is owned by central state administrations or other central public entities. A significant percentage, around 7%, of these public buildings is currently unused. The value of unused public buildings is estimated to be 13 billion euros (MEF, 2021)[1].

[1] The value of unused public assets directly managed by administrations is estimated at approximately 66 billion euros, divided as follows: 14 billion euros for “institutional” properties

There are three ways through which a public building can be recovered: (i) through sale by the owning institution; (ii) by transformation and direct use for new public needs; (iii) by transferring only the management to other entities for public or collective interest purposes (Moroni, 2020). For these reasons, the enhancement of public real estate assets has been a significant issue in the policies of central and local administrations for years (Mangialardo, 2017).
To the public-private dichotomy, Nobel Prize-winning economist Elinor Ostrom adds the "third way": common goods made by communities. That is, a place that continues to exist and function because there is a community that takes care of it and, in this sense, regenerates if supported by the self-organized community, allowing collective benefits and fostering cooperation (Ostrom, 1990).
In the early 1990s, within the context of feminist studies, American philosopher Joan Tronto and activist Berenice Fisher developed the "care theory", defining it as:

> "a species activity that includes everything we do to maintain, continue, and repair our 'world' so that we can live in it as well as possible. That world includes our bodies, ourselves, and our environment, all of which we seek to interweave in a complex, life-sustaining web" (Tronto, Fisher, 1990, p. 40)[2].

This essay aims to delve into a specific process of reusing an architectural complex of public ownership located in an Italian city (Bergamo), where the municipal authority has entrusted the management of this "common good" to a local association dedicated to promoting cultural functions. The contribution, in particular, not only presents the complex history of the site (Monastero del Carmine) and the community of managers/users (Teatro Tascabile di Bergamo) but also outlines the initial results of an ongoing research project on the technical and managerial tools used in the progressive regeneration process of this significant entity.

The urban context

The paper addresses the case of the Monastero del Carmine located in the Municipality of Bergamo, a medium-sized city in the Lombardy Region[3] with more than 120,000 inhabitants and the capital of the province of the same name, which has more than 1.1 million residents.
Bergamo is situated and developed on a small isolated hill system (up to 590 meters above sea level) at the foothills of the valleys and overlooking the plain. From its origins, the city of Bergamo has been connected to the flatlands through natural corridors that mediate the transit

leased to private individuals for a fee; 7.6 billion euros for "residential and commercial" properties – excluding "social residential" – leased to private individuals for a fee; 13 billion euros for "unused" properties; 5.4 billion euros for "institutional" properties given to private individuals free of charge and 1.2 billion euros for "residential and commercial" properties; 22.5 billion euros for "residential and commercial" properties leased to private individuals for social purposes.

[2] From this perspective, the theory of care assumes a political and moral significance related to the public sphere. In Tronto's interpretation, care is articulated into four analytically distinct but interconnected phases: (i) caring about; (ii) taking care of; (iii) caregiving; (iv) care receiving (Tronto, 1993).

[3] Region Lombardy is the most populous Italian region, with nearly 10 million inhabitants. The region is divided into 1504 municipalities grouped into 12 provinces with Milan as the capital. It is located in the center of northern Italy, at the foot of the Alps and in the middle of the Po Valley, and is situated on the main routes connecting the Mediterranean area and central Europe. Its surface area covers 23,860 square kilometers and is divided almost equally between the plains (accounting for about 47 percent of the territory) and the mountainous areas (accounting for 41 percent). The remaining 12 percent of the region is hilly.

between the mountain and the plain, along which historical settlements have progressively developed. It is precisely in close dependence on its morphological and conformational peculiarities that the city developed its spatial structure; it guided its expansion by distributing into distinct parts and planes: the main city in an elevated position on the mountain, and the hamlets, stretched outward, some of which are larger than the city itself (Pagani, 2000). The territory and the city of Bergamo have progressively shaped themselves over centuries, leaving multiple marks on its current urban structure.

Therefore, the territorial system of Bergamo shows a tension between urbanization and residual rural spaces, in line with urban changes recognizable on a regional scale in Lombardy and within the broader Po Valley. The Municipality of Bergamo today consists of 25 neighborhoods of varying sizes and functions. The neighborhood recognized as the core with high historical, cultural, and tourist value is Città Alta.

The "*Map of the City and Outer Hamlets of Bergamo"* drawn by Giuseppe Manzini in 1816 constitutes a fundamental milestone in the history of Bergamo cartography, being among the first to result from a territorial survey, and clearly shows the palm-like structure of the city.

Fig. 1. "Map of the City and Outer Hamlets of Bergamo" by Giuseppe Manzini, 1816, consulted at the Angelo Mai Civic Library in Bergamo. The map is particularly significant as it shows the central role of Città Alta in territorial development.

In fact, the original residential nucleus of Città Alta gradually expanded, reaching the plain below as early as the Roman period. This expansion did not occur in a radial manner but along well-defined paths, outlining a city with a palm-shaped layout, where the palm is formed by the dense core of the city on the hill, and the finger-like extensions of the hamlets descend to the plain, marking the directions towards nearby centers. Over time, there was a progressive consolidation of the Città Bassa, where the "character of the place as a space of different sociality, based on the ephemeral, but also on impromptu presences of services as peripheral as they are complementary to the domestic life of the ancient city" becomes evident (Pizzigoni, 2021).

The twentieth century marks the era of modern urban planning, focusing primarily on urban expansion, the construction of the "new city" on the plain, and the "modernization" of the pre-existing urban layout (Bonfantini, 2008). Specifically, in Città Alta, three plans were implemented: (i) the Rehabilitation Plan (1926-1935) to meet hygiene, building, and road requirements necessary for the modern life of the early twentieth century; (ii) the Conservation Rehabilitation Plan (1975-1980) aimed at the conscious preservation and transmission of the historical heritage; (iii) the Recovery Plan (2005-2015), interpreting the historic center as a realm of multiple interactions and a place meant to play an active and driving role within a complex territorial system.

Today, Città Alta faces issues common to many Italian historic centers:

- It is subjected to massive daily tourism that often does not fully appreciate its cultural richness.
- Most available financial resources seem directed towards mere tourist enhancement rather than cultural-tourist development.
- It risks losing the diverse social strata that constituted its vitality until the 1970s due to tensions between residents and external populations (tourists).
- It exhibits low cultural activism among its citizens.

However, within this territorial context, a diverse network of social, educational, and cultural activities emerges, provided by significant public institutions that coexist and operate by promoting quality and valuable initiatives. In Città Alta, there are: 7 museums, 4 libraries, a botanical garden, numerous schools (including kindergartens, primary, secondary, and a Classical High School), and two campuses of the University of Bergamo.

Also noteworthy is the presence of the Association for Città Alta and the Hills of Bergamo, formed by neighborhood residents, who are committed to promoting an idea of sustainable and active citizenship, responsible tourism that integrates rather than impoverishes the social composition of Città Alta, and ensures the protection of local shops and the availability of permanent cultural services.

Case Study Presentation

The *Monastero del Carmine* (Monastery of Carmine) is located in the heart of the historic center of Bergamo, in the northern part of Città Alta. This architectural complex is deeply involved in the urban development of the city and incorporates a series of architectural elements that have existed for centuries into a unified building.

The earliest records of the Monastero del Carmine date back to the 12th century when the "Humiliated Monks" established a textile workshop there. The Carmelites later took over, giving the complex its name. The monastery saw its peak activity between the late 1400s and early 1500s with the construction of most of the cloister, the refectory, the monks' quarters, and

concluded in the second half of the 1600s with the creation of the stables, the Chapter Hall, and the new library.
It was suppressed in 1797 during the Napoleonic era, followed by a period of decline and degradation. The premises were used as residences and craft workshops.
In 1956, the "parish benefice" of Sant'Agata donated the complex to the Municipality of Bergamo, and a twenty-year period of structural consolidation work began. Although these efforts remedied serious structural issues, often through emergency interventions involving the demolition of vaults and the reconstruction of floors and roofs, they led to the loss of some original architectural features.
During those years, numerous reflections and proposals were made for a new use of the Carmine complex, such as a Museum of Arts and Popular Traditions, a boarding school, or socio-cultural activities. In 1982, part of the complex was occupied by the Mycological Group and the Speleological Group of the “Nottole” (AA.VV., 1982).
Despite numerous proposals, the building remained largely unused for several decades until 1996, when it began to host the Teatro Tascabile of Bergamo. This gave it the identity it has today, enhancing its significant relationships with the life of Città Alta and its social and cultural role.

Fig. 2. The image identifies the former Carmine Monastery complex (white rectangle) within the historic city (source: Google Earth)

History of the TTB
The *Teatro Tascabile of Bergamo* (TTB), founded in 1973 by Renzo Vescovi, has historically been one of the main actors in Bergamo's cultural life and is an internationally recognized theater company. It has operated from the former Monastero del Carmine since 1996, through successive precarious municipal concessions, the latest of which was signed in February 2016.
The presence of the TTB in the former Monastero del Carmine and the prestigious cultural activities it carries out there have not only provided continuous regular maintenance of the property but also ensured its accessibility and public use. This has initiated a process of valorization, creating a vibrant place where significant cultural activities of general interest are carried out. It can be defined as a "cultural asset" not only for its architectural value but also for

the richness of the activities it hosts, implementing actions and strategies to prevent abandonment and loss of its value (SPPP, 2018, p. 3).
In 2012, the Ministry for Cultural Heritage and Activities (Regional Directorate for Cultural and Landscape Heritage of Lombardy), the State Property Agency (Lombardy Branch), and the Municipality of Bergamo signed an Enhancement Agreement (pursuant to art. 112, paragraph 4 of Legislative Decree 22 January 2004, no. 42 and subsequent amendments) for Bergamo - "Compendium of the Former Monastero del Carmine and Former Sant'Agata Prison,"[4] aimed at defining common strategies and objectives for the protection and enhancement of the Carmine/Sant'Agata compendium.
In 2015, the Municipality published a call for the selection of suitable candidates for the enhancement and management of the aforementioned real estate complex. The public procedure did not yield any suitable proposals, despite the TTB already being present at the Monastero del Carmine.
Therefore, the Municipality decided to pursue a different path, shared with all parties involved, by separating the destinies of the two complexes: the former Sant'Agata prison and the former Monastero del Carmine. This was done to create a mix of functions capable of promoting a high-quality project, primarily focused on public/cultural uses and ensuring greater economic sustainability for the entire operation in 2017.

Special Public-Private Partnership

To support this regeneration process, the Municipality of Bergamo promoted the signing of a Memorandum of Understanding aimed at defining the forms of collaboration for the enhancement of the Carmine complex.In it, the importance of the Monastero del Carmine as a place for artistic sharing, for research, training, theatrical production and for the development of various projects and initiatives (seminars, meetings, residency, performances and open rehearsals with national and international groups) is reaffirmed.
In 2016, a national law was passed (Legislative Decree No. 50/2016), which in Article 151, paragraph 3 provided the possibility for the Mibact (Ministry of Cultural Heritage and Activities and Tourism) and local authorities to activate "special forms of partnership with public bodies and entities and with private entities, aimed at enabling the recovery, restoration, programmed maintenance, management, opening to public enjoyment and enhancement of immovable cultural assets, through simplified procedures for identifying the private partner." This article, which is relevant to this regeneration experience, establishes new forms of public-private partnership-named Special Public Private Partnership (SPPP) - that, with greater operational flexibility, aim to enhance the cultural heritage spread across the country.
In 2018, after the discovery of this administrative innovation, the Teatro Tascabile and the Municipality of Bergamo, with the advice of Fondazione Fitzcarraldo, decided to adopt the PSPP for the first time in Italy, putting in place a new model of relationship between public entities, cultural bodies and private entities for the recovery and management of historic properties through specific activities. With the approval of the Special Public-Private Partnership the TTB was given the opportunity to use the Carmine complex for 20 years, renewable for an equal period (SPPP, 2018, p. 33).

[4] Monastery and Carmine are part of the same historic block. St. Agatha's Prison originated from walls dating back to 908. It was then used as a prison in 1802 . The church was divided internally to house the women's wing and offices. The prison function was maintained until 1978. Located in the northwestern part of Bergamo's Upper City, the Former Prison of Sant'Agata consists of three bodies of different widths arranged in a C-shape around the courtyard. It turns out to be articulated in several levels, on which large common spaces or very small, intimate and private rooms are distributed.

The governing, co-designing, and safeguarding body of the Partnership is the Technical Table in which a contact person from the Teatro Tascabile, a contact person from the city administration (manager of Heritage), and a contact person from MIBACT (delegate of the Superintendent of Fine Arts) participate. These are joined by experts and collaborators in relation to the topics of discussion. More generally, the technical table is the forum where choices and direct and indirect results arising from collaboration and opportunities generated in cultural heritage enhancement processes are evaluated.
Although TTB can operate administratively as a private entity, it was decided to adopt an approach comparable to that of a public administration (for example, in the selection of companies involved in construction work).
In June 2019, the firm Artedil spa was selected, and in September 2019 on the occasion of the European Heritage Days promoted in collaboration with the City Administration of Bergamo, the TTB inaugurated the works on the first and second lots (theater hall and chapter hall) and presented the plan for the realization of the third lot, which includes the creation of an "artist guesthouse" also open for hosting tourists.
The overall program (SPPP, 2018, p. 44) envisions the rehabilitation of the Monastero del Carmine in 4 phases linked to as many cultural actions: (i) Renzo Vescovi Theater; (ii) Chapter Hall; (iii) Atelier (artist guesthouse); (iv) Cloister.
The Renzo Vescovi Theater, dedicated to the founder who died in 2005, is the former refectory of the Carmelites: a large room with a rectangular floor plan, on the walls of which, painted in fresco, are twelve roundels depicting the Blessed Virgin of Carmel with Child and the most significant figures of the Carmelite Order. Since 1996 the refectory has been used by TTB for rehearsals, performances and hospitality.
The Foyer-Library, originally the kitchen serving the Monastery refectory, has been used as a space for actors' dressing rooms since 1996. In today's overall reorganization of the space, it has been transformed into the foyer-library: on the one hand the place where spectators wait before entering the auditorium for the performance, and on the other hand, on a special mezzanine, the place for consulting texts belonging to the Eurasian Theatre Library. In fact, all theater-laboratories, like the Teatro Tascabile, build a library fund within their premises, which for TTB is represented by the Eurasian Theatre Library. The Library is now owned by the University and is included in the National Library Service[5].

Materials and Methods

From a methodological point of view, the work is based (i) on an extensive literature review, (ii) on official reports, documents, and national and international press review of project and history of Monastero del Carmine, (iii) on the analysis of the legislative instrument of Special Public-Private Partnership, (iv) on interviews with significant stakeholders.
The first part of the research included the study and analysis of the case from a historical, social and cultural point of view through bibliographic research, consultation of the press review and administrative documents prepared over the years and the numerous experiences involving the monastery. The process of tangible and intangible regeneration was also examined through the projects presented when the SPPP was approved.

[5] The BTE was born from an initial nucleus of volumes that belonged to the leader and founder of the Pocket Theater Renzo Vescovi, to which was added in 2019 the Nicola Savarese fund, a great scholar of performing arts, and in particular of the relationship between Eastern and Western theater. It is currently possible to consult its approximately 4,000 volumes in a mezzanine area of the foyer on which 6 reading stations are set up, suitable for Italian and foreign students and scholars. It is a growing project: in fact, two more important funds are planned to be acquired: the personal library of Eugenio Barba, director of Odin Teatret (DK), and that of Ferdinando Taviani, perhaps the most important theater scholar of his generation.

After taking a detailed picture of the situation, we focused on mapping the stakeholders involved in the regeneration process to conduct semi-structured interviews with them.
Series of semi-structured interviews were conducted with the stakeholders. They were representatives of the institutions and the main actors involved in the practices. The interviews lasted between 30 and 90 min, and focused on the main open themes: the origin of the project and the reason of their involvement, the project timeline, the role the interviewee play in the process of regeneration, the stakeholders with whom the interviewee cooperated, the management of the event, and the results on the territory and on community everyday life.
In order to focus the analysis on the governing instrument of the process - the SPPP - the interview was structured by asking the interviewees what their role was within the life of the Monastero del Carmine before the drafting of the SPPP, during and in the period immediately following and after the first five years of the instrument's implementation.
Also of key importance was the phase of site visits to learn about the Monastery, its spaces and uses.
The stakeholders interviewed were identified by recognizing the responsibilities and expertise they brought to the SPPP project and therefore can be divided based on the role they played in the process. Seven people were interviewed who were crucial to the success of the project and represented the different thematic and technical components.
First of all, TTB members were identified who have been using the Monastery since 1996 and expressed the need to transform it into a welcoming place capable of meeting the needs of a cultural association and supporting the processes of expanding their offerings. In this regard, Alessandro Rigoletti, a TTB member, was interviewed.
As anticipated earlier, from the need to find an agreement between the ownership of the building, the Municipality of Bergamo, and the beneficiaries of it, the TTB, a fruitful relationship of discussion and advice was born with the Municipality Manager Erminia Renata Carbone; with the lawyer Franco Milella, an expert in common goods and consultant to the Fitzcarraldo Foundation, and the TTB.
The foresight and vision of these stakeholders made it possible to find in the special public-private partnership a valuable tool to enable an equal relationship between the owners and usufructuaries of the building that would give the possibility of finding useful funding for a regeneration project. architect Gloria Gusmaroli, who has been working at TTB since 2020 and is in charge of promoting the project and its technical implementation, was then interviewed.
A key role in the development of the project is given by the involvement of the community, not only from an intangible point of view, but also through the possibility of offering economic funding. This is because the design of TTB confronts the issue of the relationship between entrepreneurship and cultural associations. The Special Public-Private Partnership is the means by which to promote the sharing of choices and the simplification of procedures according to a different vision in the management of public assets and resource raising. To sustain the project vision, the municipal administration had to involve its relational capital by activating private entities toward the economic support of planned activities.
The resources on which the project rests come from different forms and sources of funding (fundraising mix). Among the most important are the Art Bonus (in 2014 a tax credit was introduced for liberal cash disbursements in support of culture and entertainment as a support of patronage in favor of cultural heritage) with which TTB activated two funding lines, one related to building interventions and one to cultural activities[6].

[6] The narrative of the first fundraising campaign with Art Bonus, along with the digital and on-site giving back, received the “Special 1st Place Award for Social Campaign” in the “Art Bonus 2021 Competition”

Since 2020 there is an increasingly strong link between the promotional communication strategy and the expected results about the involvement of funders and the economic return of the action taken, generating a sense of place that becomes the glue for a lasting relationship between TTB, economic operators and local associations. Representatives of the latter were considered in the interviews.

Discussion

The analysis conducted on the various sources presented in the previous section, allowed some key themes to emerge regarding: (i) The nature of the instrument adopted (SPPP); (ii) The role given to the temporal dimension; (iii) The characteristics of the place and its architecture; and (iv) The learning/empowerment process by the actors involved.

The first core of reflections includes the type of innovative instrument adopted by the various actors (TTB, Bergamo City Council and Superintendence) to promote the process of recovery and re-functionalization of the spaces of the Monastero del Carmine.

The SPPP turns out to be a flexible tool, which in the concept of "Special" introduced by the national legislation, hides a strong vagueness that should not necessarily be considered as a negative condition. This "ambiguous" nature of it, as claimed by some interviewees, allows its application to different types of objective contexts/conditions that differ in:

1) the architecture of the places of possible application, as the absence of explicit identification by national standards, allows for the possibility of regenerating both spaces with historical value and buildings of more recent construction;the only condition to be met the condition of public property;

2) the "community" of subjects called upon to manage the public good and ensure the maintenance physical structures and at the same time the provision of functions of public and collective interest;

3) The type of activities and functions delivered by the subjects entrusted in the management that may cover different aspects of collective interest are going to decline in a timely manner the broad concept of "culture".

The PSPP tool in the experience of Bergamo and the Monastery del Carmine has been configured as a "stage" capable of stimulating dialogue between subjects very different from each other in terms of objectives, technical-organizational skills and responsibilities towards the regeneration process activated. This open, equal, symmetrical dialogue between a public subject (Municipality of Bergamo) and an associative reality with a strong identity and history (The TTB) , took on a role of exchange and mutual learning. The diversity of the actors involved in the path was gradually accepted, until it became an opportunity for strengthening in the program of objectives and interventions.

The one presented was the first case in Italy of application of the Special Public Private-Partnership, which, for the first time, was able to create a space for reflection and sharing of ideas and planning of a shared project. The drafting of the project document allowed for the sharing of objectives and proposals, as well as the confrontation and discussion of critical and controversial issues (e.g., the management of financial aspects or the need to submit to very binding protection regulations). The SPPP has empowered a private actor to care for a public good of general interest for the entire community, legitimizing an alliance and, most importantly, increasing the credibility of a private entity of a cultural nature vis-à-vis public and funding institutions. This also succeeded in giving value to the entire regeneration process in order to receive funding and expand collaborations with other public and private actors. The instrument therefore, in its flexibility, granted more opportunities, compared to other more traditional instruments, to adapt commitments and projects.

The second aspect repeatedly considered by the interviewees and official documents, which assumed, and was debated at length when the SPPP was drafted, is the temporal aspect. Before

the SPPP, the municipality granted the Monastery space to the TTB with short-term concessions. This condition reduced the ability to plan a program of tangible (e.g., rehabilitation of some spaces) and intangible interventions. The provision of a longer management time makes it possible to think about long-term planning and imagine other related activities.
Adopting a time frame of 20 years, as a result of mediation between TTB, the consultants and the municipality, has made it possible to be able to plan complex actions and at the same time to activate other relevant initiatives: the raising of funding, to participation in calls for funding bodies, to investment on people and so on.
Time is associated, particularly when dealing with cultural associations and public funding, with the theme of uncertainty.
This story of regeneration cannot be separated from the place where it took place. The historical, cultural, and architectural richness of the Monastery allowed for this process, which took advantage of the beauty of this place and changed with the story of the Teatro Tascabile. The typical architectural structure of a Monastery has been adapted to the needs of TTB's theatrical and cultural activities. The constraints of a historic building, in addition to the difficulties, have also offered the possibility, for example by activating specific projects, to experiment with new forms of inhabiting the historic space, generating a vital osmosis between the community that manages it and the functions provided, between the monastery complex and TTB.

Conclusions

The subject of abandoned public heritage is of considerable relevance and great impact in the urban dynamics of Italian cities. On the one hand there are the problems arising from its abandonment and the costs involved in its regeneration; on the other hand having public buildings of inestimable historical and architectural value represents an opportunity for local communities.
The regeneration of public heritage can take place through its disposal, its renovation for other public activities or through a partnership with a private entity that commits itself to its management.
The experience of the Monastero del Carmine in Bergamo was the first Italian case in which the Special Public Private Partnership was adopted, i.e. the municipality and a private association become partners in the management of the property by developing an agreement.
Prior to the introduction of the SPPP in Italy, legislation favoured the use of public assets by incentivising economic and capital profitability and not by increasing cultural and social valorisation. This approach characterised the Italian legislation of the 30 years prior to 2016 and was sometimes unsuccessful. The SPPP changes the idea that a public asset must necessarily be made profitable and invests in co-responsibility between the public and private sectors, fostering a process of contamination and mutual improvement that implies the desire and the need to go beyond one's own competences and to constantly learn new disciplinary and other skills.
For the Teatro tascabile di Bergamo, a private organisation involved in the management of the Monastero del Carmine, doing theatrical work means not only staging performances and activities related to theatrical culture, but also implies engaging in cultural and building development through the care of a place and, together with it, of the community to which it belongs. Thanks to the SPPP, the Monastero del Carmine has taken on a central role in Bergamo's urban context, becoming a point of reference not only for the municipal administration, but for the entire community in terms of cultural and social initiatives.

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Track 03: Law

LAW - Planning and legal procedures for land-use and transport policies

Chairs:

- Rachelle Alterman, Technion University, Israel
- Florence Lerique, Université Bordeaux Montaigne
- Tristan Claus, KU Leuven

Keywords: *Spatial planning law, land use; land policy, property rights, housing regulations, development control, participation in planning procedures; governance of spatial planning; land-value capture; frugal use of land resources*

When grounded in laws and regulations, spatial planning intervenes in the allocation and distribution of land and development. It thereby intervenes to a lesser or greater extent in private property rights or market expectations, from regulating what may or may not be built on specific parcels of land down to outright expropriation. Research questions range from procedural-administrative processes, through substantive planning goals and their expression in land use regulation, and all the way into the global environmental arena. Can the laws and institutions that govern planning meet the challenges posed by climate change, sustainability, demographic changes and increasing economic and political uncertainties?

This track aims to provide a platform for sharing research on any topic that connects planning and law with property rights. Examples of topic areas:

Statutory (regulatory) planning systems and instruments: What are the challenges within a given country, or comparatively.

Governance structures and procedures: How does planning law structure the relationships between central governmental control, local government, markets, and non-governmental organisations?

Legitimacy of planning interventions: How does the law frame public participation, stakeholder involvement, lobbyism, and dispute resolution;

Regulatory instruments of spatial planning: How well do instruments work, such as local statutory plans, land use plans, building permits, expropriation, compensation,

regulation of agricultural land, open space and natural resources, heritage-building regulation,

Land value capture through agreements with developers, developer obligations, land readjustment, taxation of land values (betterment tax, etc.), transfer of development rights, expropriation, compensation,

Theory of property rights: How to deal with tensions between public and private rights and responsibilities (i.e. with land for public services, customary collective or private rights).

How can planning law contribute to the environment and climate change challenges: Sobriety (frugal use of land) for the compact city, permeability of the soil, cleaning of contaminated land, etc.?

Contributions may look at the general theory of planning and law or investigate particular issues, focusing either on a particular country or cross-nationally. Since legal and planning systems vary greatly from country to country, authors should make the terms they use as transparent as possible.

Fallacies and Revisions: Evaluation of Economic Benefits of Development Rights Transfer and Density Bonus --17th and 69th Neighborhoods in Shanghai Hongkou Historic Conservation Districts Regeneration as the Case

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Abstract: Development rights transfer and density bonus (TDR&DB)are often vaguely and implicitly used as a financial compensation tool in historic conservation districts regeneration in Shanghai to compensate to achieve a comprehensive cost-benefit balance. However, this is a misinterpretation and deviation of the effect of TDR&DB. This paper takes the 17th and 69th neighborhoods in Hongkou District as an example, explains the constraints on the cost-benefit of the regeneration, analyzes the market mechanism of TDR&DB, and evaluates the economic benefits of TDR&DB in detail with the help of land value allocation rate method and revenue reduction method. The study concludes that: 1) local governments often have the false illusion of FAR when using TDR&DB, they should restrain their urge to increase FAR and restore the basic attributes of public interest orientation of TDR&DB. They should explore the shift from the land expropriation model to the rights conversion model to reduce the cost of urban regeneration; 2) the idea of cost-benefit balance has obscured the essence and value of TDR, the essence of the TDR is to realize the efficient utilization of overall spatial resources through the dynamic adjustment of development rights. This provides a new way for the introduction of this system into our country; 3) market players can obtain more economic benefits by using TDR&DB, and they should make more "special public contributions" for the regional development. It is suggested to introduce the concepts of "incentive coefficient" and "incentive amount" to accurately evaluate the "special public contributions"; 4) The TDR&DB should take into account their external effects on the surrounding areas, and further research should be conducted to quantify and evaluate the external effects of the receiving lots, so as to promote the practical application of TDR&DB. The above conclusions can provide useful references for constructing a sustainable urban regeneration mechanism in China.

Key Words： Development rights transfer and density bonus (TDR&DB)，Evaluation of Economic Benefits, Economic calculations, historic conservation districts, Market mechanism, Urban regeneration

Introduction

Shanghai's "Historical Conservation Block" refers to historical block with distinctive historical architectural features outside designated historical preservation zones. These areas possess a significant number of historically valuable buildings or exhibit unique spatial layouts and streetscapes that merit preservation (Chen, 2018) . In Shanghai, there are a total of 250 Historical Conservation Block, covering over 17 square kilometers. Compared to traditional designated historical preservation zones, these blocks may not individually boast prominent historical buildings or architectural significance. However, collectively, they form the foundational fabric of Shanghai's urban landscape. These neighborhoods play a vital role in Shanghai's historical preservation framework and contribute significantly to maintaining the city's distinctive character (Chen et al.,2021). Many of the neighborhood conservation areas are located within the scope of old renovation district in the central urban areas. Within these neighborhoods, residents often face poor building safety, sanitation, and living conditions. There is a strong desire among residents for urban regeneration and improvement of public facilities. However, the regeneration of these neighborhoods faces increasing challenges, such as balancing land acquisition funds, addressing prominent conflicts between residents' needs and heritage conservation. These issues have gradually become tough "nuts to crack" in the urban regeneration process.

In the regeneration of Shanghai's Historical Conservation Block, an innovative approach is adopted, known as "pairing and combining," to integrate the conservation areas with other plots for development. For instance, in the combined development of Blocks 17 and 69, Block 17 is designated as a Historical Conservation Block, whereas Block 69 is situated within a specific urban policy zone.[①]In the regeneration process, there is often a vaguely and dimly application of TDR&DB to obtain more development rights, aiming to achieve a balanced cost-benefit ratio. Currently, this practice typically treats TDR&DB as economic compensation tools, lacking theoretical analysis of their market mechanisms, economic benefits, and calculation methods. This approach easily leads to misinterpretation and deviation regarding the role and effectiveness of TDR&DB.

1. Constraints and Bottlenecks in Shanghai's Historical Conservation Block

1.1 Conservation-oriented regeneration breaks the previous cost-benefit balance

Cost-benefit equilibrium in regeneration refers to the scenario where the capital investment in a regeneration project is either less than or equal to the income generated by the project. Unlike typical renovations of old districts, Historical Conservation Block focus on retaining or protecting rather than wholesale demolition which is characteristic of traditional regeneration. The "primarily retention-based" approach to Historical Conservation Block regeneration disrupts the existing balance between input and output of the redevelopment sites, thereby increasing the complexity of regeneration efforts.

Currently, many of the remaining redevelopment sites in Shanghai's central urban areas involve heritage conservation. Although these sites are often well-located, the need for heritage conservation typically results in lower FAR after regeneration compared to sites developed under normal circumstances. As a result, the land value of these sites cannot be fully realized. Meanwhile, as property prices rise year by year, the demolition costs for original residents also gradually increase. The profits obtained from land redevelopment are increasingly unable to cover the costs of resettling residents and the initial development expenses. This situation has led to a significant imbalance between costs and benefits in the regeneration of Historical Conservation Block (Zhu & Gao, 2018) [1].

1.2 The previous land use control system makes it difficult to readjust the spatial benefits

Currently, China's existing land use control system is a product of the incremental era. The logic of " rent-investing " under this system often leads it to become a fiscal tool rather than adhering to its original policy intentions when addressing issues related to existing urban regeneration (Zhou, 2022) .In fact, while the current land use control

system can prevent the occurrence of negative externalities, it fails to establish a market price for externalities. As a result, it cannot ensure the Pareto optimality in urban regeneration (Wolfram, 1981).

Moreover, it can lead to original residents or developers exploiting "rent gap" through land use changes, exacerbating issues of rent-seeking, gentrification, and the paradox of anti-commons, thus creating social fairness and efficiency imbalances. Original residents and developers can gain significant profits in primary land markets by claiming substantial compensation for land acquisition without bearing the costs of public services. As operational expenses for public services increase post-regeneration, the government's fiscal deficit will further worsen (Zhao and Song, 2021). Simultaneously, the post-regeneration increase in land and housing rents inevitably attracts higher-income individuals, displacing the original low-income residents and leading to urban gentrification.

1.3 The previous policies of TDR&DB cannot make up for the huge cost gap

Currently, the policies governing the regeneration of Shanghai's Historical Conservation Block primarily include the "Shanghai Urban Regeneration Regulations" (2021 version), the "Shanghai Urban Regeneration Planning Land Implementation Regulations" (2017 version), the "Opinions on Deepening Urban Organic Regeneration to Promote Historical Heritage Conservation" (2017 version), the "Implementation Regulations on Planning Land Management to Implement the Opinions on Deepening Urban Organic Regeneration to Promote Historical Heritage Conservation" (2021 version), as well as other relevant preferential policies related to urban redevelopment. These existing policies have to some extent stimulated developers' enthusiasm to participate in urban regeneration. However, their measures for TDR&DB still cannot fully bridge the substantial cost gap in the regeneration of Historical Conservation Block from the government's financial perspective. The currently available transferable and bonus FAR is too small, and the scenarios where TDR&DB can be applied are too limited, making it difficult to address the significant funding shortfall arising from the complex regeneration process.

2. Analysis of Market Mechanisms for Development Rights Transfer and Density Bonus

Transferable Development Rights (TDR) refers to the process of selling or transferring the unused development rights from a "sending plot" to a "receiving plot" through market transactions or government intervention. Typically, the unused development rights transfer among multiple plots in an "equal quantities " manner. Unused development rights refer to the difference between the maximum planned FAR and the actual utilized FAR of a plot.

Density Bonus (DB), on the other hand, involve converting public spaces or facilities into FAR as a reward to market developers. It is a form of compensation from the government to market developers for providing public services. DB are usually provided in the form of "equivalent conversion," where new development rights are rewarded to one or multiple sites (Deng, et al., 2020; Zhan, 2019).

So, how do TDR&DB contribute to the overall social benefits? This paper constructs a marginal benefit function for TDR&DB based on relevant principles of economics, and conducts an in-depth analysis of their market mechanisms. For the sake of convenience in the study, the following basic conditions are set: 1) Assume there are two plots of land with planned FAR of 6.0; 2) Assume the two plots of land have equal areas, and there are no transaction costs; 3) The current FAR of each plot of land have already reached the planned FAR.

2.1 Analysis of the market mechanism of TDR

Assuming plot G is an old community already planned for high-rise residential use, with a planned FAR of 6.0. However, during the development process, it is discovered that there are buildings of historical heritage value that need to be preserved. Therefore, the planned floor area ratio remains unchanged at the current 1.5FAR. In other words, plot G has "unused development rights" corresponding to a FAR of 4.5. Plot H, on the other hand, is for the regeneration of commercial office use in the central urban area, and it has already reached its planned FAR 6.0. Since the utility of historical heritage does not increase with the FAR, the marginal benefit curve of plot G is steeper compared to plot H. This is illustrated in Fig 1.

Now, considering the scenario of TDR, denoting the marginal benefit of plot G as R_G and the marginal benefit of plot H as R_H. When the values of their marginal benefits are

balanced at R_G', R_H', the development rights transfer is completed. At this point, plot G transfers from R_G (1.5 FAR) to R_H' (3.5 FAR), and plot H transfers from R_H (6.0 FAR) to R_H' (8.5 FAR). This leads to an increase in overall social benefits, reaching the optimal maximum value. However, for the purpose of historical heritage preservation, there is a need to limit the development of plot G, maintaining its FAR at 1.5 (as shown by positions R_G and R_G' in the Fig.1). This restriction prevents the transfer of development rights between F_G' and F_H', meaning that the land value income corresponding to $R_G'R_H'N_G'$ cannot be captured, resulting in a "deadweight loss" of social benefits, represented by the black shaded area in Fig 1. Due to the existence of this "deadweight loss," overall social benefits cannot be maximized.

It is important to note that this scenario of TDR may bring about significant negative externalities for the receiving plots. For example, there could be increased pressure on infrastructure in central areas and damage to urban landscape.

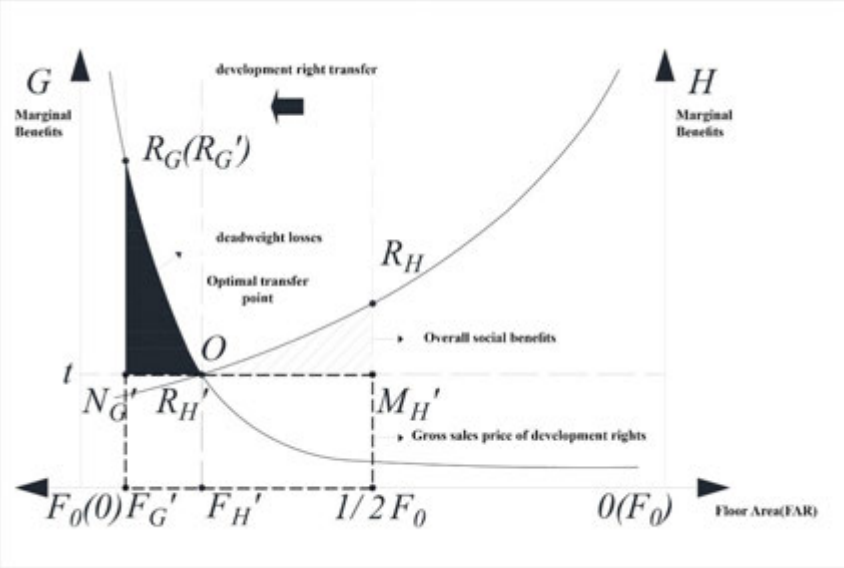

Fig 1 Analysis of the market mechanism of TDR
(Source: by the author)

2.2 Analysis of market mechanisms for DB

Consider a different scenario where plot I is designated for the preservation of historical buildings, with a planned FAR equal to the current FAR (1.5), and plot J is for

commercial office use in the central urban area, having already reached its planned FAR (6.0). Unlike the previous scenario, plot I cannot be developed due to preservation restrictions and thus does not have any "unused development rights." Plot J has already reached its planned FAR, so there is no TDR in this sense.

However, to maintain the historical buildings on plot I, plot J can increase its FAR through DB, thereby obtaining land value income corresponding to "$R_HR_H'F_H'1/2F_0$" in the shaded area of Fig 2. The process of DB not only realizes the public interest within plot I but also enhances the land value income of plot J itself. It is important to note that in reality, the value of DB cannot be infinitely increased considering the impact of development on transportation and municipal infrastructure capacity.

In this scenario, the land value income obtained by plot J through DB should be equal to the cost required for maintaining the historical buildings on plot I. The analysis of this scenario also applies to DB between restricted plots and developable plots, such as those designated for green space protection, ecological conservation, farmland protection. Additionally, DB bring about numerous positive and negative spatial externalities, which require more deeper research.

For instance, protected plots contribute to the enhancement of regional historical value and tourism attractiveness, leading to positive externalities. Conversely, receiving plots experiencing high-intensity development may cause negative externalities such as reduced sunlight exposure for neighboring high-rise buildings, excessive burden on infrastructure, and damage to urban landscape.

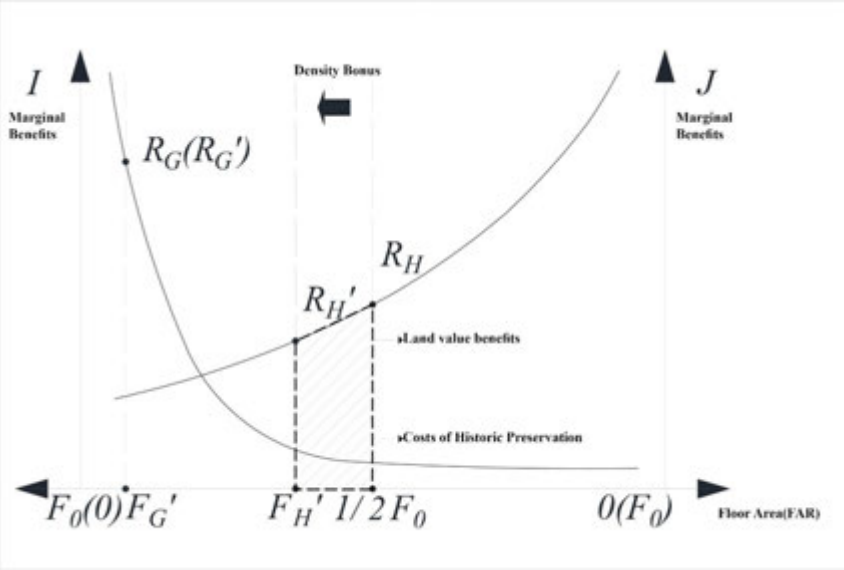

Fig 2 Analysis of market mechanism for DB
(Source: by the author)

This paper argues that relying solely on TDR cannot achieve the maximization of overall social benefits due to the presence of "deadweight loss." Therefore, it is necessary to utilize DB to balance the construction costs of heritage preservation in receiving plots. By enhancing the spatial quality of sending plots and "saving" development costs, DB contributes to the improvement of overall social benefits.

3. Economic Valuation Method for Development Rights Transfer and Density Bonus

3.1 Economic Valuation Method for TDR

The economic value of a piece of land (the sending plot) refers to the spatial value corresponding to the development rights on that land. Therefore, the economic value of development rights reflects the factors contributing to the value of the land. However, if this development rights is used on another piece of land (the receiving plot), its economic value can only represent the spatial value on the receiving plot. It is disconnected from the sending plot, reflecting the value of the receiving plot. In other

words, the price of transferring development rights involve both the price of the sending plot and the price of the receiving plot (Nihata, 2003, p. 128-130).

This paper employs the method of land value distribution rate to conduct economic valuation for transferring development rights. The prerequisite of this method is that the value of land can be determined based on the sum of products allocated according to its most efficient land use. Previous studies have shown that the coefficient of determination for FAR as an explanatory variable is 0.808, which is statistically significant (Yamashita, 2004). Therefore, FAR can be considered as a product for land value distribution. This method assumes that the sending plot and the receiving plot are traded by developers in a free market, while the government possesses complete information and has defined clear and optimal development rights, maximizing the total social output within the plots and their surrounding areas. Consequently, both the sending plot and the receiving plot can be utilized most effectively before and after the TDR&DB. Then, land prices are allocated volumetrically based on FAR, and the price of transferring development rights is determined according to the change in FAR.

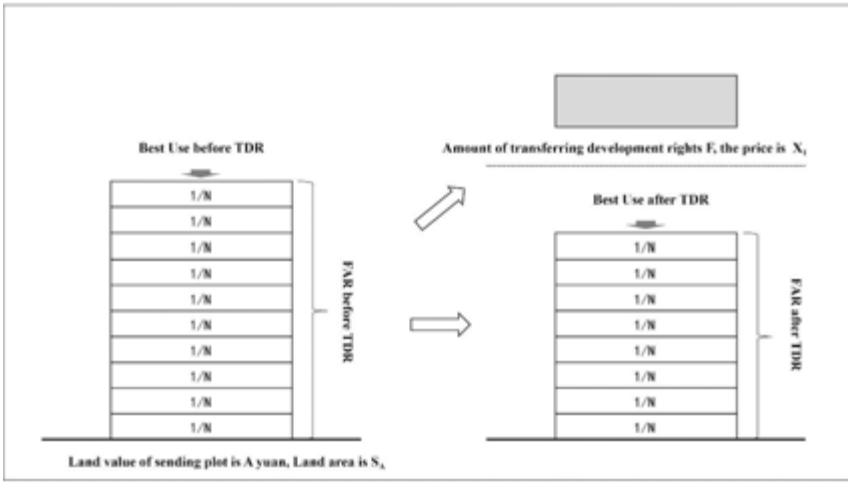

Fig 3: Transfer of development rights of sending land

(Source: TDR of architectural space and its utilization, Yasuo Hibata Nezu)

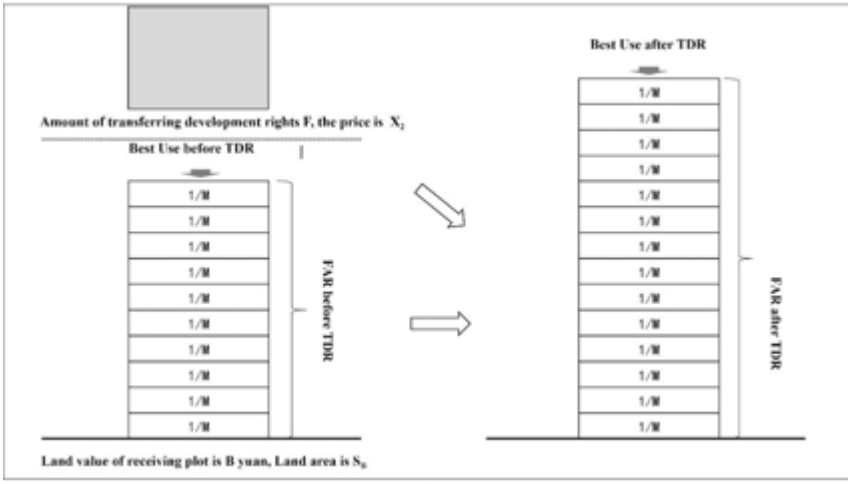

Fig 4: Transfer of development rights of the land parcel

(Source: TDR of architectural space and its utilization, Yasuo Hibata Nezu)

As shown in Fig 3 and 4, the study assumes that the land value of the sending plot is A million yuan, with a land area of S_A and a FAR of N. Correspondingly, the land value of the receiving plot is B million yuan, with a land area of S_B and a FAR of M. Now, a portion of the development rights (F) is transferred from the sending plot to the receiving plot. Therefore, before the TDR, the price of this development rights (X_1) can be calculated using formula (1), while after the TDR, the price of this development rights (X2) can be calculated using formula (2).

The price of TDR in sending plot $\mathbf{X_1}$= land value of sending plot A × (FAR before TDR - FAR after TDR)/ FAR before TDR (1)

α = **(FAR before TDR - FAR after TDR)/ FAR before TDR**

The price of TDR in receiving plot $\mathbf{X_2}$= land value of receiving plot B × (FAR after TDR - FAR before TDR)/ FAR before TDR (2)

β = **(FAR after TDR - FAR before TDR)/ FAR before TDR**

The latter parts of the two formulas are respectively defined as the allocation coefficient **α** for transferring development rights from the sending plot and the allocation coefficient **β** for transferring development rights to the receiving plot. Then, the difference in transferring development rights between the sending plot and the receiving plot is proportionally allocated, resulting in the actual transaction price of transferring development rights. The overall process can be calculated according to Table 1.

Table 1 Valuation Method for Development Rights Transfer

The Price of TDR		
a	b	c = a－b
Sending plot	Receiving plot	Difference
α·A	β·B	α·A－β·B
Distribution of the difference		The Price of TDR
d = a /（a+b）	e = c×d	f = a－e
Distribution rate	Distribution amount	The Price of TDR
$\frac{\alpha \cdot A}{\alpha \cdot A + \beta \cdot B}$	$\frac{\alpha \cdot A(\alpha \cdot A - \beta \cdot B)}{\alpha \cdot A + \beta \cdot B}$	$\alpha \cdot A - \frac{\alpha \cdot A(\alpha \cdot A - \beta \cdot B)}{\alpha \cdot A + \beta \cdot B}$

(Source: Source: TDR of architectural space and its utilization, Yasuo Hibata Nezu)

In the calculation process, it is necessary to specify the exact quantity of transferring development rights. According to the requirements of the "Implementation Rules for Strengthening Floor Area Ratio Management and Promoting High-Quality Utilization of Land Resources (2020 Edition)"(Shanghai Municipal Bureau of Planning and Natural Resources, 2020), In the central urban area of Shanghai, the maximum FAR for newly built residential lands is 2.5, while for newly built commercial and office lands, the maximum FAR is 4.0. Therefore, transferring development rights refers to the difference between the planned maximum FAR and the current FAR. For example, if the current FAR of the sending plot is 1.0 and it is planned for residential use (with a planned FAR of 2.5), then the 1.5 FAR development rights can be transferred.

Through the above calculation, we can further clarify the profit and loss of the sending and receiving plots. The sending plot needs to ensure a positive income for the development rights transfer to be tradable in the market. The profit and loss of the receiving plot can be calculated under the condition of setting a certain proportion of

leasing and selling floor space.

3.2 Economic Valuation Method for DB

the land value income obtained by the receiving plot through DB should be consistent with the construction cost required for historical preservation within the sending plot. This paper adopts the income approach method for economic calculation of DB. Assuming that the construction cost of historical preservation includes the reconstruction cost of historical buildings and sites, this cost can be obtained using the following formula (3). Here, C_A represents the unit construction cost of the sending plot, and F_A is the planned construction area of the sending plot.

Historic Preservation Costs =
Unit Area Cost in Sending Plot ×Planned Floor Area in Sending Plot

$$= C_A \times F_A \quad (3)$$

The awarded development rights is equal to the construction cost of historical preservation divided by the net present value (NPV) of income per unit area of the receiving plot. The NPV of income per unit area of the receiving plot can be calculated using formula (4). Here, $\mathbf{NPV_R}$ is the NPV of income per unit area of the receiving plot. $\mathbf{E_t}$ represents the total net income per unit area of the project in the $\mathbf{t^{nd}}$ year of the receiving plot (in yuan/m²). **i** is the rate of return. $\mathbf{C_B}$ is the construction cost per unit area of the receiving plot (in yuan/m²). If there is a certain proportion of leasing and selling, it is necessary to calculate the net present value **V** of rental income. Assuming equal annual net rental income for a finite number of years in the future, denoted as **A**, the NPV of finite-year rental income can be calculated according to the following formula. The bonus FAR is the ratio of awarded development rights to the area of the receiving plot. The economic calculation approach for DB is illustrated in Fig 5.

Awarded Development Rights =Historic Preservation Costs ÷ NPV of Receiving Plot

NPV of Receiving Plot： $NPV_{承} = \sum_{t=1}^{n} \frac{E_t}{(1+i)^t} - C_B$

Present value of net rental income for a finite number of years:

$$V = \frac{A}{i}\ （1 - \frac{1}{（1+i）^n}）$$

Bonus FAR = Awarded Development Rights ÷ Area of Receiving Plot

$$= \frac{C_A}{NPV_{承}} \times \frac{F_A}{S_B} \quad (4)$$

Through the formula for calculating the bonus FAR, it can be seen that the ratio of the unit construction cost of public contribution per unit area of the sending plot to the NPV of income per unit area of the receiving plot is the **DB Coefficient**. This coefficient depending on the nature of the public contribution and the income situation of the receiving plot. The **DB Volume** is determined by the ratio of the building area formed by the public contribution of the sending plot to the base area of the receiving plot. The greater the contribution to the public interest, the larger the volume of the DB.

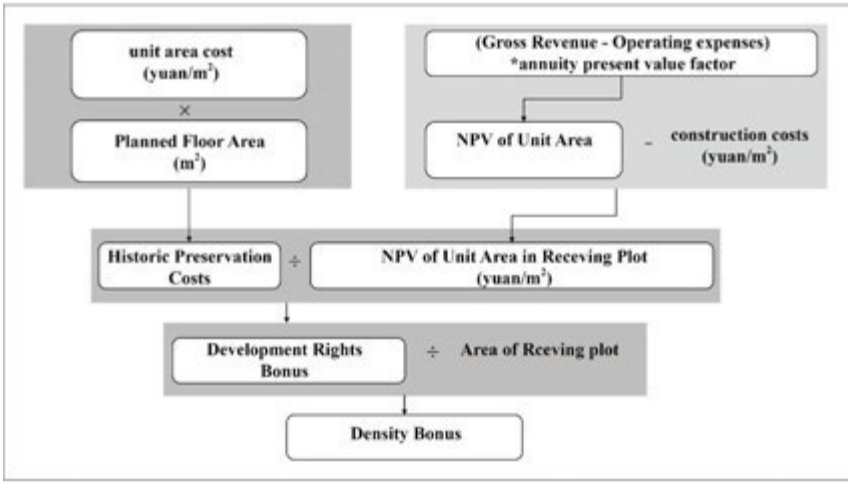

Fig 5 General idea of economic calculation of DB

(Source: by the author)

4. 17th and 69th Neighborhoods as the Case

4.1 Implementation background

The 17th block in Hongkou District stretches from Jiangxibei Road in the east to Haining Road in the south, from Henan North Road in the west to Wujin Road in the north. It covers an area of approximately 39,630 square meters and involves 3,010 households. The area to be acquired for demolition is approximately 62,000 square meters, and a total of 735 households to be relocated, as shown in Fig 6.

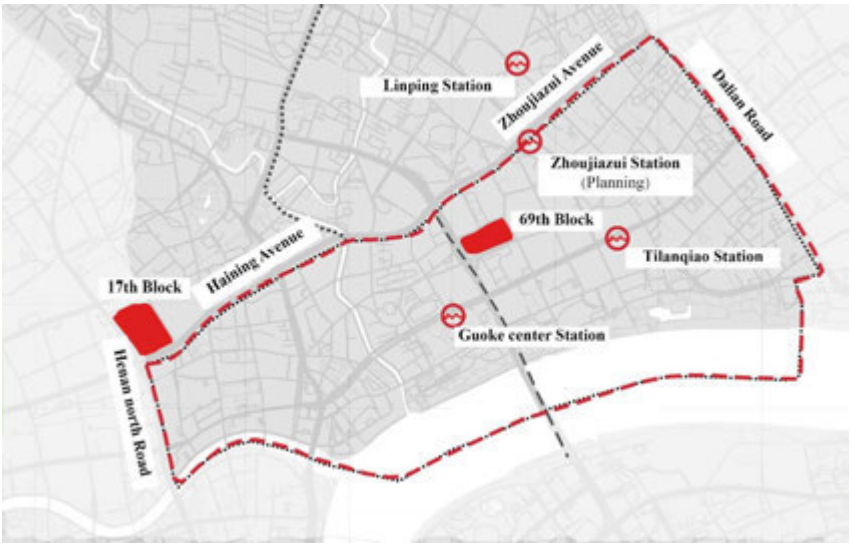

Fig 6: Hongkou District 17 and 69 block locations
(source：https://www.sohu.com/a/441881828_260616)

The houses in the 17th block of Hongkou District have a long history and were designated as the second batch of “Historical Conservation Block” in 2017. The renovation of the area must meet the requirements for historical preservation. In September 2020, the redevelopment site of the 17th block was successfully completed and handed over. At the same time, the urban planning adjustment scheme and approval documents for the 17th block were officially announced (Shanghai Municipal Planning Bureau Document No. [2020] 266). According to the planning scheme, the main land

use type in the 17th block is Class I residential land, with a FAR of 1.1 and a building height of 10 meters.

Located in the core area of North Bund in Hongkou District, Shanghai, Block 69 is designated as land parcel hk300-02 according to the latest approved "Control Detailed Planning for North Bund Area" (Shanghai Municipal Document No. [2020] 39). The planned area of the block is 20,691 square meters, with a land use designation for commercial, office, restaurant, and hotel purposes, without involving historical preservation. The plot FAR is 10.0. According to the urban design of the North Bund in Hongkou, a 300-meter-high landmark building will be constructed here in the future, aiming to create a headquarters base with global influence and benchmark leadership along with surrounding plots.

On December 31, 2020, the land auction announcement was issued (Land Parcel Announcement No.: 202028201). Blocks 17 and 69 in Hongkou District were jointly put up for auction, with a total land area of 58,025.2 square meters. The winning bid was 11.14 billion yuan, and the land use was designated for residential and commercial, restaurant, and hotel purposes.

4.2 Economic calculation

Block 17 has 1.4 FAR transferable development rights, while Block 69 can accept this transferable development rights based on a planned FAR of 4.0.

Based on the land auction and transaction data released by the Shanghai land market, the following assumptions are made: For Block 17, the construction cost per square meter for the preservation buildings is estimated to be 15,000 yuan/m^2, and the selling price is estimated to be 200,000 yuan/m^2.

For Block 69, the construction cost per square meter for commercial office buildings is estimated to be 12,000 yuan/m^2, and the selling price is estimated to be 80,000 yuan/m^2. The annual rental income per square meter is estimated to be 31,000 yuan/m^2/year, with an average vacancy rate of 15%, an operating expense rate of 25%, and a return rate of 5.7%. The evaluation period for commercial office buildings is set at 50 years.

The floor price is determined comprehensively based on the market comparison method and the benchmark land price correction method. The floor price for residential land in Block 17 is 120,000 yuan/m^2, and for commercial land in Block 69, it is 30,000 yuan/m^2. Excluding the underground part.

table 2 Calculation of the overall economic benefits of TDR&DB for 17th and 69th block

Overall economic returns (fully rented)		**(billion yuan)**
a Overall returns of Sending plot	b Overall returns of Receiving plot	c Overall returns
-1.12	-1.59	**-2.71**
Overall economic returns (fully sale)		**(billion yuan)**
a Overall returns of Sending plot	b Overall returns of Receiving plot	c Overall returns
-1.12	+4.83	**+3.71**

(Source: by the author)

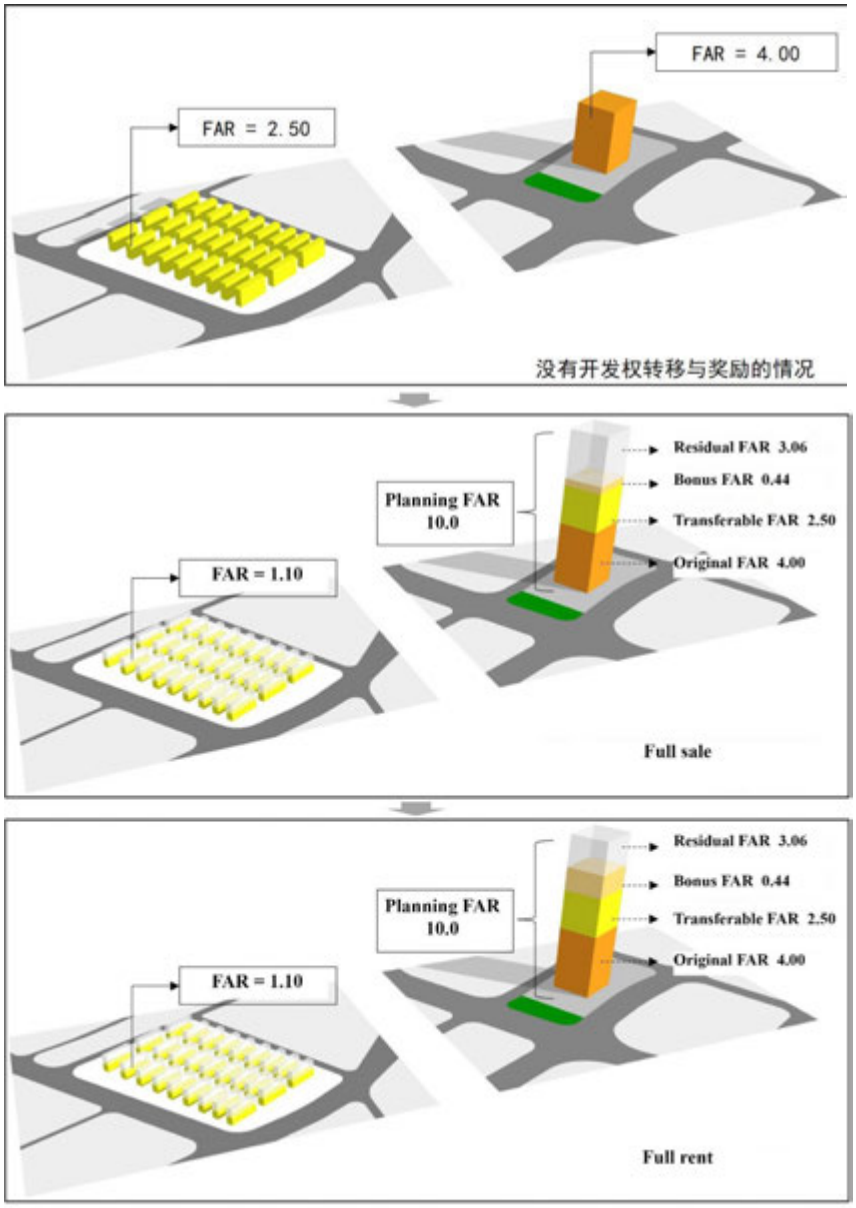

Fig7 Illustration of the changes inFAR before and after TDR&DB for the 17th and 69th neighborhoods in Hongkou District (left: 17th neighborhood, right: 69th neighborhood)

(Source: by the author)

4.3 Discussion of results

Through economic calculation, it is evident that although the selling price of villas in the Hongkou District of Shanghai is relatively high (200,000 yuan/m^2), the sending plot still incurs a loss of -1,121,839,000 yuan during the TDR. In a more general scenario, if only the development rights of historical areas are transferred without maintenance and repair, the selling/leasing price of the sending plot will not significantly increase. TDR may even result in greater losses for the sending plot, making it impossible for market transactions. The "deadweight loss" mentioned earlier is the main reason for the losses incurred by the sending plot. This also empirically explains that relying solely on TDR in the renovation of historical areas cannot effectively enhance overall social benefits within the market mechanism. Furthermore, the receiving plot will experience different profit and loss situations depending on the ratio of rent/sales floor area. If all units are leased, there will be significant economic losses (-2,201,214,000 yuan), whereas if all units are sold, there will be significant economic gains (+4,212,787,000 yuan).

The DB can to some extent compensate for the shortcomings of TDR. Not only can it balance the construction costs of historical areas, but it can also enhance the spatial quality and selling price of buildings and environments within the historical areas. This leads to an overall increase in social benefits, reaching up to 3,710,023,000 yuan (while a loss of -2,708,013,000 yuan occurs if all units are leased). Additionally, through calculation, it can be observed that the operational mode of the building has a significant impact on the return rate. Considering the future fluctuations in the usage of office buildings, a cautious approach should still be adopted in handling the DB.

The planned FAR for the receiving plot after the TDR&DB should ideally be around 7.0-8.0. However, the actual planned FAR is 10.0. The main reason for the residual FAR of 2.0-3.0 is that the local government is strongly motivated to increase the FAR to obtain more land fees to offset the costs of demolition and relocation. Another reason is that the planned FAR for the receiving plot is pre-set according to the urban design rather than based on the results of the assessment of TDR&DB.

5. Further Revision and Suggestions

5.1 Revision 1: Back to Public Interest Orientation of TDR&DB

In comparison to local governments, developers are more likely to accept the economic valuation results of TDR&DB. This is because the reduction in FAR reduces the cost of purchasing land, and developers do not need to excessively pursue development rights. They only need to ensure sufficient rent/sale income in the later stages of development. However, from the perspective of local governments, this may not meet their funding gap for demolition and relocation. Unlike Western countries, China cannot increase revenue through property taxes. This exacerbates the difficulty of completing demolition and relocation at the government level. Many local governments resort to seek higher FAR through the TDR&DB in order to obtain "profits" or "income" for government finance. However, this creates an false illusion of FAR. According to Professor Zhao Yanjing's viewpoint, the "cash flow" brought about by increasing FAR cannot be counted as "income" but rather as "financing." Increasing financing levels without synchronously improving the quality of public services will damage the net assets of all original shareholders (homeowners in the city) (Zhao, 2023) . It is this false illusion of FAR that prompts local governments to misinterpret the planning policy tool of TDR&DB, turning it into an economic compensation tool to offset land acquisition costs.

The article argues that TDR&DB are oriented towards achieving public interests, aiming to address spatial interest imbalances in specific regeneration scenarios (Zhu et al., 2022). On one hand, there should be restraint the impulse to increase FAR, making TDR&DB back to public interest orientation. For instance, in the regeneration of 17th and 69th blocks, TDR&DB can not only balance the construction costs of preserving historical charm but also enhance the spatial quality and sale price of buildings within the preserved areas. Additionally, they can generate cash-flow income in receiving plots, thereby enhancing overall societal benefits. On the other hand, local governments should explore a shift from the traditional demolition model to rights adjustment model. This involves reorganizing and adjusting the spatial rights before and after regeneration while preserving the spatial rights of original residents, significantly reducing the costs of demolition.

5.2 Revision 2：A New Way For Introducing TDR In China

From the perspective of international experience, the TDR system is designed to optimize spatial resources by coordinating the "unused development rights" from a comprehensive development perspective. However, under China's collective land management system, the concept of “unused development rights” can be considered nonexistent. In contrast, in countries with private land management system in the West, although unused development rights belong to the land holders as legitimate rights, their use still requires authorization from local governments (Chen&Qi, 2023).

This means the utilization of development rights needs to be approved and regulated by local governments through planning, permitting, and project approval processes. From this perspective, whether unused development rights exist or not, dynamic adjustments of development rights can still drive urban regeneration. Therefore, the introduction of TDR system in China is not about simply copying or imitating Western systems, but rather about understanding its fundamental role and adapting it to the local context.

Urban regeneration involves the reconfiguration of overall spatial resources, aiming to optimize the functional layout of the city and enhance the value of lands. The entire process of urban regeneration is essentially a process of reconfiguring, readjusting, and realizing development rights (Zhou & Zhuo, 2023).

Therefore, urban regeneration requires continuous, frequent, and dynamic adjustments of development rights. There are three main pathways for dynamically adjusting development rights in urban regeneration:

1) **spatial growth model:** By increasing development rights (FAR), the urban spatial layout can be optimized, achieving compact and intensive urban development and maximizing effective land use.
2) **spatial optimization model:** In situations where development rights (FAR) remain largely unchanged, this approach promotes the efficient use of low-efficiency land and upgrades its functions. It helps alleviate pressure on transportation, municipal services, and infrastructure in central urban areas, reducing negative impacts caused by urban land layout.
3) **spatial protection model:** Under strict limitations or even reductions in development rights (FAR), this approach focuses on protecting and maintaining

public resources such as historical buildings, natural resources, green spaces, and parks in the city. It aims to enhance the cultural and natural environmental characteristics of the city.

Following this three patterns of dynamically adjusting development rights should be a new and reasonable approach to introducing the TDR system in China.

5.3 Revision 3：More Refined Valuation Method for DB

It is evident that market developers can gain significantly higher economic benefits through DB. The total income without TDR&DB (calculated based on ordinary residential properties at 100,000 yuan/m^2) can reach up to 344.982 million yuan at most, while the total income with TDR&DB can reach up to 3,710.023 million yuan at most, nearly 10 times higher. Therefore, market developers should make more special public contributions to the future development of the area. The basic and mandatory public facilities that cannot cover all needs. Local governments can specify and clarify the special public contributions of market developers in the planning regulation.

One misconception in China's DB system is n the oversight of the policy context of "special public contributions," wrongly including some basic and mandatory public facilities in the DB system. This has led to the "misuse" of DB system. Special public contributions can include elderly/child-friendly facilities, walkable neighborhood facilities, low carbon environmental facilities, resilient safety facilities, improvement of central urban area spaces, enhancement of central urban area functions (facilities required for future public welfare development), landscape enhancement, historical preservation (especially in non-historical districts), etc.

To accurately account for "special public contributions," the core principle is that the economic benefits obtained through DB should be consistent with the construction costs required for that specific public contribution. It is recommended to introduce the concepts of "DB Coefficient" and "DB Volume", and conduct economic valuation for each type of "special public contribution." Additionally, establishing technical standards can help avoid waste of urban resources and prevent ineffective construction (Zhuo & Zhou, 2023).

5.4 Revision 4：Reconsidering the External Effects of TDR&DB

It's also essential to consider external effects of TDR&DB on surrounding areas (Costonis, 1973) . Typically, TDR&DB involve transferring all "unused development rights" to the receiving plots, allowing which to significantly exceed the original FAR. This sometimes even doubling the FAR, leading to significant negative external effects on transportation facilities, public amenities, infrastructure, landscape, and the housing market. It's necessary to accurately calculate the external effects on the receiving plot based on economic theory when implementing TDR&DB. Currently, due to a lack of quantitative research on these negative external effects, TDR&DB often face criticism for potentially leading to excessive development.

Additionally, the location selecting of receiving plots can help mitigate the impact of negative external effects. For example, in the 17th and 69th blocks, the receiving plot is situated in the North Bund area, which serves as the core carrier of global urban functions in Hongkou District. This area falls under specific policy regulations, effectively reducing the occurrence of the negative external effects. At times, multiple receiving plots can be designated to balance the cost and benefits of special public contributions.

Note ①: Shanghai's specific policy areas include the Central Activity Zone (CAZ), public central areas, innovative function clusters, strategic reserved areas, etc.
Note ②: Volume refers to the total floor area of land for development, and is also an important indicator to measure the amount of development rights.

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A Framework for Analysing Physical Form Outcomes of Value Capture Paths of Regeneration Projects in Residential Historic Areas

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Keywords

Value Capture, Physical Form, Residential Historic Area, Regeneration Project

Abstract

This study develops a framework to analyse the impact of value capture paths on physical form outcomes in residential historic area regeneration projects. The framework, using four independent variables: adjusting property rights, changing use, increasing intensity, and improving quality, and five dependent variables: plot form, building type, number of building floors, building density, and setback distance, is applied to the XIAOXIHU historic area in Nanjing, China. The findings reveal that the same planning control conditions can yield different spatial form outcomes, largely explained by value capture paths. The framework is informative for both planning and policy design.

1. Introduction

1.1 Regeneration Projects in Residential Historic Areas

The regeneration mode of residential historic areas can be broadly categorized into overall redevelopment and progressive regeneration (Ministry of Housing and Urban-Rural Development, 2021). The former is usually led by the government or developers, moving out all or most of the residents by means of expropriation, and carrying out shock-style overall demolition and construction; while the latter is implemented by a diversity of stakeholders, with property rights as the unit and the willing of the residents as the basis, and carrying out gradual regeneration. In recent years, with the increasing awareness of cultural conservation and property rights, "small-scale, progressive" has gradually become a positive guide for the regeneration of historic areas (WANG et al, 2023).

1.2 Regeneration Project as Systematic Social Practice

The conservation and regeneration of historic areas is a systematic social practice that involves regeneration policies, resource allocation, planning and design, construction, operation and maintenance, and community governance, etc (TANG, 2020). The "small-scale and progressive" regeneration model involves multiple interests and complex property relations. Literatures on this topic are scattered in the fields of planning, architecture, historic conservation, municipal government, economy, society, policy management and other disciplines, forming relatively independent knowledge accumulation from different perspectives. However, the working mechanism of spatial regeneration practice is not a simple combination of disciplinary knowledge, but rather a multi-sectoral, multi-actor game and collaborative behavior under the intervention of regulations and policies.

1.3 The Gap in Existing Literature

Most of the existing relevant results exist in the form of knowledge in various disciplines, explaining the mechanism of the interaction between non-physical factors and the physical environment from different academic perspectives. However, it is difficult to utilize the mechanism theory in the planning and designing practice of physical space by only revealing "the inner working mode of each element as well as the operation rules and principles of interconnection and interaction under certain conditions" (Tennekes et al, 2015). It has been pointed out that the role of complex social practices on space is centered on the issue of value capture paths. Therefore, it is necessary to follow the organizational path of practical work, integrate theoretical methods scattered in various disciplines, and establish the correlation between value capture paths and changes in the physical form.

1.4 Objective of This Study

This study intends to build a framework to analyze how the value capture path of residential historic area regeneration projects affects the physical This study intends to build a framework to analyze how the value capture path of residential historic area regeneration projects affects the physical form outcomes. Firstly, through the literature review, the analytical framework of Value Capture Paths and Physical Form of Regeneration Projects is established, and the hypothesis of correlation analysis is put forward; secondly, the research hypotheses are verified one by one through the study of 32 Regeneration Projects in the XIAOXIHU Block, Nanjing, the research hypotheses are verified one by one; thirdly, the roles of adjusting property rights, changing use, increasing intensity, and improving quality on the physical space are discussed; finally, the Implications for planning are discussed. Third, the role of adjusting property rights, changing use, increasing intensity, and improving quality on physical space are discussed; and finally, Implications for planning regulation and supporting policies are discussed.

2. Literature Review and Synthesis

2.1 Value Capture Paths of Regeneration Projects

Game theory, rent gap theory, and other theories have been trying to elucidate the financial equilibrium behind regeneration projects, and Zhao (2021) simplifies this financial equilibrium by summarising the value capture paths of urban regeneration into four categories: adjusting property rights, changing use, increasing intensity, and improving quality. (1) Adjusting property rights. For historical reasons, property in China is divided into two types: "property rights", which can be traded freely, and "limited property rights", which can only be used but cannot be traded freely. "Changing from "small property rights" to "large property rights" will bring additional premium. (2) Changing use, different uses of land bring different revenues and are priced differently in the market, and if the conversion is realised through planning, the corresponding progressive value can be derived from it; (3) Increasing intensity, through the increase in floor area ratio, from the additional floor area ratio to obtain the financing required for urban regeneration; (4) Enhancing quality, old properties often no longer reflect the appreciation of the land, if the quality is upgraded, the missing land value can be captured through property appreciation.

In reality, specific urban regeneration projects can be combinations of the above four paths. Planning and design is to maximise the difference in value of the assets before and after the

regeneration by choosing different combinations of schemes according to the specific conditions of the project, so as to create conditions for achieving financial balance of the regeneration project. Different choices will lead to completely different results after the regeneration.

2.2 Physical Form of Regeneration Projects

The classical urban morphology theory divides physical space into three hierarchies: streets, plots, and buildings (Conzen, 1960). Considering that the unit of this study is a regeneration project, the elements of the street level are not considered.

Indicators at the plot level are mainly referred to the study of Bobkova (2021). who suggest that plot form can be understood through three indicators: plot area, street frontage ratio, and compactness, of which the most crucial indicator is plot area. The geometric measure that captures the potential to host diverse strategies is simply plot area. Plots provide an essential link between the spatial and non-spatial parameters of cities, such as land-uses and property.

The indicators of the building hierarchy are mainly based on the study of Dong (2022). who, after analysing the building types in the XIAOXIHU Block over time, found five basic building types. Type A: courtyard houses from the Ming and Qing Dynasties (before 1912), Type B1: single-family house from the Republic of China era (1912-1949), Type B2: townhouses from the Republic of China era (1912-1949), Type C1: courtyard houses built in the 1950s-1960s (traditional layout), Type C2: courtyard houses built in the 1950s-1960s (modified layout).

In addition, three commonly used planning control indicators, namely number of floors, building density, and setback distance, are introduced in this study for the sake of interface with planning and design practice.

2.3 The Causal Relationship between Value Capture Paths and Physical Form Outcomes

According to above referenced studies, this study proposes a causal hypnosis between value capture paths and physical form outcomes. The hypnosis of association between independent and dependent variables is shown in Figure 1.

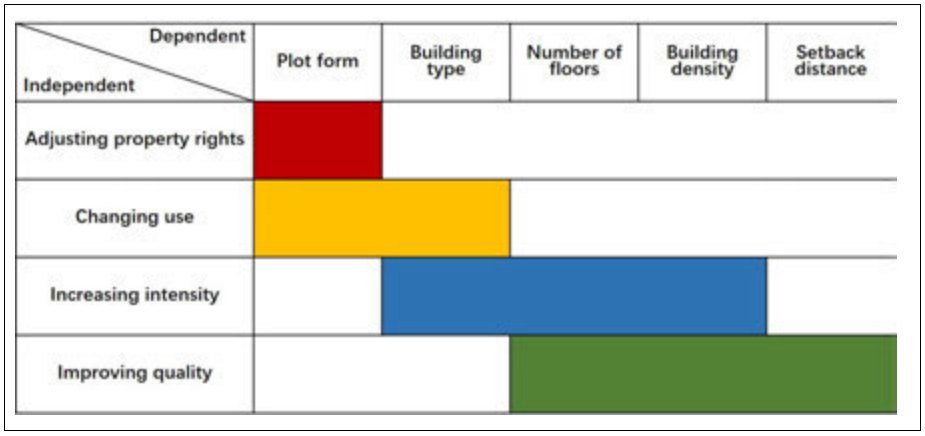

Figure 1. The Framework for Analysing Physical Form Outcomes of Value Capture Paths

3. Case Study Location and Data

3.1 Case Study Location and Overview

The XIAOXIHU Block (DAYUFANG Lane Historic Area) is located in the southern historic district of Nanjing (Figure 1). In 2015, the Nanjing Municipal Bureau of Planning and Natural Resources, as the main body of planning and management, explored the conservation and regeneration strategy of the XIAOXIHU Block as a pilot project. In 2016, the People's Government of QINHUAI District designated the district state-owned enterprise Nanjing Historic District Preservation and Construction Group Limited Liability Company (the "Historic Preservation Company") as the implementation body. In the same year, we undertook the planning and design work. The progressive regeneration changes in the XIAOXIHU Block are shown in Figures 3 and 4.

Figure 2. The XIAOXIHU Block in the southern historic district of Nanjing

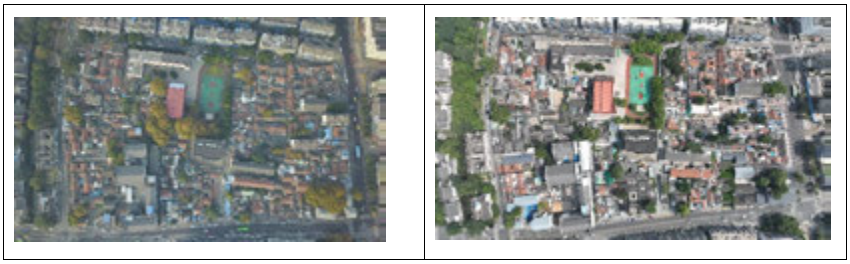

Figure 3. The XIAOXIHU Block before Regeneration
Figure 4. The XIAOXIHU Block after Regeneration

The Detailed Construction Planning for Micro-Regeneration of XIAOXIHU Block (DAYUFANG Lane Historic Area), QINHUAI District, Nanjing (hereinafter referred to as the Micro-Regeneration Plans) is the main planning basis for the progressive regeneration of the XIAOXIHU Block, and it has set up a two-level planning and control system for the different conservation and regeneration challenges of the streets, alleys, plots and buildings (Figure 5): the higher level is the 15 "Planning Control Units" surrounded by the red lines of the streets and alleys, specifying the basic control requirements; the lower level is the 127 "Micro-Regeneration Implementation Units" based on property plots, integrating the historic texture, property rights, and willingness to relocate., and the boundaries of the units and some of the control requirements can be dynamically adjusted during the process of implementation (Figure 6).

Figure 5. Two-level control unit
Figure 6. Micro-regeneration guidelines

The spatial distribution of the 32 regeneration projects in the XIAOXIHU Block is shown in Figure 7. By 2021, the first set of construction projects (P1-P17 in Figure 7) have been completed and put into use, and the main implementation contents include the regeneration of historic streets and infrastructure, the regeneration of courtyard buildings voluntarily vacated by the subject of property rights, and the regeneration of buildings to which the subject of property rights has moved back to their original locations. From 2021 to the present, led by the demonstration of the first phase of the regeneration, the subsequent projects (P18-P32 in Figure 7) will continue to be carried out.

The implementation of the regeneration projects follows the principle of "who finances, who benefits". The management agent coordinates the whole regeneration process, and according to the assessment of dangerous buildings, provides different proportions of subsidies to the owner of the property right who renews the building independently; the implementation agent acquires the building or participates in investing in part of the regeneration independently, provides public services, and obtains different degrees of balance through the sale and lease of space; the owner of the property right contributes to the regeneration of the real estate held by the owner and pays the land premium in accordance with the regulations, and obtains the benefits from the change of land price, the regeneration of the house, and the increase of the capacity of the building. capacity increase, etc.

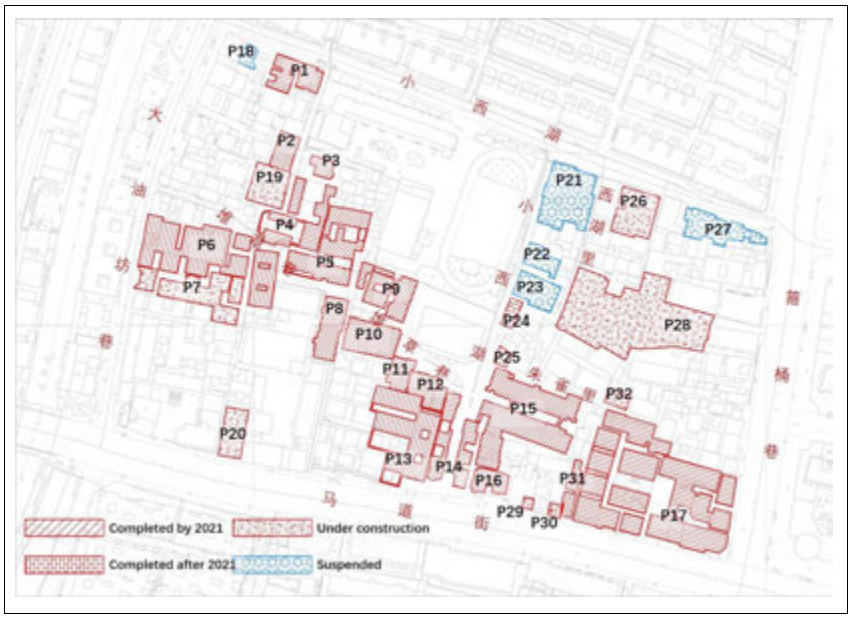

Figure 7. The 32 construction projects in the XIAOXIHU Block

3.2 Case Study Data

Through the interviews with the stakeholders and the analysis of the construction project drawings, the value capture paths and physical space changes of the 32 regeneration projects were obtained as shown in Table 1.

Table 1. Value Capture Paths and Physical Form Outcomes of 32 Regeneration Projects in the XIAOXIHU Block (Be=Before, Af=After, CU=Changing Use, II=Increasing Intensity, IQ=Improving Quality)

Projects and Value Capture Path		Plot Area/㎡		Building Type		Floors		Setback distance/m		Building density	
		Be	Af	Be	Af	Be	Af	Be	Af	Be	Af
P01	CU	3910	4090	D	D	3	3	1.3	1.9	0.65	0.67
P02	CU	191	197	A	A	1	1	0.0	0.0	0.79	0.96
P03	CU	151	151	B1	B1	1	1	0.0	0.0	0.92	0.92
P04	CU	787	787	C1& C2	C1& C2	1	1	0.0	0.0	0.54	0.28
P05	CU	881	875	C1& C2	C1& C2	2	1	0.0	0.0	0.84	0.64
P06	CU	1448	1557	A	A	2	2	0.0	0.0	0.88	0.73
P07	CU	734	865	E	E	1	2	2.2	2.7	0.91	0.93
P08	II+IQ	328	328	D	D	3	4	2.0	2.0	0.89	0.89

P09	CU+IQ	450	450	A	A	2	2	0.0	0.0	0.65	0.85
P10	IQ	389	389	A	A	1	1	0.0	0.0	0.60	0.60
P11	CU	171	171	C1&C2	C1&C2	2	2	0.0	0.0	0.70	0.64
P12	CU+IQ	238	252	C1&C2	C1&C2	2	2	0.0	0.0	0.72	0.75
P13	CU	696	781	A	A	1	1	3.4	3.4	0.67	0.68
P14	II+CU	1295	1295	C1&C2	C1&C2	1	2	6.8	8.3	0.37	0.54
P15	CU	1886	1886	D, C1&C2	D, C1&C2	5	4	0.0	0.0	0.50	0.50
P16	CU	185	175	C1&C2	C1&C2	2	2	6.7	7.1	0.81	0.48
P17	CU	3451	3451	A, E	A, E	3	3	2.6	2.6	0.60	0.60
P18	IQ	86	62	A	A	1	2	2.3	2.1	0.60	0.82
P19	II+IQ	345.6	345.6	C1&C2	C1&C2	1	2	0.0	0.0	0.80	0.88
P20	II+IQ	267	70.4	A	A	1	2	3.3	3.3	0.74	0.98
P21	IQ	673	673	A	A	2	2	0.0	0.5	0.79	0.73
P22	IQ	152	153	C1&C2	C1&C2	2	2	0.0	0.7	1.00	0.98
P23	IQ	316	270.5	A	A	2	2	0.0	0.2	0.93	0.82
P24	CU	83	83	C1&C2	C1&C2	1	1	0.0	0.0	0.84	0.85
P25	IQ	26.5	59	C1&C2	C1&C2	2	2	0.0	5.6	0.92	0.44
P26	CU	425	417	A	A	1	1	0.0	0.0	0.99	0.83
P27	IQ	596	400	C1&C2	C1&C2	2	3	0.0	0.0	0.81	0.77
P28	CU	1558	1680	C1&C2	C1&C2	1	2	0.0	0.0	0.82	0.30
P29	CU	39.7	39.7	C1&C2	C1&C2	2	2	4.3	4.3	0.92	0.92
P30	CU	32	35	C1&C2	C1&C2	2	2	2.7	1.7	1.00	1.00
P31	II+CU+IQ	192	186	A	A	1	2	2.7	3.5	0.72	0.73
P32	II+IQ	84.1	84.1	C1&C2	C1&C2	1	1	0.0	0.0	1.00	1.00

4. Results

4.1 How Adjusting Property Rights Affect Physical Form Outcomes

The impact of adjusting property rights on the physical space is mainly reflected in a significant increase in plot area. There are deeper reasons behind this phenomenon:

One is the loss of the rules and order of traditional urban tissues, which is strongly adjusted by planning control. As shown in Figure 8, the XIAOXIHU Block had 117 plots in 1936, and after the founding of the People's Republic of China (PRC), as the speed of urban housing construction could not meet the needs of the surging population, an original plot or even a building was sub-leased to a few to a dozen households. By 2016, 216 plots existed in The XIAOXIHU Block (Figure 9). Planning control (Figure 5) delineated 15 planning control units and 127 micro-regeneration implementation units, which directly led to an increase in plot area.

Figure 8. The 117 plots in the XIAOXIHU Block in 1936
Figure 9. The 216 plots in the XIAOXIHU Block in 2016

This trend is also exacerbated by the acquisition of houses by implemention agent with a background in state-owned enterprises, which are then converted and reused as a whole. A large number of projects in the XIAOXIHU Block have been undertaken by state-owned enterprises that acquire residential housing and lease it out for rent after overall regeneration. The need for market operation leads to the fact that the scattered and fragmented plots cannot be directly used by hotels, restaurants and other businesses, so the increase in plot area is an inevitable result of this implementation path. Typical projects such as P17, which originally had a number of plots (Figure 10), were later acquired and built as a hotel (Figure 11).

Figure 10. The several plots before regeneration
Figure 11. The HUAJIANTANG hotel after regeneration

4.2 How Changing Use Affect Physical Form Outcomes

Changing Use within the XIAOXIHU Block is mainly reflected in the change of residential use to commercial use or public use, and apart from the increase in plot area mentioned in section 4.1, another notable result in terms of physical form is the increase in the building setback distance. This result occurs in P01, P07, P14, P16, and P31, and the reasons behind it are equally twofold:

One lies in the fact that change of use projects is mainly implemented by state-owned enterprise, which are subject to stricter government regulation. With a dense residential population and high building density within the historic area, buildings are often connected to each other or have very little space between them, and as traditional buildings are mostly wooden structures, it is easy for fires to spread in patches in the event of a fire. For the XIAOXIHU Lot, which is over 300 meters wide in the east-west direction and about 200 meters wide in the north-south direction, the twisting and narrow internal alleyways must assume the function of fire escapes. These projects implemented by state-owned enterprise therefore need to give priority to setting back a sufficient distance to meet firefighting needs.

The second lies in the need for larger outdoor spaces for change of use for commercial purposes. These outdoor spaces are uniformly designed as green spaces (e.g., Project P11, Figure 12), shop fronts (e.g., Project P14, Figure 13), etc. to increase the popularity of retail and catering, thus indirectly bringing about an increase in the setback distance.

Figure 12. Green space outside the shops of the P14 in the XIAOXIHU Block
Figure 13. Seating outside the shops of the P11 project in the XIAOXIHU Block

4.3 How Increasing Intensity Affect Physical Form Outcomes

The morphological outcome of increased intensity is either increased height or increased density, but these two outcomes occur in two separate implementation scenarios.

Most of the projects with relatively simple property rights relationship and not affecting the sunlight conditions of other residents have adopted the way of increasing building height. Among P08, P18, P19, P20, P27, P28 and P31, the P27 is most typical. The project is adjacent to the street on the north side, which will not have any impact on the sunlight, ventilation and other conditions of the rear side, and therefore the way of increasing the height of the storey has been adopted directly. In addition, the ownership of the site is relatively simple, and there is no problem of not being able to increase the height due to divergent views of residents within the same plot.

On the other hand, projects with complex property rights, or with sensitive sunlight conditions in the surrounding plots, tend to adopt the approach of increasing density. Typical projects such as P20, the south brick house in the east-west courtyard is partly owned by government, in the north, an originally timber-framed three-bay old house housing three separate families (Figure 14). The original construction plan was to increase the capacity by adding more floors, but later, due to the objection of the residents on the north side of the site, the only way to increase the capacity was to slightly raise the ridge height and add mezzanine floors (Figure 15).

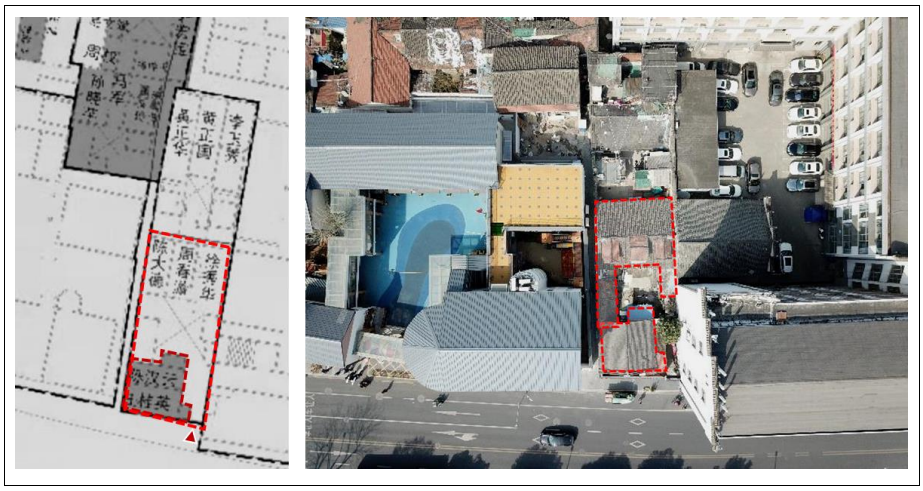

Figure 14. The several plots before regeneration

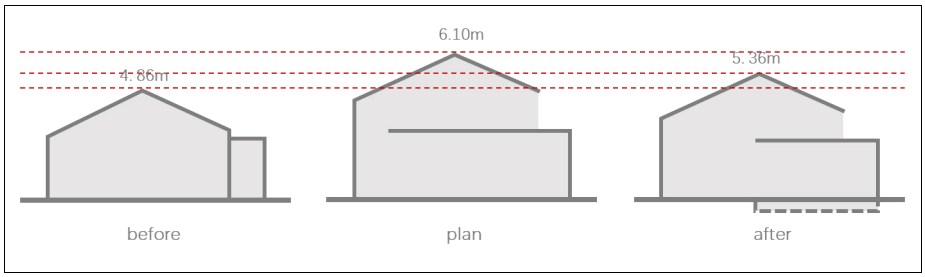

Figure 15. The HUAJIANTANG hotel after regeneration

4.4 How Improving Quality Affect Physical Form Outcomes

The effect of improving quality on the physical form is relatively indirect, with two outcomes: increased setback distances and reduced building density. Typical projects such as P21, P22, and P23, where state-owned enterprises plan to obtain funds through loans and vacate the property rights subject to be converted into high-end housing for sale, have a high demand for the quality of living environment. The project has changed from a mix of multi-family residents (Figure 16) to a mix of commercial and residential upscale housing (Figure 17), which is still in progress, and the setback spacing and building density of the upscale housing is significantly lower than before the update.

Figure 16. Mixed multi-family living before regeneration
Figure 17. Mixed commercial/residential high-end residences after regeneration (rendering)

5. Discussion and Conclusion

Despite the fact that the physical form of residential historic areas is strongly controlled by planning, significant effects of spatial value-added pathways on material forms can still be seen. Specifically, adjusting property rights will lead to an increase in the plot area, the change of use will lead to an increase in plot area and setback distance, increasing intensity will lead to an increase in the number of floors or building density, and increasing quality will lead to an increase in the setback distance and a decrease in the building density.

The value capture path does not determine the final physical form, but it does lead to certain morphological outcomes being more likely than others, which sheds new light on planning and design efforts and the design of regeneration policies. For planning design, it is important to carefully evaluate the morphological outcomes of planning control conditions (height, density, and floor area ratio) in order to protect the historic value of the historic area; for policy design, it is important to interact positively with planning design, which on the one hand enables the planning design objectives to be realized, and on the other hand avoids excessive policy dividends that lead to the upheaval of the historic form.

The value capture path - physical form outcome study in this research complements the single causal explanation of planning control - built form, which does not fully explain the particular direction of variation in physical form. This paper complements the institutional literature in planning and urban studies as it does not only focus on the interaction between stakeholders, but also examines the link between this interaction with physical form.

Acknowledgements

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Navigating complexity: Exploring land planning and management challenges in Morocco

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Abstract

This paper investigates the complexities of land management in Morocco, highlighting the shortcomings of its land tenure system and the challenges stemming from planning techniques. It examines the legal, institutional, and operational frameworks, revealing how limited consideration of land characteristics in planning processes leads to significant implementation constraints. The analysis addresses governance issues, land programming across multiple levels—national sectoral, strategic territorial, and urban—and the financial and legislative obstacles to land mobilisation. Additionally, this paper assesses the current urban policy to underscore the gaps in land resource optimisation. Finally, it identifies sustainable land use practices and proposes strategies for revitalising land management in Morocco, grounded in international standards and best practices.

Key words: Land governance, planning processes, urban policy.

1. Introduction

Land tenure is defined as “the set of relationships between people concerning access to and control over land and natural resources” (Lavigne Delville and Le Meur, 2016, p.84). Shaped by history, it has evolved through customary laws and unique local practices specific to each country. It also represents a social dynamic, mirroring the governance and cultural management of the society. Land governance defines property rights and how they are administered by stakeholders. Additionally, it intersects with several public policies across different scales of territorial development (Land and Development technical committee, 2009).

In Africa, land tenure sits at the crossroads of various imperatives for territorial sustainability, including food supply and natural resource protection (Gueringer, Perrin and Barthes, 2017). Land serves a crucial social function as a source of attachment and identity, and as a means of maintaining ties among managing communities (Mansion and Broutin, 2014). The continent is experiencing a rapid demographic growth, with projections indicating that the population will reach 2.8 billion by 2060 (Canning, Jobanputra, and Yazbeck, 2016). This growth is accompanied by swift urbanisation, which increases the pressure on urban and rural lands.

Mansion and Broutin (2014) highlight the complexity of African land tenure legislation, characterised by the coexistence of customary practices and modern regimes. Land structures exhibit a notable duality, with state-managed public lands on one side and traditional customs, which sometimes lead to social conflicts, on the other. Modern practices, established during colonisation, were based on the privatisation of property and initially favoured colonists and elites (Lavigne Delville and Le Meur, 2016).

Historically, colonisation established a legal basis for property, introducing the concept of the state domain, whereby the state became the owner of unregistered lands while preserving certain customary rights for land use and exploitation (Comby, 2007). This system has resulted in a complex legal framework that, despite independence, has not led to significant structural reforms in many African countries. Colonial regulations were maintained, allowing governments to retain control and redistribute land power (Chouquer, 2009).

The diversity of rules implies that local stakeholders have greater governance flexibility, which encourages competition among regulatory bodies (Lavigne Delville and Le Meur, 2016). This situation leads to arbitrary management practices that disproportionately harm disadvantaged populations. As a result, African land tenure systems remain characterised by legal complexity and high institutional risks, stemming from diverse and often contradictory regulatory frameworks. This context underscores an urgent need for reforms to improve land management and mitigate the risks associated with these systems (Mansion and Broutin, 2014).

In Morocco, land is a strategic priority for economic growth and reducing socio-spatial inequalities (Economic, Social, and Environmental Council, 2019). Gradually, several actions have been undertaken to amend the Kingdom's land policy. In December 2015, reflective discussions were initiated at the National Land Tenure Conference, held under the high patronage of His Majesty King Mohammed VI. The Royal Letter addressed to participants called on the government to design and implement a National Land Strategy, which is currently under development. Additionally, the legal framework is being progressively reformed to align with new socioeconomic requirements (Economic, Social, and Environmental Council, 2018).

The Moroccan land tenure system is characterised by a dual regime of registered and unregistered properties, with a diversity of legal statuses, each governed by its own institutional and regulatory framework. Land issues involve numerous stakeholders and decision-making commissions, and the rules for property transfer are varied and often complex (El Ouagari, 2021).

Furthermore, national sectoral plans are designed without a strategic orientation framework, leading to difficulties in intersectoral convergence (Economic, Social, and Environmental Council, 2019). Their lack of coherence, particularly regarding land issues, hampers operationalisation. Similarly, territorial planning documents are created without adequately addressing land issues. Major projects are often planned on parcels without an understanding of their legal and physical constraints, which hinders realisation. This also affects urban planning documents, as they are frequently developed using outdated land maps or without proper land surveying (Valyans Consulting and AESA Europe, 2022).

Consequently, the lack of control over land data during the planning process leads to discrepancies between projections and actual outcomes. Securing land plots poses a substantial obstacle to deploying national strategies and territorial documents. This difficulty stems from multidimensional dysfunctions, including operational, legislative, financial, and governance issues (Guezzar, 2019).

Therefore, this paper aims to explore the shortcomings in land planning and identify ways to improve land optimisation. Its objective is to examine the land tenure system in Morocco and pinpoint the factors contributing to challenges in land management stemming from planning techniques. The organisation of this paper is as follows: Section 2 highlights the legal framework, stakeholders, characteristics, and mobilisation processes for each legal status,

exposing the complexity of the land tenure system and its regulatory and governance shortcomings. Section 3 analyses land programming at three levels of planning: national sectoral, strategic territorial, and urban. This section demonstrates the limited consideration given to land characteristics during the planning process, leading to constraints in implementing planning documents. Section 4 examines factors contributing to land management challenges within the urban planning system, presenting financial, legislative, and governance issues affecting land mobilisation. It also details the current urban policy, highlighting gaps in land resource optimisation. Finally, the conclusion summarises key findings and outlines approaches to addressing land issues on an international scale. The aim is to identify sustainable land use planning and management practices to instil a new dynamic in Morocco.

This paper relies on a literature review of land tenure issues in Africa and Morocco, drawing on a diverse range of published sources. It is grounded in a detailed documentary analysis of legislative and regulatory frameworks pertaining to land management and planning in Morocco. Additionally, it builds on an examination of national, territorial, and urban planning documents, such as the National Strategy for the Development of Logistic Competitiveness 2010-2030, the Casablanca-Settat Regional Spatial Planning Scheme, the Casablanca-Settat Regional Development Programme 2016-2021, and the 2012 Settat Development Plan.

2. Complexity of Morocco's land tenure system

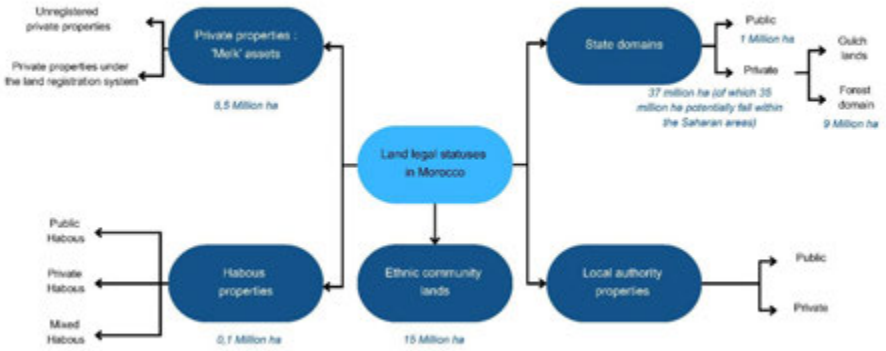
Morocco's land tenure system combines traditional Muslim law with the modern land registration law established in 1913, creating a dual legal framework for registered and unregistered property (M'Hasni, Feljy, and Khalali, 2003). A range of legal statuses, each governed by specific laws, processes, and stakeholders, further characterises the land structure. This section explores the distinctive features of each status, addressing the limitations within the legal framework and constraints on land mobilisation. In addition, it examines limitations in land governance.

2.1 Specific features of land tenure legal statuses

Morocco's history has significantly shaped land access and property rights. In the pre-Islamic era, land was collectively held by tribes, with no concept of private property. The introduction of Islam in the seventh century created a distinction between land owned by the Muslim community and land managed by beneficiary tribes (Rhomri Mounir, 2019). During the protectorate period, further changes occurred, separating land managed by the administration from privately owned land. The land registration system, implemented in 1913, officially recognised individual ownership (Economic, Social, and Environmental Council, 2019).

Today, the registration process identifies assets and specifies the associated rights. However, it remains optional, resulting in a dual land tenure system that combines Muslim and modern laws. This duality creates insecurity in real estate transactions, as unregistered property lacks publicised rights and faces restrictions on access to financing. Consequently, limited land registration undermines land management and weakens the security of property ownership. Rhomri Mounir (2019) notes that this widespread lack of registration negatively impacts the overall security of property exchanges. Furthermore, the legal landscape is complex, with numerous statuses to consider (Figure 1) and an extensive legislative and regulatory framework. However, this system has limitations, including intricate rules, varied mobilisation methods, and outdated regulations (El Ouagari, 2021).

Figure 1: Legal statuses of the land tenure system in Morocco



Note: Figure 1 illustrates the various legal statuses of land in Morocco, as detailed in Section 2.1, and specifies their extent in hectares, based on data from the Economic, Social, and Environmental Council (2018).

Private properties, referred to as "Melk" assets, are typically characterised by their alienability, prescriptibility (excluding registered properties), and seizability. These assets may be registered or unregistered and are subject to expropriation for public use. The expropriation process can range from voluntary ownership transfers to forced transfers by the state, such as confiscation or pre-emption. While private investments can facilitate rapid ownership transfers with minimal stakeholder involvement, expropriation for public use is common. However, the management of these properties, especially in rural areas, is often complicated by joint ownership and fragmentation. Additionally, the slow pace of expropriation procedures often stems from compensation assessments by authorities, which frequently fall below market value, leading to legal disputes and delays in final compensation payments to the expropriated party (Millennium Challenge Account Morocco, 2020).

According to El Ouagari (2021), the State's public domain includes properties, such as roads and buildings, that are not privately owned and are deemed inalienable, unseizable, and imprescriptible. These assets may be used for up to 10 or 20 years under certain conditions and can be transferred to the State's private domain if they are no longer needed for public use. However, the laws governing this process date back to 1914 and 1918, rendering the procedure complicated and time-consuming.

The State's private domain (SPD) includes assets that belong to the state but are not part of its public domain. These assets can be registered, expropriated, and mobilised through various means, including amicable agreements or expropriation involving pre-emption, confiscation, declassification, exchange, or donation. To encourage agricultural investments, public-private partnerships may involve leasing or selling land. However, the SPD faces challenges such as low registration rates, insufficient project monitoring, and a lengthy

expropriation process. Moreover, there is no mechanism to replenish the state land reserve, posing a significant issue due to its depletion (Millennium Challenge Account Morocco, 2020).

As stated by Rhomri Mounir (2019), Guich lands are a component of the SPD and were allocated to the military prior to 1912 as a form of compensation, exempt from taxation. These lands are inalienable, prescriptible, and seizable, and can be registered and expropriated in the public interest. However, challenges such as low registration rates and the absence of specific regulations governing their management make it difficult to mobilise these lands for investment purposes (Millennium Challenge Account Morocco, 2020).

The forest domain, a component of the SPD, includes state-owned woodlands, maritime and terrestrial dunes, and sandy dunes. This estate also comprises woodlands managed by local authorities and private individuals, with the state entrusted with management. These assets are inalienable except for cases of public utility and may be expropriated. The process for utilising these assets varies by project, with distraction applied for public utility projects, and temporary occupation or real estate exchange used for other purposes. For large infrastructure projects, expropriation for public utility may be required to transfer assets from the forest estate to the SPD. These processes involve numerous stakeholders (Millennium Challenge Account Morocco, 2020).

Local authority properties are divided into two categories: public and private. The public domain includes spaces such as streets, squares, and parks and is non-transferable, immutable, and cannot be leased for more than 10-20 years. Conversely, private property refers to assets outside the public domain that can be managed through leases, sales, transfers, or exchanges, often by tender or informal means. However, managing these properties is complicated by illegal occupation, compounded by outdated regulations, slow registration processes, and complex procedures. Despite efforts to modernise legislation for communes with Organic Law 113-14 in 2015, the legal framework remains outdated (Millennium Challenge Account Morocco, 2020).

Ethnic community lands, commonly used for farming or grazing and governed by traditional practices, possess unique characteristics, such as being imprescriptible and unseizable, yet subject to expropriation (Decroux, 1977). These lands can be mobilised through either melkisation or alienation, which involves transferring ownership from undivided community ownership to individual private ownership via rights of claim or direct agreements (e.g., partnerships, exchanges). However, despite the modernisation of the legal framework in 2019, mobilising these lands remains challenging due to slow asset clearance and a high volume of court disputes (Millennium Challenge Account Morocco, 2020).

Habous properties are assets held for pious or charitable purposes and are divided into three categories: public, private, and mixed. Public properties are used for general purposes, private ones benefit the settlor's family for up to three generations, and mixed properties combine both purposes (Idllalène, 2013). These assets are inalienable, imprescriptible, and unseizable, but they can be registered, exchanged, or expropriated with the agreement of the Ministry of Habous and Islamic Affairs. They can be mobilised in various ways, such as through donations, exchanges, auctions, tendered leases, and public-private partnerships. However, their management is often hindered by slow registration and numerous disputes, making mobilisation procedures lengthy, restrictive, and subject to the required approval of the supervisory administration (Ministry of Habous and Islamic Affairs, 2010).

2.2 Institutional framework and land governance

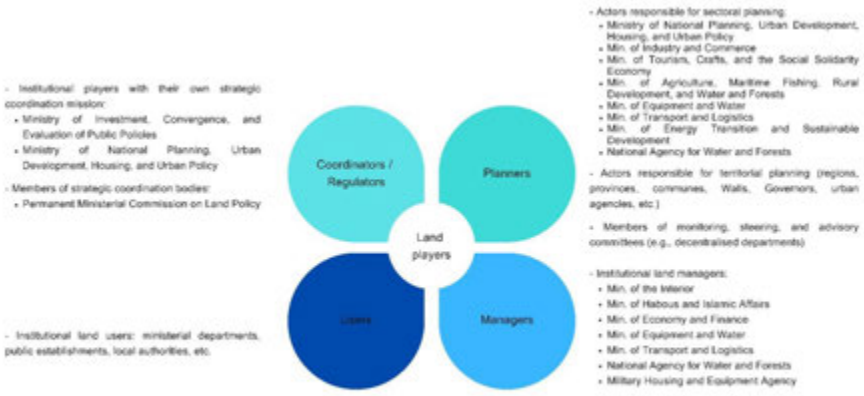
In Morocco, the dual nature of the land regime and the multitude of legal statuses result in numerous stakeholders operating under the jurisdiction of various ministerial departments (Millennium Challenge Account Morocco, 2020; El Ouagari, 2021). Table 1 lists the primary actors for each land status.

Land status	Stakeholders
Melk properties	Individuals or legal entities under private law, along with all entities empowered to expropriate.
State public domain	Ministry of Public Works and Water, Provincial Public Works Departments, Unified Regional Investment Commissions (URIC), and designated public institutions.
State private domain	Ministry of Economy and Finance via the State Domains Directorate, Regional Directorates of State Domains, URIC.
Guich lands	State Domains Directorate, State, Usufructuary Tribes.
Forest domain	Departments, Regional Directorates, and Provincial Services of Water and Forests, URIC.
Habous properties	His Majesty King Mohammed VI, Ministry of Habous and Islamic Affairs, Supreme Council for the Control of Finances of Habous, Constituents, Beneficiaries.
Ethnic community land	Supervised by the Ministry of the Interior (Directorate of Rural Affairs), Ethnic Communities, Beneficiaries, Naibs, Central and Provincial Trusteeship Councils.
Local authority properties	Local Authorities (Regions, Prefectures, Provinces, Municipalities) supervised by the Ministry of the Interior.

Table 1: Main land stakeholders in Morocco.

According to Valyans Consulting and AESA Europe (2022), land actors are divided into four categories: regulators, planners, managers, and users (Figure 2). Regulatory bodies play a key role in coordinating strategies to ensure the highest level of governance. They establish land strategies and oversee their implementation. Planners represent institutional planning bodies, including sectoral, territorial, and urban planners, who program land use and occupation. Managers are landowners, such as ministries and agencies responsible for land administration. Finally, users require access to and acquisition of land plots to fulfil their prerogatives.

Figure 2: Key actors in the land sector, categorised by field of action.



Note: Figure 2 illustrates the key stakeholders involved in land issues, categorised by their field of action. The main actors within each category are listed, compiled based on data from Valyans Consulting and AESA Europe (2022).

There are four levels of governance in Morocco: strategic coordination, sectoral and territorial planning, mobilisation, and monitoring and evaluation. Strategic coordination involves developing public policies that address land issues and align them with one another. However, at this level, coordination and communication between regulatory bodies occasionally lack synergy, resulting in limited convergence of public policies. Sectoral planning is conducted by central departments, often without fully considering local territorial features, which can hinder implementation. The absence of a comprehensive strategy and reference framework sometimes leads to land being programmed individually by each party involved, without cohesive oversight of other departments' actions. Monitoring and evaluation are characterised by systems that require strengthening at all levels of governance. Nevertheless, significant improvements are underway, including the development of the National Land Strategy and its implementation mechanisms, following Royal High Directions (Valyans Consulting and AESA Europe, 2022).

3. Sectoral and territorial planning at odds with actual land use

In Morocco, three distinct levels of planning directly impact land use across different territorial scales. At the national level, ministries conduct sectoral planning to develop cross-cutting and sector-specific strategies, which are subsequently implemented at the territorial level on designated support lands. At the regional level, strategic territorial planning involves formulating development strategies for local authorities, with the spatialisation of these documents significantly affecting land use. At the local level, urban agencies conduct urban planning, creating documents that serve as the primary instruments for land programming (Valyans Consulting and AESA Europe, 2022). This section aims to provide a comprehensive understanding of these three planning levels, highlight their associated shortcomings, and explore the factors influencing land planning and management.

3.1 Current state of sectoral planning

Since 2000, Morocco has implemented national sectoral strategies, recognising land as a “strategic resource” essential to achieving the country’s development objectives across various industries (Economic, Social, and Environmental Council, 2019). However, these national strategies have consistently fallen short of their initial objectives, with notable discrepancies between their ambitions and actual outcomes (Economic, Social, and Environmental Council, 2014a).

For example, the National Strategy for the Development of Logistic Competitiveness 2010-2030 was designed to improve the national economy’s competitiveness by establishing an integrated network of “Multi-Flow Logistic Zones”. Yet, by 2019, the implementation rate was only 14 percent, due in part to the weak institutional positioning of the Moroccan Agency for Logistic Development and the absence of relevant legislative and regulatory texts (Moroccan Court of Accounts, 2020). The successful realisation of this strategy requires the mobilisation of 3,300 hectares of land (Ministry of Equipment and Transportation, 2010). To date, the only developed area is the logistics platform at Zenata, overseen by the National Society of Transport and Logistics and facilitated by land ownership. Securing appropriate land for logistics platforms remains a crucial issue, and logistics operators with access to such land play an essential role in effective planning (Debrie and Mareï, 2019).

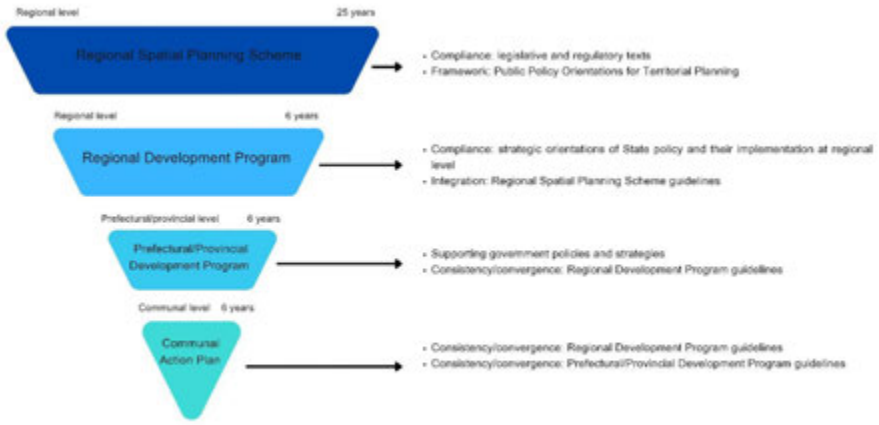
Sectoral planning at central and regional levels faces several challenges. At the central level, various ministerial departments and public agencies design national strategies intended for territorial application at the regional and local levels by decentralised ministerial departments. However, land management presents a significant barrier to effective implementation. The lack of coordination between sectors often restricts land mobilisation, weakening the territorial deployment of strategies (Valyans Consulting and AESA Europe, 2022).

According to the Special Commission on the Development Model (2021), there is a notable lack of cross-sectoral coordination and consultation between national and local levels, resulting in a top-down approach that inadequately incorporates regional and local stakeholders. This disconnect leads to strategies misaligned with on-the-ground realities, creating operational constraints. Additionally, regional strategies remain largely dependent on consultations with central headquarters due to delays in administrative devolution and limited regional delegation of power. Furthermore, the absence of detailed land maps and inadequate land information sources contribute to planning challenges, with stakeholders having limited control over land specifics. This often leads to mobilisation constraints, including legal and physical clearance issues and illegal occupancy (Valyans Consulting and AESA Europe, 2022).

3.2 Strategic territorial planning challenges

Strategic territorial planning encompasses the development of strategies by local authorities and other planners, such as urban agencies and steering committees. The Regional Spatial Planning Scheme (RSPS) guides the long-term development of regions by setting strategic directions for 25 years. Moreover, each council (regional, provincial, communal) is required to create a plan every six years, detailing upcoming projects and actions. These documents are crafted through participatory methods and overseen by a chairman to ensure effective implementation and evaluation. The Regional Development Program (RDP) focuses on sustainable regional growth, the Prefectural/Provincial Development Program (PDP) promotes social development, and the Communal Action Plan (CAP) enhances local services at the municipal level. These documents are characterised by a hierarchical structure (Figure 3).

Figure 3: Hierarchy of strategic territorial planning documents



Note: Figure 3 illustrates the hierarchy of the different territorial planning documents. The RSPS is developed in accordance with current legislative texts. The RDP must align with RSPS guidelines, the PDP must incorporate RDP directives, and the CAP must comply with the guidelines of both the RDP and PDP. This hierarchy is based on information from organic laws 111-14, 112-14, and 113-14.

According to Valyans Consulting and AESA Europe (2022), organic laws require that the RDP, PDP, and CAP be completed within the first year of council mandates. This necessitates the simultaneous development of these tools, complicating efforts to achieve legislative coherence and convergence. Each document must follow specific protocols, involving numerous committees and the same actors within set timelines. Shortcomings in human resources across planning bodies contribute to procedural inefficiencies and redundancies. Additionally, regional stakeholders' heavy reliance on the national level further hampers swift local decision-making and the timely execution of territorial documents.

These plans are not enforceable unless incorporated into urban planning documents, which are slow to design and update (El Idrissi, Omar, 2019). The absence of a comprehensive land information system exacerbates these issues, as commissioned consultancies face difficulties in obtaining accurate land data (El Ouagari, 2021). Outdated databases result in suboptimal project planning that fails to account for specific land characteristics. These systemic challenges cause significant delays and obstacles in project implementation. For instance, in the Casablanca-Settat RDP 2016-2021, over half of the planned projects failed to materialise due to inadequate land mobilisation strategies, despite the planned development of 1,500 hectares of business parks (Boston Consulting Group, 2022).

3.3 Urban planning out of step with on-the-ground realities

According to Law 12-90 on urban planning and the Dahir of 25 June 1960 on rural agglomerations, the primary urban planning documents are the Urban Development Master Plan (UDMP), the Development Plan (DP), and the Development Plan for Rural Agglomerations (DPRA). These documents are essential for guiding the urban development of territories: the UDMP outlines the general organisation and orientations for urban development, enforceable against the administration. The DP converts these orientations into legal prescriptions enforceable against third parties, while the DPRA focuses on managing rural

agglomerations through compulsory building and subdivision permits. The DP and DPRA define land use with precise regulations, imposing restrictive urban planning servitudes and making them the main tools for land programming.

However, these plans have several limitations. According to Valyans Consulting and AESA Europe (2022), a lack of coordination between documents is observed at all planning levels. This stems from the absence of national land use planning guidelines, insufficient convergence among stakeholders, and varying timeframes for drafting and publishing documents. These discrepancies significantly impact the coherence of the territorial development framework, particularly concerning land issues. Additionally, under Article 11 of Law 12-90, all documents must comply with the provisions of the UDMP. In practice, however, numerous instances of zoning and equipment nonconformity between these plans have been noted (Moroccan Court of Accounts, 2018).

Urban planning documents face multiple methodological constraints during their development (Guezzar, 2019). The initial design stage, the territorial diagnosis, often relies on a quantitative rather than a qualitative approach due to standard specifications. These specifications lack rigor and tend to produce generic and summary diagnoses, primarily based on demographic projections (Debbi, 2008). As a result, this approach frequently overlooks critical aspects, such as land-related issues. Engineering firms typically do not conduct detailed inventories on land ownership status or existing land issues (El Idrissi, Abdelwahed, 2019). The absence of an accessible land information system and effective regulations for data sharing exacerbates this problem, leading to the drafting of urban planning documents without adequate control over land use. This situation is further compounded by the difficulties urban agencies and their service providers face in collecting accurate land data (El Ouagari, 2021).

4. Impacts of urban planning on land management

This section explores the multifaceted challenges of urban planning in Morocco by examining the financial, legislative, and governance issues that affect land management within the planning system. It delves into the specifics of urban policy and its implications for land resource optimisation. By highlighting the impacts of planning documents and processes on land use, it underscores the consequences for urbanisation and investment.

4.1 Urban planning challenges

In Section 2.3, the methodological shortcomings of urban planning documents were highlighted, particularly their lack of in-depth studies during the preliminary diagnostic phases. This leads to discrepancies between projections and actual conditions, hindering the effective implementation of planning documents. These issues are further exacerbated by the absence of multidimensional programming in terms of space, time, and costs. As a result, without a clear action plan, these documents function merely as a “spatialisation of consultations with various stakeholders” (Guezzar, 2019, p.27) and “instruments for programming facilities” (Chouiki, 2019a, p.18).

Funding deficiencies are a major barrier to acquiring the land needed for infrastructure, with municipalities heavily reliant on state financial support (El Idrissi, Abdelwahed, 2019). The lack of resources undermines the effectiveness of the decentralisation policy, preventing it from addressing urbanisation challenges or supporting effective land management. This situation is further compounded by a lack of consensus among stakeholders regarding

budgeting mechanisms. The World Bank (2017) estimated that urban infrastructure would require investments of 320 billion dirhams between 2017 and 2027, with municipalities expected to contribute nearly 70 percent of this amount. However, local budgets and taxes fall short of enabling the execution of urban planning provisions or covering development costs.

Urban planning documents lack the flexibility required to adapt to socio-economic and urban changes and are characterised by their "inability to integrate the unpredictable needs of residents and investors" (Economic, Social, and Environmental Council, 2014b, p.11/12). Their preparation is marked by long lead times for publication, rendering them outdated by the time they address dysfunctions identified in the diagnostic phase (Guezzar, 2019). This inefficiency stems from an outdated and rigid legal and regulatory framework that does not accommodate local specificities or the challenges of modernisation (World Bank, 2018).

Furthermore, urban governance involves a multitude of overlapping responsibilities. The centralised state continues to initiate and approve planning documents, sidelining local communes and delaying administrative devolution. This leads to ineffective stakeholder involvement and a lack of continuity in planning processes, often due to limited resources and frequent changes in representatives (Valyans Consulting and AESA Europe, 2022).

In addition, the lack of regional delegation of authority slows decision-making. Despite the involvement of local authorities, it is often difficult to honour commitments to constructing planned facilities. The complex interplay of diverse stakeholders, each with different interests, makes achieving consensus on land use challenging and intensifies the "power play in the production of space" (El Idrissi, Omar, 2019, p.89).

Since the Protectorate, there has been a separation between development and monitoring (Chouiki, 2019a). Once approved, planning documents lack mandatory implementation monitoring and are primarily managed through the examination of building permits by urban management departments. Nevertheless, several evaluation actions have been undertaken by the Studies departments of Urban Agencies. For instance, the mid-term assessment of the 2012 Settat Development Plan revealed a 10 percent equipment completion rate, highlighting the plan's limited operationalisation between 2012 and 2017. Consequently, a new urban planning document was drafted and formally approved in 2018, with the aim of addressing these constraints (Settat Urban Agency, 2018).

4.2 Urban policy and the limited rationalisation of land use

Cities are currently experiencing rapid urbanisation, characterised by significant expansion of urban areas, the development of metropolitan regions, and widespread peri-urbanisation. This ongoing urban sprawl, a legacy of the protectorate era, has led to the overconsumption of agriculturally productive land, which is vital for both economic and ecological functions. As a result, the annual demand for urban land is estimated at approximately 7,000 hectares, requiring a budget of 1.8 billion dirhams (World Bank, 2018).

Urban planning documents play a pivotal role in shaping this dynamic, often responding to land pressure by designating new urbanisation zones. However, these documents impose regulations that promote low-rise, space-intensive development patterns. This contributes to significant environmental issues, socio-spatial fragmentation, and the intensification of unregulated habitats (Adidi, 2019).

The urbanisation process faces multiple challenges in land mobilisation, hindered by the "state's disengagement from the land market" (Chouiki, 2019a, p.17). During the Protectorate period, the government actively created strategic land reserves through expropriation for public utility. However, post-independence state intervention has become sporadic and limited to

arbitrating land issues (Guezzar, 2019). The near exhaustion of public land reserves and the absence of mechanisms for replenishment raise concerns regarding the effective implementation of urban planning documents.

The depletion of public reserves means that facilities of general interest are often planned on private property. Decentralised services frequently overestimate their land requirements, leading to locations being reserved without sufficient funding for acquisition. These plots remain frozen for up to 10 years and are returned to the owners if not utilised. Due to limited resources, these services rarely proceed with land acquisition, leaving the parcels unusable for other purposes. Additionally, departments face challenges in securing available and suitable land for new facilities. This has contributed to the low national implementation rate of urban planning documents, with no urban agencies reporting implementation rates exceeding 20 percent since 2000 (Chouiki, 2019b).

The rigidity of urban planning documents has fostered a land market outside the formal system, characterised by derogation and informal urbanisation. Introduced in 1999, the derogation procedure relaxed authorisation processes to encourage private investment, supporting the completion of significant socio-economic projects by both public and private entities (Economic, Social, and Environmental Council, 2014b, p.11/12). However, evaluations revealed mixed outcomes: although many projects have generated wealth and jobs, 24 percent of derogations were requested in territories not covered by planning documents. This has led to the degradation of agricultural land, disruption of environmental resources, and exacerbation of socio-spatial disparities. It has also contributed to the spread of unregulated urban development in certain areas (Moroccan Court of Accounts, 2018).

4.3 Land issues hindering economic development

Land mobilisation is a critical factor for economic and territorial development, with land availability and accessibility being essential for business competitiveness and attracting investments. However, Morocco's New Development Model identifies land as one of the main obstacles to entrepreneurial dynamism (Special Commission on the Development Model, 2021). Despite significant investment promotion reforms, land-related issues continue to hinder the completion of investment projects. This is supported by the National Business Environment Committee's 2021-2025 roadmap (2021, p.21), which states that "32 percent of Moroccan companies view access to land as a significant hurdle to their development". This issue is compounded by several factors, including legal, urban planning, speculation, and taxation challenges.

As stated by the Casablanca Urban Agency (2015), legal factors impede investment, including slow registration processes and a traditional regime that fosters information opacity, insecurity in real estate transactions, and limited access to financing. Incomplete clarification of the legal status of state-owned land further slows socio-economic development projects. Additionally, complex and slow land acquisition procedures create challenges in legally clearing plots. The slowness and complexity of administrative processes for urban planning documents also delay investment, leading to land retention and speculation. The lengthy procedures for drafting and approving these documents are misaligned with the short time-frame of investment, and once approved, they often fail to address the challenges of economic development and rapid change (Casablanca Urban Agency, 2015).

Urban centres today face immense land pressure, as demand for land continues to rise and market forces intensify. However, easily mobilisable land for investment is limited due to two main factors: the depletion of public land reserves and the retention of urbanisable land by speculators (Valyans Consulting and AESA Europe, 2022). Unutilised land potential exists in

areas such as industrial and economic zones, which are subject to significant speculation. This hinders the mobilisation of land for productive investment and drives up land prices in urban areas, thereby limiting the profitability of investment projects (Economic, Social, and Environmental Council, 2019).

Casablanca has encountered a persistent land crisis, with post-independence reserves quickly depleted and no public land remaining within the urban perimeter. Intense speculation has immobilised productive land for rental opportunities, causing disruption in the land market and creating a significant shortage (Kaioua, 1998). The scarcity of land in the centre of the metropolitan area has exacerbated territorial imbalances, making mobilisation challenging. Speculation drove the price of industrial land up by 40 to 80 percent between 2009 and 2015. Consequently, access to land has been identified as a major barrier to urban and economic development in Casablanca, discouraging investment and reducing the metropolis's attractiveness (Urban Sciences and Development, 2022).

According to the Casablanca Urban Agency (2015), Morocco's taxation system encompasses various fees related to land transactions, including acquisition, sale, division, construction, as well as mortgages and inheritance rights. Numerous tax exemptions and incentives are available to stimulate investment, particularly in productive sectors such as industry. However, public authorities have limited involvement in land market development, resulting in a lack of regulation to control speculation. Essential tools such as expropriation and the right to preemption exist but are insufficient (Valyans Consulting and AESA Europe, 2022). The current fiscal regime lacks mechanisms to discourage land retention and freezing, thereby exacerbating speculation and illegal practices. The absence of an appropriate fiscal tool for tax adjustments following urban zoning changes further compounds this issue (Economic, Social, and Environmental Council, 2019). The tax on unbuilt land is the only instrument available, but it faces collection challenges nationwide, weakening municipal taxation due to inadequate monitoring and control (Moroccan Court of Accounts, 2018).

5. Conclusion: Towards a paradigm shift in land planning and management in Morocco

The complexity of Morocco's land system stems from its dual regulatory structure and limited land registration, resulting in less secure property rights and challenging governance (Rhomri Mounir, 2019). The diversity of legal statuses further complicates decision-making, exacerbated by minimal stakeholder engagement and weak strategic coordination. An outdated legislative framework and complex land mobilisation procedures add to these challenges (Millennium Challenge Account Morocco, 2020).

All planning levels face a lack of reliable land data and rely on top-down approaches that fail to incorporate local insights or consider territorial constraints. Consequently, planning documents often overlook practical land use capacities, leading to significant implementation challenges (Valyans Consulting and AESA Europe, 2022). Key issues include the absence of a comprehensive database accessible to all stakeholders, which would facilitate the rationalisation of land mobilisation. These obstacles arise from gaps in land knowledge methods—such as the lack of land observatories, Geographic Information Systems (GIS), and consistent land monitoring—as well as deficiencies in the tools and sources used for land information (El Ouagari, 2021).

Urban planning has been criticised for prioritising procedural processes over proactive strategies, resulting in speculative urbanism (Chouiki, 2019b). Driven by demographic growth, urban sprawl consumes extensive land resources and adversely impacts rural areas through habitat dispersion and increased infrastructure costs (Adidi, 2019). The inadequacy of modern

financing mechanisms and continued reliance on outdated legal frameworks hinder the efficient development of urban areas (Casablanca Urban Agency, 2015). Given these challenges, there is a pressing need to rethink land management strategies to align with sustainable development goals and to address the shortcomings in land use policies that contribute to environmental degradation and inefficient land utilisation.

According to the Organisation for Economic Co-operation and Development (2017), international land use planning systems are characterised by decentralised governance and hierarchical planning documents. At the national level, general policies are established through guidelines and laws, while regions focus on economic development. Local authorities, particularly municipalities, play a crucial role, as they directly manage planning and land use decisions. These planning documents typically have a short lifespan of 10 years or less and are frequently revised to accommodate the evolving needs of urban development. Community interests are safeguarded either through neighbourhood forums or public referenda, which approve plans, ensure engagement, and address local needs.

Moreover, legislative and regulatory systems for land use are continuously updated to address modern concerns such as sustainability and efficient land utilisation. Planning structures achieve alignment through two primary modes of convergence: vertical and horizontal. Vertical convergence ensures that planning at higher levels is legally binding on lower levels, as seen in countries like South Korea, Turkey, and Switzerland. Horizontal convergence is facilitated through committees that promote coordination and consultation among various stakeholders (Organisation for Economic Co-operation and Development, 2017).

In France, a significant shift in land planning policy has prioritised land sobriety to protect natural resources, biodiversity, and agricultural land. The goal is to counteract urban sprawl and prevent the fragmentation of natural spaces. Urban and strategic planning documents emphasise efficient land use, promote stronger central areas, and control urban growth. A robust legislative and regulatory framework supports these aims by setting clear targets for reducing land consumption and soil artificialisation. These planning documents include specific, measurable objectives and are regularly reviewed through environmental impact assessments to ensure alignment with environmental commitments. Additionally, these policies foster improved land management and encourage regional planners to deepen their understanding of local land dynamics (National Federation of Urban Planning Agencies, 2021; National Federation of Territorial Coherence Schemes, 2022).

To reshape land management in Morocco, a comprehensive reform of planning and administrative methods is essential. A key priority is revising institutional, governance, and coordination frameworks. This includes accelerating decentralisation, empowering municipalities and local communities by enhancing their resources, and establishing a system in which higher-level planning documents are legally binding on lower-level ones.

Additionally, strengthening horizontal coordination through the creation or activation of coordination committees and broadening stakeholder consultation is necessary. Developing a regulatory framework for the exchange and sharing of land information is also crucial, particularly in the context of implementing the National Land Strategy. This framework should enforce coordination among stakeholders, especially when public policies are modified, and

incorporate local land specificities by involving regional actors in national strategy development.

Furthermore, amendments to planning legislation and regulations are needed to integrate sustainability, ecological transition, and land sobriety. The urban strategy requires modernisation to transition from continuous sprawl to a more rational use of land. This includes creating flexible planning documents with regularly updated timelines that respond to socioeconomic development needs. These documents should encourage vertical development and promote denser, more resource-efficient areas. Optimising public facility programming and introducing mechanisms to reactivate unproductive lots are also essential.

Lastly, improving transparency in land information access for both public administrations and private investors is crucial. Measures to regulate the land market—such as implementing fiscal deterrents against land speculation and strengthening taxation mechanisms—are necessary. This includes developing a digital tool to facilitate tax collection, ultimately increasing municipalities' fiscal potential. These proposals aim to encourage sustainable growth, maximise efficient land use, and enhance governance and transparency in Morocco's land management sector.

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Can Transferable Development Rights be Applied in the Chinese Context?

—— A Comparative Study between China and the United States

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—— A Comparative Study between China and the United States

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Abstract: Transferable development right (TDR) is an innovative land management tool created under zoning system in the United States and widely applied in the preservation of historical buildings and natural resources. Chinese scholars have introduced it and conducted extensive research, advocating for the establishment of a trading market for land development rights. However, there are significant misunderstandings that need clarification. Firstly, In China's property rights system, "development rights" is implicitly included within the "land use rights" specified in the Civil Code. Secondly, China's quotas-trading between governments differs from the TDR system in the United States, where land development rights are traded among private landowners. Additionally, the transfer of floor area ratio (FAR) between land users does not hold practical significance in the Chinese context.

Keywords: TDR, FAR, land use control, property rights

1. Introduction

Development rights transfer (referred to as TDR) is an innovative land use management tool created under the zoning system in the United States. New York pioneered this mechanism as part of an effort to preserve historic landmarks in the face of a long postwar building boom that increasingly threatened their viability[Erreur ! Source du renvoi introuvable.]. The "landmark transfers" provision, which allowed unused development rights on designated landmarks to be transferred to adjacent plots, was added to zoning resolution in 1968. This mechanism provided economic relief to owners of landmarked properties, thereby furthering the purpose of the landmark preservation law and provided the city a measure of legal protection from a takings challenge[Erreur ! Source du renvoi introuvable.].

The case of Penn Central Transportation Co. v. New York City was a milestone in the legalization of TDR. In 1960s, although the Grand Central Terminal, owned by Penn Central Transportation Company had been designated as a landmark by Landmarks Preservation Commission, Penn Central still entered into a renewable 50-year lease and sublease agreement with UGP Properties, Inc. UGP was to build office towers above the terminal; however, the commission denied the application on the ground of landmark preservation. Penn Central and UGP sued the city council, claiming that LPC's decision constituted a government “taking” of its property no less than if the government had condemned a plot of Penn Central’s land**Erreur ! Source du renvoi introuvable.**. The case wended its way to the US Supreme Court. In 1978, the Court upheld the Landmarks Preservation Law, and gave the TDR concept some legitimacy by adding that if a taking had occurred, the TDRs "undoubtedly mitigate whatever financial burdens the law has imposed on appellants, and, for that reason, are to be taken into account in considering the impact of the regulation"[1] .

In the United States, a majority of TDR programs are used either for environmental protection or farmland preservation. In addition, there are a few programs that use TDRs to protect rural character, to preserve historic sites, and to implement urban design and revitalization goals[1].

Chinese scholars have been attempting to introduce TDR to address issues such as urban-rural disparities, unfair distribution of land value increment, inadequate consideration of farmers' rights, and insufficient motivation for urban renewal in the Chinese context. The main focuses are as follows:

One type of TDR is referred to as land-use quotas-based TDR. Specifically, Researchers propose endowing rural areas with development rights in the form of quotas and transferring them to urban areas. This enables rural areas to obtain monetary compensation through quotas transactions, which will benefit farmland and environmental preservation goals. While this approach bears similarities to the American practice, the dual urban-rural land system and land quota system in China make its essence different from that of the United States.

Another type of TDR is referred to as floor area ratio(FAR)-based TDR. Relevant research suggests that in the case of urban renewal or historic preservation, permitting unused development rights to be transferred to other plots in the form of FAR can attract market entities to preserve historic buildings. This approach may seem similar to New York's landmark preservation, yet its essence differs significantly.

Based on the aforementioned background, this study conducts a comparative analysis of two sets of cases to examine the inherent differences in TDR under different land ownership systems in China and the United States. Through this research, a deeper understanding of the applicability of the TDR mechanism in China can be achieved.

Meanwhile, China’s experiences to promote land resource protection to be presented in this paper, which will be of great significance to other countries.

2. Comparative cases: The Practices of TDR in China and the United States

2.1 Land Management Systems in China and the United States

2.1.1 Chinese Land Management System

The Chinese government has implemented a dual urban-rural land ownership system, whereby urban land is state-owned, while land in rural and suburban areas is collectively owned. The Land Administration Law of the People's Republic of China stipulates that ownership of all state-owned land is exercised by the State Council on behalf of the state. Acting as agents of the central government, local governments are specifically responsible for land utilization and protection, and they are delegated the authority, in the interest of the public, to expropriate or requisition collectively owned land.

Since the start of reform and opening up in 1978, China's economy has developed rapidly, with a significant influx of foreign capital. This is partly attributed to local governments' strategy of attracting businesses at the expense of land resources. However, several issues have arisen, such as land use inefficiency, significant loss of arable land, and inadequacy in protecting farmers' rights during land requisition. During the 1986-1996 period, China's arable land decreased at an alarming rate of 280,000 hectares per year[2]. To curb this trend and strengthen land management, the central government issued an important document in 1997 titled "Notice on Further Strengthening Land Management and Effectively Protecting Arable Land", which directly led to the revision of the "Land Administration Law".

The "Land Administration Law" promulgated in 1998 reaffirmed that "treasuring and reasonably utilizing land, and effectively protecting arable land, are the basic national policies of our country". It proposed to establish a stringent land use control system, thereby strengthening the central government's authority over land use and protection. It introduced a mechanism—balancing the occupation and reclamation of arable land—to achieve the goal of maintaining the quantity of arable land. Under this system, construction land quotas are distributed hierarchically by higher-level governments through the land use master plan and the annual land use plan. The Master Plan sets long-term regulations on both the quantity and spatial distribution of agricultural land in a locality that is allowed to be converted construction land, while the Annual Land Use Plan breaks down these long-term objectives for each year[3]. Overall, the Chinese government adopted a "dual management" approach to protect arable land and promote efficiency in land utilization. At the same time, a land

inspection system was established to ensure the regulations made in the plan are executed properly.

In 2004, the central government proposed "the increase in urban construction land should be linked to the decrease in rural construction land." It clarified the corresponding implementation plan: several rural construction land parcels intended for reclamation as arable land (i.e., demolished parcels) and parcels intended for urban construction (i.e., newly built parcels) together constitute a "new construction and demolition project area" (hereinafter referred to as the project area). By combining construction and demolition, along with arable land reclamation, the goal is for the total amount of construction land in the project area not to increase and for that of arable land not to decrease. In other words, aiming to transfer the development rights of rural areas to urban districts by eliminating the development rights of rural areas, this sets the institutional background and basic form of TDR in China.

2.1.2 American Land Management System

The land ownership in the United States, where most of the land is privately owned, differs from that in China. According to statistics, sixty percent (1.4 billion acres) of the 2.3 billion acres of land surface is privately owned, 29 percent is owned by the Federal Government, 9 percent by state and local governments, and 2 percent is in Indian reservations[4]. The state-owned land is managed by U.S. Department of the Interior in the form of national parks, national wildlife refuges and the like, While privately owned lands are regulated by the local government through covenants, zoning and other legal devices[5].

In 1916, New York City adopted the nation's first comprehensive zoning, Building Zone Resolution, to regulate private property rights for the benefit of public health, safety, comfort, convenience and general welfare. The Resolution divided the five boroughs into three different kinds of use districts, five different height districts, and five different area districts[6]. In 1922, the Department of Commerce issued the Standard State Zoning Enabling Act, a model law, delegating local governments to enact zoning law through the authority of state police powers.

The conventional zoning (also referred to as Euclid zoning due to village of Euclid v. Ambler Realty Company) divides the municipalities into several districts to separate incompatible uses[6]. In recent decades, many innovative tools have been created by local governments to fulfill certain goals. Nevertheless, the zoning law sets restrictions on property owners' development rights. However, within the ownership system, the development rights by law belong to individuals, and the TDR trading typically occurs between rights holders, usually in a market environment.

2.2 Land-use quotas-based TDR： Practices of Zhejiang Province in China Comparing with that of Boulder County in the United States

2.2.1 The Practice of TDRs in Zhejiang Province, China

Situated in the Yangtze River Delta, Zhejiang has been one of the most economically dynamic provinces since the economic reforms[3], which has led to significant challenges for its land resources. Based on statistics, from 1995 to 2009, Zhejiang's GDP increased from 355.755 billion yuan to 2,299.035 billion yuan, and the per capita GDP nearly quintupled. Zhejiang Province adopted the approach of attracting investment with low-priced land like many other cities in China. As a result, rapid economic development led to a dramatic expansion of construction land, encroaching significantly on arable land. Statistics also showed that its arable land decreased by 138,700 hectares, and per capita arable land dropped from 0.048 hectares to 0.037 hectares during the period from 1997 to 2009, while construction land increased by 405,800 hectares compared to 1997.

The Land Use Master Plan for Zhejiang Province (1997-2010) was approved by the State Council in 1999 and stipulated that 66,667ha of agricultural land could be converted for construction purposes[3]. To meet the central government's request for "the amount of arable land cultivated equals that of depleted" Zhejiang had to reclaim an equivalent quantity of arable land that was to be converted to construction land.

In terms of the distribution of construction land quotas, Zhejiang provincial government allocated them nearly proportionally to cities based on their GDP performance[3]. This was a relatively fair approach, as each municipality has a desire for more quotas. However, cities or counties with strong development potential tended to have a shortage of construction land quotas, while economically backward areas had more than they needed.

To tackle this dilemma, the provincial government initiated a mechanism allowing for the transfer of construction land and farmland quotas between urban and rural areas as well as between regions, which many scholars also referred to as China’s TDR.

the TDRs between urban and rural areas can be achieved through "land consolidation," which entails cultivating abandoned parcels into arable land, and "rural construction land reclamation," which involves demolishing rural residential or industrial buildings and converting the land into arable land. In the case of land consolidation, municipalities would be rewarded with construction land quotas equivalent to as much as 72 percent of the newly cultivated arable land. By employing the latter type of TDR, local governments could acquire an equal amount of additional construction land quotas if a certain amount of non-agricultural land within their

jurisdictions was reclaimed as farmland[3].

Additionally, TDRs across localities could be realized through a two-step process. Firstly, municipalities with less demand for construction could sell their unused quotas, which were typically earned through "rural construction land reclamation" or "land consolidation," to cities or counties in need of extra quotas. However, in terms of trade-in areas, locating these purchased quotas would inevitably encroach upon prime farmland, as 85 percent of arable land had been designated as prime farmland in the Land Use Master Plan. Therefore, the prime farmland preservation accountability needed to be transferred to other municipalities capable of bearing extra burdens.

Let's assume there are one developed city, City A, and one underdeveloped city, City B in Zhejiang Province (Fig. 1). Both City A and City B will be distributed with construction land quotas through the Land Use Master Plan (LUMP) and Annual Land Use Plan (ALUP). However, due to strong development momentum, City A requires more construction land quotas. Construction land quotas obtained through land consolidation and rural construction land reclamation within its jurisdiction are intended to facilitate urban expansion. In addition, in cases where additional quotas are needed for further economic development, City A can purchase them from City B, typically acquired through similar means. Meanwhile, to locate these quotas and maintain the amount of prime farmland, City A can make a payment to City B for assuming this accountability on its behalf.

In this process, City A fully realizes its economic potential through sufficient development land, while City B, lacking development opportunities, finds that the marginal benefits from land development are lower than those from quota trading. Therefore, City B is eager to generate revenues by selling quotas. As for Zhejiang Province, it fulfills the development and protection responsibilities imposed by the central government. This can be described as a win-win transaction for all parties involved.

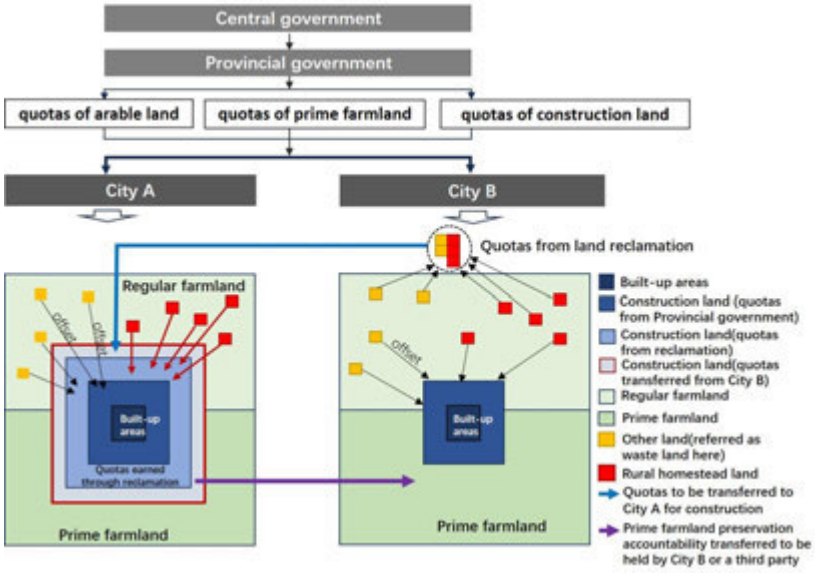

Fig. 1 The ideal type of TDRs between rural and urban areas and between localities

However, this innovative instrument, which had breached central government regulations, raised several concerns. It was reported that some local governments rushed to convert fish ponds, riverbanks, and hilltops into prime farmland to meet quotas, prioritizing quantity over quality[3]. Additionally, local governments could undermine farmers' benefits by forcibly relocating them to cities. Consequently, the central government halted further implementation of Zhejiang's practices in 2004.

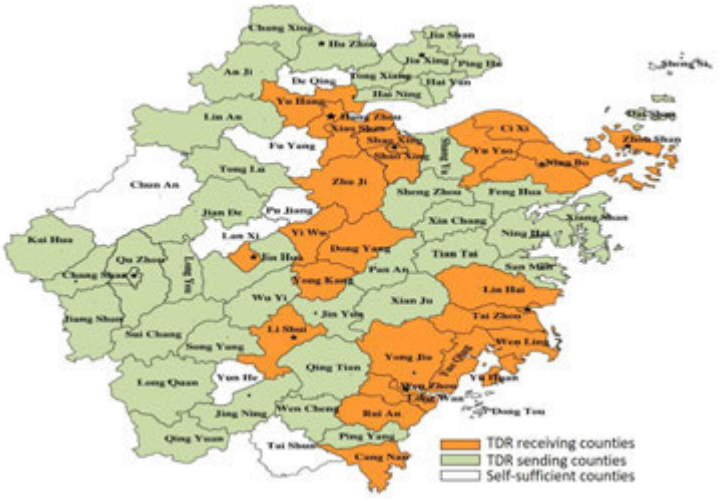

Fig. 2 Intergovernmental TDR between 1999 and 2008 in Zhejiang Province
Source: reference [4]

2.2.2 The Practice of TDRs in Boulder County, America

Boulder County, Colorado, spans 1,946 square kilometers and has a population of approximately 330,000 people as of 2022. Boulder, the most populous municipality in the county, is the county seat (Fig. 3).

Fig. 3 Location and layout of the Boulder County
Source: google

The study by Nelson, A. C., Pruetz, R., & Woodruff, D. (2013) showed how the TDR program was operated in Boulder County. In 1981, Boulder County adopted a clustering technique known as a non-urban planned unit development (referred to as NUPUD), granting a density bonus in case that 75 percent of the parcel are permanently preserved. The base density could be doubled, from one unit per 35 acres to two units per 35 acres. This clustering technique significantly contributed to resources

preservation and growth management.

In 1989, the county upgraded this mechanism to allow the density bonus to be transferred to a noncontiguous parcel, which was referred to as non-contiguous non-urban planned unit development (referred to as NCNUPUD). The NCNUPUD includes two or more noncontiguous parcels, between which development rights can be transferred. In this situation, receiving sites can achieve up to three times the density permitted under the NUPUD process. For example, one unit allowed to be developed on a 35-acre site by right, two units through NUPUD, and six units with NCNUPUD[7].

The NCNUPUD could be utilized within the jurisdiction of Boulder County, as well as being employed between Boulder County and a city in case that an intergovernmental agreement (IGA) had been reached. For example, in 1996, Boulder County and the city of Longmont entered into a TDR IGA. The Planning Area of Longmont, which was outside its city limits and intended for future development, was designated as receiving sites (Fig. 4). When property owners chose to preserve sending sites, the conservation easements were granted to Boulder County and the city jointly. If all the owners in the sending areas were willing to sell their development rights, a greenbelt, with valuable agricultural and environmental resources, was going to be created[7].

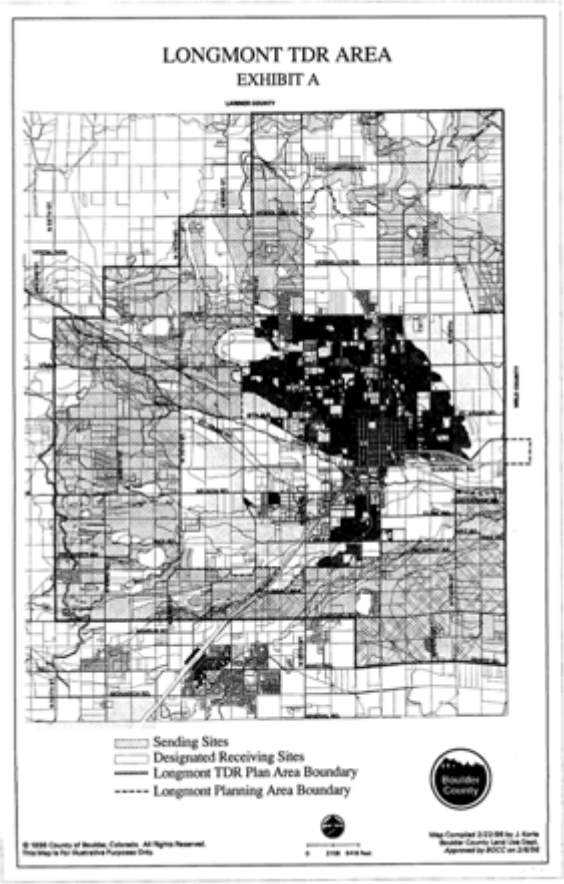

Fig. 4 Longmont TDR area
Source: https://assets.bouldercounty.gov

2.3 FAR-based TDR: A Case of Shenzhen in China Comparing with that of New York City in the United States

2.3.1 A Case of TDRs in Shenzhen, China

Shenzhen, located in Guangdong province, spans a total area of 1,997 square kilometers, comparable to that of Boulder County. However, by the end of 2023, Shenzhen's population had surged to 17.79 million people, with a GDP of 34,606.40 billion yuan. Remarkably, just 35 years ago, Shenzhen was nothing more than a small fishing village. In 1978, the Chinese government decided to implement nationwide

reforms and opening-up policies. The State Council granted Shenzhen the status of an economic special zone, positioning it as a pioneer in China's economic reform. Over the past three decades, Shenzhen has effectively utilized policies, the domestic market, and its proximity to Hong Kong to rapidly evolve into a first-tier city.

Like many other cities in China, Shenzhen's rapid economic development has consumed a significant amount of land. By 2005, the spatial capacity was estimated to be insufficient to support further development, leading to the decision, in 2009, to implement urban renewal to facilitate economic development by demolishing underutilized parcels[8].

Shenzhen has devised an urban renewal plan, through which a few urban renewal units were designated. Each unit typically involves multiple property owners and other stakeholders. Developers are authorized to create the plans, determining land use categories and their intensity. As widely acknowledged, residential and commercial utilization, combined with a higher Floor Area Ratio (FAR), can yield significant revenue for developers. However, this comes at a cost: developers are responsible for demolishing existing structures on behalf of the government, relocating native residents, and transferring a portion of the land, free of charge, to the government for public facilities. Additionally, developers are required to pay for the land use rights (usually below market prices). These expenditures prompt developers to negotiate with the government, seeking higher profits by increasing intensity.

Due to Shenzhen's high population density and significant shortage of infrastructure and public facilities, in the event that additional plots are transferred to the government for public benefit, the floor area on those plots can be transferred to other lots for the developers' benefit (Fig. 5). This approach is somewhat similar to "bonus density" adopted by New York city.

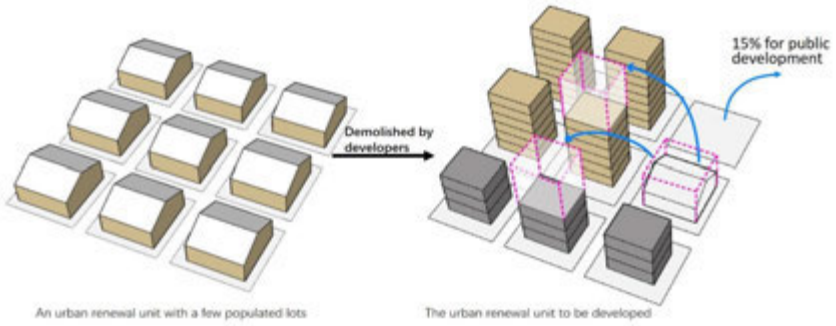

Fig. 5 FAR-based TDRs in an urban renewal unit

The urban renewal unit of Baolong Street, Longgang District, Shenzhen City can serve as an example(Fig.6,Fig.7). According to the plan, the area will be redeveloped

for industrial and residential use. In order to implement this vision, developers need to demolish the buildings on 104.5 hectares of land, among which 38.2 hectares will be transferred to the government for public facilities. Additionally, the developer, on behalf of the government, had to demolish the properties outside the urban renewal unit with an area of 8930 square meters. As an incentive, the development rights on this parcel will be transferred to a certain plot within the renewal unit at a specified ratio.

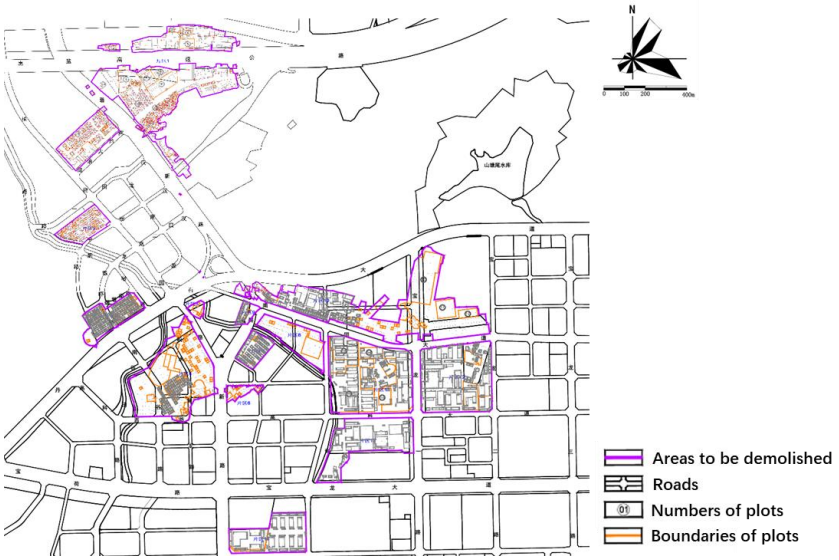

Fig.6 Urban renewal unit of Baolong street, Longgang District, Shenzhen
Source: www.lg.cn

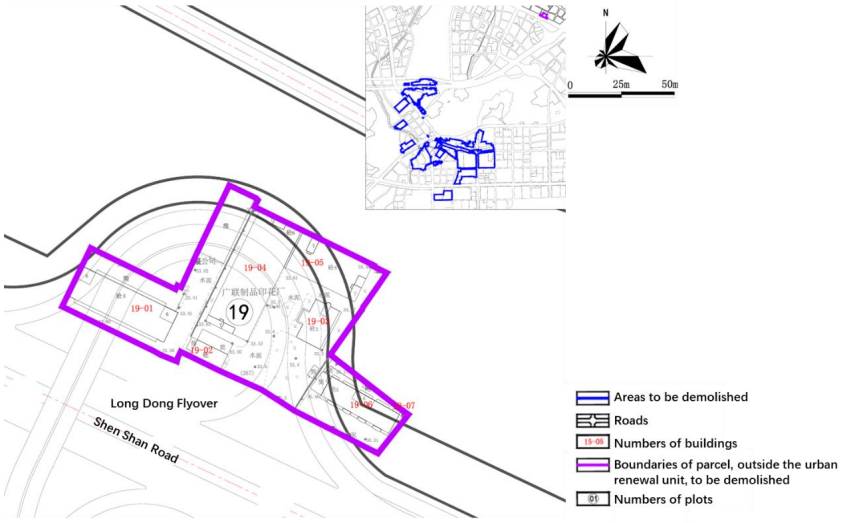

Fig.7 The parcel outside the urban renewal unit of Baolong Street to be demolished

Source: www.lg.cn

2.3.2 A Case of TDRs in New York City, America

The case of the Theater Subdistrict can illustrate how the FAR was transferred in New York City(Fig.8). The Theater Subdistrict is part of the Special Midtown District, one of the special purpose districts in New York's zoning resolution. The establishment of this subdistrict aims to protect the entertainment industry of Broadway from being encroached by abutting residential and office development. Many of the theaters in the area were built in the nineteenth century. In the 1970s, some significantly historic buildings were demolished, with only a few theaters designated as landmarks being preserved. By the 1980s, promoted by the "Save the Theaters" movement, New York City founded the Theater Advisory Council, and the area was designated as the Theater Subdistrict. Meanwhile, within the Special Midtown District, a special provision was created allowing property owners of listed theaters to sell their unused development rights, but the scope of the transfers was strictly limited.

In response to pressure imposed by stakeholders and the expansion of Times Square, New York City reformed the TDR rules in 1998. The amendment greatly widened TDR receiving areas by allowing listed theaters to transfer floor area anywhere within the Theater Subdistrict, expanded the Subdistrict to include the 8th Avenue Corridor up to 56th Street, reduced the procedural requirement to streamline the process[Erreur ! Source du renvoi introuvable.]. Through this tool The TDR trading in the Theater Subdistrict has become one of the most active programs in New York City. This initiative has enabled the preservation and of Broadway's entertainment industry and cultural brands.

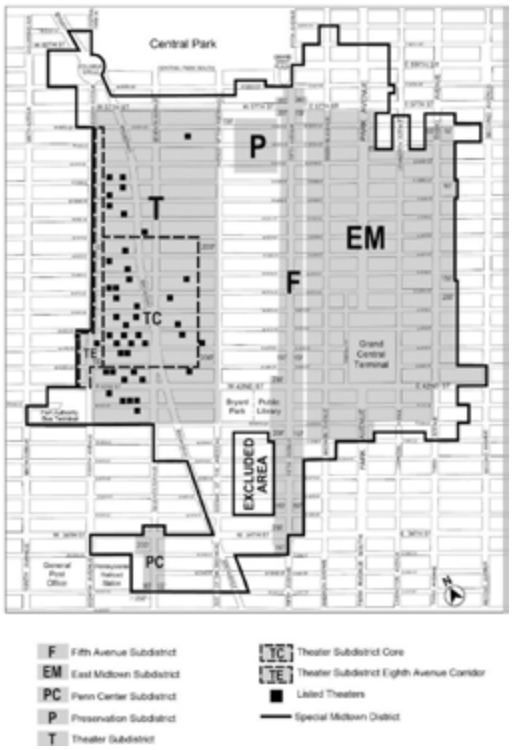

Fig.8 Special midtown district and subdistricts of New York City
Source: Zoning Resolution of New York City

3. The Difference Between TDRs in China and that in America and its Applicability in China

Two sets of comparative cases have been presented above, from which we can conclude that there are significant differences between TDRs in China and those in America.

Firstly, the goals of TDR vary. Through quota trading, Zhejiang Province and municipalities sought to fulfill the central government's objectives of farmland protection, while also addressing the scarcity of construction land quotas in developed municipalities. Conversely, Boulder County utilized TDRs for growth management, aiming to prevent urban sprawl and preserve agricultural and environmental resources. Similarly, regarding Shenzhen and New York City, the former aimed to incentivize developers to undertake governmental responsibilities, such as demolishing dilapidated

buildings and constructing public facilities, resembling more of a density bonus rather than a straightforward FAR transfer. The latter focused on the protection of historic buildings, facilitating the transfer of development rights between preservation sites and development parcels.

Secondly, the entities involved in the transaction are different. In the Zhejiang case, it was the local governments who promoted the transfers, since the quotas of prime farmland and construction land are strictly controlled by the central government. In the Boulder and New York City cases, local governments only establish rules and supervise implementation, while the transfers were still carried out by property owners. In the case of Shenzhen, developers traded with the government for additional floor areas.

The aforementioned distinctions between the two fundamentally lie in the difference in land ownership. In China, land ownership belongs to the government, which not only formulates land use regulations but also eagerly obtains revenue through selling land use rights. In the United States, since land is privately owned, the government intervenes in the amounts of development rights and the transaction process through planning, yet it does not directly engage in TDR trading.

Therefore, in the context of China, it is necessary to reexamine the essence of the TDR mechanism. Quotas-based TDR is one type used merely within a limited scope under the control of the central government, including the transfer of construction land quotas between urban and rural areas and that across regions limitedly. FAR-based TDR is essentially a density bonus, where developers take on public obligations on behalf of the government in exchange for additional floor area.

4. Conclusions

Given that Chinese scholars are advocating for the adoption of the TDR mechanism from the United States to address issues in China, such as the dual urban-rural land ownership system, government monopoly on land revenue, and lack of protection for farmers' rights, this article raises the question: Can Transferable Development Rights be Applied in the Chinese Context? It first introduces the backgrounds of land management in China and the United States respectively, and then compares the differences and similarities between the two countries' TDR systems from two perspectives: quotas-based TDR and FAR-based TDR, using two sets of case studies—Zhejiang Province and Boulder County, Shenzhen and New York City. The study finds that in both sets of cases, both the goals and the trading entities of TDR are different, which fundamentally stems from the different land systems in the two countries. As a result, the roles of the government differ. In China, with urban land being owned by the government, it has a strong incentive to acquire larger construction quotas to generate more fiscal revenue through TDR, while at the same time passing on accountability that the government fails to hold to developers.

In conclusion, the essence and connotations of TDR in the Chinese context differ significantly from those in the United States, and their implementation should fully consider China's institutional framework. Additionally, this article introduces China's experiences, thereby filling the gap in TDR research within the context of developing countries.

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Principles and rules for spatial planning governance and government in Italy

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Abstract
The paper argues that a law reforming the planning system as a spatial government activity is needed in Italy: it is necessary that regional laws descend from new principles and rules to allow for more effective operations in the respective local municipal systems and the vast metropolitan and regional area. It relaunches planning through a plan that can dictate rules not only for the performance of private initiative but also for public policy and concrete actions of the institution responsible for that plan. There are outlined the main contents of the INU proposal, starting from the necessary to move from a plan that exercises public authority (often only formal) to a plan that includes public-private and public-public negotiation transparently and helpfully for the general interest.

Keywords
spatial planning, governance, government

1. Territory and its government and governance

Following the reform of Title V of the Italian Constitution in 2001, among the various functions and activities performed by the public authorities, that of "territorial governance and government", has become increasingly important. This expression can be taken to mean a "broad complex set of interacting functions, with a strongly polysemic meaning that calls into question all the constituent institutions of the Republic that are responsible for and competent in the relative fundamental activities, including the function and method of territorial planning" (Barbieri 2023, p. 162). This is a decidedly more articulated conception than the one that, at the beginning of the 1990s of the last century, was still considered the most accredited and which saw in the government of the territory the "complex of institutions that preside over the regulation, control, and management of land use" (Morbidelli 1994, p. 755). Today, this concept covers the regulation of land use; it extends to the environment and landscape, referring to the complex sustainability of use and not only to the legitimacy concerning the rules of use itself.
However, the difficulties connected to the perimeter of this concept also reside in a rather heterogeneous legislation stratified over time, whose 'regulatory heart' is still, inexorably, represented by the national Spatial Planning Law n. 1150/1942, albeit amended and supplemented several times in eighty years of the Republic. It is flanked not only by national laws, which regulate, in competition with the town planning regulations and with each other, specific spatial areas of territory or sectors (laws such as those on the protection of natural beauty or the protection of things of artistic and historical interest, or parks, protected areas, hydrographical basins, or laws on areas destined for economic and social housing, artisan and industrial production facilities, large commercial businesses, etc.), but also regional spatial planning laws, which regulate the development of the territory of the Italian Republic(since the entry in force of Presidential Decree n. 616/1977) and sectoral laws.
If we consider that this very dense set of laws is accompanied by the respective instruments (plans), it could be useful to try to understand why the territory appears to be governed (and planned) in a hypertrophic manner.

1.1 Background. A hierarchical planning system

Consistent with what was instituted by Law n. 1150/1942, planning has long been commonly defined and described, according to an authoritative and strictly legal approach, as a "procedural facts" of acts of public power connected in cascade, each with the function of better specifying what had already been disposed of by the preceding one, according to relations of supra- and sub-ordination, or according to relations from the general to the particular. In this way, "the concept of planning is identified in the legislative regulation of an activity which, while resolving itself in a multitude of measures, intends to maintain the organic coordination of them and proceeds through a series of acts which gradually condition themselves from the most general to the most particular, that is, from the Territorial Coordination Plan to the measure by which the execution of the single construction is permitted" (Stella Richter 1984, p. 7). As has been observed in this regard, (*ibidem*, p. 8), accepting such an approach implies that in order for a given territory to be considered correctly and fully planned, it must be affected by a multiplicity of overlapping territorial and town-planning instruments; the content of the various acts linked together must necessarily be homogeneous; plans of a broader territorial scope are of greater importance than those of a more circumscribed scope, whose function is substantially executive of the more general one.
This type of conception has been the most widespread, particularly in the legal-administrative culture of town planning (and can be found in most juridical town planning manuals), until the debate on the relationship between the various institutional levels (and therefore between their

acts) was significantly reopened, concomitant with the approval of Law n. 142/1990 reforming the local self-government system, which above all was to give definitive implementation to the principle of political and administrative pluralism contained in the text of the Constitution. Having quickly fallen into oblivion, a new impetus to the discussion only came with the entry in force of Law n. 56/2014, which provided provisions for metropolitan cities, provinces, unions and mergers of municipalities and which, in the original intentions of the legislator, should have subsequently led to the abolition of the provinces.

The aforementioned is a conception that takes for granted the identity of the function of all possible types of plans, which are distinguished solely according to the greater or lesser territorial extension of their object, and that implies, therefore, that more significant extension corresponds to more generic forecasts and vice versa. It is, moreover, well known that such a conception does not correspond to the actual reality of things, nor even to the normative reality: the abstract aspiration to the systemic order of this conception only determines a flattening of the relevance of the urban planning instruments provided for by the legal system, attributing to them an identity of function that they certainly do not have and that it is probably not correct that they should have.

Other arguments supporting the criticism of the so-called cascade planning can be found concerning the fact that some planning instruments, among those foreseen by law, may only be prepared with this conditioning of the existing ones. That is, it is possible that planning may still take place regardless of the existence of plans of a more general content and a broader territorial scope: in fact, it has commonly occurred in Italy that territorial plans have either not been prepared or have been prepared after many of those destined, according to the above conception, to a conformative and executive function. This circumstance highlights the erroneousness and the futility of the reference to the 'procedural case' in explaining the planning system at various levels.

Moreover, according to the cascade conception of planning, one is led to think that the authority competent to adopt the highest-ranking plan is first and foremost entitled to plan; therefore, originally first and foremost to the State (which should have dictated the general guidelines for the development of the national territory) but above all to the region, particularly after the entry into force of Presidential Decree 616/1977, to which is attributed the task of adopting the regional territorial plan; then to a metropolitan or provincial 'intermediate body', to which is entrusted the drafting of a specific plan for its territory and, only at the end, to the municipality, whose powers of the urban plan (however named in the various regions) cannot exceed the boundaries of the administered territory.

It is well known that post-war town planning events have shown (Campos Venuti and Oliva, 1993) that the central role of planning was assumed neither by the State nor then entirely by the regions, but precisely and above all by the municipality, considered, by the same legislative regulations, as the actual holder of the power of territorial planning to which the responsibility for the conformation of the territory and the individual properties that make it up should undoubtedly be attributed since it is the municipal level where the use of land is defined, obligatorily and with the plan.

2. A new planning season

There are many good reasons to believe that the basic principles of planning must be reconsidered and new ones sought: the current stage of society requires the activation of a new process of governance of planning, capable of involving the entire institutional system in a policy of territorial government closely anchored to subsidiarity, institutional cooperation, co-planning of structural choices, coherence and operational effectiveness of the contents of the plans.

The increasing complexity of the development processes that have characterised the last few decades calls for a change in the instruments of government and governance and their management methods. This reality requires a clear shift towards the processual and integrated nature of planning, which goes beyond the current system of hierarchically ordered 'cascade' plans aimed at controlling and regulating land use and sectoral plans drawn up by different and substantially separate institutional subjects.
What is needed is an appropriate style of government based on shared knowledge, subsidiarity (Giaimo 2022: 5), methods and procedures of cooperation and co-planning between territorial authorities, consultation and participation of public and private stakeholders. The government of the territory should, therefore, be conceived as a process capable of placing itself at the centre of a new institutional, administrative and physical-organisational model of the many territories, knowing how to renounce hierarchical and dirigiste forms and proposing itself as the product of a collaborative, participated and shared construction with the territories and their respective institutions, placing itself within a broader chessboard of challenges and opportunities.

2.1 More than thirty years of subsidiarity

Reconnecting the threads of the discourse around the principle of subsidiarity is a valuable exercise that finds a valid pretext in the thirtieth anniversary of the Maastricht European Treaty (1992).
Suppose it appears, in fact, of dramatic evidence and urgency to update a reflection on the issues of the common foreign and security policy established by the Treaty in order to safeguard common values, fundamental interests and the independence of the Union. In that case, it is equally important to observe, with reference to territorial governance, the consequences that its use has had on the process of European integration concerning the character of legislation and the exercise of competing competencies but also, in general, with respect to the distribution of competences between the Union and the Member States (De Pasquale 2021). We should not forget that Maastricht did not celebrate the 'birth' of the principle but 're-employed' its original meaning and role (the roots of which go back much further than 1992), in the conviction that with its 'codification' subsidiarity could be used as a 'brake' to limit the indefinite expansion of Union law, which would otherwise be inevitable given the primacy the latter enjoys. In this way, it could be enshrined that, in areas that are not within its exclusive competence, the Union intervenes where individual states action is insufficient to achieve the objective. Symmetrically, this principle is found within a country in the relationship between state and local institutions. In essence, the conceptual core of subsidiarity lies in the principle that a higher-level entity should not act in situations where the lower-level entity (down to the citizen) can act on its own and, in addition, that the intervention of the higher-level entity should be temporary and aimed at restoring the autonomy of action to the lower-level entity. On this aspect, we should not forget that in Italy, the historical roots of subsidiary thinking inspired the Camaldoli Code (a programmatic document of the Italian Catholic forces drafted in 1943) and the Italian Constitution of 1948 itself, even though its formal entry into the constitutional dictate only occurred with Law n. 3/2001.
For this reason, interest in the principle of subsidiarity is not limited to considerations of its relevance, given a better organisation of levels of government. However, it extends to the contribution it can provide to support a broad and conscious participation in the democratic life of a country (especially at the local level), constituting 'the tool to introduce new forms of opening of the state to civil society' (Di Giacomo Russo 2015: 139). It is particularly evident if we take into account "the cultural contributions historically underpinning subsidiarity, namely social doctrine, liberal and federalist thought" (cit.: 38). In this sense, the principle of

subsidiarity also enshrines the recognition of the right to action of individuals and social groups pursuing together the goal of the common good.
Over time, subsidiarity has thus taken two prevailing directions.
In this regard, we speak of vertical subsidiarity, which indicates a completed distribution of competencies between the various levels of a state's positive order, and of horizontal subsidiarity, which indicates the *subsidatio* role played by the public subject in support and aid of private individuals.
Reasoning along the vertical direction of the territorial governance and government, the convinced assumption of the principle of subsidiarity for the innovation of spatial planning action (and of the processual and integrated nature of planning) appears more necessary than ever to overcome the historical 'system of plans' descending from Law n. 1150/1942, which was hierarchically ordered and aimed at controlling and regulating land use transformation.
A second good reason to practise the principle of subsidiarity with conviction concerns its possible declination along the ideal-typical horizontal direction that empowers citizens (individuals and associations) to carry out activities of general interest such as the care, regeneration and shared management of common goods. From this perspective, the principle of subsidiarity sanctions the recognition of the right to action of the individual and of social groups that jointly pursue the objective of the collective interest, taking on the profile of a 'philosophy of human action' that is open to solidarity and realised in the achievement of the common good.
Within the perspective of actions of care and social welfare (welfare), subsidiarity is, therefore, an enabling condition for enhancing the system of relations that involves organisations, individuals, and institutions and intervenes in defining collective choices on functions and uses of urban space, especially that deputed to the provision of services.

3. Principles and aims for contemporary spatial planning. The INU's proposal

In concurrent legislation of the territorial governance and government, the State maintains an ostentatious disinterest concerning the dutiful formulation of a catalogue of principles adequate to the agenda of emerging themes. However, contemporary urban planning law is by no means in a weak phase: thanks to regional activism, the horizontal syncretism between the most advanced planning practices, and the interventions of the jurisprudential formant, it appears to be in the midst of a generative phase, destined to affect the planning function profoundly (Boscolo 2024, p. 9). Such adaptability does not, however, overshadow the limitations of a model with regional traction, arising first and foremost from the need for more basic ordering coordinates. It is sufficient to observe the differences between the two most recent regional spatial planning laws (Marche regional law n.19/2023 and Abruzzo regional law n. 58/2023) to grasp the effects of the lack of a common legislative-regulatory frame of reference.
Within this framework, the Italian National Institute of Urbanism (INU) proposed an articulated text (*Law of Fundamental Principles and General Rules for the Government of the territory and planning*) for a law's proposal (INU 2024). The text enunciates the fundamental principles of the subject, in line with the constitutional scheme and with the function of the orientation of regional legislative production assigned to the state law, but also indicates, as an immediate corollary that actualises those same principles, the goals to which the government of the territory and planning must aim at in the crisis (climatic-environmental and socio-settlement) and formulates a series of general rules that, although structurally distinct from the principles, should also contribute to guarantee a common basis for regional legislation. Not only the article express the regulatory criteria of future delegated legislation on the crucial issues of urban taxation and public promotional intervention in urban regeneration and dictates specific rules on the issue - debated for decades and back in the news with the revival of the debate on

differentiated regionalism - of the regulation of territorial endowments (spaces for general use, supply platforms, but also ecological spaces and equipment: to guarantee green and blue networks) and the minimum levels of services (Art. 117, II paragraph, lett. m., Constitution.) to be guaranteed in every part of the country. This contribution focuses on Art. 2 of the proposal, poignantly entitled 'fundamental principles and purposes'.

The fundamental principles of the subject matter are normative enunciations with a general content, characterised by value and deontic surplus. In this, they differ from the specific provisions found at the subordinate levels of a regulatory system. Principles constitute the immanent and stable element of a regulatory system, but (far from any fixity) they guide its constant updating due to their open structure, which allows for adherence to the underlying value dynamics of the system. Principles (in the plural) constitute the backbone of a system as they compose a combinatory palimpsest within which they balance each other and from which they cannot be isolated.

INU's proposal focuses on a catalogue of principles, recognised and already in operation, capable of providing a guideline to the accelerated mutation of the discipline and of constituting a reliable reference for the interpretation and integration of a system that evolves as a result of the incorporation of new values or instances (this is the case of the soil theme, the recognition of the essentiality of ecosystem services or the introduction of measures for adaptation to climate change). The result is a photograph of contemporary urbanism rendered comprehensible in its structural order.

In the list suggested by Art. 2 of the proposal, the only legacies of the 1942 town planning law have their place, which can be identified in the principle of integral planning of the territory and in the principle of due process as the place of balancing the various interests with the territory as the terminal. Two principles whose immanence has not prevented the redesigning and actualisation of the figure of the plan (even if there are increasingly frequent 'escapes' from the plan: not only the location of public works and plants for the production of energy from renewable sources but also the reduction to the rank of building of urban regeneration in the National Building Code, Decree n. 380/2001) and the introduction of devices aimed at favouring the broadest participation, anticipated, informed and incidental within deliberative arenas.

The proposal, therefore, recalls principles deduced in regional legislation and others to which the most advanced planning experiences are informed. The consolidation of the principle of sustainability (the background to the function of 'custodial' protection of terrestrial environmental matrices assumed by the territorial governance and government) has resulted in recognition of the essentiality of ecosystem services, in ecological continuities but also urban ecosystems; in parallel, the awareness has matured that urban fabrics guarantee urbanity services because of their capacity to guarantee quality, efficiency and inclusiveness to urban users: generative environmental systems and efficient urban systems must therefore be preserved given intergenerational transmission (in a suitably extensive rereading of the renewed Art. 9 of the Constitution.).

The reference to inclusivity recalls how the urban is the place of satisfaction (or frustration) of social rights: the principle of territorial equality moves from the consideration that large cohorts risk suffering an unjust condition of marginality due to the denial of access to rights that are infrastructurally but for some also territorially conditioned. Hence, not only the radical rethinking of the issue of standards, going beyond parametric logics and favouring proximity-oriented localisations (as better articulated by Art. 16 of the proposal that prefigures the overcoming of Ministerial Decree 1444/1968), but in broader terms also an emphasis on the need to return to active policies for the many different suburbs or internal areas, in order to guarantee equal opportunities in terms of capacity and cohesion to subjects that suffer unacceptable territorial injustices.

The principle of an adequate cognitive foundation and the correlative consistency of planning solutions recognises the centrality of the cognitive apparatus, which is also implemented as a result of participation and guarantees objective cognitive frameworks, from which a rigorous constraint on the consistency of urban planning decisions derives. A constraint that becomes stringent about the invariants that are the subject of substantially constrained ascertainment and, in any case, reduces the traditional rate of discretionality of urban planning decisions (with a consequent increase in the margins of justiciability).
The principles of equalisation and compensation reaffirm the unavoidability of overcoming the intrinsic discriminatory nature produced by the solutions of resetting areas connoted by homologous statutory characteristics and reconnect the effectiveness of actions for the public city to the overcoming of recourse to expropriation. The proposal thus allows a glimpse of an innovative principle aimed at imposing, as a legitimising factor of every transformation generating diffusive externalities, the prior compensation of impacts and pressures, with the consequent internalisation of environmental costs in the hands of the promoter (a principle that is also at the basis of redistributive devices of territorial equalisation and compensation affirmed and practised, for example, by the Metropolitan Territorial Plan of Milan and Bologna).
Concerted systems represent the alternative to the 'cascade' planning model hinged on Co-planning Conferences aimed at favouring (starting from shared cognitive frameworks) inter-institutional understandings and agreements. In such a scenario, the prospect of the principle of extrinsic coherence (no longer conformity) between the various planning levels is decisive, by which the local level instrument can contextualise and better define the solutions congruent with the effective pursuit of the objective prefigured by the supra-local plan (so-called result constraint). In not dissimilar terms, a principle of intrinsic coherence also operates between the functions and components of the plan (strategic-structural, regulatory and operational), guaranteeing flexibility and overcoming the need for continuous variants in the passage from the prefigurative level to the operational-planning level, also in this case in the pursuit of intransigible planning objectives. This is the space carved out (on the push of case law) for the negotiability of profiles that the plan (characterised by graded regulatory hardness for the consolidated city and for the tissues to be redesigned and regenerated) regulates in 'non-conclusive' terms precisely to favour (also through recourse to concurrency in the case of allocation of scarce resources), the emergence of concretely feasible solutions that can be deduced in operational agreements (referable to the genus of Art. 11 of Law n. 241/1990), not inseparable from an adequate recovery of public value.
Article 2 keeps separate from the fundamental principles the list of the aims of the territorial governance and government and its fundamental planning activity, expressed in concrete statements (semantically different from the principles), in which the echoes of the challenges posed by the crisis affecting the territories resonate clearly. The requirements of climate neutrality, energy efficiency, etc., stand out on this side, but - taking up the diptych between environmental continuity and urban fabrics and the parallelism between ecosystem services and urbanity services (which would lead one to reflect on the status of environmental and urban common goods) - the regeneration and limitation of soil consumption find articulated discipline above all. Regeneration (urban and territorial) understood in its broadest meaning, as a tool for raising the quality of settlement but also social and environmental as an expression of the recovery function of degraded contexts; the subject-soil to be framed not only in quantitative terms but - as suggested by the most up-to-date European indications that push towards an authentic cultural reframing - with attention to qualitative profiles and biodiversity and, more generally, to ecological dimensions and - again - in function of the recovery of resilience through safety programmes, as indicated by the Nature Restoration Law approved by the European Parliament in July 2023.

3.1 Focusing on urban standard

In the Italian technical and disciplinary field, it is a shared opinion (Giaimo 2019; Laboratorio standard 2021; De Leo 2021) the need to update the discipline of urban standard introduced in Italy by Decree n. 1444 in 1968, especially within the framework of law of principles on the concurrent subject of territorial government and governace (Barbieri 2023), in implementation of the reform of Title V of the Constitution (Law n. 3/2001). Today, Italy is divided into 21 territories between regions and provinces with ordinary and autonomous statutes that regulate public utilities (urban standard) in a manner that is also significantly differentiated, both in terms of definitions, approaches, and technicalities. It is also fundamental not to lose sight of the fact that in addition to the legitimate specificities on a regional legislative basis (in the application of Presidential Decree n. 616/1977), there are different levels of objective achievement of urban standards in the various regional realities, both in quantitative and qualitative terms.

More so on this occasion, the operation aimed at (trying to) clear the field of possible misunderstandings through the exercise of definitions proves to be of fundamental importance. The expression ‘urban and territorial endowments’ refers to the set of areas, buildings and public or private equipment for public use, aimed at the realisation and provision of services of public utility and collective interest, at favouring suitable settlement conditions and quality of life, of relations, of social cohesion, as well as at improving universal accessibility, quality and usability of public space. The set above of areas, buildings, and equipment may also be used for temporary uses, provided they fall within the scope of services of public utility and collective interest.

Considering the enduring criticality of the contemporary condition regarding welfare policies and citizens' wellbeing, we must acknowledge that writing the law of principles on the territorial governance and government is a good and proper opportunity to guarantee the pursuit of certain fundamental rights. Therefore, the expression 'minimum and mandatory urban and territorial endowments' should be referred to the essential level of services (ELS) concerning civil and social rights, which the State must guarantee throughout the national territory under Article 117, paragraph 2, letter m) of the Constitution.

Another issue is alluded to through the term ‘services,’ by which we mean the actions and/or works that provide something and/or perform functions to satisfy the needs of the community. The notion of ‘service’ has mistakenly led some to interpret the need for greater attention to settlement quality by assimilating Ecosystem Services (SE) to urban standards (i.e. ‘minimum and mandatory urban and territorial endowments’).

It is due to the change in the cognitive perspective of knowledge related to the ecological functions of soils, particularly in the meaning developed by Ispra (2018) based on EU Directive 231/2006. Such an approach recovers, albeit in an anthropocentric interpretation, the value of environmental resources (Full World, Daly 2005) and transforms the meaning of ‘functions’ into ‘services’, where these services respond to a direct or indirect demand for ecological services performed free of charge by Natural Capital and recognisable quantitatively from a biophysical and economic point of view.

According to the most established definitions in the literature, Ecosystem Services are ‘the multiple benefits provided by ecosystems to human race’ (MEA 2005) and ‘the contributions that ecosystems make to human wellbeing’ (CICES 2013): it is emphasised that for both definitions, the ecosystem component provided (good or function) is understood as the outcome of an ‘end product’ of ecological systems. The change of perspective introduced by ES lies in the connection between human wellbeing and ecosystem functionality, which is made evident by assuming the perspective of the beneficiaries or recipients of the services/benefits (Cortinovis, Zardo and Geneletti 2016).

The ecosystem approach, as defined by the COP 5 Working paper (UNEP/CBD/COP/5/23, 103-109, 2000), therefore, aims at quantifying the functions that natural capital performs in a more 'anthropocentric' vision, seeking to remove barriers between the human economy, social aspirations and the natural environment. The developed actions integrate ecological, social and economic information and highlight the (direct or indirect) 'benefits' that nature generates for humans to achieve a socially and scientifically acceptable balance between the priorities of nature conservation, resource use and benefit sharing.

Within this perspective, the term 'ecological and environmental endowments' is to be understood as the areas of public and private property, natural or semi-natural, that contribute to the achievement of the goals of environmental sustainability about the protection of the environment, biodiversity and ecosystems, as envisaged with the amendment of the Constitution in 2022 in Art. 9, i.e. precisely where (Arts. 1 to 12 - Part I) the fundamental principles are enunciated.

This is all the more evident when one considers that the EU Parliament approved the Nature Restoration Law on 12 July 2023. A measure proposed by the European Commission (partly contested by farmers) makes nature protection and the restoration of European habitats a legal obligation. Therefore, striving to support the ES mthodological integration in planning is even more necessary.

It has been argued (Salata 2021) that regulatory ES are best suited to support urban planning and the identification of operational priorities related to urban 'quality' and collective wellbeing about their close dependence on planned land use treatment. A public urban garden with an excellent tree-arbustive endowment can absorb much more atmospheric particulate matter than the mere lawn of a private garden. At the same time, a tree row planted in a private garden could retain much more agricultural nutrients than a small urban forest if that garden were in a run-off corridor dependent on diffuse nutrient sources.

The spatial analysis of ES can prove decisive in the structural and operational design of urban and spatial regeneration (on both public and private land), directly affecting urban quality and public health.

It is evident, therefore, that the ES are not superimposable not only to the urban standards of 1968 but also not even to an actualised conceptualisation in terms of endowment: attempting to superimpose the 'ecosystem service' to the 'urban and territorial endowment' can, especially in such a delicate moment of construction of methodologies in support of the protection of biodiversity through the integration of the ES in planning, generate great misunderstandings.

It is also intuitive that specific endowments can contribute to improving ecosystem capacities in different urban contexts (and also extra-urban contexts, mainly agricultural), as well as the fact that it is possible to characterise ecosystemically the (public and private) green spaces of cities by understanding what initiatives to adopt to make them more performing under different profiles, but it is not true that all urban and territorial endowments can generate ecosystem services.

More appropriately, it is believed that, in the formation of new urban planning tools and the revision of existing ones, municipalities should carry out, based on appropriate operational indications, a reconnaissance and quanti-qualitative verification of the actual state of areas, buildings and public or private equipment for public use aimed at the realisation and provision of services, services rendered and related performances, including those provided under agreements. It needs to be updated to reflect the resident population, the population actually present, the fluctuating population, the demographic structure, and the social composition.

All these materials must become an integral part of the documents that contribute to forming the cognitive framework of the urban and territorial planning tools for the sustainable government of the territory aimed at urban and territorial regeneration.

4. Conclusions

The law proposal put forward by the INU is a 'multifunctional' regulatory model capable of flanking the formulation of the fundamental principles and general rules of territorial government and governance with the regulation of several matters of exclusive State legislation. It also identifies those matters in which this law provides for a delegation to issue the necessary legislative decrees within the principles and timeframes defined therein. The INU's proposal regulates the scope and concept of territorial government and governance; the fundamental principles and purposes of territorial government; the tasks and functions of the State, regions and local territorial authorities; the instruments of planning and co-planning.
The law text drafted by INU presents two particularly innovative aspects: the shift from a predominantly parametric approach in the sizing of urban standards to the use of new qualitative-quantitative criteria, ensuring that the prefiguration of new urban allocations proceeds hand in hand with the introduction of the ELS (Essential Levels of Services);
the proposal of a plan form that tends to replace the principle of conformity with that of consistency progressively.
As a result of this transition, the urban planning discipline should seek substantial agreement between each new planning instrument and the objectives and addresses set by the superordinate plans.
This will achieve two effects: favouring the flexibility of urban planning instruments and reducing the recourse to urban planning variants.
These are contents and innovations to be introduced with the aim of making urban planning, at all levels, more in tune with the new challenges that the territorial government and governance must face: from the needs of ecological transition to adaptation to climate change, from the prevention of hydrogeological risk to the progressive zeroing of soil consumption.

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Appendix

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[1] Own translation from the Italian text.

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Land readjustment in Braga Municipality - Looking into the future, learning from the past

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Abstract
Land readjustment, a promising yet often underestimated approach, encounters numerous hurdles in Portugal. Like many urban centres, Braga confronts the pressing need to accommodate a growing population and economic expansion, while safeguarding urban quality.
The analysis delves into three case studies of land readjustment implemented through Execution Units, an operational planning tool. These cases underscore the challenges in balancing public objectives with private stakeholders' interests, steering legal frameworks, and achieving equitable outcomes. Despite successful collaborations and infrastructure developments in some instances, challenges persist in securing agreements, implementing comprehensive urban solutions, and fostering community engagement.
The findings emphasize the importance of adaptive policy frameworks, collaborative governance structures, and strategic planning to overcome these challenges and realize sustainable urban development goals in Braga Municipality.
Keywords: Master Plan; Braga Municipality; Execution Unit; Spatial planning

Introduction

The land readjustment process is an urban planning practice aimed at redistributing and reorganising land use in specific urban areas (Lombard and Rakodi, 2016; European Commission, 2020; Briata and Fioretti, 2023). In countries such as Spain, France, Germany, United States, and China, land readjustment is a common practice and is used for various purposes, such as infrastructure improvements, revitalisation of brownfields, creation of green spaces, promotion of affordable housing, and development of other real estate projects with public interest. “In dynamic and diverse urban contexts such as those found in Europe, effective collaboration among stakeholders is crucial for the success of land readjustment projects”, as highlighted by (European Commission, 2020). With urban areas across the country facing issues related to urbanisation and land use management, innovative urban planning strategies, such as land readjustment, are being explored as proactive tools for sustainable urban development.
Urban areas in Portugal are facing challenges akin to those observed in other European cities, encompassing land use conflicts, infrastructure provision, and environmental degradation (Freilich and Shultz, 2018; Briata and Fioretti, 2023). Within this framework, novel approaches in urban planning are imperative to navigate the intricate interplay between urban expansion and the pursuit of sustainable urban spaces (Magarotto and Costa, 2021; Schmid et al., 2024). Emerging urban planning instruments, such as land readjustment processes, endeavour to address the imperative of reorganising specific areas within urban agglomerations (Muñoz Gielen and Mualam, 2019; Schmid et al., 2024).
Land readjustment aims to redistribute and reorganize land use as a valuable tool in development areas and addressing the complex challenges of urban territory, including infrastructure needs and real estate pressure (Freilich and Shultz, 2018; Muñoz Gielen and Mualam, 2019; Schmid et al., 2024; Güngör and Polat, 2017; Samora-Arvela et al., 2017; Magarotto and Costa, 2021). In this regard, land readjustment emerges as a proactive response

to rapid urbanization and the need for more equitable and quality urban development, leading to the effectiveness of land readjustment in creating more efficient and inclusive urban spaces, promoting a better quality of life for residents (Xi et al., 2014; Fernandes and Seixas, 2018; Salvati et al., 2018; Zhang et al., 2022).

Moreover, academic research highlights the significance of land readjustment as an effective tool for fostering sustainable urban development and social equity. This perspective highlights the relevance of land readjustment not only as an urban planning tool but also as a mean to achieve broader social and economic development goals in cities.

The challenges associated with land readjustment in Braga resonate with broader global trends in urban development. The rapid development worldwide has led to increased pressure on land resources, exacerbating issues related to land use conflicts, infrastructure provision, and environmental degradation (Fernandes and Seixas, 2018; Salvati et al., 2018; Schmid et al., 2024). This states the urgent need for solutions to address the complex interplay between urban growth and sustainability.

While the theoretical benefits of land readjustment are widely recognised, its practical implementation often encounters challenges stemming from institutional, legal, and financial constraints. The success of land readjustment is contingent upon effective coordination among multiple stakeholders, including government agencies, landowners, developers, and local communities (Muñoz Gielen and Mualam, 2019). Moreover, the complex legal frameworks governing land tenure and property rights can complicate negotiations and delay project timelines on land readjustment. This legal complexity is also evident in European contexts (Muñoz Gielen and Mualam, 2019; Schmid et al., 2024). These outcomes underscore the importance of addressing institutional barriers and streamlining regulatory processes to facilitate the effective implementation of land readjustment initiatives in Braga.

In addition to addressing institutional and legal challenges, successful land readjustment in Braga must also consider the social and environmental dimensions of urban development. As emphasised by Bravo-Rodríguez and Rivas-Navarro (2021) in Spain, Condessa et al., (2015) in Portugal, Gueydan (2021) in France and Louw (2008) in Netherlands, community engagement and participatory decision-making are essential for ensuring the equitable distribution of benefits and mitigating potential social conflicts arising from land readjustment. Furthermore, proactive measures to protect natural ecosystems and enhance green infrastructure can contribute to the resilience and sustainability of urban landscapes.

Incorporating these principles into the planning and implementation of land readjustment initiatives can help Braga navigate the complexities of urbanisation while fostering inclusive and environmentally sustainable development. The aim of this study is to discuss the challenges encountered in the land readjustment process in Braga Municipality, evaluate the effectiveness of Braga's Master Plan in addressing these challenges, and propose improvements to optimise land readjustment initiatives in the future master plan. Additionally, the study seeks to explore innovative territorial planning strategies and compare them with international experiences, with the goal of providing specific recommendations to promote sustainable urban development in Braga.

Methodology
Study area

The study area encompasses the Municipality of Braga, located in the northern region of Portugal. The city of Braga is renowned for its rich history, vibrant culture, and impressive landscape, being included in the UNESCO Heritage List for its landscape value since 2019. It is situated approximately 50 kilometres northeast of Porto and about 25 kilometres east of the Atlantic coast. The city is set amidst a mountainous landscape, with fertile valleys and winding rivers, providing a unique natural environment for urban development.

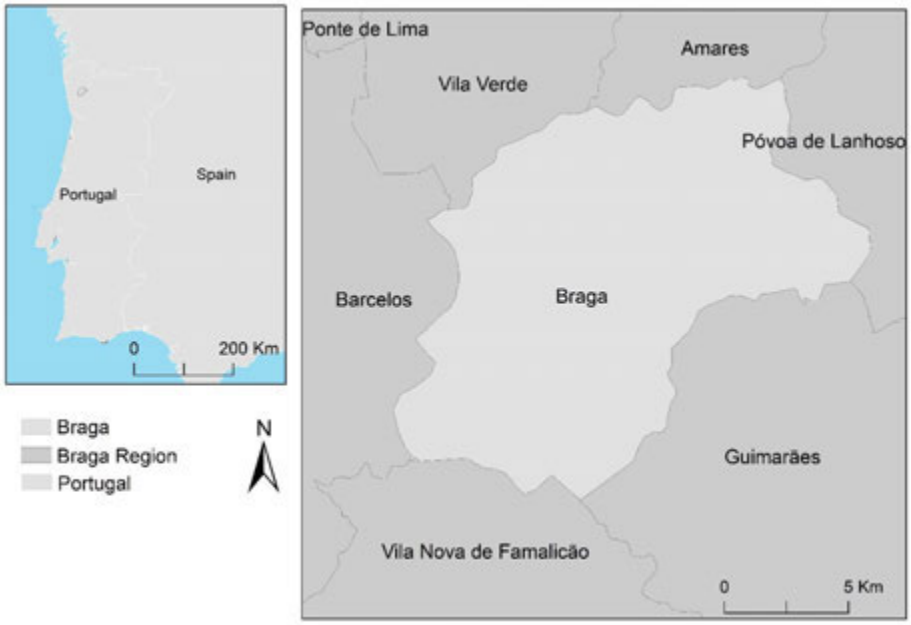

Figure 1 – Braga Municipality. Source: Own elaboration

Being one of the few municipalities in Portugal with population growth between 1991 and 2021 (6%), the increase in housing prices in Braga has emerged as a pressing challenge for residents and the city's economic industrial cluster. In tandem with this scenario, a significant reform of the Portuguese planning system has taken place, particularly focusing on the implementation of territorial management instruments. This reform has spurred the development of enforcement tools aimed at ensuring a coherent spatial planning framework. This transition is exemplified by Decree-Law no. 380/99, dated September 22, which introduced a new implementation entity alongside the traditional “loteamentos”, known as “unidades de execução”.

After decades of stagnant prices, juxtaposed with the expansive urban land traditionally delineated within the ambit of initial planning generations, this trend has recently sparked concerns regarding housing affordability. Many families now grapple with the challenge of securing suitable accommodation at reasonable prices. Additionally, the escalating land prices for economic activities in Braga present a significant challenge for both existing businesses and prospective investors. The economic expansion in Braga in the last decade increased demand

for industrial land, driving up prices due to heightened competition among businesses. As a result, it is crucial for local authorities and stakeholders in the real estate sector to proactively address this issue, seeking solutions that promote equity and fair access to land.
To explore the challenges and potential of land readjustment in Braga Municipality, we focused our study on three specific cases. Among the few cases already decided by the city council, we chose this set of cases for their significance and relevance to land readjustment scenarios. By examining these cases, we aim to gain valuable insights into the processes, obstacles, and results of land readjustment, aligning with the objectives of our study.

Data Collection

The data collection process involved analysing relevant literature and documentation concerning land readjustment cases in Europe, Portugal and the Municipality of Braga. Initially, an extensive review of existing literature on land readjustment, urban planning, and sustainable development was conducted. This literature review focused on practices and experiences related to land readjustment cases, in countries with wider experience and contexts somehow related to the Portuguese framework. Through this analysis we identified trends, challenges, and best practices associated with land readjustment, providing a robust theoretical foundation for the study.
In addition to the literature review, official government documents, land readjustment project reports, and other pertinent materials pertaining to specific land readjustment cases were examined. These documents included urban development plans, zoning regulations, and project reports, all of which are publicly available.
Analysing these documents yielded insights into the objectives, strategies, implementation processes, and outcomes of land readjustment cases in Braga.
The combination of these data collection methods facilitated a comprehensive understanding of land readjustment cases, complementing the ones in the Municipality of Braga, and laying a solid foundation for the analysis and interpretation of study results.
However, it is important to acknowledge the limitations of this study. One limitation is the restricted availability of land readjustment cases in Braga, which may have influenced the depth of the analysis and the comprehensive understanding of each case's specific contexts. Additionally, given the predominantly qualitative nature of the approach used, there is a potential for bias in interpreting the results, as the conclusions are based on subjective interpretations of the collected data. These limitations emphasise the need for caution when generalising the findings and underscore the importance of future research to further investigate specific aspects of land readjustment in Braga.

Land Readjustment in the European Context

Despite the inception of the modern concept of land readjustment in the first half of the 20th century in Europe the tangible outcomes of land readjustment processes have only begun to materialise recently within the planning framework (Condessa et al., 2015). This delay is primarily attributed to reforms associated with decentralisation and the simplification of the planning process (ESPON, 2018). In land readjustment, the generated public value typically manifests as green spaces, infrastructure, social housing, and facilities. These outcomes are realised through instruments that vary significantly among countries (van der Krabben and Needham, 2008; Hartmann and Spit, 2015; Muñoz Gielen, Maguregui Salas and Burón Cuadrado, 2017).
For a brief overview of the European landscape, we explore the land readjustment tools in France and Spain, both of which have experience in applying such mechanisms and have

notably influenced the Portuguese system (Condessa et al., 2015). This influence stems from the administrative heritage of the two countries, particularly the Napoleonic tradition (Newman and Thornley, 1996; Pollitt, Thiel and Homburg, 2007).

These countries are known for their rigid planning structures, which are mainly hierarchical and involve significant state interference in all planning processes (Organization for Economic Cooperation and Development, 2017).

France stands out due to its long tradition in this field, dating back to 1803 when landowners were encouraged to collaborate for spatial planning actions (Gueydan, 2021). This historical context offers unique insights into the evolution and implementation of land readjustment practices compared to other countries. However, it was only in 1967 that the association foncières urbains became a legal tool, established by the Code de l'Urbanisme (Law 67/1253 of Decembre 30th, 1967). This tool, still in force today, coexists with traditional forms of urban management like licensing. The creation of association foncières urbains (where land parcelling is deliberated) allows for the subsequent development of a zone d'aménagement concerté.

Typically, these tools involve land parcelling and subsequent urban design (Vacher, 2014; Hartmann and Spit, 2015), underpinned by a complex legal framework aimed at providing clarity and facilitating interaction between public and private landowners (van der Krabben and Needham, 2008). The initiation of the land readjustment process commonly relies on both cadastre and urban design, a consistent practice observed across the identified cases. These characteristics are also associated with active involvement from planning authorities (Hartmann and Spit, 2015; Muñoz Gielen, Maguregui Salas and Burón Cuadrado, 2017) and operational urbanism, which became more prominent in the planning landscape with the integration of neoliberal ideals. In this paradigm, the State delegates competences to the private sector and lower levels of administration to pursue their interests and address bureaucratic hurdles that impede public action (Alonso, Clifton and Díaz-Fuentes, 2015; Gray and Kallin, 2023).

While significant, it's noteworthy that land readjustment isn't the prevailing approach to development management in these countries. Instead, licensing, and isolated actions of rehabilitation and building tend to take precedence. This dynamic exists within a legal framework where the rights of private ownership are constitutionally established (Condessa et al., 2015).

Despite extensive literature on land readjustment, specific cases are not deeply-described in scientific literature (Condessa et al., 2015) and are challenging to compare (Louw, 2008). Nonetheless, we address five significant cases in France and Spain that either contributed to the discussion or suggested improvements to the case studies of Braga.

In Spain, the expansion of the AVE (*Alta Velocidad Española)* network and the development of Murcia's airport contribute to enhancing the metropolitan area, which faces challenges in establishing its position within the territorial hierarchy. Land readjustment processes have been reported as crucial in securing land reserves and achieving the primary objectives of the municipal plan, which has been in place since 1985. In Murcia, urban development primarily relies on local plans or detailed studies, with detailed studies being predominant: out of 550 planning processes, 486 were conducted through detailed studies, while only 117 were through execution units (Moncada-García, 2022).

Another notable case in Spain concerns Granada, where at the beginning of the plan implementation, the municipality adopted a strategy of collaborating with the private sector by abdicating the allocation of land reserves for public use. Since the beginning of the century, the approach has shifted, and planning authorities have guaranteed land provision to ensure social cohesion, as by the establishment of two sports pavilions reported by Bravo-Rodríguez and Rivas-Navarro (2021).

Table - 1: Cases in France and Spain. Source: Own elaboration based on literature review

Case of study		**Spain** *(Sur Granada)*	**Spain** *(Murcia)*	**France** *(Les Charmes du petit bois)*	**France** *(ÉcoQuartier La Baudière)*	**France** *(Marne Europe)*
Base information		Plan	Plan	*AFU*	*AFU*	*ZAC*
Frames	Started	1978 and 1985	1977	2007	2010	2020
	Higher level plan	*Plan General de Ordenación Urbana*	*Plan General de Ordenación Urbana*	*Plan Local D'urbanisme*	*Plan d'Occupation des Sols*	*Plan Local d'Urbanisme*
	Aim of the land reserve/Public entities responsibility	Reserve land for equipment and road infrastructure as part of the sequence of urban actions	Reserve land for green spaces, airport, road, and rail infrastructure as part of the sequence of urban actions	Reserve land for green spaces, amenities, and road infrastructure as part of the sequence of urban actions	Reserve land for green spaces and amenities as part of the sequence of urban consolidation actions	Reserve land for green spaces, amenities, metro, and road, as part of the sequence of urban consolidation actions
	Implementation	Coordinated by the municipality. The land readjustment could be done by *unidades de ejecución* or detail studies	Coordinated by the municipality. The land readjustment could be done by *unidades de ejecución* or detail studies	Coordinated by the municipality and executed by private. The process of land readjustment was based in *Agence Foncière Urbaine*	Coordinated and executed by the municipality. and The process of land readjustment was based in *Agence Foncière Urbaine*	Coordinated by the municipality and executed by private. The process of land readjustment was based in a *Zone D'aménagement Concerté*
	Purpose	Give scale to the city by creating amenities and consolidating the metropolitan space	Design the city to accommodate significant investments that improve connectivity with the countryside and incorporate extensive green spaces	Provide housing options, including social housing, and establish amenities in the outskirts of the Dijon	Prevent urban densification in the neighbourhood by establishing amenities and green corridors in a rural context	Urban consolidation in a global metropole around a expansion network of the metropolitan system
Status		Completed	In progress	In progress	In progress	In progress

In France, the Les Charmes du Petit Bois case initiated a land readjustment process to facilitate the provision of social housing. Landowners were to sell their land to the agence foncière urbaine if they lacked interest in participating in the development process. Forty percent of them opted to sell their parcels, thereby enhancing the attractiveness of the urban development project. Public investment was implemented in stages (Vacher, 2014).

Similarly, in the case of ÉcoQuartier La Baudière, land readjustment aimed to mitigate undesirable urban density in a rural setting and establish facilities to alleviate the impacts of low density. The revision of higher-level plans facilitated the construction of green spaces, and public investment followed a phased approach (Vacher, 2014).

The third French case, Marne Europe, aimed to anticipate externalities generated by a metro station to consolidate urban space, illustrating the versatility of land readjustment in addressing different scales and purposes. The objective was to remediate a brownfield as part of the Grand Paris Express Projet (Mouton, Guelton and Poinsot, 2024).

The objective of this paper is not to offer an in-depth analysis of these cases and as, such, additional details are summarized in Table 1. It is noteworthy that these cases have some

common grounds. First, there is a strong subjacent public aim. These processes have been instrumental in securing land reserves, facilitating social housing provision, mitigating undesirable urban density, and anticipating externalities generated by infrastructure projects. Also, municipalities play a pivotal role in all cases, either by facilitating the execution of planned initiatives or by creating the necessary fiscal, legal, and expertise conditions for private landowners to pursue their intentions.
Overall, all these cases underscore the importance of context-specific planning approaches, the need for innovative solutions to urban challenges, and the role of collaborative efforts between public and private stakeholders in achieving sustainable urban development.

Land Readjustment in Portugal

While urban planning is constitutionally designated as a public responsibility, private developers have largely dominated its implementation in recent decades in Portugal, with recognised constraints for adequate urban development. In response to this prevalent practice, the principle of equity was introduced by a wide legislation reform in 1999 (by Decree-Law no. 380/99 of 1999 - Legal Framework of Planning Instruments – RJIGT). This piece of law mandated that municipal plans incorporate compensation procedures to ensure a fair redistribution of benefits and costs among property owners and between them and the local government. Municipal Master Plans are therefore required to delineate general criteria.
Land adjustment implementation occurs within specific territorial units known as Execution Units. According to RJIGT, "the Municipality promotes the coordinated and scheduled execution of territorial planning, with the collaboration of public and private entities, carrying out infrastructures and equipment according to the public interest, objectives, and priorities established in intermunicipal and municipal plans, using the means provided for by law" (cf. Article 146).
This process entails identifying the physical boundaries of the area intended for urban development and identifying all property owners. These boundaries are delimited by the municipality on its own initiative or at the request of interested owners (cf. Article 147 of RJIGT) and are subject to a period of public discussion on terms analogous to those foreseen for Detailed Plans or Urbanization Plan.
Each Execution Unit must specify the extent of municipal administration involvement in the process. To uphold the principle of equitable redistribution of benefits and costs, three distinct execution systems are outlined: compensation, imposition, and cooperation (Condessa et al., 2015).
In the compensation system, private stakeholders, such as landowners and developers, take the initiative to develop the urban layout, provide necessary infrastructure, and determine the distribution of costs and benefits among all involved parties, including the municipality. Moreover, they are obligated to compensate the municipality, often through the allocation of land parcels for public use or payment of taxes, in accordance with municipal regulations. The municipality retains the authority to approve, modify, or reject the proposal based on legal provisions outlined in municipal plans and regulations.
In cases where the local government spearheads Execution Unit projects, landowners' participation is typically compulsory, although full consent may not always be legally required. Under the imposition system, the municipality undertakes urban execution directly or by setting agreements with private developers.
Conversely, in the cooperation system, the municipality initiates the process and collaborates with private stakeholders voluntarily or at the municipality's instigation.
In both cooperation and compensation systems, the definition of specific mechanisms to ensure equity among all parties involved and support compensation, whether in the form of cession of

land or currency, is crucial. This stage is where the principles of equity, transparency, and fairness are conceptualized.
Nevertheless, local authorities and private stakeholders retain the legitimacy to define additional mechanisms, provided they adhere to the principle of equity.
The rights and obligations of the parties are defined by an urbanization contract as defined in, specifically aiming at (a) establishing the rights and obligations of the parties involved in the execution unit; (b) specifying the obligations of the parties involved regarding the execution of urbanization works, the responsibilities they are subject to, and the deadline for compliance; (c) outlining the formalization of the transfer to the Municipality of the areas to be relocated by private parties for infrastructure purposes (Articles 148 and 150 of RJIGT).
Land readjustment in Portugal has indeed faced numerous challenges, resulting in few successful cases being delivered. Despite its potential, there is a scarcity of literature on the subject, indicating a lack of comprehensive understanding and documentation of land readjustment initiatives in the country. Additionally, municipalities grapple with the implementation and effectiveness of execution units, which are intended to facilitate urban development projects. This struggle underscores the complexity and obstacles inherent in land readjustment processes, highlighting the need for further research, effective governance, and innovative strategies to overcome existing challenges and promote sustainable urban development.

Braga Municipality cases

Land readjustment processes in Braga Municipality are relatively recent, having been incorporated since the 2015 version of the Master Plan (Notice No. 11741/2015 of October 14). It represents the third iteration of Master Plans in Braga, following versions from 1994 and 2001.
The current zoning of Braga Master Plans includes 40 Unidades Operativas de Planeamento e Gestão (UOPG), where Execution Units delimitation is mandatory unless specific requirements outlined in Article 99 of the Master Plan regulation are met. These requirements stipulate that a development project must be proven to be the most appropriate solution, not harm the environment or significantly compromise any possible integrated solutions with adjacent land, not compromise the potential application of land readjustment mechanisms to adjacent plots and have the necessary infrastructure provisions such as access to public roads, water supply, and sewage systems, within a specified distance from road.
The UOPG cover a total area of 3371 hectares, representing 16% of the municipality's territory. They vary in size, with the largest covering 807 hectares and the smallest 7 hectares, with an average size of 33.84 hectares. Execution Units may encompass sub-areas within these larger UOPG, with specific limits to be decided and approved by the city council.
As of April 2024, the Braga City Hall Council had approved five Execution Units under the provision of the Master Plan, while three others were awaiting final decisions after the public participation period. All these units were initiated under private initiative, and none required the distribution of charges and benefits. This lack of requirement stemmed from either having a single owner or alternative agreements in cases where there were multiple owners.
More recently, the Braga Municipality has undertaken additional land readjustment initiatives under the *Plano de Urbanização das Sete Fontes*. This plan, published in 2022, encompasses 26 execution units and includes detailed urban design and land readjustment procedures. It aims to create a large park surrounding the historic water supply system to Braga City, dating back to the 18th century, covering 30 hectares, and featuring various amenities.

While the land readjustment within the Sete Fontes Plan presents interesting dynamics, its highly specific context sets it apart from land readjustment cases governed by the Master Plan. Consequently, the Sete Fontes Plan will not be examined within the scope of this paper.
The paper conducts an analysis of three land readjustment cases within Braga Municipality outlined by the Master Plan. These cases were selected based on their representativeness and complementary nature, allowing for an elucidation of primary challenges, stakeholder perspectives, and resultant outcomes. Despite not necessarily being considered successful from the authors' standpoint, these cases are viewed as initial efforts aimed at transcending prevailing development approaches and addressing challenges in integrated planning practices.

Lomar Unit

The Lomar Unit project began in 2017 as the first of its kind in Braga. It was initiated to support the expansion of Bosch, the municipality's main industry, which employs around 5,000 people and generates two billion euros in revenue annually. Bosch has invested in land acquisition and proceeded with the construction of a new building for production infrastructure and offices, a new cafeteria, and a new parking lot, reinforcing human resources with the creation of 1,000 full-time positions, totalling an investment exceeding 36 million euros (CM-Braga, 2017).
The Execution unit is part of the UOPG 25 – Parque Oeste e envolvente – Ferreiros, a major UOPG located in the South-West part of the city of Braga. Its main objectives include enhancing the Este River by creating a park along its banks, structuring the road network to facilitate the expansion of industrial zones and the organization of economic activities, providing the area with general infrastructure, notably the South Wastewater Treatment Plant, and ensuring adequate coordination with existing urban clusters (Article 110 of Master Plan regulation). According to the same document, this Execution Unit should be ensured through a system of cooperation. The Municipality of Braga considered there to be an unquestionable public interest in the execution of urbanization works (such as road, parking spaces and sidewalks) that can ensure appropriate use for economic activities, as well as recognised the interest in supporting and promoting investment projects that are pivotal for the municipality's economic development.
The preliminary proposal for the execution unit limits approved in June 2017 was enlarged, after the participation of three neighbouring landowners during the public hearing period. The final proposal required cooperation from the municipality and the seven landowners, who held property of the 15 parcels of land within the Execution Unit limits. After adjustments, it was approved in November 2017.
The urbanization agreement among the stakeholders took place in September 2019 and aimed to regulate the relations between the parties involved and establish the terms and conditions of their participation, through a cooperation system, in the partial execution of UOPG 25.

Figure - 2: Lomar Unit final proposal. Source: Braga Municipality website (CM-Braga, 2024)

The agreement foresees three stages of implementation. First phase comprehended a construction of the road and Bosh buildings. Phase two regarded another stretch of road and building the parking area. Both these phases are concluded and in use, as shown in aerial photographs (Figure 3). Third phase foresees the construction of a local access to a local (to be built) park in the west limit of the Execution Unit and is not yet complete.

Despite being an interesting and successful example, we can point out that the only executed infrastructure was dependent on a single company, with high interest in the development. The remaining part, subject to investment of other private owners and the municipality has not yet been undertaken, revealing difficulties in implementing upon the need to conciliate different landowners.

Figure - 3: Current situation of Lomar area. Source: Aerial view of 2021 (DGT, 2021)

Quinta da Mata Unit

The Quinta Mata Unit was established in response to the Municipality's urgent need to construct the South Wastewater Treatment Plant. This facility is essential for augmenting the city centre's sewage treatment capacity, which has been strained by recent urban growth. Consequently, there is a significant public interest in defining the boundaries of the Execution Unit and ensuring prompt land allocation. The initiative has been spearheaded by the Municipality in collaboration with AGERE, the local company responsible for water and sewage management. The proposed urban project entails the construction of industrial pavilions, in accordance with the zoning regulations outlined in the Master Plan. Meeting the maximum index is imperative as it guarantees the allocation of land required for the sewage treatment station. Additionally, the urban design necessitates the construction of a new road in the southern part of the unit to facilitate connectivity with the local road network. Despite extensive negotiations with the landowner, consensus on the allotment design has not yet been achieved.

It is noteworthy that, under Portuguese law, the approval of execution unit delineation does not hinge on the acceptance of landowners. However, as seen in the Lomar case, a public hearing is conducted, allowing citizens to participate. If any landowner within an execution unit opts out of the land readjustment process, the municipality is obligated to initiate expropriation proceedings and assume their duties and rights. Nonetheless, the provision of land for infrastructure, equipment, and green areas can only be realized upon reaching a land adjustment agreement, typically through replotting or joint allotment, followed by land registration.

In this case, although expropriation is a viable option, the municipality has refrained from initiating procedures in anticipation of reaching an agreement. Given that expropriation processes tend to be protracted, the municipality risks missing funding deadlines if an agreement is not reached in time. In Braga, as in Portugal generally, expropriation is considered a last resort due to various structural challenges. These include the inefficiency of the legal

system, the absence of a standard method for evaluating land value (leading to potentially high payments by public authorities), and the complexity of legal procedures. This aligns with Condessa's observation that a lack of a reliable land valuation mechanism integrated into the planning process is a major pitfall of land readjustment initiatives (Condessa et al., 2015). Consequently, in Braga municipality, expropriations are infrequent, and efforts are made to secure agreements whenever possible.

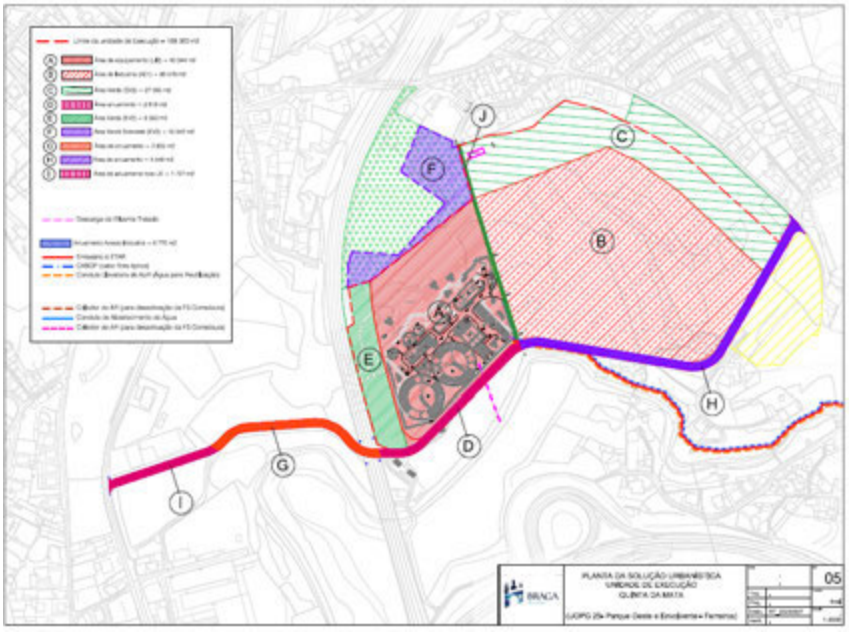

Figure - 4: Quinta da Mata final proposal; Source: Braga Municipality website (CM-Braga, 2024)

Alto da Vela Unit

The Alto da Vela Unit had its preliminary version approved on November 2023 and the final limit on March 2024. The project includes the provision for 24 detached housing units, supported by a winding road adapted to the hilly location. Initially, it encompassed two landowners, but the owner of the major parcel acquired the smaller one to avoid negotiating. This is a recurrent situation. In fact, five out of the eight execution units in Braga Municipality today have a single owner, despite including several parcels. This may be explained by a reluctance to deal with partners in development projects but also denotes a high acquisitive capacity from local companies.

Figure - 5: Alto da Vela final proposal. Source: Braga Municipality website (CM-Braga, 2024)

The urban infrastructure for Alto da Vela is, from our perspective, not entirely satisfactory. The new road is a continuation of an existing one (which supports the construction of seven detached houses) but fails to ensure a connection with the existing local road further north. A new execution unit is expected to fill that gap. However, there is no guarantee on the timing of that development, leaving the Braga territory with yet another dead-end road.

The lack of road terminations is a highly common outcome from the past years' policy of development in Braga Municipality, often limited by the cadastre, enhanced by the new roads indicated in the Master Plan, and the lack of proper land management. The Master Plan design has contributed to this situation by "drawing" many new roads on the zoning plans. As developers frequently report that reaching agreements with neighbours is not possible, the municipal management has allowed bits of roads to be started without the guarantee of connections (see examples in Figure 5).

The Alto da Vela Execution Unit was successful in assuring two pieces of land to be joined, but it does not provide what we believe is one of its main objectives – to provide a comprehensive road structure and connections to the local network. Despite having gone through all the formal procedures of an execution unit, in our opinion, it fails to deliver an adequate urban solution. This proves yet again the municipality's fragile capacity for negotiation and its ability to be firm on objectives. Despite its pitfalls, this is an example has representativeness among current practice.

Figure - 6: Example of dead-ends in Braga, highlighted in yellow.

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Discussion & Conclusions

The analysis of three distinct cases of land readjustment within Braga Municipality provides valuable insights into the complexities and challenges inherent in urban development initiatives. These cases offer a comprehensive view of the varied dynamics and outcomes associated with such projects as we also verified with the European examples.
The cases in Braga do not present significant indications of community involvement, despite the mandatory public hearing periods stipulated by law. Similar challenges are observed in the European examples. On one hand, there is recurrent situation of a single landowner in land readjustment process and on the other hand processes that involve several landowners have difficulties in meeting their end (as in the Lomar case). This is an aspect, the outcome could benefit from improved communication, (as well as fiscal, juridical, and policy changes) to

attract private landowners to collaborate more closely with the planning authorities. However, this scenario differs significantly from European cases where most of the processes progress independently of the number of owners. We believe this is primarily due to the strategic and public objectives associated with these operational tools in spatial planning instruments. This process implies a high level of information, and the cases suggest that Portuguese landowners may not yet have the skills to understand and recognize the benefits for themselves, others, and the collective. This aspect is considerably relevant due to the recent introduction of land readjustment tools into the daily planning practice. The longevity of land readjustment in the national context seems to have a significant impact and Portugal is quite a youthful player in this matter, namely compared to other European counties.

The examination of the case studies also highlights a tendency of the municipality to prioritize procedural fulfilment over the pursuit of urban solutions of sufficient quality. Land readjustment is frequently approached as a mere obligation rather than an opportunity to guarantee optimal urban solutions.

Across all cases, the tension between public interest objectives and the interests of private stakeholders is evident. While projects like the Lomar Unit demonstrate successful collaboration between the municipality and major industry players, challenges arise in reconciling diverse interests and ensuring equitable outcomes for all stakeholders. The municipality's need to address pressing infrastructure requirements, such as the South Wastewater Treatment Plant in the Quinta da Mata Unit, underscores the imperative of balancing public utility needs with private property rights.

Negotiating agreements among multiple landowners and coordinating diverse stakeholder interests emerge as significant challenges in all the cases under study. The delays and obstacles encountered in reaching consensus on infrastructure provision and land allotment design highlight the complexities of navigating legal frameworks and competing priorities. Despite legal provisions for land readjustment processes being met, as seen in the Alto da Vela Unit and in European examples, challenges persist in securing agreements and ensuring timely project implementation.

Another common thread across the cases is the inadequacy of infrastructure planning and implementation, particularly regarding road connectivity and comprehensive urban solutions. While certain infrastructure components, such as road construction and building developments, have been realized in the Lomar and Quinta da Mata Units, challenges remain in achieving seamless integration with existing urban networks. The fragmented road network and lack of connectivity, exemplified in the Alto da Vela Unit, reflect broader issues in municipal negotiation capacity and urban planning effectiveness. The European cases appear to concur that the urban project must be interdependent with the surroundings.

Conclusions point out that while land readjustment holds immense potential for transforming urban landscapes and fostering sustainable development in Portugal, overcoming these challenges is paramount. Addressing fragmented land ownership, streamlining regulatory processes, securing funding, and fostering community support are essential steps towards successful land readjustment projects in the country. In addition, strengthening the legal bases governing land readjustment is imperative to promote investor and community confidence.

The cases underscore the importance of collaborative governance structures and strategic planning in navigating the complexities of urban development. Effective coordination among stakeholders, transparent negotiation processes, and proactive engagement with the community are essential for addressing diverse interests and achieving sustainable outcomes. The success of projects like the Lomar Unit highlights the potential for fruitful collaboration between the municipality and private sector entities in driving economic growth and infrastructure development.

Addressing the challenges identified requires adaptive policy and legal frameworks that facilitate streamlined decision-making, expedite project approvals, and ensure equitable outcomes for all stakeholders. Proactive measures to streamline land readjustment processes, clarify legal requirements, and provide support for negotiation and dispute resolution can enhance the efficiency and effectiveness of urban development initiatives.

Investing in integrated planning approaches and prioritizing infrastructure development are critical for addressing the evolving needs of growing urban areas. Comprehensive strategies that emphasize connectivity, sustainability, and community engagement can help mitigate infrastructure shortcomings and foster inclusive and resilient urban environments.

The analysis of land readjustment initiatives within the Municipality of Braga provides valuable insights into the complexities of urban governance and the challenges of translating intentions into tangible outcomes. By acknowledging the importance of community engagement, skills development, and policy adaptation, the Municipality of Braga can design the next Master Plan with more suitable tools. Consequently, these cases serve as significant milestones in the municipality's journey towards transcending traditional development approaches and realising its vision for a prosperous and inclusive urban future.

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Multi-Planning Integration: Construction and Progress of China's National Territory Spatial Planning System

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Abstract: Spatial planning entails the adept control and scientific management of national territorial space a task crucial for achieving a balance between development and conservation.

In 2019, China initiated a spatial planning framework. This reform stands as a milestone, showcasing significant innovation in planning concepts, technical methodologies, and management systems in China over recent decades. This paper first reviews the pre-reform landscape, including the diverse planning types, prevalent issues, and experimental endeavors. Subsequently, it delineates the principal measures undertaken in China's national territorial spatial planning, encompassing aspects such as institutional management, systematic composition, compilation content, and technical methods. Lastly, it discusses the consequential shifts in objectives and goals within the realm of national territorial spatial planning objects and goals. China's spatial planning reform offers valuable insights for nations and regions grappling with the challenges of global climate change and aspiring for sustainable development.

Keywords: Spatial planning; National territory spatial planning; Planning reform; China.

1. Introduction

Spatial planning originated within the context of European integration. In the 1960s, strategic spatial planning was elevated as the conventional approach for urban and regional planning in Europe (Liu and Zhou, 2021, p.1). The European Spatial Development Perspective (ESDP), issued in 1999, was a quantum leap in the practical application of spatial planning (Rivolin and Faludi, 2005, p.196). The European Commission (1999) concluded that regional development was propagated through coordinated spatial policies, enhancing economic, social, and environmental harmony. Subsequently, governments and their planning communities across European Union countries began implementing spatial planning in practice (Yu, Cheng and Jiang, 2020, p.16). Spatial planning is considered a vital public policy for rational land resource allocation and orderly spatial structure layout in most countries globally (Medeiros, 2019, p.172; Trkulja, Tosic and Zivanovic, 2012, p.1729). It has become a fundamental institutional framework for addressing the challenges of spatial development and governance, especially in an era of economic globalisation (Zhang, Man and Zhang, 2023, p.1). The specific content, organisational methods, hierarchical systems, and other aspects of spatial planning vary among countries by being tailored to their socioeconomic development and national characteristics. However, they typically exhibit strong systematic and continuous features, ensuring comprehensive planning and management coverage of their territories. Spatial planning plays a significant role in the comprehensive coordination of national or regional political, economic, social, and ecological elements.

During the early 21st century, as China evolved, it progressively formulated methods in spatial planning, including urban-rural planning, land-use planning, main functional zone planning, etc. The implementation of these plans has propelled the rapid urbanisation process. However, in recent years, China has faced challenges such as global climate change, slowing urbanisation rates (Niu et al., 2024, p.24), negative population growth (Cheng and Guo, 2023, p.102), and environmental pollution (Yang, Xing and Jones, 2019, p1; Cai, Wang and Li, 2023, p.76). Due to limited resources and environmental carrying capacity, the government must utilise inventory resources and attain sustainable development. The previous approach to incremental development, predominant during China's rapid urbanisation, and managed by

various departments, is no longer suitable for the current national situation (Song et al., 2024, p.10). Against this backdrop, in March 2018, part of the institutional reforms in China was establishing the Ministry of Natural Resources (MNR). This ministry was tasked with establishing a spatial planning system while overseeing its implementation, marking the most significant spatial planning reform in China's history. "The Opinions on the Establishment and Supervision of the Implementation of the National Territory Spatial Planning System" (hereinafter referred to as the "Opinions") released in May 2019, proposed the establishment of a "top-level design" for the National Territory Spatial Planning (NTSP) system and its supervision (the Central Committee of the Communist Party of China and the State Council, 2019). This launched the comprehensive implementation of spatial planning reform nationwide. In 2022, the first national-level comprehensive implementation of "multi-planning integration" for overall plans was executed. The plans of 31 provincial-level regions in mainland China were submitted to the State Council, with 14 consented to. The authorizing bodies have received over 90 percent of the 350 municipal-level overall plans and 2,220 county-level overall plans nationwide, with the majority having completed the review process. Some municipalities and counties are receiving approval gradually. Overall, a unified and scientifically efficient NTSP system was formed nationwide. In an era of ecological civilisation, this newly established NTSP system is a plan that induces high-quality development and coordinates the protection and development of space. It also follows the requirements of strategic guidance and rigid control, achieves integrated urban-rural development, and coordinates the allocation of comprehensive territorial elements. It aims to address issues such as overlapping scopes and conflicting content among various previous plans, strictly adhere to the bottom line of food security, ecological security, and national security, and achieve high-quality development and life in urban and rural areas. It realises the organic integration of various spatial planning such as economic and social development, urban and rural construction, land use, ecological environment protection, forestry, water conservancy, transportation, and marine affairs.

Recently, NTSP has been a focal point of Chinese societal attention and a hot topic of discussion in the domestic planning academic community. However, due to being in a continuous process of reform exploration, there has been relatively little research on it internationally. After nearly six years of practice, the reform of China's NTSP has yielded phased achievements. In this context, this study systematically reviews the progress of China's NTSP reform and summarises its practices and characteristics. The aim is to provide a reference for countries or regions facing global climate change challenges and needing sustainable development.

2. The Origin of China's NTSP Reform

2.1 China's Spatial Planning Types Before the Reform

Most developed countries coordinate and guide spatial development through integrated spatial planning systems. Dissimilar to this, this is determined by China's institutional characteristics and basic national conditions. Before the NSTP reform, there were multiple plans instead of a strictly unified national spatial planning system. According to incomplete

data, over 80 types of plans, which the traditional spatial planning system incorporates, have a legal basis (Li et al., 2020, p.63). Each plan serves a different purpose. Amongst various types of plans, strategic, land and resources, ecological and environmental, urban and rural construction, and infrastructure (Figure 1), may serve the purpose of strategic guidance, resource protection and utilisation, construction, and development. The content is diverse but not well-structured.

Per laws, regulations, and national government documents, spatial planning with clarity and extensive influence include urban-rural planning, land-use planning, main functional zone planning, and eco-environmental protection planning. They are managed by the Ministry of Housing and Urban-Rural Development, the former Ministry of Land and Resources, the National Development and Reform Commission, and the former Ministry of Environmental Protection respectively. Based on China's administrative division system, spatial planning is split into national, provincial, municipal, county, and township administrative levels, Conclusively, due to a lack of consolidation and disorderly nature, the coexistence of multiple plans with "each doing its own thing" has led to prominent issues.

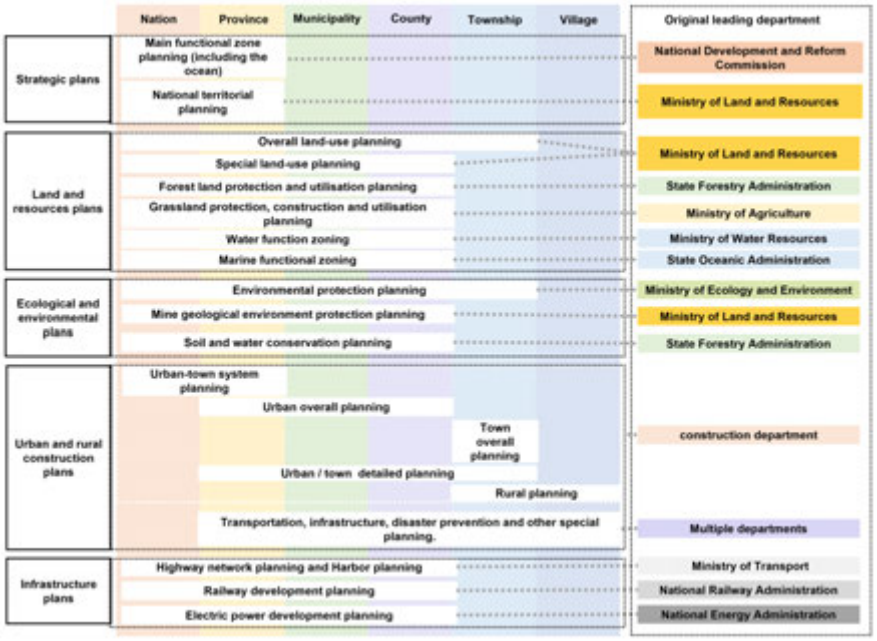

Figure 1: Traditional spatial planning system in China

2.2 China's Spatial Planning Issues Before the Reform

Before the NSTP reform, many spatial planning types with overlapping and conflicting content existed. Over 80 different types of plans corresponded to various administrative levels. They were managed by different departments, had different preparation and approval authorities, and were based on different laws and regulations. They also held different legal

statuses, and used different technical standards, making coordination and alignment challenging. Additionally, there were often significant disparities in objectives, content, and outcomes due to the diverse values and focal points. Prominent issues of functional overlap and content discord ensued among different plans.

The approval processes for various plans were complex, lacking overall coordination among management departments. Due to the leadership of several administrative departments, institutional and structural obstacles existed operationally in spatial planning at all levels. During the administrative review, different approval authorities, procedures, and focus areas led to a more prolonged coordination process. Furthermore, by statute and administrative documents, administrative powers to allocate land development rights were granted to different planning departments, thus creating independent approval authorities between departments and a lack of coordination.

Disorderly growth caused by the absence of long-term effective guidance in Urban development stems from the frequent changes in local plans caused by the lack of a planning authority. The "priority of superior power" feature of China's governance system, ensures that higher-level governments possess more authority. Higher-level plans serve as a basis for lower-level plans, with higher-level departments authorizing approval and supervising the implementation of lower-level plans. Higher-level plans often lack strategic and policy guidance. Thus, when lower-level plans try to imitate them, they lack operational and adaptive strength. At the same time, there is a phenomenon where lower-level plans tend to prioritise their interests, magnify the scale of development incrementally, and adjust layouts accordingly to the detriment of the higher-level plans' frameworks.

The foundational data for various plans lack uniformity (Liu, Zhan and Liu, 2019, p.51), with discrepancies in geographic coordinate systems, making it difficult for plans to connect. Cities like Guangzhou, early adopters of the "multi-planning Integration" approach, objectively face this challenge. Consequently, it is crucial to establish a unified coordinate conversion platform and a unified data infrastructure platform to achieve the conversion of different geographic coordinate systems and unify the spatial basic parameters of multiple plans. This would facilitate the subsequent planning and implementation of the "multi-planning Integration."

2.3 China's Exploration of " Multi-Planning Integration " Before the Reform

In the 1990s, prior to the NTSP reform, local cities like Shanghai conducted voluntary exploratory experiments, integrating different tiers of plans independently. In 2014, this evolved into pilot projects executed in 28 cities and counties selected by the National Development and Reform Commission, the Ministry of Environmental Protection, the Ministry of Land and Resources, and the Ministry of Housing and Urban-Rural Development. This initiated research on the "multi-planning Integration" scheme for economic and social development planning, urban-rural planning, land-use planning, and eco-environment protection planning. For the duration, a plan served as the core with other plans complementing it. It comprised three schemes dominated by economic and social development planning, urban-rural planning, and land-use planning, respectively.

In 2017, predicated by the city and county pilot projects and led by the General Office of the Communist Party of China Central Committee and the General Office of the State Council, nine provincial-level administrative units were selected. These units, inclusive of Hainan and

Ningxia, were chosen to conduct provincial-level spatial planning pilots and formulate unified provincial-level overall planning. It was mandatory to adopt a "top and down linkage, collaborative promotion" approach, synchronously advancing provincial, municipal, and county-level NTSP pilot projects. This ensured the interconnectivity and hierarchical management of spatial planning. Due to institutional reforms, this pilot project was discontinued. Overall, the phases of evolution in "multi-planning integration" from local voluntary experiments to departmental deployment and nationally coordinated pilots are replete with accomplishment and experience aiding NTSP reform. However, challenges as departments overly emphasise their functions persist, leading to insufficient integration of multiple plans.

2.4 A New Era of China's Spatial Planning Reform

In 2019, the "Opinions" officially proposed establishing a "multi-planning integration" NTSP system. This consolidates the previous separate spatial planning (main functional zone planning, land-use planning, urban-rural planning, etc.) previously managed by different departments, into a unified NTSP system. It shall be regulated by the Ministry of Natural Resources (MNR).

This unified system represents the inheritance and development of main functional zone planning, land-use planning, and urban-rural planning. It is a comprehensive, systematic, and innovative construction of the spatial system. Its purpose is to make overall arrangements for the all-region, all-element, and all-process development and protection of terrestrial and marine, urban and rural, above-ground and underground "mountains, rivers, forests, farmlands, lakes, grasslands, sands, glaciers," and other national territorial spaces. Its terminus a quo includes responding to the requirements of China's new era of ecological civilisation construction, changing the previous emphasis on development and neglect of resource protection, and guiding the sustainable development of national territorial space. Synchronically, the government has clarified the legal status of NTSP reform from the legislative perspective, amending the "Land Administration Law" to stipulate the requirements and legal effectiveness of NTSP. It represents a systemic and reconstructive planning reform in aspects such as planning systems, management institutions, technical methods, and interdisciplinary fields, for China in recent decades.

3. Major Measures of China's NTSP (Reform

3.1 Unified Management Functions of Spatial Planning

China being vast in territory and population, possesses a complex national administration. Over time, numerous spatial planning and management mechanisms have been developed lacking a unified top-level design and institutional framework. This has resulted in conflicts between different management departments, driven by departmental interests and the struggle for "discourse power," leading to conflict between different spatial planning.

The core measure of the NTSP reform is to centralise the responsibility of NTSP under one department, while "strengthening the guiding and restraining the role of NTSP on various special plans." The previous issue of "multi-planning conflicts" precipitated by institutional mechanisms will be explored.

To bolster the management of NTSP, China established the MNR in 2018. It integrated

previous responsibilities for the formulation and approval of all spatial planning. This consolidation comprises the management of national territorial planning and land-use planning from the former Ministry of Land and Resources, main functional zone planning from the National Development and Reform Commission, and urban-rural planning from the Ministry of Housing and Urban-Rural Development. It also includes resource investigation and demarcation registration management responsibilities related to natural resources from the Ministry of Water Resources, the Ministry of Agriculture, the State Forestry Administration, the State Oceanic Administration, and the National Bureau of Surveying, Mapping, and Geoinformation. A high degree of accord in spatial planning rights has been achieved through institutional reforms. This initiated the reconstruction of the NTSP system, ending the history of "Nine Dragons Water Control" of planning formulation and management by multiple departments. All spatial planning formulations are to be uniformly managed by the MNR.

The MNR is tasked with establishing the spatial planning system and supervising its implementation, promoting the strategy and system of main functional zones. It oversees the formulation, approval, and implementation of overall, detailed and special planning by governments at all levels and relevant competent departments (Table 1). The MNR issued guidelines for formulating plans and has convened national video conferences to promote the formulation of NTSP. The aim is to standardise the development of NTSP across the country according to the requirements of a "unified map, unified standards, unified planning, and unified platform."

Table1: Institutions responsible for formulating and approving NTSP (NTSP Bureau of the MNR, 2021, p.11)

Corresponding planning			**Formulation department**	**Approval department**
overall planning	national-level NTSP		The Ministry of Natural Resources and relevant departments	the Central Committee of the Communist Party of China and the State Council.
	provincial-level NTSP		provincial-level Government	After deliberation by the local People's Congress Standing Committee, it shall be submitted to the State Council
	municipal, county and township level NTSP	the municipal-level NTSP approved by the State Council	municipal-level Government	After deliberation by the local People's Congress Standing Committee, the provincial-level government shall report to the State Council

	other municipal, county and township level NTSP	same-level Government	Provincial governments clarify the requirements for the compilation and approval of content and procedures
detailed planning	Within the boundaries of urban-town development	natural resources department of the municipal or county government	Municipal and county level government
	Village areas beyond the boundaries of urban-town development	township government	Municipal and county level government
special planning	special planning for coastal zones, nature reserves, and trans-administrative or basin NTSP.	local or higher-level natural resources department	same-level Government
	Special planning for specific fields involving spatial utilisation,	relevant authorities	Approved according to relevant regulations

3.2 Composition of the NTSP System

The "multi-planning integration" NTSP system framework includes "five levels, three types, and four systems" (Figure 2). The "five levels" are the administrative levels of the national, provincial, municipal, county, and township in China's management system. The "three types" of planning include national territorial spatial overall planning, detailed planning, and special planning. The "four systems" are the formulation and approval system, implementation and supervision system, legal and policy system, and technical standards system of NTSP.

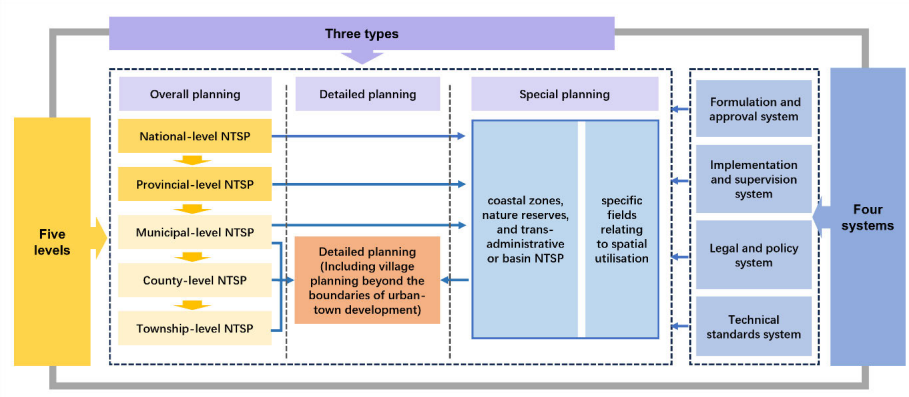

Figure 2: "five levels, three types, and four systems" of NTSP system

3.2.1 Overall Planning of NTSP

The national-level overall planning is a comprehensive arrangement that outlines the policies and principles for protecting, developing, utilizing, and restoring national land space, while focusing on strategic considerations. It is formulated by the MNR and other relevant departments, authorised by the Central Committee of the Communist Party of China and the State Council. The Provincial-level overall planning which implements the national-level overall planning, guides the formulation of overall planning at the municipal and county levels, and emphasises coordination, is organised by provincial governments. Post-review by the local People's Congress Standing Committee, it is submitted to the State Council for approval. Municipal-level, county-level, and township-level overall planning refine the requirements of higher-level overall planning and provide specific arrangements for development and protection within their administrative regions, centred on implementation. Municipal governments organise several municipal-level overall planning, approved by the State Council, reviewed by the local People's Congress Standing Committee, submitted to the provincial government, and transferred back to the State Council. The framework for planning content and procedures is enshrined in the overall planning for municipal-level, county-level, and township-level, based on local conditions by provincial governments. The township-level overall planning may be compiled based on several townships as units or consolidated with municipal-level overall planning, all contingent on local circumstances by local authorities.

3.2.2 Detailed Planning of NTSP

The detailed planning provides practical arrangements for land use, development intensity, and construction in specific areas. It serves as the legal framework for land development and protection activities, land use control, issuance of urban and rural construction project planning permits, and various construction activities. There are two types of detailed planning; within urban-town development boundaries and beyond urban-town development boundaries. The former is organised by the natural resources department of the municipal or county government and submitted for approval by the same-level government. The latter are in rural areas with one

or several administrative villages, used as a unit. Detailed planning is prepared by the township government as a practical village plan and submitted for approval by the higher-level government.

3.2.3 Special Planning of NTSP

Special planning rare specialised arrangements created for specific regions (basins) or fields indicating specific functions and requirements for spatial development, protection, and utilisation. It includes; (1) Special planning for coastal zones, nature reserves, and trans-administrative or basin NTSP. This is organised by the local or higher-level natural resources department and submitted for approval by the same-level government. (2) Special planning for specific fields involving spatial utilisation, such as transportation, energy, water conservancy, agriculture, information, municipal infrastructure, public service facilities, military facilities, ecological and cultural heritage protection, forestry, and grassland planning, organised by relevant authorities.

3.3 Core Contents of NTSP Compilation

The current NTSP invokes the implementation of national strategies, clarification of spatial development goals, and optimisation of urbanisation patterns, agricultural production patterns, and ecological protection patterns. It dictates the determination of spatial development strategies, the transformation of territory spatial development and protection methods, and the enhancement of the quality and efficiency of territory spatial development and protection. On this basis, preliminary work as unified base map data, clear classification and zoning standards for land and sea use, double evaluation, and double assessment in the compilation of NTSP has been executed by various regions. The structural optimisation of territory spatial layout and the protection and utilisation of various natural resource elements have been executed. Delineating the "three zones and three lines" is the principal objective of establishing the entire NTSP (Figure 3). Coordinated planning and this delineation are at the core of unified control of various spatial planning purposes.

The "three lines" refer to the permanent basic farmland red line, ecological protection red line, and urban-town development boundary. The permanent basic farmland red line indicates the cultivated land under permanent special protection. This ensures national food security and the supply of important agricultural products. It is necessary to strictly demarcate according to relevant national regulations while implementing the permanent basic farmland protection tasks, disintegrated and assigned by superior plans. The ecological protection red line is a rigid control line within the ecological space. It indicates areas with special and important ecological functions within the ecological space that must be safeguarded, ensuring national ecological security. This is inclusive of forests, grasslands, wetlands, and water bodies. It also comprises urban and rural areas, mining land, and aquaculture areas that should be gradually and orderly phased out. The urban-town development boundary is the territorial spatial boundary where urban development and concentrated construction can be executed within a certain period. It includes cities, towns, and various development zones. It is a policy line for urban spatial control, emphasizing conservation, intensification, and green development. Each province controls the scope of urban development boundaries, not exceeding 1.3 times the total scale of

urban construction land in 2020, while having the autonomy to guide cities and counties in delineating urban development boundaries.

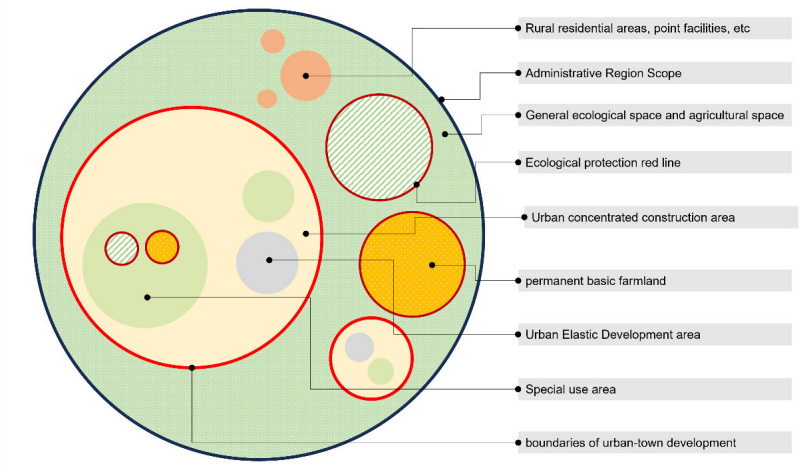

Figure 3: The division of the "three zones and three lines"

These considerations must be adhered to in delineating the "three lines": (1) The "three lines" must be perceived as the red line with non-navigable boundaries for adjusting economic structure, planning industrial development, and promoting urbanisation. Protection targets of 18.65 billion mu of arable land and 1.546 billion mu of permanent basic farmland must be set by the state by 2020 (NTSP Bureau of the MNR, 2023, p.79). (2) Demarcation per the priority order of arable land and permanent basic farmland red line, ecological protection red line, and urban-town development boundary. This ensures the three control lines do not intersect, overlap, or conflict. (3) An incorporation of the results of this delineation of "three lines" into "one map" of NTSP, achieving integration of "numbers, lines, and maps". Synchronously, it improves the functionality of the national territory spatial basic information platform, ensuring that targets such as arable land, permanent basic farmland red line, and ecological protection red line be implemented, assessed, and held accountable.

The national results of this delineation reveal that more than 30 percent of the land territory and 150,000 square kilometers of sea area are designated as ecological protection red lines, leading the world in implementing the ecological protection red line system (People's Daily, 2023).. Policies like comprehensive land consolidation, redevelopment of inefficient urban land, the nexus of urban and rural construction land increase and decrease, and entry of collectively operated construction land into the market should be introduced. These policy measures should be consolidated with the overall planning and detailed planning implementation management mechanism to form a platform and institutional design. This optimises the territory spatial pattern after delineating the "three zones and three lines", which is both principled and flexible, shifting focus from "how to delineate" to "how to manage".

3.4 Digital Technology Application of the NTSP System

The NTSP system emphasises the use of digital technology to establish a unified national

digital NTSP "one map" system (Figure 4). This aims to lead the transformation of territory spatial governance through "digitalisation" and advance government management and service efficiency.

The "one map" system of NTSP is characterised by; (1) Basic data possessing authenticity, systematicity, and standardisation. Based on "the third national land survey and annual change survey", high-resolution remote sensing images and three-dimensional surveying and mapping data, integrating various spatial data like meteorology, hydrology, geology, and population, the system adopts unified standards for data inclusion. This unified base map accurately indicates the national territory spatial data. (2) Management implementation which features interconnectedness, efficiency, and authority. Data is relayed through the system to various departments and regions.

Using the basic information platform, the NTSP "one map" implementation supervision information system is constructed, integrating the results of the national "three zones and three lines" delineation and the "five levels, three types" of NTSP. This encapsulates the entire domain, effectively updates, and is authoritative and unified. This serves as a framework for cross-departmental, cross-level, and cross-process planning management. The digital and intelligent management of the entire process of the NTSP is a noteworthy accomplishment.

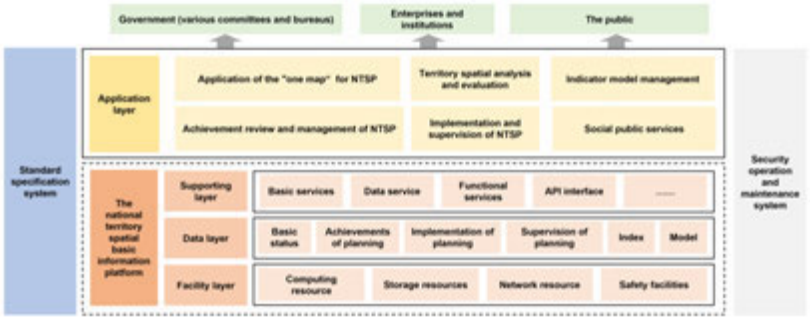

Figure 4: Construction framework of NTSP "One Map" (NTSP Bureau of the MNR, 2023, p.190)

4. Discussion

4.1 From Urban-Oriented Planning to Entire Land and Sea Area-Oriented NTSP

An important change in the reform of NTSP is the expansion of planning scope from urban areas with concentrated populations, facilities, and industries to encompassing the entire territory. This covers marine and terrestrial areas, including elements like urban and rural construction land, transportation, and water conservancy. It consists of other construction areas and non-construction land (arable land, forests, and water). This change is closely linked to the concept that "mountains, rivers, forests, farmlands, lakes, and grasses form a community of life" which is emphasised by Chinese President Xi Jinping. In preparation for NTSP at all levels and based on this idea of coordinated governance, coordination of all types

of natural resource elements across the entire territory is perceived as an important goal.

To cope with this change, corresponding changes have been made in the technical methods used in planning preparation, including making the types of basic land use and spatial zoning more complex. In this process, the MNR issued the "Classification Guidelines for Land and Sea Use in Territorial Spatial Survey, Planning, and Utilisation Control." It unified the investigation, statistics, and planning classification standards for all NTSP involved, including 24 primary classes, 113 secondary classes, and 140 tertiary classes. It is worth noting that this classification absorbs and connects the original classifications of land-use planning and urban-rural planning. It incorporates concepts related to marine functional zoning, which was not previously addressed by land-use planning and urban-rural planning.

Due to the significant changes in the objects and scope controlled by planning guidance, there has been a huge impact on the development of the planning industry in mainland China. In planning preparation, the composition of planning teams has become unprecedentedly diverse. In addition to urban planning professionals, many professionals in geographic information technology, land planning, geography, marine science, ecology, and mineral resources have joined, forming comprehensive planning teams with multidisciplinary backgrounds. Previously, most of China's urban master plans were prepared by urban planning institutions such as the China Academy of Urban Planning & Design. The units responsible for preparing the overall planning of NTSP have become a tripartite situation of urban planning institutions, land planning institutions, and surveying, mapping, and information institutions. Completion of a plan often requires the collaborative efforts of these three types of institutions, sometimes supplemented by local urban design institutions. They form a consolidated vessel to complete the planning together, dissimilar to the traditional planning projects that can be completed by a single design unit or team. In the specific work of planning preparation, because the teams involved belong to different units, and sometimes work locations are not in the same city, there are also significant differences in work habits. During the several years of preparation, the entire project is often segmented into several sub-projects for operation. This means that it is in a fragmented state, and each team completes its section according to its work habits and expertise, resulting in a mosaic-like outcome. This type of planning preparation consortium is not in line with the requirement of "multi-planning Integration" advocated which undermines the systematic nature of planning and leads to significant fragmentation.

4.2 From Blueprint Planning to Bottom-Line Planning

Another important change in the reform of NTSP is that the planning objectives are more comprehensive than before. This shifts from a previous focus solely on maximizing the spatial expansion of local economic growth to effectively addressing ecological, environmental, and social-cultural issues while continuing economic growth, emphasizing ecological priority, green development, and sustainable development. This reflects a change in the value of planning, emphasizing tight constraints on resources and the environment, and increasing the level of resource conservation and intensive use.

This change is precipitated byo the requirements of China's ecological civilisation system reform. To achieve the goal of sustainable development, it is necessary to scientifically constrain urban-town spatial development and strictly protect the bottom line of food security

and core ecological space. Therefore, delineating of the "three lines" has become one of the core contents of NTSP. Among them, the permanent basic farmland red line and ecological protection red line determine the bottom line of national land resource protection. This aims to ensure agricultural production and ecological security; the urban-town development boundary determines the upper limit of land development, ensuring high-quality development.

This bottom-line thinking of planning is different from that in Western developed countries. The pressure of population and cities on the environment and farmland in Western countries has not been so great as to affect national security and survival. There has been no systematic planning theory based on the premise of protecting farmland. In countries where the relationship between people and land, especially land resources, is not tense, the focus and approach of spatial planning control may differ. Although there is also an emphasis on controlling urban sprawl, the urban space in Western countries typically exhibits large areas of ecological leisure and agricultural space, extensive low-density suburban residential areas, and small-scale high-density central cities. After more than 40 years of rapid urbanisation in China, issues such as food security and ecological security have emerged. This has not been seen in Western developed countries, and it affects the public's survival and quality of life. By delineating the "three lines", China's reform of NTSP aims to ensure ecological security, food security, and national security.

The NTSP must plan the development of urban individuals under the premise of meeting national food and ecological security. Subsequently, the "three lines" become a prerequisite for urban-town spatial planning. In the specific process of planning preparation, the delineation of the "three lines" is carried out uniformly at the national level, and the MNR has formulated rules for delineation. Protection tasks are determined from the national level to the township level, including scale, quantity, and layout, with an accuracy reaching the scale of patches and then delineated in a coordinated manner from the bottom up on a unified base map. In this process, three rounds of trials of "top-down" and "bottom-up" have been experienced, forming a unified national "three lines" result, which is incorporated into NTSP at all levels. As can be seen, the "three lines" as a bottom-line constraint, in the five-level NTSP system, the requirement is for strict implementation from top to bottom and gradual transmission. The results of delineating the "three lines", to become one of the independent outcomes of NTSP, have been officially used before planning is approved. Between September 28, 2022, to April 11, 2023, the MNR approved the delineation results of the "three lines" for all provinces nationwide. Thus, the first comprehensive delineation of the "three lines", that is the most basic and important control outcome in the NTSP system, has been completed. It serves as the foundation for land use control in territorial spatial planning. In the process of approving construction land, various regions must strictly implement control measures under the "third line". After delineating the "three lines", how to use the results specifically and formulate corresponding management rules is one of the key areas currently being researched by the MNR.

It is worth noting that delineating the "three lines" is an attempt at reform, representing an innovative endeavor that inherits various historical regulatory policies, technical standards, and relevant planning initiatives. Due to factors such as data limitations, temporal constraints, and experiential gaps, certain controversies surrounding the practical application of the outcomes within society are inherent. A perspective suggests that the outcome lacks precision

and may pose certain hindrances to regional economic development, advocating for potential adjustments in the future. The feasibility and modalities of such adjustments constitute a widely debated topic among the academic and professional planning communities.

5. Conclusion

In addressing the historical issue of inconsistency in multiple planning systems, China has undertaken a nationwide reform of its NTSP in recent years. This reform not only reflects changes in the governance approach of the country but has also sparked intense academic discourse. Since 2018, over 2000 Chinese-language papers have been published on the subject. Scholars and industry professionals in China have engaged in vigorous discussions regarding the reform, spanning various disciplines such as urban planning, geography, land resource management, ecology, resource science, environmental science, and marine science. In the practical realm of planning, these academic discussions have aided the government continuously, particularly the MNR. This is done by formulating technical guidelines and showcasing a collective effort between academia, government, and industry to actively explore solutions at the nexus of technology- theory- institutional frameworks.

At the institutional level, this reform has completed the top-level design of the NTSP system, establishing the foundational and statutory status of NTSP within the national spatial governance system, thereby forming the "Chinese solution" to spatial governance. At the operational level, under the leadership of the MNR, significant progress has been made in the formulation of NTSP. This includes the establishment of the "three lines" nationwide, which serve as non-negotiable boundaries for sustainable development. Furthermore, the overall planning at the national, provincial, municipal, county, and township levels has almost been completed, approved, or in the process of approval. Additionally, a unified digital territorial spatial planning "one map" system has been established nationwide. These efforts have laid the groundwork for China's sustainable development. It will serve as the basis for development activities until 2035, serving as the primary public policy tool for spatial and resource allocation.

While China's NTSP reform has achieved breakthroughs in multi-planning Integration, several unresolved contradictions and issues persist. First, legislative reforms are imperative.. Although the revised "land management law" of 2019 clarifies the legal status of NTSP, detailed provisions regarding its formulation, approval, implementation, and oversight are lacking. Consequently, NTSP is currently in a transitional state deficient of comprehensive legal support, undermining the gravity and authority of the planning process. There is a need to strengthen legislative efforts to specify the entire process and critical junctures of planning formulation, approval, implementation, modification, and supervision. This must ensure alignment with existing laws and enhance the role of the rule of law in guiding, regulating, and safeguarding the " multi-planning Integration " reform. Second, interdepartmental coordination still requires strengthening. Despite achieving integration among the main functional zone planning, land-use planning, and urban-rural planning, NTSP cannot replace special planning, and other departments still need to formulate corresponding special planning. These industry regulatory authorities often prioritise their development needs, paying less attention to conflicts between development and protection, and the tight

constraints between demand and resources. This often results in special planning lacking precise alignment with the content of overall planning and insufficient guidance for detailed planning formulation, thus limiting the effectiveness of coordinated guidance. It is imperative to promptly establish a special planning management system, break down barriers between different departments, and coordinate spatial conflicts on the "one map" of NTSP. There should be a strengthening of the implementation of special planning derived from overall planning and better promotion of socio-economic development.

Spatial planning, as a form of public policy, exerts significant influence on the development of a country or region. Despite substantial political, economic, and socio-cultural disparities between China and other countries, China has incorporated experiences from developed nations such as the Netherlands and Japan in formulating its spatial planning reform. Over the past few years, China has accumulated its own experiences and lessons, which could serve as a reference for countries or regions in similar development stages, grappling with global climate change challenges, and striving for sustainable development to enhance their spatial planning systems.

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A Comparative Study on Zoning Guidelines for Different Planning Types in China

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Abstract

Zoning guidelines are technical methods commonly employed in various types of urban planning, including comprehensive urban design, landscape planning, regulatory detailed planning, and architectural features and styles planning. These guidelines aim to protect and define urban character, controlling spatial forms in specific districts. Often, when different zoning types are compiled without clear distinctions, redundancy and contradictions can arise, leading to inefficient management.

This article, in conjunction with relevant zoning guideline examples, distinguishes between the zoning guidelines corresponding to the four types of planning by comparing their coverage, control objectives, content, and methods. It defines the roles, functions, and interrelationships of these guidelines at different scales. This approach aims to systematically control urban landscapes through a layered and cumulative process, effectively addressing different levels.

Keywords

Zoning guidelines, comprehensive urban design, landscape planning, regulatory detailed planning, architectural features and styles planning

1 Introduction

Zoning guidelines, as a technical approach, are commonly employed across various planning types such as comprehensive urban design, landscape planning, regulatory detailed planning, and architectural features and styles planning. The objective of these guidelines is to protect and shape the distinctive urban character by controlling and guiding the spatial form of specific urban sectors.

Presently, there is no strict and uniform definition of "cityscape zoning" in China, and different types of planning compilations have varied connotations and requirements. For instance, in cityscape planning, cityscape zoning refers to areas within a city that share similar development traits (Dai and Liu, 2013); in urban landscape planning, it indicates regions that require special control within urban planning management or landscape character protection and construction (Bai, 2015); in architectural features and styles planning, it pertains to areas with similar architectural cultural and structural characteristics (Zhao, 2017). Correspondingly, the different types of zoning guidelines also vary in their control levels and focus tasks.

However, the current domestic compilation of various zoning guidelines often leads to confusion, resulting in poor linkage with higher-level plans, and insufficient conveyance of key contents from superior plans. Moreover, as the importance of planning management increases, zoning guidelines are expected to directly guide planning management. However, there exists a disconnect between control and implementation, making the practical application of zoning

guidelines inadequate (Wang et al., 2019). Therefore, it is essential to distinguish between different types of zoning guidelines to avoid duplication, misalignment, or even contradictions, thereby enhancing the efficiency of planning management.

This article incorporates case studies from the Comprehensive Urban Design Guidelines of Jurong City, the Cityscape Guidelines for Landscape Planning of Fujian Province, the Statutory Maps for Regulatory Detailed Planning of the Futian District in Shenzhen, and the Cityscape Guidelines for Architectural Features and Styles Planning of Fuzhou City. By differentiating the coverage, control objectives, content, and methods of various types of zoning guidelines, the study aims to define the roles, functions, and interrelationships of these guidelines at different scales. This approach seeks to systematically control urban landscapes in a layered and cumulative manner, addressing different levels systematically.

2 Comparative Analysis of Zoning Guideline Types

Different types of planning have distinct roles and functions within the entire planning system, and thus, their corresponding zoning guidelines differ in coverage due to their inherent nature of guidance and control (Figure 1).

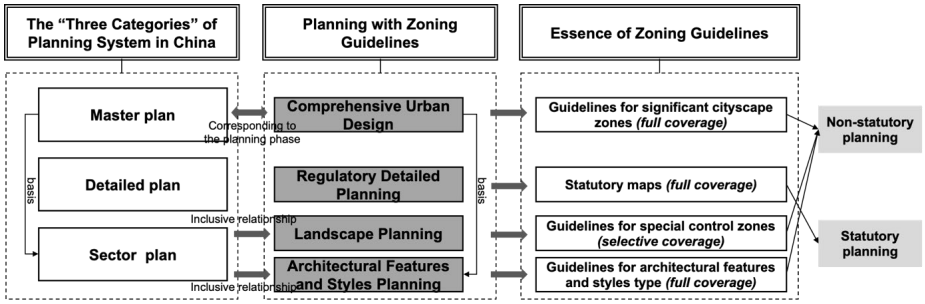

Figure 1. Relationships Among the Four Types of Zoning Guidelines

2.1 Zoning Guidelines in Comprehensive Urban Design

Comprehensive urban design, as a non-statutory planning corresponding to the stage of master plan, can guide and control the large-scale urban form from a macro perspective, emphasizing urban characteristics. The cityscape zoning guidelines at the meso-level are a crucial intermediary in the comprehensive urban design process, bridging the overall structure and macro guidance system, and guiding the urban design of lower-level areas. Although cityscape zoning in comprehensive urban design is extensive, not all urban spaces are distinctively characterized or resource-rich. Therefore, it is unnecessary to impose control requirements on the entire area. Instead, through the assessment and grading of cityscape zones, extremely important and moderately important cityscape zones are selected for focused "cityscape zoning control" (Wu et al., 2021).

For example, in the Comprehensive Urban Design Guidelines of Jurong City, the central urban area of Jurong can be divided into 11 cityscape zones. Through sensitivity grading and landscape sensitivity analysis, these zones are categorized into three levels. The extremely important cityscape zones include the Old City Cultural Cityscape Zone, the South High-Speed Rail Hub Cityscape Zone, and the North Evergrande Cultural and Tourism Cityscape Zone. Moderately important cityscape zones include the Golden River Science and Education Cityscape Zone, the Main Urban Comprehensive Cityscape Zone, and the East Urban

Comprehensive Cityscape Zone, along with five general cityscape zones. Direct control is applied specifically to the extremely and moderately important cityscape zones (Figure 2).

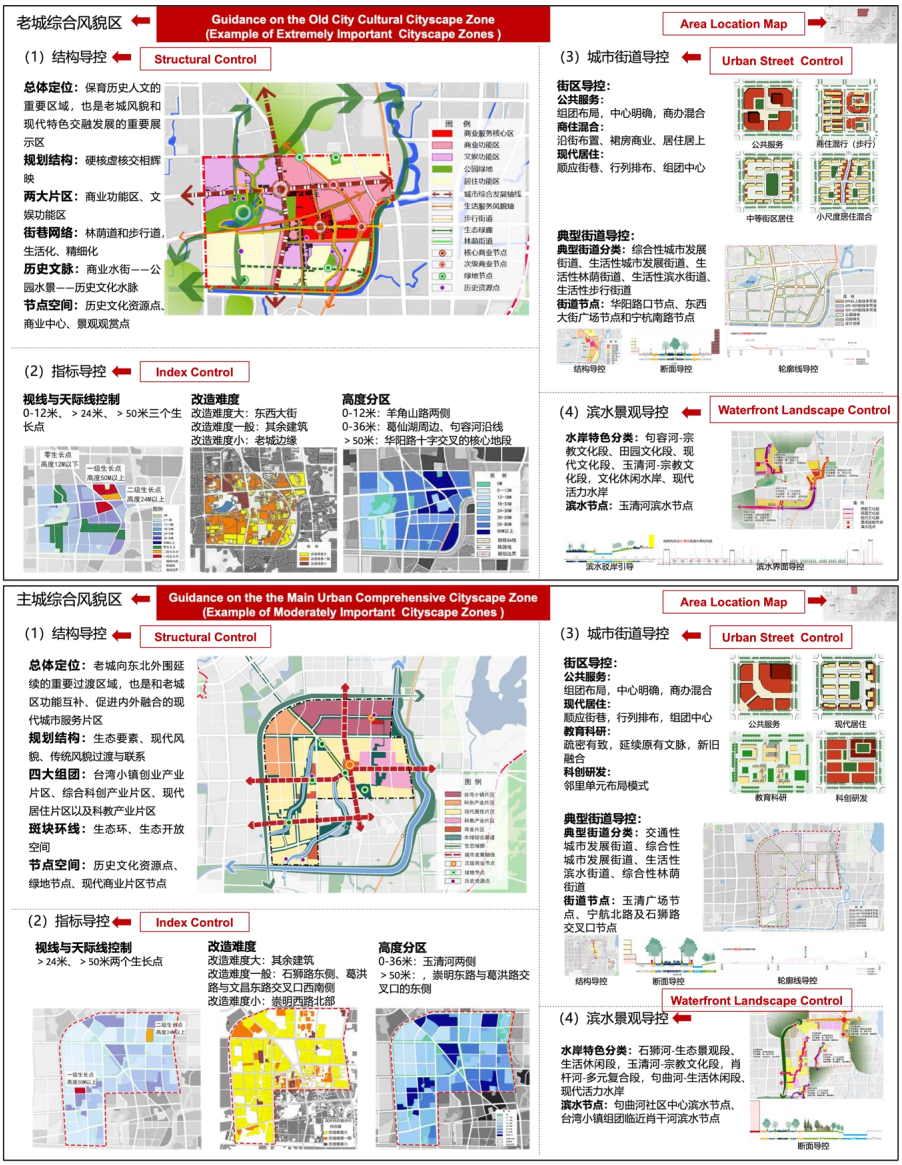

Figure 2. Example of Zoning Guidelines in Comprehensive Urban Design
Source: Urban Planning& Design Institute CO., LED of Southeast University. (2020) Comprehensive Urban Design Guidelines of Jurong City. Nanjing: Southeast University Press.

2.2 Zoning Guidelines in Landscape Planning

Landscape planning, also a non-statutory planning, is not compulsory for all cities. However, it shares many similarities with comprehensive urban design in terms of objective setting, theoretical references, focus areas, and design methods. The main differences lie in "tendency of dissemination, visual dominance, and technical flexibility" (Li and Zhu, 2009). It is a refinement of the urban design section of master plan and can serve as the superior plan for individual urban designs (Fujian Provincial Department of Housing and Urban-Rural Development, 2013). The zoning guidelines in landscape planning typically refer to special control zone guidelines, which are essential for urban planning management or landscape character protection and construction, providing specific planning control guidelines. These zones have characteristic dominance and unified control, differing from the comprehensive cityscape zoning in comprehensive urban design. Outside of special control zones, general control zones are guided by standard requirements.

Taking the Cityscape Guidelines for Landscape Planning of Fujian Province as an example, areas requiring special control include historical cultural heritage cityscape zones, natural ecological protection cityscape zones, urban core areas, and key urban node areas. For instance, a well-preserved ancient town district within a town is designated as a special control area, necessitating the development of corresponding street pattern control guidelines and architectural features and styles control guidelines (Figure 3).

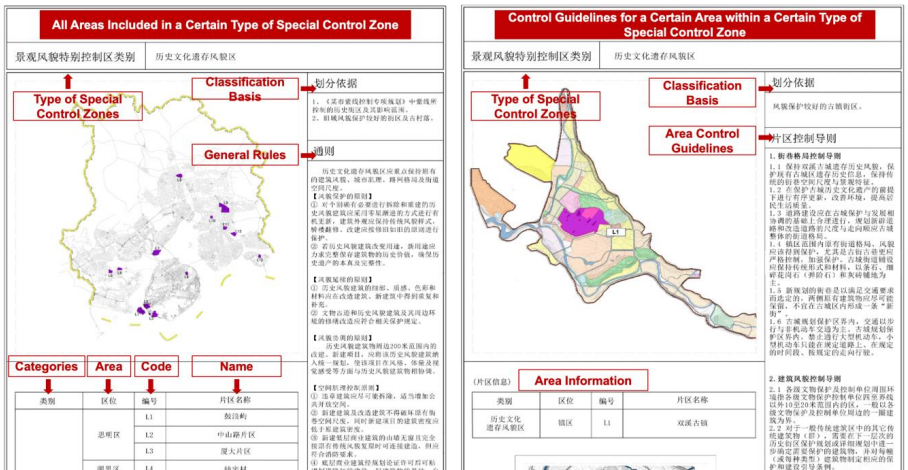

Figure 3. Example of Zoning Guidelines in Landscape Planning

Source: Fujian Provincial Department of Housing and Urban-Rural Development. (2013) Cityscape Guidelines for Landscape Planning of Fujian Province (Trial Implementation). Available at: https://zjt.fujian.gov.cn/xxgk/zfxxgkzl/xxgkml/dfxfgzfgzhgfxwj/qt_3796/201311/t20131104_2870981.htm (Accessed: 30 May 2024).

2.3 Zoning Guidelines in Regulatory Detailed Planning

Regulatory detailed planning, as a core component of China's statutory urban planning system, not only deepens the implementation of master plan but also serves as the direct basis for setting land lease conditions and guiding lower-level planning designs. The zoning guidelines in regulatory detailed planning are statutory maps that need to be prepared for all management units within the control plan's scope. Thus, unlike landscape planning, its planning scope is comprehensive and legally binding.

For example, the Statutory Maps for Regulatory Detailed Planning of the Futian District in Shenzhen divides the entire Futian District based on land use, urban spatial structure, municipal facilities, and natural environmental conditions into 29 management units, including areas like Huaqiang North, the Central District, and Meilin. Full-coverage maps are prepared for each management unit from the block to the plot level, specifying control indices (Figure 4).

2.4 Zoning Guidelines in Architectural Features and Styles Planning

Architectural features and styles planning, as a specialized plan focused on architectural character, builds on master and detailed planning with thorough, specific, and targeted content (He, 2010). The zoning guidelines in architectural features and styles planning essentially belong to a category of architectural features and styles type zoning guidelines, classifying architectural character based on the building's function, height, and location within the urban spatial structure, and providing corresponding control requirements. The planning scope of architectural features and styles type zoning guidelines is comprehensive, covering all types of buildings, including residential areas, mixed-use areas, public buildings, elementary and secondary schools, kindergartens and community public buildings, parks and squares, green buffer zones, and logistics parks.

Taking the Cityscape Guidelines for Architectural Features and Styles Planning of Fuzhou City as an example, the entire city of Fuzhou is designated into controlled areas, which include historical sections, key urban functional areas, significant urban civic activity centers and their surrounding areas, and important urban corridors. Each category is further subdivided into types; for instance, the key urban functional area consists of 13 commercial and business districts, 5 cultural and sports center districts, and 5 transportation hub areas and their surroundings. The guidelines provide directives on architectural height, facade design, facade width, discount rate, permeability, height-to-width ratio, levels of building height, facades, roofs, landscaping, and the materials and colors used (Figure 5).

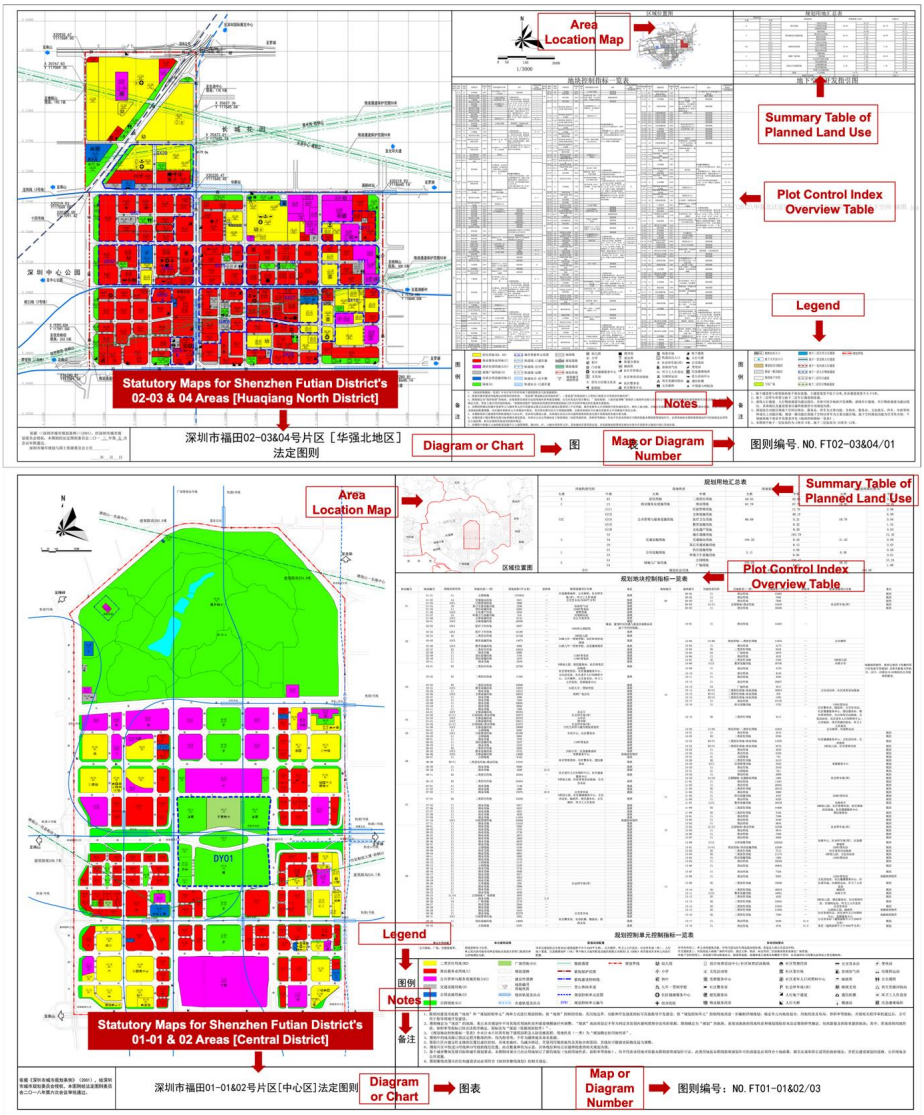

Figure 4. Example of Zoning Guidelines in Regulatory Detailed Planning
Source: Shenzhen Municipal Planning and Natural Resources Bureau. (2021) Statutory Maps for Regulatory Detailed Planning of the Futian District in Shenzhen. Available at: http://pnr.sz.gov.cn/ywzy/fdtz/cggbcx/ftq/ (Accessed: 31 May 2024).

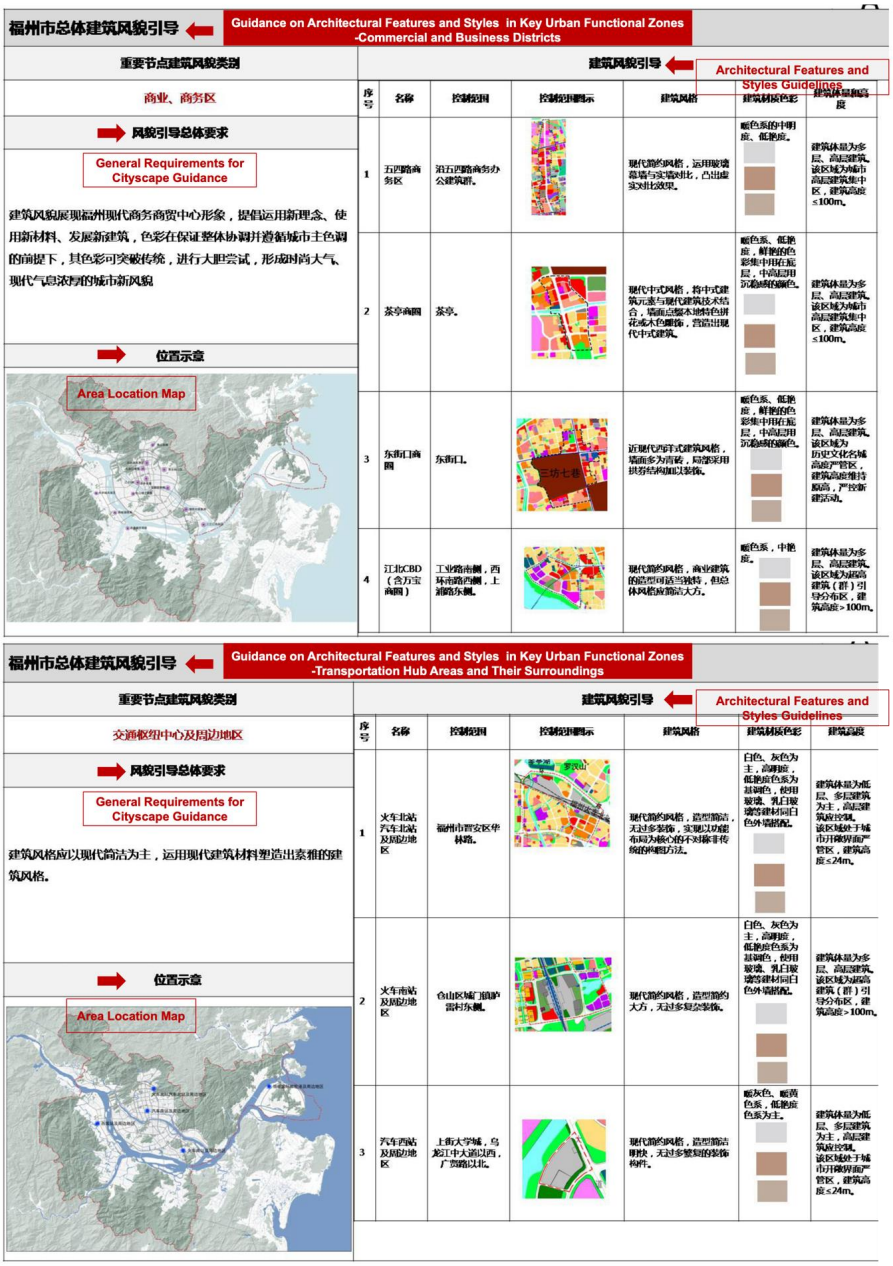

Figure 5. Example of Zoning Guidelines in Architectural Features and Styles Planning
Source: Fuzhou Municipal Bureau of Natural Resources and Planning. (2018) Cityscape Guidelines for Architectural Features and Styles Planning of Fuzhou City. Available at: https://www.fuzhou.gov.cn/zwgk/zxwj/bmwj_1/201803/t20180330_2171523.htm (Accessed: 31 May 2024).

3 Control Differences in Zoning Guidelines

Different levels and types of zoning guidelines have distinct guiding control targets, degrees, and methods, and they vary in their control objectives, content, and methods (Table 1).

Table 1. Comparison of Control Measures Among Zoning Guidelines

Types of Zoning Guidelines	Control Objectives	Control Content	Control Methods
Zoning Guidelines in Comprehensive Urban Design	Inherit and convey the overall characteristic spatial structure, guiding the preparation of lower-level plans.	It requires the control and guidance of subsystems such as characteristic patterns, urban form, open spaces, and landscape features by cityscape zoning. It also needs to provide more refined control points and basis for the street patterns, urban streets, and waterfront landscapes of the zone.	Consider both macro and micro levels
Zoning Guidelines in Landscape Planning	Provide a basis for planning management of special control zones, connected with the regulatory detailed planning.	Mainly control and guide aspects such as functional positioning, overall intention, landscape corridors, architectural styles, and skyline (with emphasis based on zone characteristics).	Targeted guidance, general rules or guidelines
Zoning Guidelines in Regulatory Detailed Planning	Provide a basis for land transfer, detailed construction planning, and architectural design.	Control land use (boundaries of different types of land, building types within various types of land), environmental capacity (building height, building density, plot ratio, green space ratio, etc.), construction control (building volume, form, color, etc.), activity control (location of plot entrances and exits, parking spaces, bus station land boundaries and station locations, pedestrian traffic and other transportation facilities, etc.), and facility matching control (location of municipal pipelines, boundaries of engineering facility lands, etc.).	Integrate into regulatory management unit maps
Zoning Guidelines in Architectural Features and Styles Planning	Provide a basis for urban design, architectural design, and construction management.	Mainly includes building form, volume, color, material, ancillary facilities, environmental elements, etc.	Targeted guidelines

3.1 Control Objectives

In comprehensive urban design, meso-level cityscape zoning guidelines serve as a critical medium connecting the objectives of comprehensive urban design with the next level of planning and design. They can propagate the overall characteristic spatial structure, guiding and controlling regulatory detailed planning, cityscape planning, or district urban design.

In landscape planning, these guidelines provide a basis for the planning management of special control areas, facilitating the implementation of overall planning objectives on specific subdivided plots to enhance the operability of specialized landscape planning.

In regulatory detailed planning, the statutory maps directly guide constructive detailed planning, providing the basis for land lease conditions and architectural design.

In architectural features and styles planning, the zoning guidelines, through guiding and controlling the character of buildings and streets, provide a basis for urban design, architectural design, and building management, thus protecting the city's diverse and cohesive traditional character.

3.2 Control Content

In comprehensive urban design, cityscape zoning guidelines should reinforce macro goals and characteristic structures at the zoning level, meaning control of subsystems like characteristic patterns, urban form, open spaces, and landscape character needs to be conveyed through cityscape zoning. Additionally, indicators for views and skylines, transformation difficulty, height zoning, etc., need to be controlled, providing more detailed guidance for the district's block patterns, urban streets, waterfront landscapes, and architectural character (Wu et al., 2021).

In landscape planning, special control zones include historical cultural heritage areas, natural ecological protection areas, urban central nodes, civic activity nodes, transportation hub nodes, and other special areas. These guidelines focus on functional positioning, overall intentions, landscape corridors, architectural character, and skylines, proposing protection and coordination principles for character preservation, ecological utilization, and more, with particular attention to "three edges" (next to mountains, waters, roads) and "three nodes" (urban centers, civic activities, transportation hubs) (Fujian Provincial Department of Housing and Urban-Rural Development, 2013).

In regulatory detailed planning, the statutory map control system encompasses multiple aspects: land use control, which includes boundaries for different land uses and building types within each category; environmental capacity control, covering building height, density, floor area ratio, and green space ratio; building construction control, addressing building volume, color, and materials; activity control, specifying locations for plot entrances, parking spots, public transport areas, and other traffic facilities; and infrastructure control, defining positions of municipal pipelines and boundaries of engineering facilities.

In architectural features and styles planning, the control elements of zoning guidelines include architectural style, building volume (plan and height), architectural form (facade, roof, walls, and base), color (roof, walls, doors, and windows), building materials (roof, walls, doors, and windows), ancillary facilities, and environmental factors. The focus is more on the detailed and micro-level aspects of individual building elements.

3.3 Control Methods

In comprehensive urban design, these guidelines usually consider both meso and micro perspectives, corresponding to the sections and control content, comprising "structural control + index control + form control". Each content section may include one or more forms within "master plans + general rules + specific rules + detailed rules," primarily emphasizing guiding control. The index control section, as a quantitative guide, provides clear and crucial evidence for local development management (Qian, 2021).

In landscape planning, these guidelines typically include “general rules + district guidelines”, setting design guidance according to the landscape characteristics and planning management requirements of special control areas. They also emphasize alignment with control regulations to incorporate landscape control requirements into the respective units or plot regulations.

In regulatory detailed planning, on one hand, statutory maps are strategically compiled in layers and levels to define control points for each spatial dimension, organized by street unit, community unit, and plot unit. On the other hand, these statutory maps are integrated with urban design guidelines to enhance the control and guidance over urban spatial quality (Huang, Sun, and Zhang, 2019).

In architectural features and styles planning, zoning guidelines target different building types, specifically controlling them from mandatory, advisory, and suggestive perspectives.

4 Conclusion

This paper conducts a comparative study of zoning guidelines within comprehensive urban design, landscape planning, regulatory detailed planning, and architectural features and styles planning. It distinguishes these guidelines by their inherent nature of control, coverage, control objectives, content, and methods, clarifying the roles and functions that zoning guidelines should fulfill at different scales and their interconnections, thereby achieving the effect of urban character control in a layered and incremental manner.

However, zoning guidelines, as a technical tool, are commonly found in various types of planning throughout China, and are not limited to just the four types mentioned above. Yet, some zoning guidelines, such as charming urban and rural landscape zoning guidelines (Wu et al., 2022), have not been widely implemented. Currently, the drafting process and content of most zoning guidelines in China are not clearly defined. There are overlaps in control content among some guidelines, and their control directions may even be contradictory, which is highly detrimental to the execution of planning management work. Moreover, since most zoning guidelines are non-statutory and not all cities prepare them, different types of cities in China—such as scenic cities with distinctive landscapes or smaller cities with less internal variation—have different requirements for cityscape control. Which types of zoning guidelines should be drafted for these different types of cities still needs further study. This suggests that a more standardized approach and clearer guidelines are necessary to ensure effective urban planning and management.

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Study on the Response of Local Legislation to Coordinate the Interests of Multiple Subjects in Urban Renewal from the Perspective of Property Rights

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Abstract: This article analyses the challenges of coordinating the interests of multiple parties in urban renewal and the institutional response through the development of local legislation on urban renewal in Beijing, using the policy mechanisms and practices of urban renewal projects in Beijing as an example. The article is divided into three sections: (1) defining the characteristics of property rights in urban renewal, and clarifying the key points of the legislation; (2) constructing an analytical framework of 'subject identification-interest expression-interest coordination' for the pluralistic subjects; and (3) analysing the responses of local legislation, including the concept and responsibilities of each type of subject, and the establishment of conflict negotiation and mediation mechanisms. Overall, the legislative design effectively responds to the property rights dilemma in practice. This principled legal framework clarifies the responsibilities of different government departments and facilitates the next step of developing specific policy tools to guide project practice.

Key words: Urban renewal; property rights; co-ordination of interests; multiple subjects; local legislation

1 Introduction

Urban renewal is currently a significant development strategy in China. The new period of urbanisation in China is faced with the need to promote the optimisation of urban structure, functional improvement and quality enhancement, and has put forward new requirements for the transformation of urban development methods. It has become a consensus among Chinese cities to safeguard urban renewal activities through laws. Since 2020, Shenzhen, Shanghai, Liaoning and Guangzhou have enacted or disseminated local regulations, while Chongqing, Xi'an, Zhuhai and Chengdu have introduced local regulatory documents.

Urban renewal is a complex process that involves a multitude of legal and regulatory issues, including land management law, urban planning and construction law. Currently, China has not yet enacted specific legislation on urban renewal at the national level. The coordination of the interest related to property rights must adhere to the framework of laws and regulations in order to ensure the legality and fairness of the renewal process. Consequently, property rights has become a pivotal concern in the examination of local legislation on urban renewal. This plays a pivotal role in guiding and constraining the resolution of property rights issues in practice. The reasonable resolution of property rights issues can facilitate the smooth progression of urban renewal and the realisation of sustainable urban development.

Nevertheless, the current policy framework for property rights remains inadequate, and a comprehensive analysis of the property rights relationship in urban renewal is required. The ladder theory of public participation, as proposed by Arnstein & Sherry (1969), identifies three levels of participation: no participation, symbolic participation, and civic power. However, public participation in China's current urban governance remains limited and the autonomous participation is weak(Hu Juan, 2013). This paper takes the policy mechanism and project practice of urban renewal in Beijing as an example and analyses the characteristics of the property rights in urban renewal, the key points of concern in renewal legislation. An analytical framework for the property rights of multiple subjects is built to analyse the challenges of coordinating the interests of multiple subjects. Lastly, the institutional response in urban renewal in light of the practice of local legislation in urban renewal in Beijing is discussed.

2 Defining the connotation of property rights in urban renewal and identifying the key points of legislation

As urban renewal is not just a matter of "wiping the slate clean" for the original property rights holders, the various types of renewal involve a wide range of stakeholders. Urban renewal is characterised by many objects, many types of relationships and complex property rights relationships. This paper starts from an analysis of the characteristics and problems of property rights relationships and further identifies the key points that should be considered in the legislation.

Urban renewal is not simply a "wiping the table" type of process for the original property owner. There are many stakeholders involved in different types of renewal, and the renewal period will occur during the replacement, reorganisation or buyout of property rights. This will result in changes to the original property rights relationships. Urban renewal is characterised by many objects, many types of relationships and complex property rights relationships. This paper analyses the characteristics and problems of property rights relationships and identifies the core points that should be addressed in legislation.

2.1 Characteristics and Problems of Current Property Rights Relationships

2.1.1 Diversified and complex property rights relationships for stock assets

2.1.1.1 Unclear management rights and responsibilities

As an example, Beijing has a significant number of old residential communities, with a total floor area of approximately 160 million square metres of urban residential districts constructed before 2000, representing over 25 per cent of the city's urban housing. In the context of restructuring, bankruptcy and reorganisation of the original ownership units of the districts and the implementation of the housing system reform, the property rights of the old districts exhibit characteristics of diversification and fragmentation. In particular, the special type of "public housing" in old residential areas, namely non-commercial housing, is typically constructed by the government or enterprises and then leased to lessees. The management of this type of public housing is even more dispersed, with property rights, asset management of the housing (which may be in the hands of the government), and the actual property management unit being inconsistent. The inconsistency between the actual occupants and the property rights unit, as well as the property management unit has led to unclear management responsibilities and low levels of property management.

2.1.1.2 Obstacles to reaching Willingness for Renewal

For commercial buildings, it is also challenging to reach a unified willingness to renew. Currently, commercial buildings are frequently sold in a decentralised manner, with fragmented property rights. This results in inconsistent renewal needs among owners, which in turn makes it challenging to reach a willingness to renew. The associated negotiation costs are high, which often leads to a prolonged project cycle due to a lengthy negotiation process. This, in turn, further increases the investment cost of the project.

2.1.2 Unequal rights and obligations of property rights holders of stock assets

2.1.2.1 Low utilisation efficiency of land and housing of state-owned enterprises (SOEs)

The stock of land and housing resources of Beijing's state-owned enterprises (SOEs) is considerable in scale, yet the current utilisation efficiency is low. In Beijing, the majority of SOEs acquire land at a lower cost. While a considerable proportion of land has a low plot ratio, with approximately 60% of SOEs' land having a plot ratio of less than 0.5 (Chen Xiangling et al., 2015). However, there is currently no evaluation mechanism or assessment requirements for the efficiency of land use by SOEs. Furthermore, the cost of holding land and housing assets by SOEs is low, and renewal often brings high economic costs, arising from the demolition and reconstruction of buildings or changes in the function of the land. Consequently, SOEs lack incentives to renew.

2.1.2.2 Residents' low willingness to contribute to renewal and reconstruction

At present, the old residential communities has not yet established a mature property management and property fee payment mechanism. Residents lack responsibility for the maintenance of community public space and the collection rate of the property charge is low. On the one hand, residents anticipate the advantages of enhanced asset value and improved living quality resulting from renewal. However, they are reluctant to shoulder the associated economic costs, such as renovation fees. On the other hand, residents exhibit a lack of awareness regarding the quality of their old residential communities. The majority of elderly residents are content with the current state of property management, which is based on cost-saving measures. Consequently, they are unwilling to pay a high level of property fees to obtain a higher quality living environment.

2.1.3 Difficulty in reorganising rights and interests

The renewal of stock space assets frequently entails changes in ownership and use rights, as well as fluctuations in asset values before and after renewal. Current methods of reorganising interests and benefits of the assets are limited. In particular, the revitalisation and utilisation of historic buildings is chanlleging. Due to their high historical conservation value, the form of renovation is based on conservation and repair, and the original function of the buildings is mainly residential(Figure 1). Following renovation, they are mostly used as offices, flats, retail and other integrated business operations. The majority of these historic buildings are in the form of public housing property rights. Therefore, they are unable to obtain ownership of the buildings while only be granted the right to operate the building. This leads to difficulties in balancing the costs of the project with the long-term operating revenues, as well as difficulties in obtaining bank loans through the mortgage of the buildings.

Figure.1 No.23 House of Shijia Hutong, originally used for residential purpose, now converted into Shijia Hutong Museum

2.2 Identifying the key elements of the legislation

Property rights in urban regeneration include not only the ownership of assets, but also the right to use and the right to operate. In addition to residential and commercial buildings with clear property rights, attention should also be paid to tenants of public housing, management units of public spaces and facilities, and transformation and operation companies involved in the adaptive use of historic buildings, etc. Therefore, the definition and interpretation of property rights are the core legislative points of urban renewal. The interests of different subjects change before and after urban renewal, and the reorganisation of these rights and interests depends on the change of ownership and use rights, so the key to optimising the allocation of urban resources through urban renewal is to reduce the institutional costs of reorganising the above property rights. By analysing the main features and problems of property rights in current urban renewal, it can be concluded that the core of the coordination of interests in urban renewal legislation is to reduce the system costs, which can be divided into four aspects: defining the boundaries of property rights, emphasising the reciprocity of rights and responsibilities, restructuring the flexible rights and interests, and improving the dispute resolution mechanism.

Firstly, the boundaries of property rights for different renewal objects should be classified and defined. This should be accompanied by a clarification of the rights and responsibilities of various property owners according to the characteristics of their rights and interests. In addition, the corresponding asset management rights should be refined. Secondly, there should be an emphasis on the equivalence of rights and responsibilities. This should be accompanied by the establishment of a system of full life-cycle responsibility for property owners. Furthermore, the right to renewal should be equated with the obligation to renew. For instance, in the case of older residential areas and other privately owned properties, it is essential to clarify that the owners of

these properties are responsible for maintaining them and for funding any necessary renewal or reconstruction. In accordance with the Land Management Law and other pertinent legal requirements, state-owned land use right holders are responsible for the use of land and all buildings within the designated land use period. This responsibility encompasses the obligation to ensure that the land is used efficiently for industrial purposes in alignment with urban development requirements. Concurrently, the mechanism for reorganising rights and interests should be flexible. In the event that a property rights holder lacks the capacity to renew, a third party may be engaged to facilitate renewal through a range of methods, including transfer and collaboration. Finally, the dispute resolution mechanism should be enhanced to provide institutionalised channels for the expression of demands and consultation for multiple subjects.

3 constructing a framework for analysing the interests of multiple parties in urban renewal

In general, the subjects involved in urban renewal projects can be divided into three main categories: management subjects, implementation subjects and property rights subjects. The renewal and transformation of physical space inevitably brings about changes in the interests of different subjects, which leads to a large difference in the demands. The lack of effective negotiation and distribution mechanisms results in a large number of renewal projects gives rise to contradictions and disputes (Wang Shujing & Guo Fei, 2021). Consequently, it is imperative that different subjects are guided to effectively express their core demands and facilitate the formation of consensus among them. The topic divides the analysis of property rights issues in urban renewal into three stages: subject identification, interest expression, and interest coordination, with the aim of elucidating the roles and responsibilities of different subjects in the city and the key points of policy support needed at different stages of the urban renewal process.

3.1 Subject identification Stage

3.1.1 Property Rights Holders

3.1.1.1 Types of Property Right Holders

As the concept of property owner is vague and lacks clear explanations in various regulations and policies, this paper uses the concept of "property right holders" in the *Beijing Urban Renewal Regulations* to analyse property rights issues in urban renewal. The assets involved in urban renewal can be divided into three categories: private assets, state-owned assets, and public property rights, including public space and public facilities. Each category of asset corresponds to a distinct type of property rights holder. Among these, private assets include land and housing assets owned by individuals and private enterprises. State-owned assets comprise land and housing assets owned by SOEs and government agencies, which are often subject to stricter supervision due to their special nature. Finally, space assets such as roads, parks, metro stations, and other social common use assets are included.

It is necessary to determine the corresponding responsible subjects according to the different types of characteristics. For those with clear property rights, such as old commercial housing, commercial buildings, and public buildings with clear property rights (such as schools, hospitals, and administrative organisations), the owners shall be the right holders of the renewal and reconstruction. In the case of property rights

relationships that are more complex, such as those pertaining to publicly owned housing, it is necessary to identify and designate specific types of property rights units. These may include, for example, enterprise-owned dormitory flats, guaranteed housing built by the government in the early days, and so forth. These units shall serve as the right holders for renewal and reconstruction. In the case of public assets, such as roads, squares, green spaces, waterfront spaces and other public spaces, the relevant authorities shall be the right holders for renewal and reconstruction.

3.1.1.2 Concept of property right holders and their rights and obligations

The majority of the relevant provisions pertaining to the rights and obligations of property rights holders are derived from the Property Management Ordinance, which delineates the rights and obligations of property rights holders. For instance, the ordinance explicitly states that property rights holders in Shenzhen can declare the urban renewal programme, demolition and reconstruction type of renewal. Furthermore, the ordinance allows property rights holders to express their will to renew. In particular, with regard to the renewal of commercial buildings, commercial housing and other housing, the concept of 'owners' as defined in the Civil Code is analogous to that of property right holders. Consequently, property right holders are entitled to exercise rights and assume obligations with regard to the exclusive part of the building, as well as the common part, including the right to make decisions, to undertake repairs and maintenance, and to assume obligations in this regard.

3.1.2 Implementing entities

3.1.2.1 Concept and Responsibilities of the Implementing Body

The implementation entity is typically a government-commissioned organisation or a market-oriented enterprise, which is specifically responsible for project declaration, scheme design, identification of construction units, management of the construction process, acceptance of project completion and completion of delivery, and is also responsible for property management, etc. It is the executor of urban renewal.

However, there is no uniform and clear definition of the concept and responsibilities of the implementation entity in Beijing. Consequently, different projects are easily confused with the concepts of property rights and construction units. In addition, for comprehensive regional renewal projects, including commercial building renovation and old residential area renovation, there are often multiple implementation entities, and it is challenging to establish cross-project collaboration between different implementation bodies. Therefore, it is essential to clarify the selection of the implementation entities and the specific content of the work.

Chinese cities such as Shanghai and Shenzhen have elucidated that urban renewal projects can be implemented by property rights holders, market players, or led by the government. However, the definition and responsibilities of the implementing entities vary from place to place (e.g. Table 1). From the perspective of urban renewal implementers, these can be broadly classified into four categories: property rights holders' independent implementation mode, market players' individual implementation mode, government-led implementation mode (including local state-owned enterprises), and co-operation implementation mode.

Table.1: Comparison of Different Cities on Implementing and Coordinating Subjects

municipalities	The main body of implementation	Responsibilities of the implementing entity

Shanghai	**Implementing entities:** property right holders implement on their own or in cooperation with market players Coordinating body: market players	The main body of renewal coordination is responsible for promoting the willingness to achieve regional renewal, integrating market resources, investigating the current situation, conducting thematic studies, preparing regional renewal programs, and coordinating and promoting the implementation of renewal projects, etc.
Shenzhen	**Implementing entities:** by the property rights holders, enterprises with real estate development qualifications (hereinafter referred to as market players) or municipal or district people's governments	Preparation of urban renewal unit plans, fulfillment of the obligation to hand over public land, urban infrastructure and public service facilities, innovative industrial housing, public housing, etc., without compensation, and establishment of fund supervision accounts or other supervisory measures, etc., in accordance with the plans.
Chongqing	**Implementing entities:** Government, property rights holders, relevant entities	Signing of performance monitoring agreements, advice on area planning programs, etc.

(Source: mapping based on comparisons of local documents)

3.1.2.1 Selection of implementation organisations

The manner in which different cities select the implementation body varies. For instance, the city of Shenzhen stipulates that an urban renewal project that adheres to the stipulated regulations may be implemented by property rights holders, market entities, or through a joint effort between municipal and district governments. In addition, Shenzhen differentiates between the roles of the reporting body and the main body in implementing renewal projects. The scope of the reporting body's responsibilities varies depending on the specific renewal project. For instance, the reporting body may be tasked with reporting on the original property rights or those held by a market entity. In such cases, the reporting body may be required to coordinate with multiple property rights holders. Alternatively, the reporting body may be commissioned by a single property rights holder or market entity to oversee the project.

Concurrently, in instances where multiple property rights holders fall within the scope of renewal, various jurisdictions permit urban renewal projects to adopt a collaborative implementation mode. For instance, the city of Shanghai has put forth the concept of a coordinating body for renewal, which is tasked with facilitating the achievement of regional consensus on renewal, integrating market resources, and preparing regional renewal programmes. Additionally, the proposal suggests that market entities (non-property rights holders) may serve as both the implementing body and the coordinating body.

3.1.3 Neighbouring rights holders

In current practice, there is a problem of difficultly in dealing with the conflict of neighbouring relationships. For example, the vertical pipeline reconstruction within the building itself of the old district faces the problem of whether the property right holders with neighbouring relationships agree or not. This can result in the implementation of the project being affected. In urban renewal activities, neighbouring property rights holders are expected to provide the necessary facilities, help to achieve an improved quality of the living environment, eliminate housing safety hazards and pursue other public interests. Nevertheless, the majority of cities currently lack the requisite framework to accommodate the concept, rights, and obligations of neighbouring rights holders.

3.2 Expression of Interest Stage

3.2.1 Status and Problems

It is evident that public participation represents an important avenue for the expression of interest. This paper primarily analyses the form of interest expression that involves the participation of property rights holders as a central element. Currently, Beijing has established a process of public participation in urban renewal, and has accumulated some practical experience. For instance, in the context of installing lifts in

older districts, local government officials and community self-governance organisations convene residents to engage in deliberations and communication with the objective of resolving conflicts and disputes. This is typically conducted through a structured forum known as a "discussion meeting." In the renewal of commercial districts, business associations, as industry organisations, act as intermediaries in the upgrading and management of commercial districts, inviting commercial tenants in the districts to participate in the renewal activities.

However, most urban renewal projects still suffer from a lack of resident participation, as evidenced by the absence of a mechanism for coordinating the interests of all parties involved in the transformation of old neighbourhoods, the lack of interaction between multiple actors, insufficient publicity of policies, and imperfect information and feedback mechanisms.

The grass-roots governments of street offices and communities are frequently responsible for coordinating the interests of all parties in a project and guiding bottom-up demands for renewal. However, the current limited number of grass-roots government (street offices and communities) staff, as well as the lack of operational paths to promote co-operation among all parties, make it challenging to negotiate and discuss the actual work of the project.

3.2.2 relevant experience

Successful cases of urban regeneration usually have used consultation throughout the process. The Roppongi project in Tokyo, Japan, explored the "everyone does it, everyone benefits" model. The implementing body and the original owners set up "agreement meeting" to widely gather the opinions of the residents. And through the rights exchange, the value of the rights of the land owners, legal building owners, other rights holders or implementers before the renewal, and the proportion of the funds provided, are used to allocate the due rights of the buildings and their land after the renewal. Through the rights exchange, the complex land ownership problems are solved by allocating the due rights of the renewed buildings and their land in proportion to the value of the rights and the funds provided by the former land owners, other rights holders or implementers.

Shanghai has established the 'One Map, Three Meetings' system, which facilitates communication and consultation between community units and residents on matters of immediate interest and community development. This system also allows for the collection of opinions and suggestions from residents through the establishment of a system of programme design maps, hearings, co-ordination meetings and appraisal committees. This integration of pluralistic main bodies throughout the planning and consultation, construction and implementation, and operation and management processes is designed to stimulate the long-term motivation for self-renewal of the aboriginal people. Integrate multiple subjects throughout the entire process of planning, consultation, construction, implementation, and operation management, thereby fostering long-term motivation for self-renewal of the residents.

3.3 Coordination of Interests Phase

3.3.1 Present situation and problems

Urban regeneration itself is a process of reconciling existing interests, and an effective mechanism for coordinating interests is crucial to the implementation of regeneration. From a practical point of view, the most difficult problem in the consultation process is the 'resolution of disputes', and this is also an issue that has received a great deal of attention in legislation.

Nevertheless, the coordination mechanism of interests in the current renewal practice in Beijing is still in its infancy, as evidenced by the following four aspects: (1) It is challenging to ascertain who benefits and who pays in the financing of renewal projects. Furthermore, in the transformation of old neighbourhoods, residents desire to enjoy the benefits of improved living quality, yet the awareness of contributing to the payment of fees has not yet been established. (2) The current urban renewal projects are challenging to achieve consensus on the willingness to renew. For instance, some of the current safety, energy saving and environmental protection aspects of the buildings do not meet the standards. Furthermore, there is a lack of cooperation from small owners in the renewal and transformation process, which has resulted in difficulties in implementing the project. (3) There is a dearth of efficacious conflict mediation mechanisms, and the majority of communities have yet to implement an effective democratic deliberation workflow. (4) It is challenging to establish an effective communication mechanism with property owners for projects with complex ownership structures.

3.3.2 relevant experience

In order to protect the interests of the "majority", Hong Kong, Taiwan and Japan have introduced compulsory sale systems. In Hong Kong, the Land (Compulsory Sale for Redevelopment) Ordinance stipulates that a person in possession of more than 80 per cent of the freehold interest may, in the event of unsuccessful attempts to purchase the minority freehold interest, apply to the court for a compulsory sale order to auction the minority freehold interest on the basis of a valuation report on the value of the freehold interest. The sale is to be conducted by way of public auction in order to ensure that the interests of the minority freeholders are not prejudiced. In order to ensure that the interests of minority shareholders are not prejudiced, the sale must be conducted in the form of a public market auction.

In Japan, the right to request for sale was created, whereby the purchaser designee has the right to request the owner who does not agree to the redevelopment, or his/her successor, to sell his/her right to zone ownership and the right to utilise the base at the market price. Furthermore, if the aforementioned subject experiences significant difficulties in his/her life after the right to request for sale has been exercised and his/her continued residence will not have a significant impact on the implementation of the

resolution on redevelopment, he/she may apply to the court to request for the postponement of the period of the transfer. Taiwan has established a rights conversion system, which facilitates the conversion of rights such as building ownership, lease contracts, and mortgages. To illustrate, in the case of building ownership, negotiations are held in principle, and in the event of a failure to reach an agreement, a rights conversion plan is implemented to assess the value of each right, with the land and buildings subsequently allocated in proportion to the value.

4 Response of local regulations to the issue of coordination of interests

Finally, this paper analyses the main aspects of urban renewal, including the implementation process, negotiation of interests, and dispute resolution procedures outlined in the ***Beijing Urban Renewal Regulations***[1]***(hereinafter referred to as The Regulations)***, which is implemented in 2023. The aim is to demonstrate how local legislation responds to the needs of disputing and coordinating interests in reality. ***The Regulations*** address the solutions in several areas, including the rights and obligations of the property rights holders, implementing entities, and neighbouring rights holders, as well as the rules and procedures of the consultation mechanism and the disposal of objections.

4.1 Clarify the concept and rights and obligations of property right holders

4.1.1 Concept, rights and obligations

The Regulations clarify the legal relationship of urban renewal, make it clear that property right holders are responsible for the renewal of the properties they hold, enjoy corresponding rights and assume corresponding obligations, and encourage property right holders to play the role of the main body in urban renewal, effectively responding to the problem of residents' unwillingness to bear the costs of renovation, and safeguarding the right to propose and vote on the renewal programme.

Article 18 proposes that the rights of property rights holders include the right to propose proposals for renewal needs, independent or cooperative renewal with market entities, independent selection of the implementation of the main body, joint implementation of the renewal of the renewal and other renewal methods and paths, and the right to enjoy the right to operate and the right to income according to the law, the right to be informed of the implementation of urban renewal, the right to supervise and the right to make suggestions, etc.

Article 19 puts forward, the property rights holder shall bear the obligations including cooperate with the investigation, provide materials, cooperate with the illegal construction management, construction, etc., and actively perform the decision of the owners, etc., and clearly participate in the update meeting, carry out common consultation is the property rights holder common part to manage, execute the

[1] Beijing Urban Renewal Regulations

implementation of the implementation of the programme by the law after the vote, review and adoption of the obligations in the aspects of the project involving hidden safety hazards of the people's livelihood, the property rights holders have the obligation to To carry out or co-operate with the renewal.

4.1.2 Special property right holders: state-owned enterprises

State-owned enterprises occupy a unique position in relation to property rights. On the one hand, they are property right holders, which entails the right and obligation to renew and reconstruct their own assets. On the other hand, they are the users and possessors of state-owned assets, which entails the responsibility of preserving and increasing the value of state-owned assets. Consequently, the "Regulations" for state-owned enterprises to update the responsibility and task for special provisions are necessary in order to resolve the aforementioned low efficiency of state-owned enterprises in land use. The assessment mechanism is not yet mature enough to address this issue.

Article 7 proposes that state-owned enterprises and institutions, as property right holders, should take the initiative to carry out renewal.

Article 56 proposes that the state-owned assets supervision and management agency should establish and improve an assessment mechanism that is appropriate to the participation of state-owned enterprises in urban renewal activities.

4.2 Implementing entities and Their Responsibilities

4.2.1 Connotation and Determination of the Implementing entities

The Regulation specifies the connotation, duties and selection method of the implementation subject, which effectively responds to the current unclear meaning of the implementation subject, and the unclear concept of the property right subject and the construction unit.

Article 20 proposes that for different tenure relationships, differentiated ways of determining the main body of implementation should be designed. The urban renewal project involves a single property right holder, who is responsible for determining the implementation of the main body. In the case of a property right holder with more than one property, the implementation of the main body is jointly commissioned after consensus. In the event that consensus cannot be reached, the property right holder is required to vote in accordance with the law to determine the implementation of the main body. However, in the case of urban renewal projects with complex tenure relationships, the aforementioned rules cannot be applied to determine the implementation of the main body. Instead, the laws and regulations pertaining to public interest, public safety, and other relevant considerations must be taken into account. In the event that the necessity for renewal is absolute, the people's government of the district is empowered to adopt the bidding process and other means of determining the implementation body in

accordance with the law.

Concurrently, the Shanghai mechanism for coordinating the main body, as set forth in Article 22, explicitly permits the designation of regional (district) renewal projects or multiple urban renewal projects as urban renewal implementation units. This designation allows for unified planning, coordinated implementation, and the balancing of funds for regional renewal through the packaging of multiple projects. For urban renewal projects implemented as an implementation unit, a unit co-ordination subject system is established, authorising the district people's government to determine the subject that is compatible with the urban renewal activities within the scope of the implementation unit to be the coordinating subject of the implementation unit.

4.2.2 Duties and rights of the implementing entity

Article 23 delineates the qualifications of the implementation body and its specific work responsibilities, which serves to enhance the enthusiasm of relevant enterprises to participate in urban renewal, protects the rights and interests of the implementation body, and also provides guidance to the implementation body on the implementation of the project. In addition, the implementing body is responsible for conducting an assessment of the current situation within the project, an assessment of the performance of housing buildings, an assessment of fire safety, a solicitation of renewal needs, and the preparation of an implementation plan. In light of the actual situation, the district government may empower the implementation unit coordinator to undertake functions such as integrating market resources. Given the multifaceted nature of the implementation body's responsibilities, it is advisable to select a body with the requisite expertise to fulfil the aforementioned roles. This could include entities with the capacity to plan and design, renovate and construct, manage properties and operate at a later stage.

4.3 Rights and obligations of neighbouring rights holders

In accordance with the Civil Code, neighbouring rights holders are obliged to provide the necessary facilities in a manner consistent with the principles of favourable production, convenient living, solidarity and mutual assistance, fairness and reasonableness. Article 28 stipulates that neighbouring rights holders must provide the necessary facilities for urban renewal activities, including cooperation (e.g. surveying, etc.), granting the necessary access areas and construction workplaces, and providing the necessary water and drainage facilities for the implementation of renewal and reconstruction. Concurrently, in the event that losses are incurred by the neighbouring rights holders as a consequence of the aforementioned provision of facilities, they shall be compensated or indemnified in accordance with the relevant legislation.

4.4 The establishment of a consultative platform

With regard to the establishment of a consultation platform, the Regulations provide for institutional design at three levels: public participation, consultation and voting, and democratic deliberation mechanisms.

Article 8 sets forth the overarching principles of public participation, which must align with the tenets of transparency, impartiality, and fairness. These principles are intended to enhance the involvement of property rights holders and interested parties in the formulation of urban renewal plans, the creation of policy, and the conduct of democratic decision-making in accordance with the law. Moreover, they are designed to empower owners' self-governing organizations, thereby safeguarding the public's right to know, participate, and supervise in urban renewal projects.

Article 24 delineates the stipulations pertaining to consultative voting on the implementation programme. In instances where multiple property rights holders are involved, the owners are required to vote on the implementation programme of the common parts in accordance with the law.

Article 25 proposes the establishment of a democratic deliberation system for urban renewal projects. This system would facilitate multi-dimensional consultation on project generation, implementation and evaluation, and would provide a platform for the expression of opinions and suggestions from a range of stakeholders. This could be achieved through the use of community forums and other forms of engagement, in conjunction with the specific needs of the project.

4.5 Procedures for handling objections

The Regulations stipulate a corresponding mechanism for the disposal of objections in the event of refusal to implement the implementation plan or in the event that a small number of people are unable to reach a consensus, thus forming an effective programme for the protection of public interests and public security.

In the event that an individual property rights holder declines to implement the implementation programme adopted by vote, other property rights holders, owners' associations or owners' committees are entitled to file lawsuits to the People's Court in accordance with the law. And the use of the People's Mediation System to help parties reach voluntary mediation agreements is encouraged. In the event that the implementation of the project entails considerations of public safety as stipulated by laws and regulations, the district urban renewal authority may make a renewal decision with reference to the relevant provisions on major administrative decisions. Should the property right holder be dissatisfied with the decision, they may apply for administrative reconsideration or file an administrative lawsuit in accordance with the relevant legislation.

5 Conclusion

The article commences with an examination of the definition of property rights, followed by an analysis of the connotations of property rights. This is then extended to encompass the connotations of property rights in urban renewal. The characteristics of the current situation are then constructed, a framework for analysing the interests of multiple subjects is constructed, and finally, the response of Beijing's urban renewal legislation to the current property rights issues is analysed. The article presents a research framework comprising the identification of subjects, expression of interests

and coordination of interests. It then analyses the problems and experiences of the current situation. The primary strategies of the legislation are evaluated in the context of Beijing's legislative practice, including the clarification of the types of property rights and the corresponding objects of property rights, the clarification of the concept of property rights subjects and their rights and obligations, and the clarification of the implementation subjects and their responsibilities in the process of defining the rights and obligations of neighbouring rights. In general, the legislative system has been designed to address the issues related to property rights in Beijing. On the one hand, the legislation has established a system of duties for the property right holder (Table 2), which facilitates the delineation of rights and responsibilities and thus contributes to the protection of rights and interests in practice. Concurrently, the legislation should also facilitate the rights and responsibilities of neighbouring right holders, which would also assist the public in distinguishing ownership and facilitate the smooth implementation of urban renewal projects involving the public interest.

In essence, the majority of the institutional framework within the legislation is guided by principles. While the policies in principle cannot be directly supported in project practice, they offer numerous advantages and provide flexibility in the implementation of the law. This encompasses the specification of the details of support policies in terms of funding, planning and land to be issued by different sectoral authorities. Additionally, it empowers district-level governments to consider regional characteristics and realities when formulating support policies conducive to the implementation of the project, such as guidelines on the specific implementation process.

In the subsequent stages of legislation and law implementation, it is recommended that the operational guidelines be refined in the future, taking into account the successful experience of specific projects. For instance, in the domains of interest consultation and conflict resolution, it is proposed that the workbook on consultation and shared governance be further refined in the subsequent phase, with due consideration of the experience of practical projects. This will enable grassroots staff and residents to participate in proposing topics and putting forward their needs for the urban renewl.

Table 2: Comparison of Property Rights Dilemmas and Institutional Responses

Property Rights Dilemma	**Stage**	**Practical challenges**	**Response of Local Legislation**
Ambiguity in property rights boundaries	Subject identification	The responsible entities for different updating objects are not clearly defined	Clarify the concept and rights and obligations of property right holders
			Clarify the responsibilities and tasks of SOEs
The difficulty of property rights restructuring		Lack of clarity in the responsibilities of the implementing entities	Clarify the process of determining the implementing entities and its responsibilities

		and failure to protect their rights and interests	
Ambiguity in property rights boundaries		Lack of definition of neighborhood relations, difficult to achieve public interest and public security	Clarify the rights and obligations of neighboring rights holder
The difficulty of property rights restructuring	Expression of Interest	Lack of interaction between different parties	Define the rules of the democratic consultation mechanism
The rights and responsibilities of property rights holders are not equivalent		Lack of feedback mechanism	
	Coordination of Interests	Lack of awareness of funding	Clarify the concept and rights and obligations of property right holders
		Conflict of interest affects public safety and public interest	Define the procedures for handling objections

There are still limitations and shortcomings in this paper, as it only analyses the conflicts of interest and adjustments associated with the change in ownership of the asset, but does not analyse the corresponding changes in interests associated with the increase in plot ratio, the change in land use and the increase in housing value. In the future, all types of interest changes in urban renewal should be analysed more systematically, as well as the impacts and problems they bring.

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Track 04: Borders

BORDERS - Transboundary planning for sustainability and cohesion

Chairs:

- Alois Humer, University of Vienna
- Thomas Perrin, Research centre TVES-Lille
- Simin Yan, Universität Heidelberg, Geographisches Institut

Keywords: *planning systems, regional planning, city regions, soft spaces, planning cultures, EU Cohesion Policy, cross-border cooperation, comparative planning studies, transnational planning, actors, scales, institutional change, policy transition*

Current transformation processes towards sustainability and equity that planning seeks to frame require a transboundary perspective on problems and policy responses. While local, regional or national authorities are typically endowed with the mandate for regulatory spatial planning, the existence and importance of planning across administrative borders of jurisdictions is evident. Cross-border regions and large-scale macro-regions are often associated with European spatial planning, but transboundary planning processes also exist within countries at various scales, visible, for example, in the emergence of soft spaces such as city-regions. These transboundary planning processes are especially interesting regarding their governance arrangements, their relationship with statutory planning systems and practices, and their mechanisms for democratic control and participation. Moreover, new planning scales might challenge existing administrative divisions and practices, causing or solving challenges related to policy integration.

This track discusses new planning spaces, formal and informal planning arrangements and comparative perspectives on planning systems, cultures, and practices in Europe and beyond across various scales and borders. We are interested in exploring not only the spatial but also the institutional and practice implications of such new and, at times, ‘transitional’ planning spaces. Comparative research, including the local, city-regional, regional, national and supra-national levels, is most welcome. Research on planning systems and planning cultures can provide essential insights into ideas, policies and practices – and the role actors play in shaping these – especially when transcending national perspectives and exploring local and regional specificities. Comparative perspectives within and between different country contexts can also reveal processes of policy transfer and policy diffusion and illustrate how planning ideas travel across borders.

We welcome theoretical perspectives, empirical, analytical work, and policy-centred discussions alike. For example, contributions to the Track BORDERS might address the following issues:

- Comparative perspectives on planning systems and planning cultures
- The changing nature and role of borders in spatial planning

- Visions and strategies at the macro-regional or continental level
- Planning across internal and external EU borders
- Drivers for cross-border cooperation and EU integration
- Wicked problems such as climate change as transboundary challenges for planning
- Maritime spatial planning and its linkages and interactions with planning on land
- Processes of international policy transfer and policy diffusion
- Spatial planning in functional regions and soft spaces
- Democratic mechanisms and citizen involvement in non-statutory planning processes
- Instances of rescaling and the resulting processes of institutional change
- Planning beyond territorialism
- Planning practices that cross administrative divisions and sectoral siloes
- The role of city-regions in the sustainability debate and the just and green transition

THE EVOLUTION OF SPATIAL PLANNING IN THE BORDER AREA BETWEEN SHENZHEN AND HONG KONG, CHINA

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Abstract
Spatial planning in border areas is a complex undertaking, particularly due to diverse governmental systems. This complexity is further highlighted by the unique "One Nation Two Systems" principle in China, which governs the distinct governance structures of Hong Kong and Shenzhen. The Guangdong-Hong Kong-Macao Greater Bay Area (GBA) Development Outline has triggered significant changes in spatial planning within the border area between Shenzhen and Hong Kong. This study aims to examine the evolution of spatial planning in this border region, identifying various stages of planning development, key outcomes, influential factors, and coordination mechanisms. Ultimately, the study seeks to propose a more democratic and efficient coordination mechanism for border area planning, drawing on insights from the case study.

keywords: spatial planning, cross-border cooperation, policy transfer

1. Introduction

Spatial planning in border areas presents a unique set of challenges that require careful coordination and collaboration across various jurisdictions and stakeholders. The presence of different governmental systems, divergent objectives, cultural disparities, and uneven socio-economic development further complicate the planning process in these border regions. This is particularly evident in the case of the border area between Hong Kong, a Special Administrative Region (SAR) of China, and Shenzhen, a mainland Chinese city adjacent to Hong Kong.

Under the "One Country, Two Systems" principle, Hong Kong maintains a high degree of autonomy and operates under its own independent governmental system, distinct from the mainland Chinese system. This has historically led to a prolonged development segregation between Hong Kong and Shenzhen, despite their geographical proximity. However, the promulgation of the Guangdong-Hong Kong-Macao Greater Bay Area (GBA) Development Outline in 2019 and the enactment of the Hong Kong national security law in 2020 have positioned Hong Kong and Shenzhen as the core twin cities of the GBA, with Hong Kong being urged to integrate further into mainland China's national development strategy. Instead of being organised by transregional planning, Shenzhen and Hong Kong have their own urban planning system while continuously influencing and developing border areas under mutual government coordination and democratic feedback. This has led to a series of changes in the urban planning and social development in the Shenzhen-Hong Kong border area, driven by political dynamics and policy transfer.

This study explores the evolution of spatial planning in the border area between Shenzhen and Hong Kong, examining how both sides have worded towards unified development goals and consensus on win-win situations in spatial planning through multiple driving forces. Through the case study, the study aims to identify more democratic and effective coordination mechanisms and promotion methods for spatial planning in the border area, ensuring that planning can be effectively implemented and utilized in practical operations beyond the realm of technical feasibility.

2. Research Overview

Scholars have engaged in extensive debates on regional planning as a form of policy transfer and a complex system that necessitates looking beyond borders. Despite this theoretical discourse, practical planning activities, politics, and governance often confine regions within territorial political units. This juxtaposition has been labelled the "planning paradox" by Paasi, A. and Zimmerbauer, K. (2015), emphasizing the importance of acknowledging open and porous borders in strategic planning, even in the presence of delineated territorial political units.

Existing empirical studies on urban planning in border areas primarily focus on conducting factual surveys and offering planning guidance. However, these studies frequently overlook the long-term and dynamic nature of border area planning, shaped by technical considerations, socio-cultural elements, and the political landscape. Scholars like Sykes, O., Shaw, D., and Webb, B. (2023) have explored cross-border planning initiatives in various global regions such as the EU, ASEAN, and China's Belt and Road Initiatives, providing a comprehensive perspective on this form of planning. Researchers have also delved into specific cases in diverse regions with unique characteristics. For example, Song, Z. and Zhu, Q. (2020) analysed the spatio-temporal patterns of urbanization in 134 border counties in China, investigating the driving forces behind urbanization in these areas. Additionally, S P Mulya et al (2021) examined land use changes in the border area of Bogor Regency and City from 2010 to 2020, viewing border planning as a direct outcome or framework for decision-making while overlooking its long-term dynamic and adaptable nature. Wen, X., Lyu, Z. & Liu, T. (2023) studied port areas at China's borders, outlining the features of the cross-border flow network, including infrastructure, ecological networks, industrial networks, and cross-border communities, while proposing optimization measures for spatial considerations. Innovative approaches for developing cross-border functional areas have been explored, as evidenced in the work of Jakubowski, A. et al. (2022) who introduced the concept of the Cross-border Functional Area (CBFA) in the Lithuanian-Polish borderland. Their case study illustrates that establishing a flexible destination management structure can enhance cooperation among key stakeholders across borders, facilitate cross-border projects, and promote tourist products effectively.

Planning is not just a blueprint and a result, but a constantly coordinated dynamic process. Planning in border areas takes place amidst complex political and socio-economic environments. This paper aims to comprehend the evolution of border area planning through long-term policy changes and planning advancements, to gain a more comprehensive understanding of the influences of factors such as policies, socio-cultural environments, and various stakeholders on the development of border planning.

3. Methodology

To comprehensively investigate the evolution and dynamics of spatial planning in the border area between Hong Kong and Shenzhen, this study delves into the policies and initiatives of border area planning in Shenzhen and Hong Kong in the past decades. This period is characterised by significant political transformations and notable progress in the border area, making it a crucial focus for analysing the impact of social change and policy transfer on spatial planning and development in the border area.

The methodology involves analysing various policies and planning maps to select pertinent content and create diagrams illustrating the changes in the scope of the Shenzhen-Hong Kong

development area over different periods. These diagrams aim to identify the key outcomes and changes of various development stages, both physical and non-physical.

Furthermore, the study considers public opinions, social affairs, and key economic issues to identify the driving factors influencing planning and decision-making processes. Coordination among government-specific departments is deemed essential for facilitating discussions at both high-level and technical levels. Once strategic consensus is reached, multiple stakeholders, including the Shenzhen district bureau, Hong Kong NGOs, Members of the Hong Kong Legislative Council, urban planning consultants, headquarters, and companies, are involved in the spatial planning formation and decision-making process. Analysing the roles and involvement of these diverse parties is crucial for understanding the coordination and development mechanisms in the planning process.

4. Planning and Policy Development in the Border Area

4.1 Identification of the Planning Stages in the Border Areas

Spatial planning has been developed rapidly in Hong Kong and Shenzhen in the past decades, especially in their border area which hold significant potential for collaborative development. Despite Shenzhen and Hong Kong having distinct development phases and planning systems, they have reached a consensus under the regional strategic policies. Four main planning stages in the border of Shenzhen and Hong Kong are identified: the independent and self-interested stage, the Shenzhen one-side promoting stage, the regional strategic coordinating stage, and the Hong Kong-Shenzhen two-side cooperating stage.

(1) Stage 1: Self-interested Stage

Initially, both Shenzhen and Hong Kong focused on their development and interests regardless of coordination with the other. For example, Hong Kong initiated plans to develop two new towns near the border, primarily aimed at meeting the needs of residents and creating job opportunities, without taking into account coordination or cooperation with Shenzhen. Additionally, Hong Kong used to plan its NIMBY facilities, such as tombs at the border area, directing facing the city centre of Hong Kong in the border area. The presence of NIMBY facilities in the border area of Hong Kong faced consistent opposition from the citizens in Shenzhen. During this stage, spatial conflicts arose, and the border areas were not fully utilized as valuable space.

(2) Stage 2: Shenzhen One-side Promoting Stage

Due to the topographical constraints, Shenzhen had extensively developed much of its border area, with development activities suspended. During the past decades, Shenzhen expressed a keen interest in establishing collaborative relationships with Hong Kong to attract Hong Kong high-level enterprises, advanced academic institutions, and international experience. Two Shenzhen-Hong Kong cooperation zones, including the Qianhai Development Zone and the Houhai Development Zone, were planned in the border area of Shenzhen to develop the financial industry and headquarters with Hong Kong by 2018 at the initiative of Shenzhen.

(3) Stage 3: the Regional Strategic Coordinating Stage

The release of the regional policy GBA Development Outline in 2019 marked the initiation of a strategic vision and development objectives for GBA cities where the development of Qianhai and Houhai Development Zone was emphasised and proposed to get more political support. After the GBA Development Outline was released in 2019, integrating Hong Kong into the national development framework was a key issue, leading to enhanced planning and

mutual interaction in the border area. The companies and institutions from both cities were joined together and formed a new industrial cooperation.

Following the release of the GBA Development Outline, Shenzhen unveiled Shenzhen Territorial Planning and each administrative district formulated its respective five-year plan for 2020-2025. Each district in Shenzhen urged to plan its Shenzhen-Hong Kong development zone to achieve more resources and benefit from regional cooperation. Three main development zones were proposed, including the Futian Free Trade Zone, Luohu Economy Belt, and Sha Tou Kok development area. Hong Kong enterprises and academic institutions have been involved in these development areas, while Hong Kong did not have a plan to establish its own cooperation zone within its territory.

(4) Stage 4: Hong kong-Shenzhen Two-side Cooperating Stage

To increase land supply and foster greater cooperation with Shenzhen, the Hong Kong government unveiled ambitious plans to develop the Northern Metropolis in the border area in 2021. This strategic initiative aims to increase land supply and foster greater cooperation with the neighbouring city of Shenzhen. Subsequently, both cities started cooperating on the border area planning.

In 2022, the Luohu District of Shenzhen, which has the closest relationship and the most bordering areas with Hong Kong, was positioned by the Shenzhen government as the Shenzhen-Hong Kong Modern Commerce and Trade Upgrade Development Zone, aligning its development with Hong Kong. Luohu District not only issued the Shenzhen-Hong Kong Industrial Development White Paper and a spatial integration framework but also established a Shenzhen-Hong Kong Development Department under its original Luohu Development Bureau, to comprehensively integrate with Hong Kong for planning and development and manage affairs related to Hong Kong. As a result, Shenzhen has transitioned from a strategy of individual development zone integration to a regional Shenzhen-Hong Kong coordinated development strategy, achieving breakthroughs in terms of development scale and strategic vision.

Further on, Hong Kong developed an Action Guideline for the Northern Metropolitan in 2023, focusing on expanding the areas and refining the infrastructure within the region. This Action Guideline further specified the scale and building design plans of the development area, while also establishing a detailed timetable to expedite the planning and construction of the Northern Metropolitan.

Released time	Properties	Policies/Plannings	Main content
2019.2	Regional policy (GBA)	Guangdong-Hong Kong-Macao Great Bay Area Development Outline	The goal is to build the GBA into a world-class Bay Area and a world-class city cluster.
2019.8	Territorial Policy (Shenzhen)	Opinions on Supporting Shenzhen to Build a Pioneering Demonstration Zone of Socialism	Shenzhen plans to take the lead in establishing a modern economic system and play a key role in the construction of an international technology and innovation centre in the GBA.

Released time	Properties	Policies/Plannings	Main content
		with Chinese Characteristics	
2019.12	Territorial Policy (Shenzhen)	Luohu Port Economic Belt Development Plan	Launch five major initiatives to create a sustainable development pilot demonstration zone.
2021.6	Territorial Planning (Shenzhen)	Territorial Spatial Master Planning of Shenzhen (2020-2035), and Shenzhen 14th Five Year Plan and the Long-Range Objectives through 2035	In 2030, Shenzhen plans to be an important global city as an innovation centre, financial centre, business centre and cultural centre. The plan clarifies urban vision, urban development pattern, ecological pattern, people's livelihood, innovation development, etc.
2021.9	Territorial Policy (Shenzhen)	Comprehensively Deepen the Reform and Opening up Plan of the Qianhai Shenzhen-Hong Kong Modern Service Industry Cooperation Zone	The total area of the Qianhai Cooperation Zone has expanded from 14.92 km^2 to 120.56 km^2.
2021.10	Territorial Policy (Hong Kong)	The Chief Executive of Hong Kong's 2021 Policy Address, and Development Strategies for Northern Metropolitan Areas	The construction of a 300 km^2 metropolitan area in the north of Hong Kong, in conjunction with the ports and transportation infrastructure of Shenzhen and Hong Kong, to form a strategic layout of "twin cities, three circles" between Shenzhen and Hong Kong.
2022.9	Territorial Policy (Shenzhen)	Luohu Shenzhen-Hong Kong Deeply Integrated Development White Paper	Luohu whole district is positioned as Luohu Shenzhen-Hong Kong Deeply Integrated Development Area with a total area of 95km^2.
2023.10	Territorial Policy (Hong Kong)	Action Guideline for Northern Metropolitan Areas	The construction of a 300 km^2 metropolitan area in the north of Hong Kong, in conjunction with the ports and transportation infrastructure of Shenzhen and Hong Kong, to form a strategic layout of "twin cities, three circles" between Shenzhen and Hong Kong.

Diagram 1: Key Policies of Shenzhen and Hong Kong in Chronology
Source: Provided by the author

4.2 Identification of the Influenced Outcomes and Changes

These stages have been shaped not only by multi-level economic and social policies but also by input from citizens and non-governmental organisations. This influence has resulted in the expansion of developing areas, relocation of NIMBY(Not In My Backyard) facilities, alignment of industries and functions, enhancement of cross-border infrastructure connections, and transformation of boundary control points in the border area.

(1) Extension of Developing Areas

Expansion of Development Areas Within the overarching trend of promoting border region development, a significant shift has occurred in the expansion of development areas. Both Shenzhen and Hong Kong have progressively increased the number of development zones and the scale of land occupation to capitalise on the regional value in the border area and foster collaborative opportunities.

After undergoing shifts in planning and policies, Shenzhen and Hong Kong have significantly expanded their development areas in the border region, albeit at varying paces. With the release of the Greater Bay Area (GBA) Development Outline, Shenzhen delineated specific industrial objectives for the Shenzhen-Hong Kong cooperation zones and meticulously planned infrastructure, such as metro lines, to improve connectivity in the border area. Embracing the concept of establishing a Port Economic Belt in the border region, multiple development zones have been proposed. Subsequently, Hong Kong proposed the Northern Metropolis in the border area, envisioning extensive land development for local housing, industrial purposes and collaboration with Shenzhen in technology and innovation. This strategic shift signifies a move towards a more integrated and interconnected approach to development, emphasizing cross-border cooperation and synergy in technology and innovation.

Before 2019

Regional strategic planning in 2019

Shenzhen formulated its 5-year plan in 2020-2021

Hong Kong envisioned the Northern Metropolis in 2022

Luohu, Shenzhen was positioned as a main district to coordinate with Hong Kong in 2022

Hong Kong made an Action Guideline for Northern Metropolis in 2023

Diagram 2: Expanding development areas of Shenzhen and Hong Kong in the border area
Source: Provided by the author

(2) NIMBY Facilities and Space Conflict

In the context of border planning considerations between the two regions, NIMBY facilities that previously posed challenges to each other have garnered attention. These facilities have been highlighted in government policies and neighbouring public opinions as requiring relocation to address spatial conflicts in the border area.

Prior to 2019, Hong Kong had planned to construct a tomb at the border between Hong Kong and Shenzhen, directly facing the residential area of Shenzhen. This decision sparked extensive protests among the citizens of Shenzhen due to certain Chinese cultural beliefs. However, following the announcement in 2019 by the Hong Kong government to halt the construction of the tomb, taking into account the well-being of the Shenzhen citizens, plans were made to relocate the tomb as part of the Hong Kong Northern Metropolis Development Strategy in 2021 to accommodate new industrial development.

(3) Alignment of Cooperative Industries and Functions

With the expansion of the development areas, the scope of industries for cooperation broadened from finance, technology and innovation, and modern services to include logistics, the food industry, modern consumption, modern commerce, and more. To leverage Hong Kong's advanced international status and receive special policy preferences, several special development areas are planned within the Shenzhen border area, subject to some Hong Kong standards or laws, referred to as "Within the domestic boundary, but outside the national border" or "Domestic but extraterritorial."

In addition to industrial cooperation, Shenzhen and Hong Kong have collaborated to establish several Sino-foreign cooperative universities in the border area, leveraging Hong Kong's internationalized education resources. These cooperative programs in the border area include The Chinese University of Hong Kong (Shenzhen) and the City University of Hong Kong (Shenzhen), among others.

(4) Cross-border Infrastructure Connectivity

Shenzhen has put forth plans to enhance the public transportation infrastructure in the border area, focusing on improving connectivity through the introduction of several metro lines linking to the cross-border ports. In alignment with this initiative, Hong Kong included the development of the Wenjindu Station near the Wenjindu Port in its Northern Metropolis Development Strategy 2021. Subsequently, Shenzhen unveiled its updated metro expansion plans in 2021, which included extending Metro Line 25 to the Wenjindu Port to enhance accessibility.

In response to these developments, Hong Kong made slight adjustments in its Northern Metropolis Action Guideline 2023, modifying the railway line type and relocating the Metro Station closer to the boundary control points. This strategic shift aims to streamline cross-border travel and improve connectivity between the two regions. Ongoing discussions between Shenzhen and Hong Kong focus on establishing a transfer station at the port to facilitate seamless cross-border transportation for residents on both sides. Efforts are also underway to explore the feasibility of a metro line directly connecting to the basement of the Wenjindu Entry Inspection Building, further enhancing transportation convenience and efficiency in the border area.

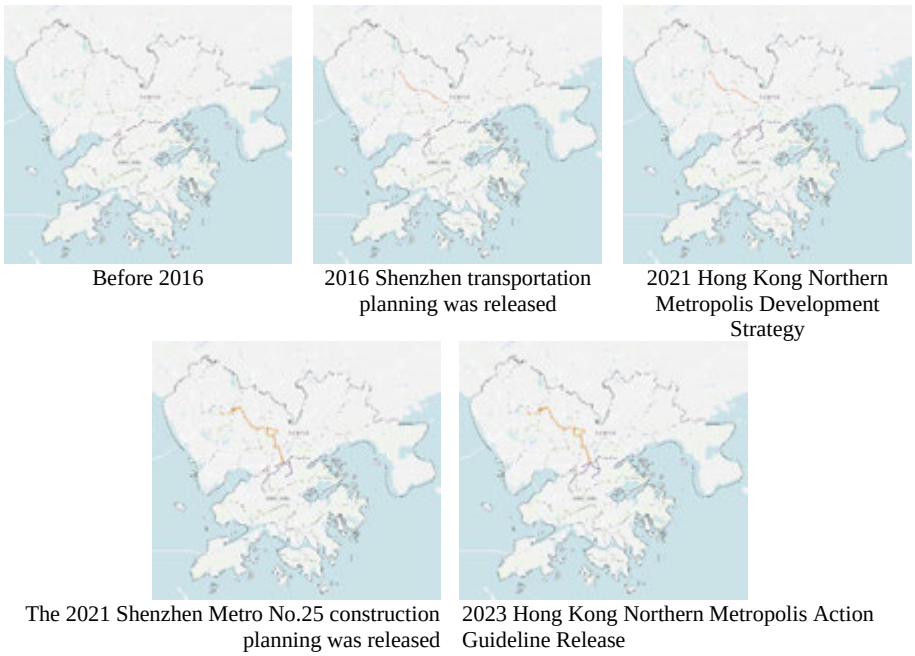

Diagram 3: Transporation planning in the border area between Shenzhen and Hong Kong
Source: Provided by the author

(5) Transformation of Boundary Control Points

The functional positioning of the seven Shenzhen-Hong Kong land ports is experiencing notable transformations in response to policy adjustments. Notably, since 2019, both the Shenzhen Bay Port and Huanggang Port have undergone significant upgrades, with Huanggang Port pioneering an innovative one-stop customs clearance model aimed at improving efficiency and service quality. Looking ahead, the strategic planning for the seven ports will involve repositioning them based on functionality, with freight ports situated on the periphery and passenger ports centralized within the city. These strategic changes are expected to introduce fresh opportunities and challenges to the development of the Shenzhen-Hong Kong ports, impacting trade flows, passenger traffic, and overall port operations in the border area.

(6) Planning and Construction Process

Historically, Hong Kong's intricate public consultation and approval procedures have often led to delays in urban planning and construction projects. Nevertheless, through ongoing communication and collaboration with Shenzhen, Hong Kong has expedited the planning and implementation of the Northern Metropolis. The 2023 Hong Kong Northern Metropolis Action Guideline outlines a defined construction schedule to complete the project within a two-decade timeframe.

5. Influencing Factors and Coordinating Mechanism

5.1 Factors Influencing Planning and Decision-making

The analysis of factors influencing planning in the border area involves multiple levels of consideration. The strategic coordination between Hong Kong and Shenzhen is shaped by a combination of political, market, technical, and public opinion factors.

(1) Political Context

Reflecting on history, the year 2019 marked a critical political transformation point, where national policies directed the cities in the GBA towards a new development trajectory. The coordinated development of Shenzhen and Hong Kong has become a national strategy. Since then, Hong Kong and Shenzhen have been dedicated to deepening cross-border cooperation continuously, promoting the coordinated development of the two places in areas such as innovation, industry, talent, and urban planning, and jointly constructing a more competitive city cluster in the Greater Bay Area.

(2) Market Demand

In the past, Hong Kong held a more advanced and developed position compared to Shenzhen, particularly in terms of the economy. However, in recent years, Shenzhen has significantly bolstered its capabilities in business, trade activities, manufacturing, and modern services. This has resulted in increased tourism and family visits from Hong Kong to Shenzhen and more business trips between the two cities than before. Statistics from the Hong Kong Customs and Excise Department show that from 2010 to 2019, the average annual growth rate of land-based cross-border passenger flow between Shenzhen and Hong Kong was approximately 2.80%. This indicates that the economic and social ties between the two places have grown closer, and cross-border exchanges have been continuously strengthened. The heightened market activity and cooperation across the border have led to a steady rise in land prices in these border regions. Therefore, utilizing the border area to facilitate twin-cities development is a logical response to this market demand.

(3) Technically Comprehensive Feasibility

The evaluation and approval of spatial planning proposals rely on various technical considerations, including factors such as land carrying capacity, transportation feasibility, environmental impact, etc. These aspects require in-depth analysis and expert judgment from planning consultants or institutions, as well as thorough review and assessment by relevant government departments. Before the Hong Kong government formally proposed the development of the Northern Metropolis, a comprehensive land survey and analysis were conducted to gather basic data on developable land to support the border development initiative. Similarly, Shenzhen also conducted a comprehensive analysis of areas available for development and urban renewal in the built border regions, based on which development zones that can be coordinated with Hong Kong were proposed.

(4) Public Opinion

The active engagement of residents, businesses, and various stakeholders in the planning processes of Hong Kong and Shenzhen has become increasingly significant. Their concerns and perspectives play a pivotal role in shaping the planning decisions and strategies, influencing the direction of development in the region. Stakeholders such as local residents, cross-border enterprises, and academic institutions specializing in regional development provide valuable insights that directly impact the planning process. In Hong Kong, non-governmental organizations (NGOs) and members of the Legislative Council play a crucial role in representing the interests of the public and specific stakeholder groups. These entities advocate for community interests and provide input on spatial planning initiatives to the Hong

Kong government, significantly influencing the planning and decision-making processes. For example, Dr. Zhang, representing an academic institution in Hong Kong, has presented research findings on border development, proposing development areas, targeted industries, and strategic orientations to inform planning efforts. Additionally, Legislative Council members from Daguling village in Hong Kong have persistently advocated for the preservation of the village's environment and opposed the establishment of 'Not In My Backyard' (NIMBY) facilities during border area development. Their steadfast advocacy has been integral in shaping the planning discussions and decision-making processes in both Hong Kong and Shenzhen, contributing to the formulation of more balanced and practical development plans.

5.2 Cross-border Coordinating Mechanisms and Role Casting in the Planning Process

Given the different planning and regulatory systems between Hong Kong and Shenzhen, it is challenging to easily align their spatial planning efforts. Therefore, coordination mechanisms are particularly important in cross-border planning. Key components of the coordination mechanism in the case of Shenzhen and Hong Kong include the involvement of government coordination departments, related government bureaus/departments, planning advisory institutions, the Legislative Council and public participation. These stakeholders play integral roles in addressing the complexities arising from the differing planning and regulatory systems of Hong Kong and Shenzhen. By fostering collaboration among these entities, the coordination mechanisms serve to bridge the gap between Shenzhen and Hong Kong and facilitate the harmonization of their cross-border planning endeavours.

(1) Government Coordination Departments

Hong Kong has established the Northern Metropolis Office as a key coordinating body for the region, while Shenzhen's former Development and Reform Bureau functions as the central hub for the Shenzhen-Hong Kong Modern Service Industry Cooperation Zone, facilitating cross-border communication and collaboration between the two cities. These governmental coordination departments act as vital bridges for fostering dialogue and cooperation between Shenzhen and Hong Kong, particularly in border areas. These entities are tasked with overseeing all aspects of coordination between the two regions, organizing technical discussions, facilitating official visits between both sides and more. By facilitating regular communication and engagement through various initiatives, these coordination departments play a crucial role in enhancing mutual understanding and promoting collaboration between Shenzhen and Hong Kong.

(2) Related Government Bureaus/Departments

The key government bureaus/departments involved in the planning and policymaking process mainly include the Hong Kong Development Bureau, Hong Kong Security Bureau, Shenzhen Development and Reform Commission, Shenzhen Planning Bureau, and Shenzhen Port Office. Each of these departments focuses on their respective areas of expertise to contribute to the planning and policy formulation process. Their expertise and insights are essential in providing valuable input and guidance in shaping policies and strategies that align with the goals and priorities of both Shenzhen and Hong Kong. By leveraging the collective knowledge and experience of these government officials, the planning process can be more comprehensive and effective in addressing the needs and challenges of the region.

(3) Specialized Groups

Shenzhen and Hong Kong have collaboratively established 19 Shenzhen-Hong Kong Specialized Groups, each focusing on different technical domains to facilitate cross-border cooperation and development. These specialized groups cover a wide range of areas, including the Connecting Northern Metropolis Development Strategy, Qianhai Construction, Hetao Construction, Technology and Innovation, Port Construction, Financial Services, Cross-border Transportation, Cross-border Railway Infrastructure, Special Services, Commercial and Trade, Hong Kong Teenager Entrepreneurship and Employment, Social Welfare, Medicine, Education, Public Service, Culture and Sports Tourism, Law, Environment Protection, and Talent. The members of Specialized Groups consist of both experts and officers of these government bureaus or departments from Shenzhen and Hong Kong.

To promote border area development and enhance coordination, regular meetings are convened in either Shenzhen or Hong Kong, where specific topics are discussed in a roundtable format, enabling each Specialized Group from both sides to delve into their respective fields in detail, exchange insights, and collaboratively devise solutions that benefit both regions. By fostering open dialogue and strategic planning through these specialized groups, Shenzhen and Hong Kong can effectively address shared challenges, leverage each other's strengths, and drive sustainable development and growth in the border region.

(4) Planning Advisory Institutions

Given the varying levels of information accessibility in Shenzhen and Hong Kong, advisory bodies serve as vital intermediaries in bridging the information gap and fostering effective communication between Shenzhen and Hong Kong. These advisory bodies play a critical role in ensuring that both sides are well informed about each other's policies, plans, and initiatives, thereby facilitating a more seamless and coordinated planning process. Urban planning consultants are instrumental in this endeavour, leveraging their expertise in urban development to facilitate communication and collaboration among stakeholders from both sides of the border. These consultants possess a deep understanding of the complexities of urban planning and can effectively convey insights and recommendations to relevant parties. In addition to their role in coordinating the spatial planning for both sides, urban planning consultants also play a crucial role in engaging with potential enterprises and companies that may be impacted by or involved in the planning process. By involving these stakeholders early on and soliciting their input, consultants can ensure that urban development plans are more sustainable, inclusive, and responsive to the needs of all parties involved. This collaborative approach not only enhances the quality of planning outcomes but also fosters a sense of shared ownership and commitment to the development of the region.

(5) Legislative Council and Public Opinions

The Legislative Council of Hong Kong plays a pivotal role in approving planning and development projects in the region. Both Hong Kong and Shenzhen prioritise public consultation stages in their planning processes, allowing the public to review proposals and offer input for optimization. The Legislative Council and public opinion influence decision-making, ensuring projects are legally sound and aligned with community needs. Active involvement of these entities guarantees that planning outcomes reflect the preferences of the communities they serve.

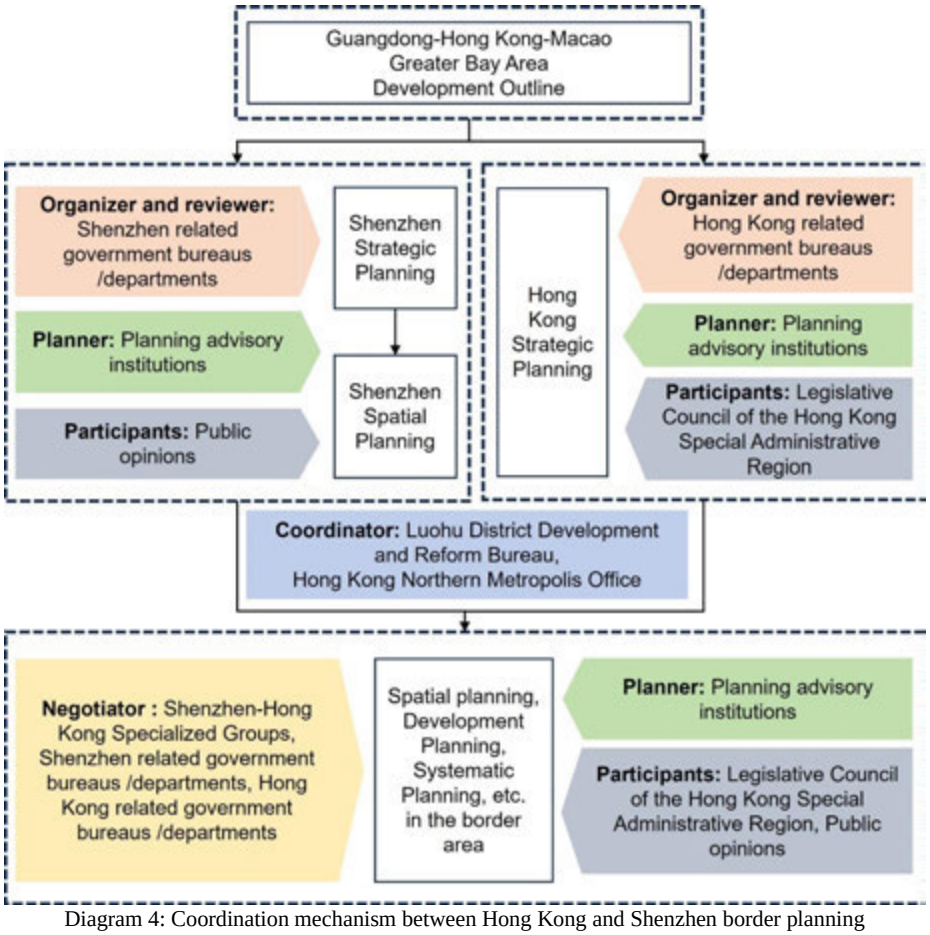

Diagram 4: Coordination mechanism between Hong Kong and Shenzhen border planning
Source: Provided by the author

6. Conclusion

By employing a multi-faceted approach that integrates policy analysis, mapping techniques, stakeholder engagement, and decision-making processes, this study provides a comprehensive understanding of the complexities and dynamics of border area planning in the Shenzhen-Hong Kong border region. The cross-border regional strategy plays a pivotal role in shaping development ideas of border areas, determining the establishment of common goals and development ideas between the two sides. Consistent macro development strategies, driven by market demand and technological conditions, can accelerate the planning and development of border areas. In the context of different political systems and socio-cultural conditions, building a communication bridge for border area planning becomes a shared responsibility for both sides.

In the case of border area planning between Shenzhen and Hong Kong, a cross-border coordination mechanism has been successfully established through collaborative efforts, enabling continuous optimization and adjustment of planning on both sides to achieve

mutually beneficial outcomes. Drawing insights from this case study, several suggestions are proposed to enhance the democratic and effective coordination mechanism for border area planning implementation.

Firstly, it is advisable to organize specialized workshops for the relevant specialized groups for more frequent and informal discussion. In the coordination mechanism, intentions and proposals are often expressed in a relatively indirect manner, making it difficult to receive immediate and precise responses during official coordination meetings. For instance, when Hong Kong presents its plans for Wenjindu port construction in such meetings, they may clash with the planning on the Shenzhen side. As a result, refining and reaching consensus on optimized proposals often require a significant amount of time for feedback. The specialized workshops would provide a platform for each side to fully articulate their technical details and primary concerns. By involving consulting firms experienced in both regions to manage spatial resource allocation and plan regional industrial development, the workshop can significantly expedite the scheme-making process on behalf of both parties. This approach aims to facilitate cross-border construction by implementing innovative mechanisms and unified standards. Secondly, an information-sharing mechanism shall be established to timely disseminate information on border area planning, policies, and development dynamics, promoting interaction and cooperation between both parties. During the planning formulation process, planning adversaries could be the key bridges to understanding the planning and intentions of the other party. In most border planning cases, planning adversaries are often cross-national companies with a better understanding and information about foreign planning. Finally, establishing a bilateral supervision and evaluation mechanism could enhance democracy and public engagement in border areas, incorporating public opinions and input from legislators from both sides. Regularly evaluate the progress and effectiveness of border area planning, and make timely adjustments and optimizations to planning schemes, ensuring the achievement of win-win goals for both parties.

Border areas planning serve not only to resolve spatial conflicts but also to promote mutual benefits. Therefore, the planning of border areas necessitates the establishment of tailored, effective, and rational coordination mechanisms, information-sharing mechanisms, as well as evaluation and supervision mechanisms. Although the focus of this case study is on the border area between the Special Administrative Region and mainland China, the coordination mechanism utilized during the planning process holds significant relevance and applicability to cross-border planning endeavours that involve different systems.

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Administrative boundary effects of cross-border migration of manufacturing enterprises: a case study from the Pearl River Delta in China

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Abstract
This study examines the migration trajectories of 468 representative leading manufacturing enterprises in the Pearl River Delta (PRD) region, aiming to analyze the impact of various administrative boundaries on the relocation and site selection decisions of these enterprises. The analysis focuses on the cross-boundary migration behavior of enterprises at both the inter-prefecture-level city and intra-prefecture-level city levels. The key findings are: (1) Despite the highly contiguous urban development in the PRD region, few enterprises choose to migrate across prefecture-level cities. (2) Driven by cost considerations and the local industrial network, urban boundary areas have become a significant target for enterprise relocation. (3) County/district and street boundaries within cities do not impose constraints on enterprise migration. Instead, intra-prefecture-level city migration is relatively frequent.

Keywords
Administrative boundary, Manufacturing enterprises, Cross-boundary migration, Dynamic mechanism, Pearl River Delta

1 Introduction

Manufacturing industry is a crucial driving force for urban development, and the aggregation and diffusion of manufacturing spaces often play a pivotal role in the evolution of urban and regional spatial patterns. The headquarters of manufacturing enterprises are particularly significant as they exercise critical control and influence over regional industrial chains. Observing the location selection and relocation activities of manufacturing enterprises provides an important perspective for studying the evolution of regional industrial spatial structures. As early as the 1940s, the cross-regional relocation of enterprises in the United States driven by labor costs and competition among enterprises attracted the attention of academics (McLaughlin and Robock, 1949). Evolutionary economic geography pays more attention to the study of industrial clusters and enterprise dynamics (Cooke and Morgan, 1998), focusing on analyzing the historical evolution of the spatial distribution of economic activities, especially emphasizing the "dynamic", "historical inheritance", and "synergy" of this process (He et al., 2014). Neoclassical economic theory argues that enterprises seek to locate in areas that maximize expected profits, which is the primary driver of relocation (Nakosteen and Zimmer,

1987). It is often observed in research that the advantages of headquarters agglomeration drive enterprises to relocate their headquarters to a few central cities (Holloway and Wheeler, 1991), which further strengthens the agglomeration advantages of enterprise headquarters (Klier, 2006; Wu and Ning, 2010).

For different types of enterprises, academics have explored various perspectives on their relocation patterns. For cross-border manufacturing enterprises, clustering factors, innovation factors, and enterprise heterogeneity characteristics are key factors influencing their location choices (Ye et al., 2019). For Chinese state-owned enterprises, institutional factors still play a dominant role (Wang et al., 2021), and tend to be strengthened. Institutional embeddedness can significantly promote enterprise relocation (Long et al., 2020). High-tech enterprises tend to relocate nearby and prefer to move into existing technology parks or headquarters agglomeration areas (Zhang and Zhang, 2022). Case studies of Japanese and Taiwanese enterprises in China show that cultural factors are also important in influencing enterprise location choices (Chang et al., 2010). Additionally, regional ecological benefits and government regulations on environmental protection are also among the important factors affecting enterprise relocation (Chen et al., 2019). It is evident that for different types of enterprises in different regions, the factors influencing their relocation are often complex and diverse.

On one hand, with the rapid development of information technology, the theory of regional network spatial structure represented by "space of flows" (Castells M, 1989) (Sassen, 1998; Hall, 1999) is increasingly being applied to analyze the emerging phenomenon of "Mega-City Regions." It is generally believed that within mega-city regions, as infrastructure continues to iterate and cross-border infrastructure (highways, subways, high-speed railways) is continuously constructed, the hindrance effect of administrative boundaries begins to dissipate. This allows for effective flows of population, industry, and capital between regions, leading to the formation of various functional agglomeration spaces during the process of these flows (Yuan et al., 2023). Existing research has observed a high frequency of flows of various factors within the Guangdong-Hong Kong-Macao Greater Bay Area. It is believed that boundary effects will significantly decrease, promoting rapid growth in cross-city border areas and forming a high-density industrial functional network (Li et al., 2018). In the "highly integrated and mobile" functional network of the Greater Bay Area (Fang et al., 2022), enterprise relocation is undoubtedly an important way for the agglomeration and diffusion of industrial functional elements. On one hand, the functional connections of spatial organizations between subsidiaries and headquarters within enterprises significantly promote the network density of the PRD, enhancing the overall functional polycentricity of the metropolitan area and simultaneously greatly increasing the agglomeration function intensity of cross-city enterprises. On the other hand, the distribution of enterprise headquarters exhibits a certain degree of heterogeneity, not entirely concentrated in the main urban areas of Guangzhou and Shenzhen. The agglomeration function intensity of headquarters in the Guangzhou-Shenzhen corridor, especially in areas near Shenzhen such as Longgang and Bao'an, has significantly increased (Zhao et al., 2021).

On the other hand, the significant impact of administrative divisions and administrative boundaries on regional economic development, enterprise location selection, and relocation has been verified in numerous studies. Although administrative boundaries are non-physical, they

can cause discontinuities between regions through boundary effects, leading to regional inequality (Zheng, 2023). In Chinese geographical and planning research, "administrative region economy" is believed to have originated from the central government delegating economic development authority to local governments since the reform and opening up, greatly enhancing the enthusiasm of local governments to develop local economies (Sun et al., 2020), and forming a distinctive "local corporatism" (Jiang et al., 1996). The "institutional distance" between administrative regions is believed to deeply affect regional economic integration, indicating that local governments compete more for capital elements than for labor, establishing obvious institutional spatial boundaries and administrative barriers (Wang et al., 2023). The special environment of China's economic transformation has created substantial differences in political resources possessed by governments at different regions and levels. Private enterprises have to consider the location decision of their headquarters under the guidance of strategic thinking in pursuing political resources (Wan, 2009). For resource-based enterprises, among the four factors that influence enterprise relocation - policy, economy, strategy, and sentiment - government policy factors have the most significant impact on the relocation of resource-based enterprises (Li, 2015).

Based on this, the following hypotheses are proposed in this study: Under the conditions of highly contiguous development of physical space and high-frequency flow of industrial factors in the Guangdong-Hong Kong-Macao Greater Bay Area, the administrative boundaries, in general, would not have a significant impact on the migration of enterprises' partial functions, such as the cross-prefecture-level city layout of subsidiaries and branches. However, does it still have a certain effect on the relocation of corporate headquarters? If the administrative boundary has no impact on the relocation of corporate headquarters, what kind of spatial pattern should the relocation of corporate headquarters in the Greater Bay Area exhibit? If there is a certain impact, what is the mechanism of this administrative boundary's effect, and how does it occur?

2 Data and Methodology

2.1 Study area and data

The research area of this study comprises nine cities at or above the prefecture-level in the PRD region, specifically including Shenzhen, Dongguan, Huizhou, Guangzhou, Foshan, Zhaoqing, Zhuhai, Zhongshan, and Jiangmen. The spatial identification precision of corporate headquarters locations is at the level of subdistrict/township, with a total of 604 spatial units. The research focuses on the 468 enterprises listed in the "Top 500 Guangdong Manufacturing Enterprises 2022" jointly released by Guangdong Enterprise Confederation and Guangdong Entrepreneurs Association, which are located within the aforementioned research scope. Through the use of business registration change information data from websites such as *Tianyancha* and *Qichacha*, the author retrieved the address change information of the enterprises since their establishment, excluded duplicate change data in terms of actual geographical location, and recorded the spatial migration of these enterprises. Additionally, information such as the city of operation, establishment time, and industry type of these enterprises was also collected.

Due to the significant time span of the sample enterprises' establishment, ranging from the

1980s to 2016 (131 enterprises were established before 2000, 249 between 2000 and 2010, and 88 after 2010), it is difficult to conduct standardized analysis of each enterprise based on a unified time frame. To reflect the overall trend characteristics, the study focuses on the migration trajectories of enterprises since 2000 (for enterprises established after 2000, the sub-district address where they were located at the time of establishment is selected). This time span of over 20 years can stably reflect the development status and spatial migration demands of the enterprises, considering that the average lifespan of manufacturing enterprises is only about 10 years, and the probability of demise significantly decreases for enterprises that have survived for more than 20 years (Xie, 2018).

2.2 Methodology

Social network analysis is a crucial research method in new economic sociology, focusing on studying social phenomena and structures from the perspective of "relationships." In recent years, it has also been widely used to measure economic and industrial relationships between spatial locations (Hou et al., 2009; Huang et al., 2023). This paper primarily employs social network analysis methodology and the network analysis functions of UCINET to measure and analyze the migration network of manufacturing corporate headquarters in the PRD region.

In the study, the addresses of the enterprises are standardized to the centroid of the respective sub-districts to facilitate a better analysis of the spatial connections between sub-district units. Based on the frequency of enterprise migrations between sub-district spatial units, a corporate migration network is established for the 604 sub-district spatial units in the PRD to study the degree of connection and network structural characteristics between different spatial regions. In the social network, enterprise migrations between spatial units are considered as a type of connection, and Gephi is used to visualize the network map and identify the strength of connections between various subgroups.

3 Multiscale characteristics of cross-border migration of enterprises

3.1The distribution of enterprise migration samples

Based on the statistical analysis of the migration trajectories of the 468 sample enterprises in this study since 2000, the data reveals the following patterns: (1) Only one enterprise underwent cross-provincial migration, specifically from Zhejiang Province to Guangdong Province. (2) There were only three enterprises that migrated across different prefecture-level cities. (3) Eighty-four enterprises migrated across different urban districts within the same city. (4) Eighty-six enterprises migrated across different sub-districts within the same urban district. (5) One hundred and twenty-one enterprises migrated within the same sub-district. (6) One hundred and seventy-three enterprises never underwent any migration.

The data suggests that most migrations occur within the same city or urban district, indicating a relatively localized pattern of corporate relocation in the PRD region. Cross-provincial and cross-city migrations are relatively rare, reflecting the concentration of economic activities and the attractiveness of the local environment for manufacturing enterprises.

Tab.1 Types and quantities of enterprise migration

Types	Number of enterprises	Proportion (%)
Inter provincial migration	1	0.2
Migration across prefecture level cities	3	0.6
Inter district migration within the city	84	17.9
Same district relocation within the city (excluding sub-district relocation)	86	18.4
Internal relocation within sub-district	121	25.9
No migration	173	37.0
Total	468	100

In this study, non-relocated enterprises and enterprises that only migrated in a sub-district are regarded as spatially stable manufacturing factors, and then we can observe which areas are more conducive to the long-term stability of manufacturing enterprises. By sorting out the distribution of 293 qualified enterprises, it can be seen that the stable manufacturing area in the PRD region mainly includes 7 sectors: Shenzhen Nanshan-Guangming sector, Zhuhai Jinwan-Doumen sector, Zhuhai-Zhongshan boundary sector, Dongguan east sector, West of Dongguan City-Guangzhou Nansha sector, Foshan Shunde sector, Foshan Nanhai-Sanshui sector.

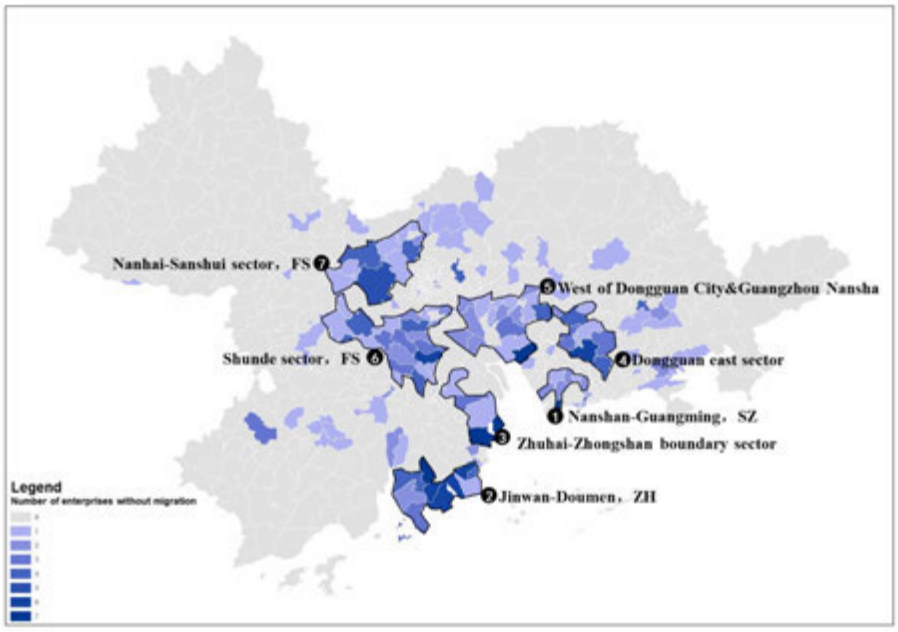

Fig.1 Distribution map of enterprises without migration and migrated over short distances

As above, by analyzing the places where 174 cross-sub-district migration enterprises have moved in and out, it is possible to analyze which regions are losing manufacturing and which

are strengthening. The analysis shows that most of the headquarters of manufacturing enterprises moved out of the central areas of cities, such as Futian District, Shenzhen, Xiangzhou District, Zhuhai City, and Chancheng District, Foshan City. The places where enterprises move in are relatively scattered. On the one hand, the suburbs of cities are an important direction for the proliferation of manufacturing headquarters. The concentrated areas include Doumen District of Zhuhai City, Guangming District of Shenzhen City, and Sanshui District of Foshan City. On the other hand, in Shenzhen, there is also a tendency for the headquarters of manufacturing enterprises to further gather in the central area of the city, such as Yuehai sub-district in Nanshan District and Xin'an sub-district in Baoan District.

Overall, the migration frequency of leading enterprises in the PRD region is relatively low, failing to form a dense and complex migration network within the region. Instead, they have maintained overall stability. The scope of enterprise migration is primarily confined to within the administrative jurisdictions of prefecture-level cities, rarely breaching administrative boundaries. Among these, Shenzhen, Zhuhai, and Foshan are key cities with relatively active enterprise migration. While the networks between these cities exhibit geographical proximity, they lack correlation.

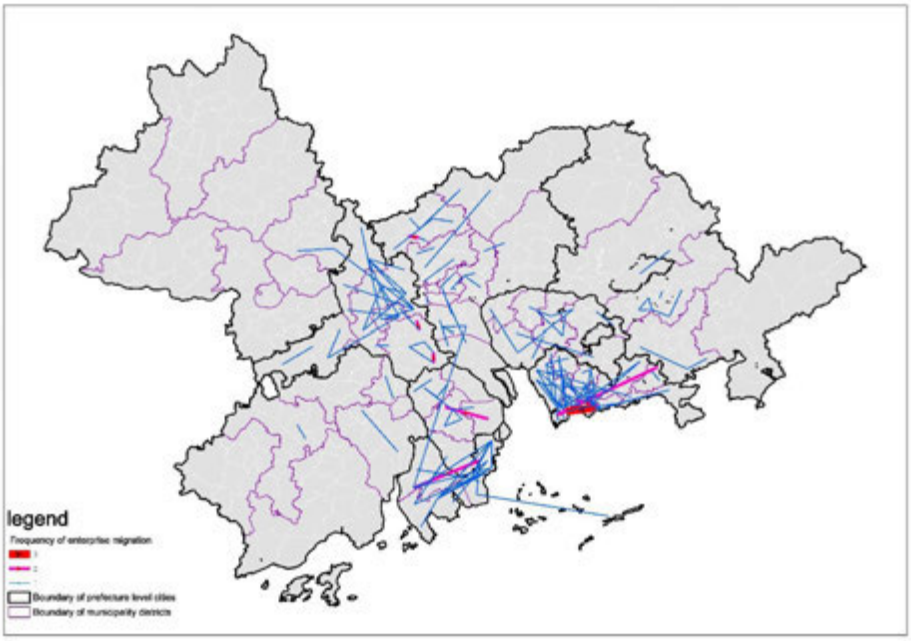

Fig.2 The migration trajectory of enterprises and the administrative boundaries of prefecture level cities and municipal districts

3.1Migration network of enterprises across prefecture level cities

As mentioned above, the spatial migration network of corporate headquarters in the PRD region exhibits a high degree of "unitization." Specifically, enterprises tend to exhibit high-frequency

migration within the administrative jurisdictions of prefecture-level cities, while cross-city networks have not formed, demonstrating a significant administrative boundary effect. Applying social network analysis to observe the spatial migration networks of enterprises in each city, it can be found that the enterprise migration networks in the PRD region can be broadly classified into the following types:

(1) High-frequency - Networked: This category includes Shenzhen and Zhuhai. It is characterized by frequent migrations of enterprises within the city, exhibiting relatively complex spatial network features. Notably, some sub-districts have formed significant clusters of enterprises, and these sub-districts serve as the core of the city's enterprise migration network. For example, Yuehai Sub-district, Nanshan Sub-district, and Xixiang Sub-district in Shenzhen, and Nanping Sub-district, Hongqi Sub-district, and Tangjiawan Sub-district in Zhuhai.

(2) High-frequency - Discrete: This group comprises Guangzhou, Foshan, Dongguan, and Zhongshan. These cities exhibit a certain level of activity in enterprise migrations within their respective domains, but they have not formed spatial networks. From the perspective of spatial connections, there are numerous subgroups of spatial units that form migration relationships, but they are disconnected from each other, failing to form highly concentrated enterprise clusters within sub-districts as seen in Shenzhen.

(3) Low-frequency - Discrete: This category includes Huizhou, Jiangmen, and Zhaoqing. These cities have a low level of activity in enterprise migrations within their administrative boundaries, with only a small number of migrations, let alone the formation of dense spatial networks. One of the objective reasons for this is that their economic development base is relatively weak, resulting in a lower number of enterprises within their domains.

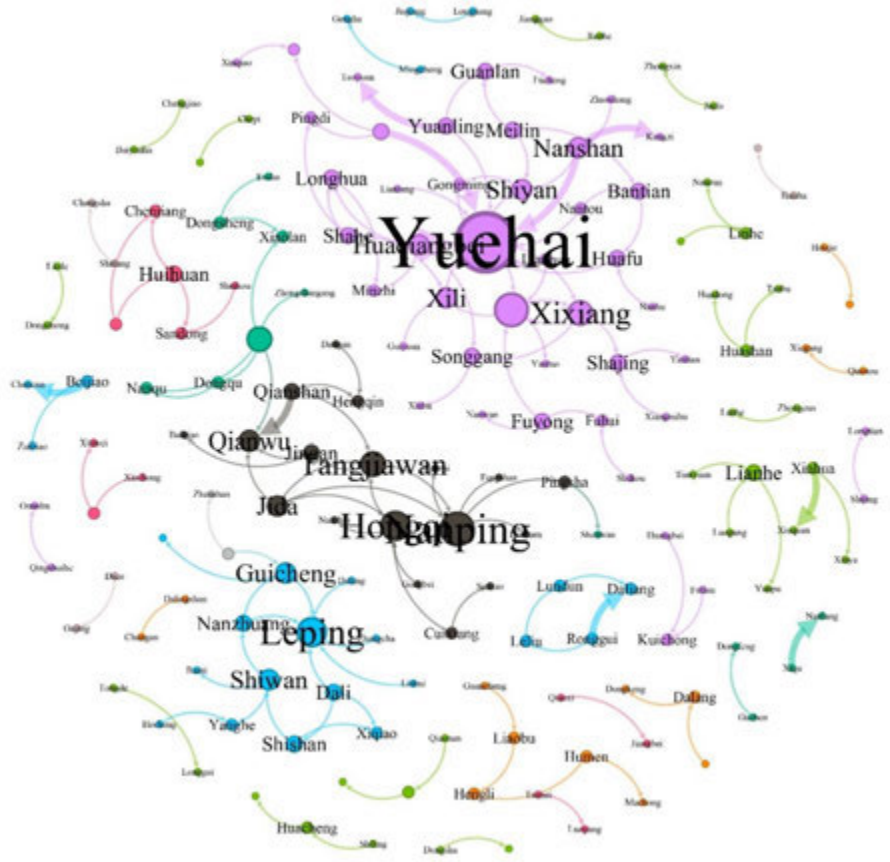

Fig.3 Spatial Network of Enterprise Migration in 9 Cities of the PRD

3.2 Internal enterprise migration network within prefecture level cities

Due to the high degree of typicality of Shenzhen's enterprise migration network within the PRD region, Shenzhen serves as an exemplary case to analyze whether the administrative boundaries of municipalities and sub-districts can play a role in enterprise migration. To investigate this issue, this study utilizes social network analysis to cluster the spatial migration relationships of enterprises within Shenzhen. It is found that sub-district boundaries and municipal district boundaries have a significant limiting effect on enterprise migration in Shenzhen. From the perspective of overall spatial relationships, enterprises in various municipal districts have high-frequency migration relationships, making it difficult to form distinct spatial subgroups based on municipal districts in the network structure. This phenomenon is significantly different from the network relationships across prefecture-level cities. Among sub-districts, enterprise migration seems to be more of a norm, with a high frequency of migrations between enterprises located in Nanshan, Yuehai, Xili, Huaqiangbei, Shatou, and other districts belonging to different

municipal districts.

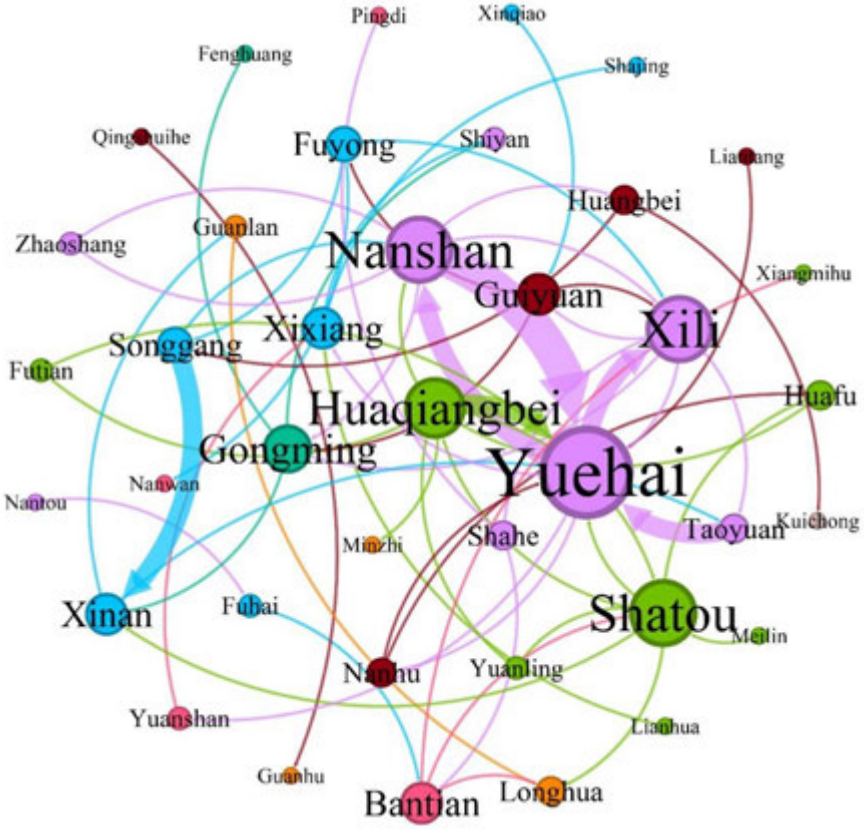

Fig. 4 Spatial Network of Enterprise Migration in Shenzhen City

4 The spatial agglomeration of enterprises in typical border areas

4.1 Characteristics of Enterprise Headquarters Agglomeration in Border Areas

In general, there is a clear trend of manufacturing enterprise headquarters relocating from central urban areas to outer suburban areas. Except for a few areas such as Yuehai Sub-district in Shenzhen, manufacturing enterprise headquarters in the central urban areas of Shenzhen, Guangzhou, Zhuhai, and other cities have experienced significant losses. Correspondingly, the outer suburbs, or urban fringe areas, have become the primary destination for manufacturing enterprise relocations.

This study also employed the standard deviational ellipse (SDE) tool to analyze whether there is a clear directionality in the overall migration patterns of manufacturing enterprise headquarters in various cities. The analysis results reveal significant differences in the distribution of manufacturing enterprise headquarters across cities.

(1) In the Shenzhen-Dongguan-Huizhou region, Shenzhen's manufacturing enterprises exhibit a clear trend of spatial diffusion and northward movement. The dispersion of enterprises in Dongguan remains stable but there is an overall southward movement. Meanwhile, enterprises in Huizhou tend to move closer to Dongguan and Shenzhen. Overall, there is a clear trend of manufacturing enterprise headquarters relocating from the central areas of their respective cities to cluster in the boundary regions of Shenzhen, Dongguan, and Huizhou.

(2) In the Guangzhou-Foshan-Zhaoqing region, the distribution of enterprises in Guangzhou remains generally stable. In Foshan, enterprises have relocated from towns and sub-districts near the Guangzhou-Foshan boundary to more distant areas, resulting in increased dispersion. While the sample size of enterprises in Zhaoqing is small, there is also a tendency for them to migrate to more peripheral areas.

(3) In the Zhuhai-Zhongshan-Jiangmen region, enterprises in Zhuhai tend to migrate from central districts such as Gongbei and Xiangzhou to peripheral areas near ports like Doumen and Jinwan, with an increased concentration of enterprises. In Zhongshan, there is a clear trend of diffusion in the enterprise distribution, with a noticeable concentration towards areas adjacent to Zhuhai. The sample size of enterprises in Jiangmen is small, and the overall change in distribution characteristics is not significant.

(4) Overall, there is a significant clustering of enterprise headquarters along the Shenzhen-Dongguan, Shenzhen-Huizhou, and Zhuhai-Zhongshan boundaries. Although enterprises are relocating from central urban areas to outer suburban areas, they are not crossing administrative boundaries, completing address changes within their respective administrative jurisdictions.

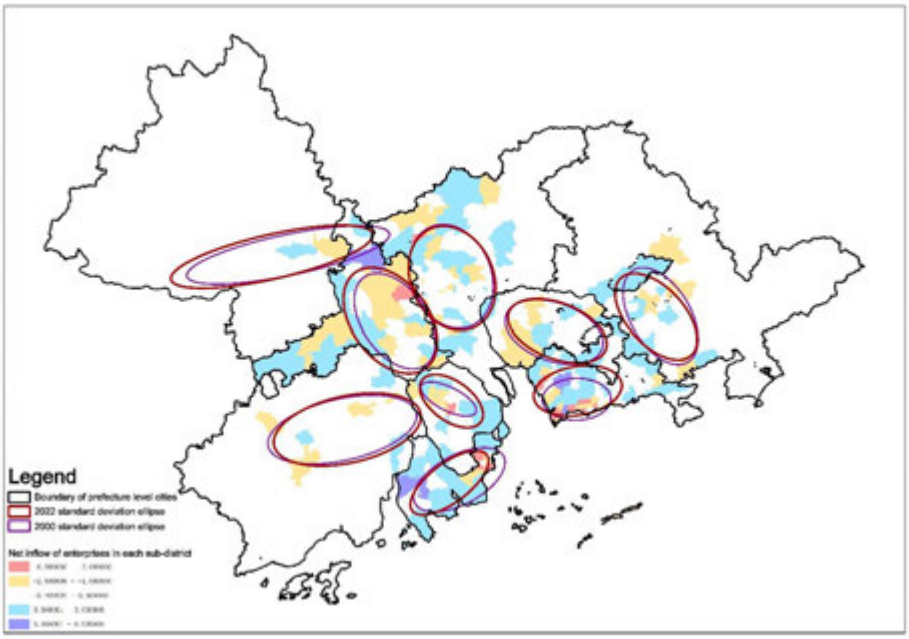

Fig.5 Elliptical Analysis of the Distribution Standard Deviation of Manufacturing Enterprises in Various Cities of the PRD

Tab.2 Standard deviation ellipse analysis of the distribution pattern evolution of manufacturing enterprises in various cities

region	Distribution of enterprise start-up			Distribution of mature enterprises		
	XStdDist	YStdDist	Rotation	XStdDist	YStdDist	Rotation
Shenzhen	0.170	0.104	88.784	0.221	0.121	80.314
Dongguan	0.252	0.143	109.204	0.257	0.137	110.83
Huizhou	0.148	0.264	149.107	0.142	0.258	137.466
Guangzhou	0.200	0.265	158.766	0.205	0.267	156.156
Foshan	0.161	0.265	144.918	0.190	0.294	143.150
Zhaoqing	0.514	0.102	78.125	0.513	0.110	77.252
Zhuhai	0.249	0.122	61.613	0.231	0.098	53.066
Zhongshan	0.151	0.059	116.348	0.179	0.099	125.589
Jiangmen	0.377	0.154	77.311	0.372	0.166	77.580

4.2 Case analysis of typical border areas

4.2.1 Shenzhen-Huizhou Border: Unilateral Agglomeration Driven by Shenzhen Enterprise Spillovers

Shenzhen, with its robust industrial innovation foundation, boasts the largest number and highest quality of manufacturing enterprise headquarters in the PRD region. In recent years, due to the continuously rising costs of land and other factors in the central urban area, relocating to lower-cost suburbs has become an important choice for manufacturing enterprises to maintain their competitiveness. Among these destinations, the border areas of Shenzhen, Dongguan, and Huizhou are significant migration hubs. However, it is noteworthy that most of the manufacturing enterprises relocating to this border area originate from the central urban area of Shenzhen, while there is a limited influx of enterprises from Huizhou and Dongguan.

To promote coordinated development among the three cities, around 2010, the idea of constructing an industrial cooperation demonstration zone in the border area was proposed. This initiative aimed to leverage the respective advantages of the three cities and jointly develop competitive industrial park platforms. However, since the concept remained at the level of overall planning without establishing a cross-regional development mechanism for benefit sharing and balancing, the progress of the cross-administrative cooperation platform was sluggish.

Huizhou hopes to rely on the growth poles of Shenzhen and Dongguan to drive its manufacturing development and maximize its land resource advantages. However, it also

worries about losing control over land use. Similarly, Dongguan has concerns about its dominant role in developing this area and the associated land interests, leading to a lack of proactive cooperation. Ultimately, the "Pingxinqing" cooperation zone was shelved due to difficulties in balancing the interests of the three parties, difficulties in coordination, and the inability to break through institutional barriers. Shenzhen had to build an industrial park called "Shenzhen International Low-Carbon City" within its own jurisdiction. This kind of cross-boundary conflict over interest coordination undoubtedly plays a significant role in Shenzhen's unilateral transfer of industries to border areas.

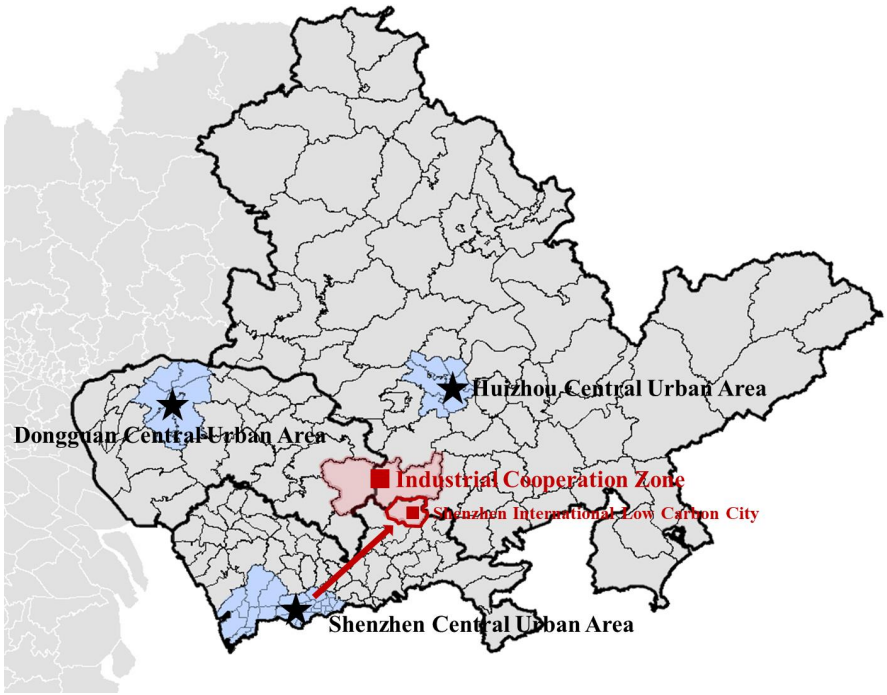

Fig.6 Distribution of industrial platforms in the cross-border areas of Shenzhen, Dongguan, and Huizhou

4.2.2 Zhuhai Zhongshan Border: Enterprise Agglomeration Driven by High Level Platforms

Compared to the difficulties encountered by Shenzhen, Dongguan, and Huizhou in coordinating development in their border areas, the border region between Zhuhai and Zhongshan has developed a significantly different spatial pattern. In Zhuhai, some enterprises have spontaneously relocated from the land-saturated central urban area to the Zhuhai High-tech Industrial Development Zone. Similarly, in Zhongshan, numerous enterprises have shifted from the central urban area and other towns to the coastal Cuiheng New Area in the east. Under the joint promotion of these two forces, a contiguous emerging industrial cluster has taken shape

in the border area between Zhuhai and Zhongshan. While the two cities have not formulated significant planning schemes or joint agreements for the border region, this emerging industrial hub is still accelerating its formation.

The key factors behind this difference lie in the geographical conditions and economic development levels of the region compared to the Shenzhen-Dongguan-Huizhou border. Firstly, Zhuhai and Zhongshan have smaller municipal areas, and their border areas are closer to the central urban districts, making it more convenient for enterprises to change their business locations. Secondly, although the governments of the two cities have not jointly formulated plans or issued relevant policies, they have reached a consensus on the key direction of regional development under the guidance of higher-level planning. Both cities have identified the Pearl River Estuary region as a potential area for future development and have established high-level industrial development support platforms, which has facilitated the concentration of enterprises in this region.

This example also demonstrates that the industrial park platforms established by local governments are significant driving factors for promoting industrial transfer and the relocation of enterprises. These platforms offer enterprises numerous preferential conditions in terms of land, tax policies, infrastructure, public services, and talent attraction, making them attractive destinations for relocation.

Fig.7 Distribution of Industrial Platforms in Zhuhai Zhongshan Cross border Area

5 Mechanism of Administrative Boundary Effect

This study aims to apply the "Thrust-Traction" model from the field of urbanization research to explain the typical phenomenon of enterprises relocating from central urban areas to outer suburbs without crossing prefecture-level city administrative boundaries, from the perspective of comprehensive cost-benefit analysis.

(1) Under the model of local government corporatism, retaining tax-generating enterprises is crucial for promoting local economic growth. Local governments often adopt various measures to retain enterprises. Governments can offer incentives such as land supply, tax concessions, and infrastructure support to encourage enterprises to develop locally in the long term.

(2) As enterprises develop locally, they form close social network ties with the local production network. These ties include not only explicit connections in the industrial and supply chains, but also localized demands for education, healthcare, and other services for the company's employees. This stable embedded relationship is a significant reason for deterring enterprises from migrating across prefecture-level cities.

(3) Cross-city migration of enterprises may involve significant uncertainty, especially when there are significant differences in the business environment between different cities, which can lead to significant adaptation costs for enterprises in new cities.

For enterprises located in regional central cities, staying local requires paying higher land costs and higher operating costs in terms of energy, labor, and logistics. However, the benefits are also evident: staying in regional central cities ensures continued government support, avoiding the need to re-establish relationships with neighboring city governments, and minimizing disruption to existing business networks. Additionally, there is a risk of losing skilled employees who may not be willing to relocate.

For enterprises in peripheral cities, relocating to regional central cities during the upgrading process to access higher-level business resources and research and development capabilities is a viable option. However, the high operating costs in regional central cities may adversely affect business operations. Furthermore, complete relocation often requires re-establishing government-enterprise relations, and there is significant uncertainty about whether they will receive the same level of support as in their original location. Therefore, relocating to border areas adjacent to regional central cities offers the advantage of more convenient access to information, services, and research and development, while maintaining local cost advantages and "government-enterprise relations" advantages.

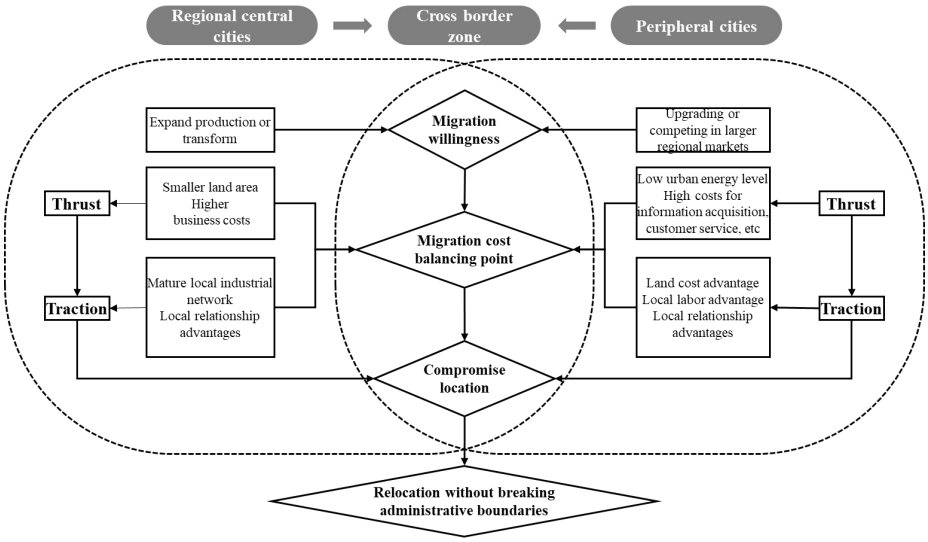

Fig.8 Analysis framework for enterprise migration decisions based on the " Thrust-Traction " model

6 Conclusions and Discussion

The research has shown that while the PRD region has achieved a high level of concentrated development in terms of physical space and the complexity of human, logistics, and information flow networks among cities, there still exists a certain degree of "administrative division barriers" in the relocation of manufacturing enterprise headquarters at the prefecture-level city level. Within prefecture-level cities, however, enterprises exhibit frequent cross-regional migration and mobility without being affected by administrative divisions at the municipal district or sub-district level. This indicates that the phenomenon of "administrative district economy" is primarily manifested at the level of prefecture-level city governments in China, which is consistent with existing research on local corporatism.

From the perspective of the mechanisms of enterprise relocation and site selection, two primary "push-pull" forces determine the migration decisions of enterprises: optimization of operating costs and maintenance of localized networks. From the cost perspective, as the population and functions of central urban areas continue to grow, land prices, energy, transportation, and other operating costs for enterprises inevitably increase, making it difficult to meet the new spatial demands of enterprise transformation and expansion. Therefore, relocation to urban suburban areas with relatively lower costs is a common phenomenon in the development of manufacturing enterprises. Under the sole influence of cost factors, it is a reasonable assumption for enterprises to cross administrative boundaries and relocate to adjacent cities with lower comprehensive costs.

However, enterprise operations are extremely complex systems, and the ability to integrate into the local industrial ecological network is a crucial factor. In China, the government often plays

an important supporting role in local industrial development, including but not limited to the supply of industrial land, the formulation of industrial assistance policies, preferential policies for talent recruitment, support for scientific and technological research and development activities, the provision of public service facilities, and urban infrastructure construction. Once an enterprise leaves its original city and relocates to a new location, it will lose its stable government-business relationship that has been cultivated for many years and incur significant costs in adapting to the new environment. Correspondingly, local governments are also reluctant to let local enterprises leave their jurisdictions due to considerations such as tax revenue and employment.

It is important to note that the enterprise relocations discussed in this study are based solely on the registered location of enterprises obtained from the business administration departments. Although this address can generally be considered as the location of the enterprise headquarters, it does not fully reflect the spatial and temporal characteristics of the economic activities of the enterprise. Modern enterprises often have complex organizational structures and operate in multiple locations, often establishing different types of branches or subsidiaries in multiple cities or flexibly leasing office space to meet production needs. A comprehensive review of the spatial distribution and migration characteristics of various functions within enterprises and a re-examination of the comprehensive effects of administrative boundaries will be an important direction for future improvements in this research.

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Coordinated optimisation of multi-level rail transit network and Regional spatial: International contextual differences and the case of Shanghai[1]

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Abstract:

As the urbanisation rate in China continues to rise, there is an urgent need to enhance the rail transit system to facilitate the growth of major cities and regions. This study examines the contrasts and interconnections between China's rail transit system concepts and those of other countries, as well as the discrepancies in the histories of construction and operational approaches. Based on a clear understanding of these differences, the study employs multiple data sources to analyse the rail transit network in Shanghai. It finds that the network is well-developed, particularly in high-speed railways and metros. However, it lacks an intermediate level. To address this issue, the study proposes a multi-level rail transit network and spatially coordinated optimisation strategy tailored to urban demands. This strategy encompasses rail transit networks at three spatial scales, with specific strategies determined by the availability of urban resources. In conclusion, the study proposes a multi-level rail transit network and spatially coordinated optimisation strategy tailored to urban demands. This strategy encompasses rail transit networks at three spatial scales, with specific strategies determined by urban resources. The study emphasises the significance of recognising contextual variations and tailoring solutions to local requirements.

Keywords: Regional integration; Rail transit network; Metropolitan areas; Cross-cultural comparison; Shanghai

1. Introduction

Currently, China's urbanisation rate has exceeded 60%. As the functions of large cities expand, their spheres of influence expand accordingly, and this expansion has led to the blurring of the boundaries between cities and their neighbourhoods. Against this background, the Chinese government has made coordinated regional development an important national strategy. China's major cities, including Shanghai, emphasise development strategies from a 'city-region' perspective (Shanghai Municipality People's Government, 2018). As a vital transportation network for supporting the growth of large cities and regions, the planning and construction of rail transit systems must be expanded to align with the transportation and development needs of the city and its surrounding areas.

Rail transit plays a pivotal role in public transportation and serves as a crucial infrastructure for supporting the spatial development of cities and regions. Existing research indicates a

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significant influence relationship between rail transit and urban space (Urena, Menerault, and Garmendia, 2009; Cao,2023). Consequently, the rail transit system should be adjusted following changes in urban development orientation. China's megacities, including Shanghai, are attempting to plan and build rational rail transit systems in their urban areas to support efficient inter-city connectivity through rail transit systems and effectively promote regional development.

It should be noted that urban rail transit is a term that encompasses various types of local rail systems that provide passenger service within and around urban or suburban areas. In China's national standard, "Nouns and Terms Commonly Used in Urban Public Transport," urban rail transit is defined as "a general term for fast and high-capacity public transport that is usually powered by electric energy and operates on wheeled rails." The scope of this study is defined as the Shanghai metropolitan area, Shanghai city area and central Shanghai, with reference to official data. Given the different spatial scales that can be effectively served by different rail transport types, the study focuses on four rail transport types: national high-speed railway, inter-city railway, suburban railway and metro. Due to the differences in spatial scale and administrative authority, there are differences between Chinese and foreign cities in terms of rail transit concepts and service situations. For example, the understanding and construction of the four types of rail transit described in the previous section are not the same in China and abroad.

Furthermore, the construction and operation entities and existing problems are also different. Furthermore, research has indicated that the functional structure of the Shanghai metropolitan area is not a 'centre-periphery' commuting circle structure, in contrast to other metropolitan areas that exhibit a concentrated and significant centripetal commuting flow. Therefore, in the Chinese context, the scale and structure of the metropolitan area differ from that of foreign countries (Niu, Yue and Li,2020). Understanding these differences is a crucial prerequisite for comparing other countries' cases and discussing the Chinese scenario.

The objective of this study is to examine the similarities and differences between China and other countries in terms of concepts related to rail transit systems. Additionally, the study will compare the differences in the construction history and operation of rail transit in different countries. Based on elucidating the discrepancies, the pivotal concerns confronting the construction of Shanghai's rail transit system are analysed through multi-source data. It is necessary to summarise the influential relationship and basic laws between rail transit networks and spatial development, proposing reasonable solutions as well.

The subsequent analysis presents the current development status of rail transit in Shanghai, focusing on the contextual differences between international and local conditions. This analysis also proposes a strategy for optimising a multi-level rail transit line network within the context of the Shanghai metropolitan area. The initial section of the study examines the international contextual differences of rail transit systems, considering similarities and differences in spatial scales, development history, and the relationship between rail transit networks and urban development. Additionally, case comparisons are made. In the second part, an assessment is made of the service capacity of Shanghai's rail transit system, the current problems of the rail transit system are analysed, and the focus of future optimisation is deduced, all based on multi-source data. In the third part, a problem-oriented approach is taken, and an attempt is made to propose a solution consisting of goals and layout strategies for rail transit at different spatial levels.

2. International Contextual Differences and Case Comparison of Rail Transit Systems

The modern metropolitan area represents a novel interpretation of the 'city region' concept in the context of globalisation and information technology. The concept of the metropolitan area or metropolitan region is multifaceted and ambiguous, encompassing a variety of administrative, functional and spatial entities, as well as other connotations (Zhang Wang and Hu, 2022). China's rail transport planning and construction are similarly closely related to administration, function, and space. Therefore, the scope of the study was determined based on official information, including the extent of the Shanghai metropolitan area as defined in the Spatial Cooperation Plan of Greater Shanghai Metropolitan Area (Shanghai Municipality People's Government, Jiangsu Province People's Government, Zhejiang Province People's Government, 2022) , as well as the extent of Shanghai city and central Shanghai area as defined in Shanghai 2035 (Shanghai Master Plan 2017-2035)(Shanghai Municipality People's Government, 2018) (Figure 1). High-speed railways and inter-city railways primarily serve the Shanghai metropolitan area and beyond. Suburban railways primarily serve the Shanghai city area, while the metro primarily serves the central Shanghai city.

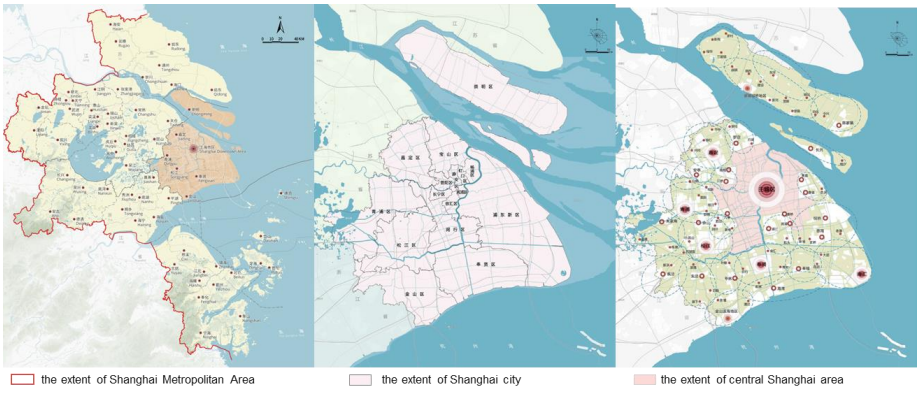

Figure 1. Scope of the study.

Tokyo (Cao,2023) , Paris (Sun, 2024), and London (Chen, Shi and Liu, 2010) have constructed multi-level rail network systems across various rail transport levels within the scope of integrated regional development. These systems serve different travelling scopes with clear functional planning and achieve regional connectivity through line layouts and hub construction. They serve as appropriate reference cases. The selection and construction of the Shanghai Metro at the early stage involved the participation of departments or companies from Japan, France, Germany, and other countries (Yu, 2023). A comparison of the differences between Shanghai and other developed cities in terms of spatial scale, development history, rail transit network structure and suburban railway construction will assist in understanding the development of Shanghai's rail transit. It will serve as the basis for subsequent research.

2.1 Spatial Scale

The discussion of the spatial scale constitutes the foundation of the case study. Analysing administrative units and populations covered by similar spatial layers through analogies helps eliminate comprehension biases arising from international contextual differences, aiding in

scientifically determining the scope of comparison and reference

Using a radius of 30 km for comparison, this circle can cover the main urban area of Shanghai, the Tokyo metropolitan area and surrounding areas, the Greater Paris area (The Metropolis of Greater Paris) and surrounding regions, as well as the Greater London area (The Metropolis of Greater London) and surrounding regions, covering approximately 14.47 million people, 20 million people, 8 million people, and 10 million people, respectively. Using a radius of 50 km for comparison, this circle can cover most of the Shanghai metropolitan area, most of the Tokyo metropolitan area, most of the Île-de-France region, and most of the London metropolitan area covering approximately 25 million people, 30 million people, 12 million people, and 14 million people, respectively.Regarding spatial scale and population coverage, the central Shanghai area is comparable to the metropolitan areas of the other case cities. Similarly, the Shanghai city area is analogous to the metropolitan area boundaries of the other case cities. In China, rail transport is typically approved and projected by the central government and constructed and operated by state-owned enterprises. The national railway system, which includes high-speed railways, general-purpose railways and comprehensive transport hubs, is planned in the Medium- and Long-Term Railway Network Planning. The urban rail transit system in various population densities reflects the overall distribution of the urban population, which is related to the demand for rail transit service capacity.

The overall population density within different spatial circles in Shanghai is higher than that of Tokyo, Paris and London, particularly in the core and central urban areas. Job density indicates the segregation of employment opportunities within a city, which may result in a greater distance between workplaces and residential areas, placing additional pressure on the rail system during peak commuting hours. From the perspective of job density, Shanghai has an overall job density lower than Tokyo but higher than Paris and London, with the difference in job density particularly pronounced in the core urban areas compared to Tokyo. This reflects a more significant polarisation in the population distribution centre in Shanghai (Figure 2), while the job distribution centre in Tokyo is even more pronounced (Figure 3).

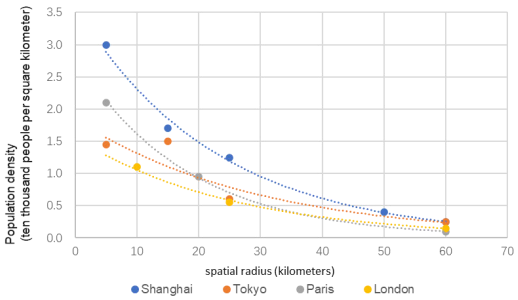

Figure 2. The spatial distribution of population density.

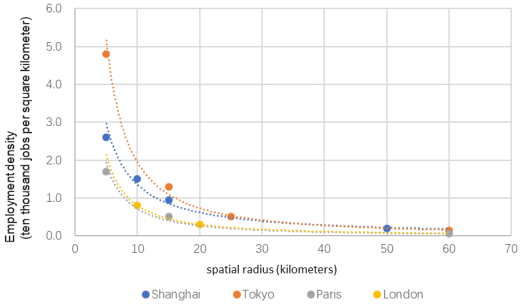

Figure 3. The spatial distribution of job density

The study concludes that the scope of the Shanghai city is comparable to that of other metropolitan areas, based on an analogy between spatial scales. Consequently, the efficiency of the rail system in Shanghai should be at least as high as that of other global metropolitan areas in the future. Additionally, the rail transit system should have a competitive advantage over car trips. It must be mindful of the potential increase in post densities and commuter trips, which could lead to pressure.

2.2 Development History

A review of the development history of rail transport systems can assist in understanding the process of planning and construction of existing rail transport systems, as well as in evaluating the priorities for future rail transport in the context of the city's development stage.

In China, the government is typically responsible for approving and projecting rail transport projects, with state-owned enterprises assuming the role of construction and operational responsibility. China's national railway, which is comprised of a comprehensive national network deployed in a unified manner, with resource property rights belonging to the state and the objective of connecting China's major cities through extensive new infrastructure development, represents a significant national strategy for China. It is now at a first-class level in terms of scale and service capacity (Perl and Geotz, 2015). The metro network of each city is a public service, and the responsibility for this lies with the local government. The city's level of development and the locality's financial capacity are, therefore, critical factors in determining the extent of the metro network. Over the past two decades, the metro service capacity of major Chinese cities, including Shanghai, Beijing, Guangzhou, and others, has undergone a significant expansion, reaching a high level of development. However, the scale of suburban railways built and operated in China is tiny, influenced by factors such as urbanisation, government priorities, and the difficulty of cross-regional intergovernmental collaboration.

To illustrate, the city of Shanghai initiated the preliminary programme of metro planning in 1956, established the Shanghai Metro Company in 1985, and commenced trial operations for the inaugural metro line in 1993. Since then, the construction and operational mileage of the Shanghai metro has increased rapidly, especially with the opportunity presented by the 2010 Shanghai World Expo. The Shanghai government identified rail transit development as a critical strategy to address urban transportation issues. Plans were made to complete more than 400 kilometres of metro lines before the Shanghai World Expo, marking the beginning of Shanghai Metro's transition from a single line to the formation of a network. By 2022, the total length of

the Shanghai metro network will have reached 831 kilometres(Yu, 2023) (Figure 4). Similarly, the construction of high-speed railways related to Shanghai is of a considerable scale and has a robust service capacity. In contrast, the construction of the suburban railway in Shanghai commenced relatively late, and its long-term sustainability has been questioned due to concerns about the potential for development uncertainty. This is attributed to the separation of power and responsibility, the mismatch between the time distribution of the remaining capacity and the demand, the financial risk associated with the general efficiency of the passenger flow, and the poor integration of the track with the city's spatial layout (Li, 2022).

Figure 4. Statistics on operating mileage and passenger volume of Shanghai rail transit lines

A comparison of the population and rail transport development of the Shanghai suburban railway, the Tokyo metropolitan area and the Île-de-France region reveals that the urbanisation process in Tokyo and Paris has seen the construction of railways at an earlier stage and the formation of a larger scale of municipal rail systems. It can be assumed that suburban railways have supported the development of the metropolitan area to a certain extent. In contrast, Shanghai initiated the construction of its rail transit system only after its population reached 10 million on a smaller scale. This requires that the operational service of the Shanghai suburban railway, compared to private cars, should have a particular competitive advantage in terms of convenience and timeliness (Figure 5).

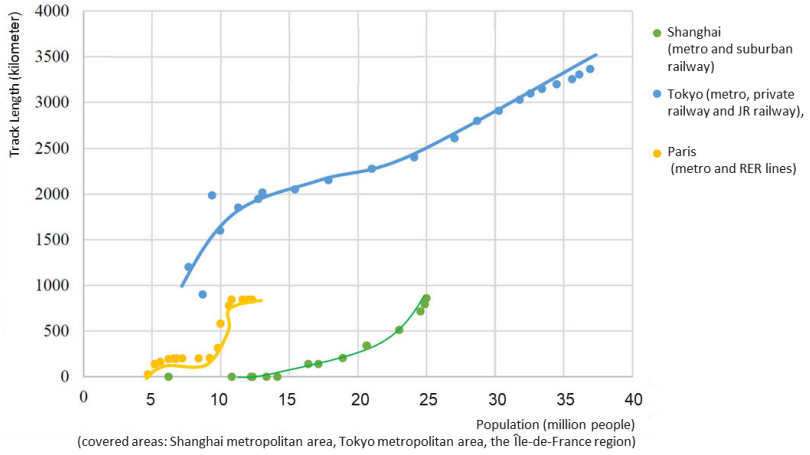

Figure 5. Relationship between track length of rail transit construction and population growth

2.3 Relationship between Rail Transport Network and Urban Development

There is a close relationship between urbanisation and the development of the rail transit system, which is reflected in the discussion on the development history and generally recognised by the existing research (Gu and Kou,2017; Hu et al., 2023). Understanding the role of the rail transit network in the spatial structure of the city will assist in clarifying the functional positioning and mode of Shanghai's regional rail, thereby further enhancing the scientific nature of Shanghai's rail transit planning and construction programme.

In terms of rail transit types, subways typically provide high-density homogeneous services to the core areas within a 5km radius, radiating to the central city within a 15km radius. Shanghai's subway construction has reached this level. Suburban railways usually radiate outward, connecting suburban centres and new urban nodes along different development corridors. This requirement aligns with Shanghai's goal of elevating the development level of new cities. This section analyses and refers to the multi-level rail transit networks in Tokyo and Paris as case studies. This is in line with the goal of the Shanghai Municipality of simultaneously upgrading the development level of the new towns. Consequently, this section employs Japan and Paris case studies as a point of reference for analysing their multi-layered rail networks. At this spatial level, the rail transit in Paris consists of the RER (RéseauExpressRégional) line and the Transilien line. The RER, as a regional rapid railway, is a hybrid commuter rail and rapid transit system serving Paris and its suburbs. Its purpose is to alleviate the city's population concentration and achieve urbanisation of its suburbs. It is planned to serve Paris and its suburbs at the same time as the RER line. In terms of online network structure, the RER line penetrates deep into and through the centre of Paris, connecting with the metro network through the core hubs. This is due to the better engineering conditions in Paris, which allowed the RER line to be built under the metro in the centre of the city, forming a two-tiered network of municipal rail and metro.At first, rail transport serving the Tokyo metropolitan area comprised national railway lines, private railway（私鉄 Shitetsu） lines, and underground lines. However, the National Railway was split and privatised due to poor management, resulting in the formation of the Japan Railway Group, from which the JR lines were derived. Initially, the private railway lines had no access to the city centre. They could only connect to central Tokyo via the National Railway Yamanote Line (now JR Yamanote Line), which led to a sharp rise in passenger pressure on the private railway and Yamanote Loop. This was later attempted to be resolved through the operation of a suburban private railway and a city underground running directly through the city (Cao, 2023). Nevertheless, the Yamanote Line continues to experience significant passenger pressure in terms of city rail service. The Yamanote Line is connected to 15 radial lines of JR railways and private railways, which are situated within 30-50 km and 50-80 km circles around the periphery of the Tokyo metropolitan area. These radial lines connect the system of centres in the Tokyo metropolitan area to form a de facto ring-shaped central belt. The periphery of the Tokyo metropolitan area generates a significant centripetal commuter flow within the Tokyo metropolitan area. The cross-section of the city line into the centre of the metropolis reaches its maximum in the vicinity of the Yamanote Loop (5 km radius circle)(Zhang et al., 2023),

Analogous to the rail transit networks of Shanghai, Paris, and Tokyo, the study concludes that there are significant differences between the rail transit systems constructed in Shanghai and those in cities such as Paris and Japan. These differences are primarily related to the construction of municipal railways. Consequently, it is imperative to exercise greater caution when considering the construction of municipal railways and their relationship with other

railways. At the same time, the construction of railways must be viewed as a policy tool for urban resource allocation, particularly in the context of the urbanisation rate of Shanghai. Given that the city's urbanisation rate has already exceeded 89%, the construction of municipal railways in the city can be considered to have the potential to influence the spatial resources of the city and demographic changes to a greater extent. In light of this, it is crucial that the municipal railways effectively connect the city centre, suburban centres and new town areas.

2.4 Construction and Operation of Suburban Railway

Based on the preceding analysis, it can be concluded that the construction focus of Shanghai's future rail transport will be the city-area rail. Consequently, the discussion will be specifically centred on the city-area transport. Firstly, to facilitate comparison, the Tokyo metropolitan area, which has a larger total population and a more developed rail transit system at the same level, is chosen as a case for comparison. This enables the analysis and discussion of possible situations that may arise in the future development of Shanghai's municipal rail transit. Secondly, to provide a reference for the construction and operation of Shanghai's municipal rail transit, the rail transit service capacity and management and operation mode of Tokyo, Paris and other cities are compared.

With regard to the spatial structure reflected by the travel flow, it can be observed that both the central city of Shanghai and the periphery of the Tokyo Metropolitan Area Department are distributed with more central nodes. However, the nodes in the periphery of Shanghai have a lower energy level, and the number of trips flowing into the central city is also smaller. Compared to the million-strong populations of Yokohama, Saitama, and Chiba on the periphery of the Tokyo Metropolitan Area Department, the new towns around the Shanghai central city are all less than 500,000 people, representing a smaller scale. Furthermore, the daily trips from the new towns into the central city of Shanghai are approximately 100,000-300,000, considerably smaller than those into the Tokyo Metropolitan Area Department. The reasons for this phenomenon are numerous, and the related factors interact in complex ways. On the one hand, the failure of Shanghai's new towns to reach their expected scale is related to poor transport timeliness. On the other hand, Shanghai hopes that the new towns will become independent and integrated node cities directly connecting to other cities in the region rather than relying on the nodes in the central city of Shanghai. This necessitates the enhancement of rail transport efficiency and the implementation of effective support mechanisms for Shanghai's new towns while concurrently avoiding the creation of high-intensity commuter traffic. The imbalance in the job-to-population ratio has resulted in large-scale long-distance commuting and high-intensity rail traffic in Tokyo. Shanghai has a more balanced job-to-life ratio than Tokyo, with smaller differences in job-to-life ratios across the city. Therefore, the impact of rail on the job-to-life balance should be carefully considered in the process of developing the city region.

Using Tokyo, Paris, London, and New York as examples, discuss the service capacity of suburban railways, emphasizing the need for timeliness and sustainability in the construction of Shanghai's suburban railway system (Table 1). Therefore, the construction of a city-region railway in Shanghai should also be undertaken with the aim of ensuring timeliness and sustainability. In order to ensure timeliness, the travelling speed of the city-region railway should be significantly increased compared to the metro (30km/h), up to about 50km/h. This will alleviate the connectivity obstacles caused by spatial distance and ensure a high frequency of train departures. From the perspective of the stage of development and the interval between train departures, it is necessary to avoid opening too many urban lines when the new city's level

of competence is insufficient to ensure the sustainability of the urban railway setup. There is a certain contradiction between the insufficient capacity of the new city and the sustainability of the urban railway setup. On the one hand, the construction of a large number of new lines may result in the inefficient utilisation of resources in the context of a limited volume of the new city. Conversely, if the number of urban railway trips is insufficient, it will be unable to support the development of the new city. This contradiction should be considered from the perspective of the more significant regional level, i.e., through the inter-city railway connecting the new city and other cities, to support the development of the new city in line with the development of the new city into a new city. This is also consistent with the objective of developing the new city into an individual and integrated node city.

Table 1. Comparison of suburban railway service capacity

City	Paris	Tokyo	London	New York
travel speed	40—50 km/h	45—60 km/h	—	45—70 km/h
peak hour departure frequency	3—5 min	2—5 min	4—8min	8—20min
off-peak departure frequency	—	—	20—30min	30—60min

In terms of management and operation, two points require clarification: the sustainability of construction and operation and the manner in which management and operation are coordinated. With regard to the construction and operation of rail transit networks in metropolitan areas, there is considerable variation between different cases in terms of the public and private sectors involved. However, there is a consistent reliance on financial support and development along passenger routes in order to ensure the sustainability of rail transit development. In China, rail transport is typically approved and projected by the central government, with state-owned enterprises assuming responsibility for construction and operation. The national railway system, comprising high-speed railways, ordinary-speed railways and comprehensive transport hubs, is planned in the Medium- and Long-Term Railway Network Plan. The urban rail transit system is organised and formulated based on urban master plans and urban transport development plans. Consequently, there are specific challenges in the cross-area and cross-line operation of rail transport between the national railway system and the urban rail transport system, which serves the metropolitan area and the metropolitan region.

3. Current Situation of Megacities in China: A Case Study of Shanghai

Shanghai is the largest economic centre in China and an emerging global city. It is also the core city of the Yangtze River Delta city cluster. In the Shanghai Urban Master Plan, also known as 'SHANGHAI 2035,' formulated by the Shanghai government, the goal vision of 'Striving for the Excellent Global City' is proposed. As a significant component of the public transport system, the rail transport plan must consider Shanghai's development strategy and address the challenges in the planning and construction of the existing rail network. Furthermore, it also helps to summarise a model suitable for Chinese cities.

A review of the historical development of Shanghai's rail transport reveals that it can be divided into three periods, each characterised by a distinct relationship between the rail system and the spatial development of the city. The period between 1993 and 2010 represents the initial integration phase between Shanghai's rail network and urban space. This involved the

construction of comprehensive metro corridors with the objective of enhancing connectivity in critical areas of the central city. Additionally, the metro was designed to address deficiencies in public transport services in these areas. From 2011 to 2020 is the second stage, which is characterised by the enhancement of the metro network. During this period, the metro network underwent continuous encryption in order to accommodate the rising demand for rail travel in central Shanghai. This resulted in a gradual shift in the proportion of rail travel compared to ground bus travel. Shanghai is in the third stage of rail transit and urban spatial development. This stage is characterised by a shift in the rail transit system from lagging behind spatial development to optimising and guiding spatial development. It can be observed that the Shanghai government has identified the optimisation of the rail transit network as a significant undertaking. This period presents an opportune moment for adjusting the rail transit network in Shanghai. During this period, it is crucial to analyse the current situation in accordance with the development goals and to consider the synergistic relationship between rail transit and space.

3.1 International Perspective: China's Interface with International Markets

'Dual circulation' is a national economic strategy proposed by the Chinese government. The Economist summarised the strategy as 'keeping China open to the world (the "great international circulation") while reinforcing its own market (the "great domestic circulation")'. As China's largest economic centre and an important node supporting the 'dual circulation' policy, Shanghai should efficiently connect domestic and foreign markets.

From the perspective of hubs, the analysis of the connection between Shanghai's main hubs and regions suggests that Shanghai's major external hubs face significant pressure and exhibit low passenger flow decomposition efficiency. The external hubs analysed here include Shanghai Pudong International Airport and Shanghai Hongqiao Integrated Transportation Hub. Nevertheless, the introduction of rail transit lines still requires discussion, and the main corridors are predominantly westward, with inadequate connections to the north and south.

Shanghai Pudong International Airport, the largest international airport in the Yangtze River Delta region, serves as one of the most critical international gateways in the area. Situated in the eastern coastal area of Shanghai, it is yet to be linked by high-speed rail. Connecting to other cities in the Yangtze River Delta and Hongqiao Station requires traversing through the main urban area of Shanghai, resulting in inefficiency and adding to the city's traffic burden. Currently, Shanghai is constructing the Dongfang Transportation Hub, aiming to effectively alleviate passenger flow by introducing high-speed rail and urban rail transit.

The Shanghai Hongqiao Integrated Transport Hub encompasses the airport, railway station (Hongqiao Station), metro stations, and long-distance bus stations. It serves as the primary transport hub connecting domestic destinations in Shanghai. Currently, it is facing challenges due to the presence of multiple overlapping passenger flows and difficulty in expanding capacity. All high-speed rail lines operating in Shanghai, including the Beijing-Shanghai High-Speed Railway and the Shanghai-Hangzhou-Ningbo High-Speed Railway, terminate at Hongqiao Station. In terms of passenger flow, Hongqiao Station handles nearly 60% of Shanghai's railway passenger transportation demand, with daily passenger throughput approaching 90% of its design capacity (430,000 passengers per day). The annual passenger throughput at Hongqiao Station is two to five times that of Shanghai's other two railway stations, with passenger flows exceeding ten million, namely Shanghai Station and Shanghai South Station (Figure 6). The passage resources at Hongqiao Hub are extremely limited, making it challenging to meet the increasing connectivity demands. This also reflects the inability of

Shanghai's other railway hubs to fulfil a synergistic role.

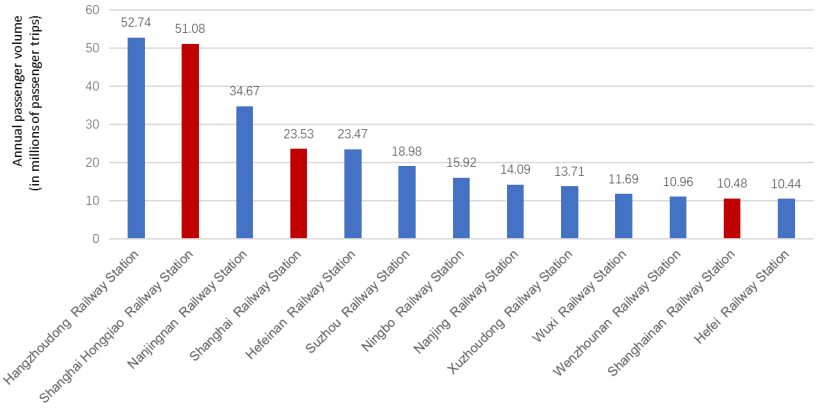

Figure 6. Annual passenger flow statistics of major railway stations in the Yangtze River Delta Urban Agglomeration (2021)

3.2 Regional Perspectives: Capacity to Lead Regional Development

As the core city of the Yangtze River Delta urban agglomeration, Shanghai should effectively lead regional development. Therefore, from a regional perspective, an evaluation is made of the connectivity of rail transit with major cities in the region and its impact on the urban spatial system.

Firstly, there are few intercity and suburban railways, making it difficult to meet the demand for direct connections between major cities in the Yangtze River Delta urban agglomeration. At the metropolitan level, the construction of major national high-speed railways has basically met the connectivity demand of core cities. The proportion of rail transit trips between Shanghai and cities such as Suzhou, Wuxi, and Changzhou in the Yangtze River Delta urban agglomeration has reached 20.7%, 29%, and 41.1%, respectively. However, it is currently unable to effectively connect various levels of nodes through rail transit. The proportion of current rail transit hubs entering node centres is only one-third. Studies suggest that travel efficiency should correspondingly increase with the development of urban agglomerations and the increase in urbanisation rates. The single high-speed rail model of metropolitan areas should evolve towards a multi-network direct connection approach, i.e., transitioning from interconnection between high-level cities and connecting high-level cities to the next-level nodes through various types of rail transit. This poses requirements for intercity and suburban railways in metropolitan areas (Chen Zhou and Qiao, 2017). There is still a significant gap between the Shanghai metropolitan area and the Tokyo metropolitan area (Figure 7).

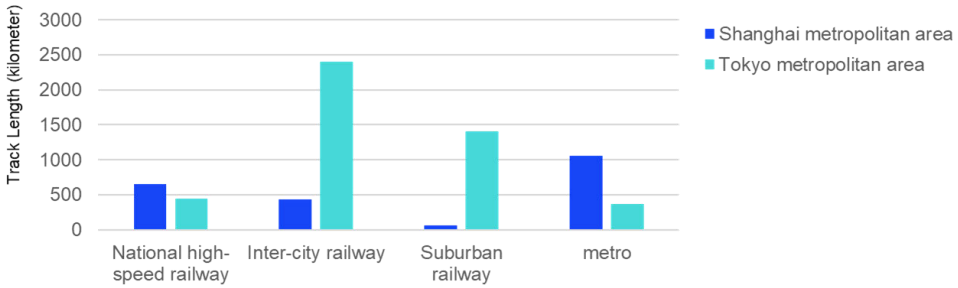

Figure 7. A comparison of the operational development of rail transit in the Shanghai metropolitan area and Tokyo metropolitan area

Secondly, under the background of regional integration, rail transit still cannot support the construction of new cities to become independent nodal cities, and there is a risk of marginalisation for new cities in Shanghai. As mentioned earlier, Shanghai hopes that new cities can become independent, comprehensive nodal cities, which requires good internal and external connectivity to enhance the radiation capacity of new cities. On one hand, the timeliness of the connection between new cities and the central area of Shanghai is poor. Compared with other cities near Shanghai, new cities lack competitiveness, and the travel time from each new city to the main railway stations of Shanghai exceeds several times that of cities near Shanghai. Rail transit travel is less competitive than car travel in new cities. The rail transit connecting new cities is all subways. For example, in the central, vibrant area of Shanghai, People's Square, driving or taking rail transit from new cities to strategic nodes of the city takes nearly an hour, exceeding the time taken by driving from new cities (Figure 8). On the other hand, new cities lack high-level hubs and have insufficient external radiation capacity. External transportation in new cities mainly relies on expressway networks and lacks high-level railways to meet multifunctional demands. Compared with cities of similar population size, new cities lack transportation hubs that match the city's scale and level to support external connections.

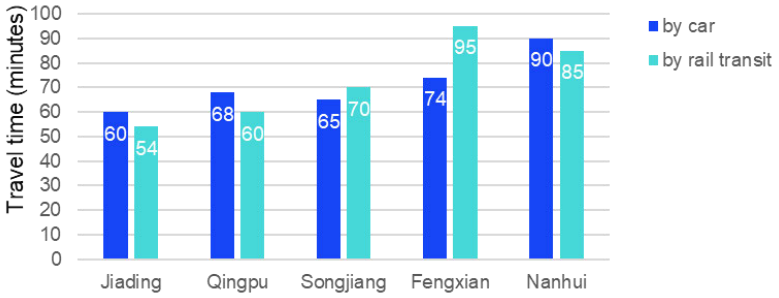

Figure 8. Comparison of travel time from the new city to the central urban area of Shanghai using different modes of transportation

3.3 Urban Perspective: Railway Network Efficiency

As a megacity, Shanghai is subject to considerable pressure in terms of transportation. The capacity of public transportation, particularly high-capacity rail transit services, is crucial. This is closely related to the city's operational efficiency, livability, and sustainability. Consequently, it is of paramount importance to evaluate the efficiency of the rail transit network and to analyse its service capacity.

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On the one hand, there is a considerable demand for long-distance commuting within the central city of Shanghai. The existing metro network is unable to adequately support the development of new urban strategic spaces. Due to operational speed and station stops, the metro network's efficient service range to urban agglomeration spaces is limited to a radius of less than 20km. As a consequence of the expansion of Shanghai's strategic space in the suburban areas, there has been a notable increase in long-distance commuting, resulting in a situation where a considerable number of long-distance commuters occupy the capacity of stations along the lines. By calculating the cumulative congestion contribution of each sub-district, it was found that the density of the metro network in the central ring area of Shanghai had significantly decreased, which was closely related to road congestion. Conversely, there is a considerable volume of travel between Shanghai and its surrounding areas, yet there is a dearth of rapid rail transit modes for rapid connections. Currently, the fastest mode of travel between Shanghai's sub-centres and new cities and areas near Shanghai, as well as between new cities and areas near Shanghai, is by road, which is a lengthy process.

4. A Viable Approach: Multi-level Rail Transit Network and Spatial Co-optimisation Strategies

4.1 Relationship Discussion

Complex mutual influences exist between rail transit networks and urban spaces, influenced by node levels and functions, reflecting requirements on time elements. When urban and regional development needs are reflected in rail transit networks, these demands are manifested not only in spatial connections but also in requirements for connection time and intensity. From a practical perspective, reflecting this relationship can be achieved by discussing the composition of multi-level rail transit networks from a spatiotemporal perspective.

Research suggests that the rail transit system of a megacity should consist of at least three levels corresponding to three spatiotemporal scales, each level containing different types of rail transit and serving different functions. These levels should contain various rail transit types and serve different functions, with the levels interconnected through hubs. Firstly, the central level consists of dense rail transit networks formed by metro and suburban lines. These lines are primarily used for daily life and commuting trips, with service capacity reaching specific locations within an hour. Secondly, the metropolitan level, which should not be divided by administrative boundaries and also includes adjacent metropolitan areas, consists of a well-structured rail transit network composed of suburban and intercity lines, supplemented by metro lines. This network mainly serves longer-distance daily life and commuting trips, connecting

central cities, new cities, and peripheral cities. It also connects urban nodes within 1 hour. Thirdly, the regional level, which encompasses metropolitan areas and beyond, is characterised by the linking of major city nodes through intercity or high-speed rail lines, the construction of transportation corridors, and the provision of services primarily for business travel, with service capacity reaching urban transportation hubs within one hour.

4.2 Possible Key Points and Methods for Synergistic Optimisation

Based on the analysis of case studies and the discussion on the relationship between rail transit networks and urban spaces, a multi-level rail transit network and spatial synergistic optimisation strategy for megacities is proposed, including five possible critical areas of focus.

Before detailing the specific areas of focus, it is essential to emphasise that while the mutual influence between rail transit networks and urban spaces is established, the construction of rail transit should be based on the development goals and layout strategies of cities and regions, taking into account the specific development situation, financial resources, and construction capabilities of the city. A study on Spain suggests that Spain's ambitious layout and construction of high-speed rail systems have led to inefficient route construction and high costs (Perl and Goetz, 2014). Conversely, Shanghai and its surrounding area have a well-developed infrastructure, extensive transportation networks, a stable economic environment, and an appropriate institutional framework, which provides an ideal context for a comprehensive discussion on rail transit systems.

(1) Regional Corridors and Urban Strategies

The construction and optimisation of regional corridors are inextricably linked to urban vision and development goals. As a case in point, the city of Shanghai has set forth objectives about regional leadership, economic development, ecology, and culture. Consequently, it is essential to consider the provision of adequate and rational support for external gateways, the establishment of corridors of an appropriate type that align with the pattern of regional industries, ecology, and culture elements, and the prioritisation of corridor development based on urban functions and travel demands.

(2) Multi-level Networks and Urban-Town Systems

Based on spatial circle layers, it is necessary to consider urban-town systems, propose requirements for connection time and intensity for rail transit networks, and reflect these in rail transit types and operating modes in order to ensure efficient connections between different nodes. It is recommended that rail transit channels be constructed according to the varying connectivity characteristics of metropolitan areas, with a particular focus on strengthening channel connections for key development areas.

(3) Hub Systems and Element Allocation

Rail transit is connected to urban spaces through stations, and hub systems of rail transit with different functions and levels are more efficient compared to single large hubs and can more effectively influence urban resource allocation. Possible hub types include regional comprehensive hubs, linking international, national, and regional travel; regional essential hubs, linking major cities in the region; regional new city hubs, serving as essential nodes for new cities to integrate into the region; urban multifunctional hubs, linking suburban railways and

subways; urban subway hubs, connecting multiple subway lines.

(4) Improvement of Rail Network Efficiency in Central Areas

With urban development, the construction of metro networks often becomes an essential means to alleviate urban transportation pressure in central areas. Therefore, most megacities have well-developed metro networks in central areas, with limited space underground. Analysing urban travel demands, coordinating with urban central systems, and focusing on improving travel efficiency in strategic functional areas of cities are important directions for rail transit optimisation. In addition, the construction of suburban railways is also an effective way to improve the efficiency of rail networks in central areas.

(5) Development, Construction and Operation Mode

The delineation of clear development, construction, and operation methods is crucial for the sustainability of rail transit construction. In the context of China, the delineation of administrative powers is of particular importance, requiring clarity on the responsibilities between central and local governments, as well as among local governments. Furthermore, the establishment of coordinated organisations and methods, along with the determination of lead departments to coordinate multiple management and operation entities, are essential. Third, in the coordination process, it is essential to clarify technical solutions, dispatch responsibilities, and service standards in order to guarantee the reliability of coordination. Fourth, in addition to providing essential financial support, it is necessary to implement a reasonable development strategy along the line in order to ensure the sustainability of rail transit development.

5. Conclusion

The comparison reveals differences in the concept of spatial scale, administrative authority and understanding of rail transport types between megacities in China and other countries. With regard to spatial scale, the city limits of Chinese megacities are comparable to the metropolitan area limits of cities such as Tokyo, Paris and London. Furthermore, the population distribution is more concentrated.

The differences in regional administration and development styles are reflected in the development history of rail transport, which in turn affects the different sequences of spatial development and rail transport system construction in different cities. In the case of Shanghai, the critical difference lies in the fact that the high-speed railway and metro are very well-developed in the rail transit network. However, there is a lack of intermediate level, i.e., the urban rail within a service radius of 50 km. This affects the construction of the hub system accordingly, and ultimately, the service efficiency of Shanghai's rail transit system fails to reach the level of other urban metropolitan areas.

The study proposes an optimisation idea, namely a strategy of multi-level rail transit network and spatial co-optimisation. The rationale behind this strategy is that there is a complex interrelationship between the rail transit network and urban space. This is reflected in the impact of the rail transit system on the spatial and temporal characteristics of the region, as well as the requirements of the regional cities and the development needs of the region in terms of the linkage of the rail transit network. The strategy comprises a three-tier rail network construction model corresponding to the three spatial and temporal scales. It also includes specific synergistic optimisation points and methods. Specific optimisation points relate to the

construction objectives and layout strategies of cities and regions. For example, in Shanghai, these include (1) regional corridors related to urban development strategies, (2) multi-layer rail transit networks related to the urban system, (3) rail transit hub systems related to urban resource allocation, (4) rail transit network efficiency, and (5) development, construction and operation modes.

The study highlights that Chinese megacities such as Shanghai have a favourable foundation for development, a dense transport network, a relatively stable economic climate and an appropriate institutional framework. Consequently, it is possible to discuss a strategy for optimising the rail transport system in an idealistic manner that is as comprehensive as possible. The logic of multi-level rail transit networks with spatial co-optimisation is appropriate for other regions. However, caution is needed in terms of the way it is achieved and the specific strategy.

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Analysing Local Cross-border Cooperation in Fragile Peripheral Areas in Northern Italy

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Abstract
The Italian National Strategy for Inner Areas created a legal and innovative territorial arrangement requiring municipal collaboration for policy and decision-making. This paper aims to verify the strategies, approaches, and projects associated with local cross-border cooperation, discuss the implications and effects, and generate reflections on the defined and unexploited opportunities to interact with municipalities within and outside the inner area's boundaries. The findings indicate that cross-border strategies are linked to healthcare, education, and mobility services. However, all the examined documents fail to make explicit indications that one municipality must cooperate with another to activate such an asset or system. The new local strategy must take advantage of the proximity of the nearby inner areas to boost integrated regional development and better exploit the territorial capital.

Keywords: Local cross-border cooperation, Integrated territorial development, territorial cohesion, National strategy for inner areas, socio-economic development

1. Introduction

Planning systems, territorial policies, models of governance and administrative structures usually change over the years as they need to be updated and coherent to respond to complex and uncertain challenges within the urban, peripheral and rural environment. In this process, a range of concepts and approaches are constantly created, adapted, revised, and implemented. For instance, 'from government to governance', the mix of top-down and bottom-up initiatives, multi-level governance, social and territorial cohesion, integrated regional development, and participatory processes. In the European Union (EU) context, there is the pursuit of a more balanced, integrated and assertive territorial development through democratic processes that respect a sustainable energy transition and innovative strategies that take advantage of the territorial potential (EC, 2022).

Over the years, the EU Regional Policy, also known as the Cohesion Policy, has been adapted, including and raising attention to the territorial cohesion dimension (Faludi, 2018). Policy instruments such as the European Structural and Investment Funds (ESIF) are means of counterattacking the socioeconomic and territorial disparities of member states' regions. The quest for multidimensional cohesion demonstrates the commitment to achieving spatial justice and delivering citizens' rights, especially in fragile and peripheral territories. Another key element within the EU sphere is the devotion to transnational planning and cross-border cooperation for more than 30 years. It is worth pointing out that the EU internal border regions cover about forty per cent (40%) of the EU territory and host about 150 million people (European Parliament, 2022). Research, innovation, conceptual frameworks, priorities, objectives, axes, instruments, mechanisms, tools and funds are all (interconnected) elements that make positive changes possible and feasible in this type of context.

In the sense of European cross-border cooperation, Interreg A assists, encourages, and finances the collaboration between EU regions (NUTS III). Basically, '[i]t aims to tackle common challenges identified jointly in the border regions and to exploit the untapped growth potential

in border areas' (Autonomous Province of Bolzano, 2023, p. 5). Studies such as overcoming obstacles in border regions (EC, 2016) underline, on the one hand, common issues in this type of border (legal, administrative, and language barriers, economic disparity, physical access, sociocultural differences, lack of interest from public authorities working together) and by the other, reasons for crossing borders (leisure, to buy goods and/or services, to visit friends and/or family, employment, business, education and so forth). Nevertheless, despite the relevance and the extensive research and interest in this type of cooperation (EU member states), this paper pays attention to the local (or domestic) cross-border cooperation taking place in Italy due to a relatively new policy requirement.

Linked to EU partnership agreements and programming periods (2014-2020 and 2021-2027) and conceptually and methodologically influenced by multi-level governance, local development projects, and the place-based approach, the Italian government launched the National Strategy for Inner Areas, or *Strategia Nazionale per le Aree Interne* (SNAI) (Barca et al., 2009; Barca et al., 2014). In sum, the SNAI seeks to reverse demographic trends, foster socioeconomic development, unlock the territorial capital, and deliver better essential public services such as healthcare, mobility, and education, especially to fragile peripheral areas – known as Inner Areas in the Italian context. Barca et al. (2014) state that the Italian territory is covered by about sixty per cent of inner areas and around one-quarter of Italy's population.

Despite the significance of the national goals, what is also relevant about this policy (or programme) and a subject of analysis is the creation of new areas (or boundaries) that comprise numerous municipalities and involve all Italian regions. It requires local, provincial, and regional collaboration. Also, it is important to note that depending on the country or state legislation (law, codes and other formal agreements), this type of municipal cooperation and territorial arrangement is restricted and unfeasible. Legal obstacles and the absence of financial resources (possibly from the regional or central government) discourage and limit this relationship. In this national case, the inner areas, on the one hand, demonstrate a possibility to boost the integrated territorial development and reverse the existing fragility condition (since the central level encourages, creates and facilitates the requirement of funds and demands local cross-border cooperation) and, by the other hand, may create new challenges to the local authorities due to the new attributions linked to the strategy design, time-management, participatory process, definition of goals and projects, monitoring and evaluation.

This national policy has established more than one hundred new areas across Italy in the last decade (Dipartimento per le politiche di coesione, 2023), and several questions emerge due to the possible implications and effects of this type of territorial arrangement which links with spatial planning, governance, regional policies, and socioeconomic and territorial cohesion dimensions.

As related above, this paper is interested in the municipal cross-border aspect. Thus, this contribution aims to answer the following questions: (i) How do the national and local strategies address the aspect of cross-border cooperation? (ii) What are (if so) the indications, approaches, strategies, and projects to bolster integrated development and take advantage of the endogenous and exogenous potential growth that neighbouring and inner area municipalities can offer? (iii) What are the possible implications and effects of this new territorial arrangement at the local level?

In order to address the previous questions, one specific inner area has been selected: the Inner Area of Alto Lago di Como e Valli del Lario in Northern Italy. Currently, this new arrangement

covers 41 municipalities, is home to more than 50 thousand inhabitants (Comitato Nazionale Aree Interne, 2022), is located in two provinces, Como and Lecco, embraces Lake Como and the mountains, and borders Switzerland.

Therefore, this paper aims (i) to verify what are the intentions, vision, goals, strategies, approaches and projects that can be associated with the cross-border cooperation matter and (ii) generate a critical reflection grounded on the defined but also the unexploited or neglected opportunities to interacting with municipalities within and outside the inner area boundaries in order to address local needs, enhance territorial cohesion, socioeconomic development, and endogenous and exogenous growth.

The qualitative research method, which includes textual analysis and follows methodological studies such as Weck and Kamuf (2020) and Borén and Schmitt (2022), examines four official documents. The first two represent approved strategies from the national to the local level, 'Strategia Nazionale per le Aree Interne' (Barca et al., 2014) and Strategia d'Area – Alto Lago di Como e Valli del Lario (Comune di Taceno, 2018). The others, 'Un'Agenda strategica per l'Alto Lago di Como e Valli del Lario' (DAStU, 2023a) and 'Il ritratto territorial dell'Alto Lago di Como e Valli del Lario' (DAStU, 2023b) have been selected because of their complementary aspect and the time span they have been published. They are documents developed from two workshops and a partnership between the scientific and political environment (Department of Architecture and Urban Studies, Politecnico di Milano and Regione Lombardia). Still, the latter is the basis for constructing the new Area's Strategy as part of the 2021-2027 PP.

The first section introduces the research topic, questions, aims, and methodology to address such a theme. The second section localises the inner area of Alto Lago di Como e Valli del Lario geographically and details the area's characteristics and existing fragility (issues, barriers and challenges). The third section examines and presents findings related to local cross-border cooperation. The fourth section discusses the possible effects of local cross-border cooperation and the strategies. It approaches the socioeconomic development aspect and the inner area's strategies to interact within and outside the boundaries. The fifth section concludes the paper and points out future research.

2. The Geography of Alto Lago di Como e Valli del Lario: Characteristics of the Territory and Recent Dynamics

The Inner Area of Alto Lago di Como e Valli del Lario currently covers 41 municipalities (2021-2027 PP) and is home to 50,082 inhabitants (Comitato Nazionale Aree Interne, 2022). This new territorial arrangement is located in two provinces (Como and Lecco) in Northern Italy, and both are within the Lombardy Region limits. Ten municipalities from the Province of Lecco have been added to the current PP.

Lake Como is the main natural resource, but there are also the mountains, where several municipalities are located. The economic and productive structure of the area is directly linked with the manufacturing sector (steel processing, engineering and machinery components and textiles) (DAStU, 2023a).

Figure 1 shows the municipalities involved and the new boundaries created due to the SNAI effect. Through this map, it is possible to recognise that Lake Como divides the provinces[1] and

[1] The municipalities of Lecco and Como have a different classification, being considered hubs that offer basic services to the residents of the surrounding municipalities.

municipalities (discussed later), and the capitals of provinces are not part of the inner area. This specific inner area brings an important feature that helps to explain local daily problems, challenges and barriers: the altimetric difference.

The altimetric difference is not in itself a problem. However, one must recognise the existence of global cases in which this factor creates difficulties and obstacles, especially in attracting people, managing and delivering essential services to the population, as well as the interaction and physical connection with other settlements, towns and cities. In fact, the problems are maximised by the existing agreements, arrangements, infrastructure and governance. Low population density combined with altimetric barriers can trigger problems for socio-economic development. Scholars argue that the accumulation of skilled and educated people working together (human capital and agglomeration factor) is usually considered vital to socio-economic growth and explains the city's success worldwide (Glaeser, 2011).

Concerning the inner study area, in addition to low density (more pronounced in the mountain communes), the most common problems are associated with ageing, lack of prospects and opportunities, strengthening the desire to leave the communes or having to travel daily for work, leisure or education, lack of services, infrastructure and accessibility related to local public transport, which enhances, favours and maintains the concept of car-dependency.

Furthermore, there is a lack of educational and health services that cannot cater to an ageing population that demands frequent services and assistance. In the case of this inner area, the geomorphological configuration, a factor responsible for the natural beauty and landscape, is also one of the causes of the lack of connection and the difficulty in implementing better services due to the existing difference in altitude.

In numbers, it is possible to go from 200 to 1,500 metres in a few kilometres. Population density, also among the challenges, is very low, with an average of 87.28 inhabitants per km2. More specifically, of the 32 municipal administrations, 68% have a population of fewer than 1,000 inhabitants, and 29% have fewer than 300 inhabitants in the mountain area (Comune di Taceno, 2018). On the other hand, Alto Lago di Como e Valli del Lario is rich in natural resources, landscape views, gastronomy, architecture, and heritage (Comune di Taceno, 2018). Lake Como, for instance, is an internationally recognised natural resource with natural ecosystems and touristic activities that enhance the quality of life of the inner area's municipalities.

Thus, this section presented central characteristics to understand the study area to address later the strategies, approaches and projects linked to the cross-border matter.

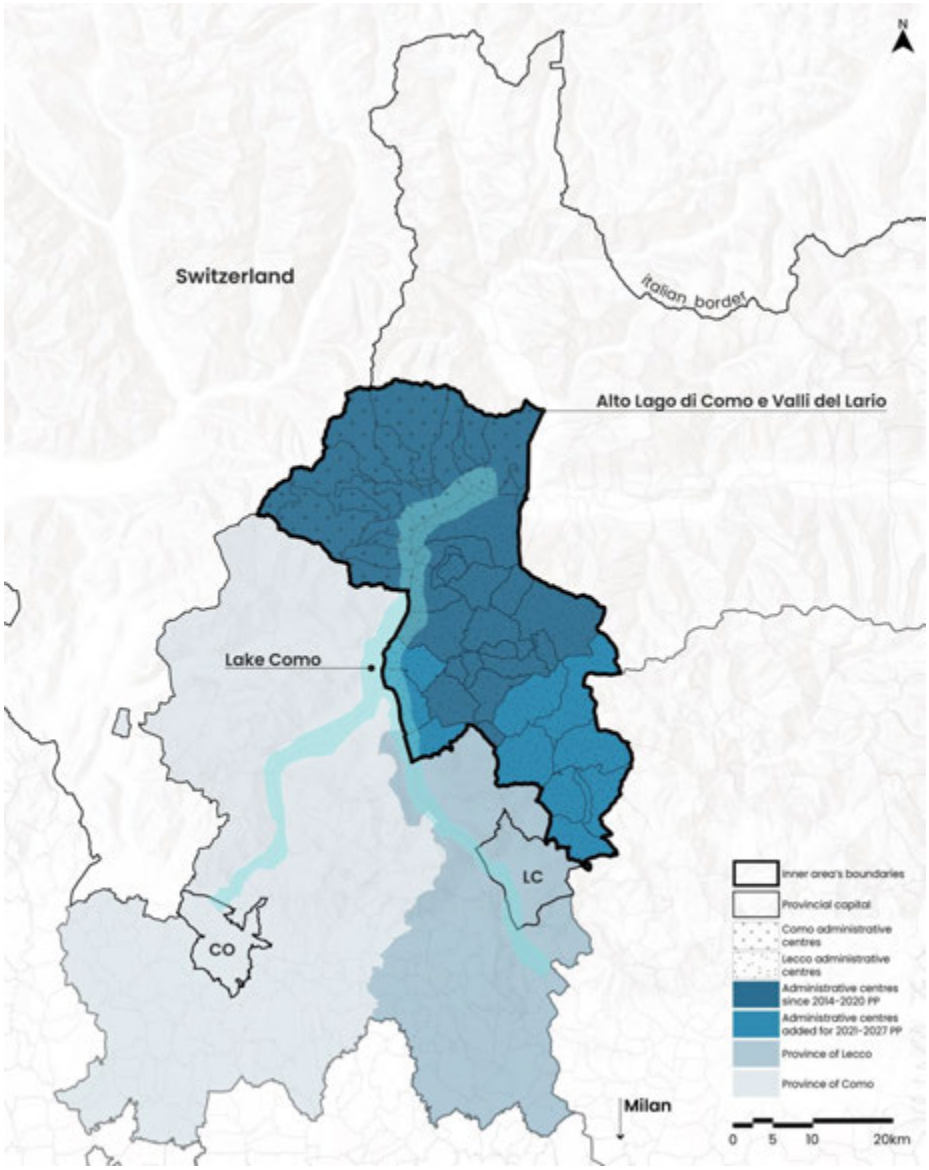

Figure 1. Inner Area of Alto Lago di Como e Valli del Lario. Source: Author's own elaboration.

3. Reviewing the strategies and projects of Alto Lago di Como e Valli del Lario

This section examines four official documents with the aim of verifying the intentions, vision, strategies, approaches and projects linked to cross-border cooperation in the context of the Inner Area of Alto Lago di Como e Valli del Lario strategies and plans. The methodology is based on textual analysis and studies by Weck and Kamuf (2020) and Borén and Schmitt (2022). Although with a more general aspect (due to the nature of a national strategy or plan), the SNAI

will be reviewed to ascertain what guidelines and recommendations exist regarding cross-border possibilities in the context of inner areas. After that, the focus falls strictly on the inner area of study. Thus, three documents strongly connected with the inner area's municipalities (2014-2020 PP) are analysed. It is important to note that the 2021-2027 PP strategy is being developed. However, two workshops have already been held with the local community and actors representing public authorities, the private sector, academics, and experts. The meetings resulted in two interesting documents (DAStU, 2023a, 2023b) that provide updates and original analyses of Alto Lago di Como e Valli del Lario. These documents will serve to find out what is currently being discussed and what has been new since the national strategy was published in 2014 and the local one in 2018.

The findings are organised and presented by level of government (from national to local) and follow the publication timeline. Given the challenge in transferring the local needs, aims and desired scenarios into projects and interventions for various reasons, the content below depicts not only the defined projects but also (where applicable) the vision, statements, intentions, guidelines, suggestions and recommendations. In other words, the results are not just looking for explicit statements but for everything that can be related to the subject of cross-border cooperation. Although cross-border cooperation intensely links to EU member states and external borders, this paper is also interested in how the group of municipalities (which make up an inner area) are using this innovative territorial arrangement to rationally and intelligently exploit the territorial capital and European and national funds to create a mechanism of cooperation to help reduce disparities and tackle common challenges across their domestic borders (EC, 2024).

3.1. The National Strategy for Inner Areas

The national strategy initially states that the policy created is a work in progress with strict agreement with the regions. It recognises the importance of effective dialogue between the central and regional levels with the municipalities and provinces. In fact, the SNAI place the municipalities as the main actors in the creation of the local strategy. 'The municipalities involved in each project area will create appropriate forms of service partnership (or, where appropriate, associations) that will help to boost the long-term sustainability of the strategy' (Barca et al., 2014, p. 9). In addition, the policy-makers emphasise that the growth of the inner areas in the coming years depends on external factors (exogenous development).

In order to identify internal and external dynamics, it is suggested that the inner areas, through the various local bodies and subsystems, propose realistic scenarios that can be realised by defining tangible objectives and projects that can be implemented. In this scenario, it is possible to recognise the transfer of responsibility through bottom-up initiatives. 'Local communities alone can interpret the variety and complexity of the local society and territorial capital that characterise them, and turn them into projects' (Barca et al., 2014, p. 18).

For the inner area's 'success', the national policy again focuses on the importance of endogenous and exogenous factors. They assume that the endogenous factor may trigger innovation, maintenance and preservation of local identity and internal knowledge about territorial activities. Hence, it would empower the inhabitants, boost the local economy, and attract other people to consume inner services and products.

With respect to (domestic or international) cross-border integration and cooperation, the inner areas, through funding and local development projects, need to become evolving territorial

systems that connect with the other areas of the Italian territory 'in terms of space, relations, economy - and culture (Barca et al., 2014, p. 16). Policy-makers see the inner areas as an issue that influences not only the national level but also the European and global levels.

Although the inner areas themselves are responsible for developing projects (according to local characteristics and future objectives), there are some sectors that SNAI obliges – in an attempt to strengthen and provide basic citizenship rights. Besides combating demographic trends such as depopulation, SNAI focuses on providing essential public services as a crucial means of reducing existing disparities and fragility. Mobility, healthcare, education and virtual connectivity are the basis of this national policy. Municipal cross-border cooperation may be seen in the demand for new forms of governance that require 'new associated management models for municipal activities' (Barca et al., 2014, p. 42).

The central level of government recognises its role in providing essential services to the inhabitants of Italian territory, regardless of geographical position. As a way of improving these services in inner areas, they state that there needs to be a reorganisation of educational facilities as well as health centres (hospitals and smaller units) in order to concentrate (where possible) and guarantee specialised and emergency services for citizens. For these actions to be feasible, mobility projects, especially accessibility, are expressed. Better coordination of transport planning that analyses transport demand and encourages modal shifts towards collective transport (Barca et al., 2014). These issues are vital for adequate flows into and out of the inner area to utilise essential services.

This section has presented possible links and indications of cooperation between municipalities. The national strategy serves as a guide for constructing all local strategies. In the following sections, the documents present findings on cross-border cooperation in the North Lake Como area.

3.2. Strategia d'Area Alto Lago di Como e Valli del Lario

The local strategy, officially named *Strategia d'Area Alto Lago di Como e Valli del Lario*, rather than the national one, naturally indicate and points out municipalities. The links with the theme of cross-border cooperation align with intentions, goals, and projects aimed at maximising basic public services such as education, healthcare and mobility. In addition, it details the topics of governance, tourism and entrepreneurship initiatives.

The document begins by reiterating that due to its proximity to influential universities and research centres and its history in specific production sectors (see section 2), the inner area's population has cognitive and social capital and an orientation towards 'doing business'. Alto Lago di Como e Valli del Lario is located in two provinces, which naturally increases the number of public bodies, facilities, institutions, and authorities, which, in this case (but not exclusively), implies governance challenges.
As for municipal cross-border governance, the inner area shows concrete actions in the legal sphere. There have been several mergers and unions of municipalities and administrative centres in the last decade. For example, the merger between Bellano and Vendrogno, the merger of other municipal centres that gave rise to the Comune di Gravedona and Uniti and, more recently, the Comune di Valvarrone, which was formed through the merger of Introzzo, Tremenico and Vendrogno. The above examples demonstrate the wish to improve the management of services and personal capacity and reduce operating financial costs. It is important to emphasise that these occurrences are related to both provinces, Lecco and Como.

Although there is 'local' centralisation on the part of the two mountain communities in the management of civil protection functions and other social services, technical issues such as the type of interface, the use of different digital systems (software) and also the deficit of administrative and institutional capacity building are points that explain the reduction or limitation of cross-border cooperation in this area. Moreover, the inner area has two different health agencies (ATS), one for each province. On the other hand, local public transport is managed by a single agency – 'Agenzia del Bacino di Varese-Como-Lecco'. The management of navigation on Lake Como competes with 'Gestione Navegazione Laghi', which runs Lake Maggiore and Lake Garda.

In the view of improving the management of local services and consequently local governance, the municipalities defined the subsequent topic of intervention topic and two related projects: 'rationalising functions in associated form, increasing the level of associationism between local authorities' (Comune di Taceno, 2018, p. 23). Shortly, the projects aim to improve the following types of services: civil protection, land register, and seismic regulations. They also aim to implement capacity-building actions in the administrative sector as well as for officials and other professionals linked to local strategy development. In this process, the aim is not only to train local bodies but also to have an integrated organisational model. Together with the above actions, the projects linked to local administrations seek to implement information, awareness-raising and empowerment dynamics for the local community (active citizenship).

With regard to educational projects, the local strategy recognises the difficulty in providing such a service due to financial and organisational issues, geographical position and (low) population density. Thus, the centralisation of services and especially facilities mentioned by the local strategy follows the guidelines of the central level (SNAI). In this sense, essential public services such as education and healthcare are somewhat closely linked to and dependent on mobility, accessibility and virtual connectivity as factors in achieving better performance.

In terms of education, the topic is 'strengthening the educational offer to favour the territorial anchoring of settled populations (and new populations)' (Comune di Taceno, 2018, p. 23). The projects revolve around teaching English language, integrated subjects, and new technologies, as well as having such facilities as hubs for reconciling work and family time by better aligning pre-school and after-school timetables. Offering extracurricular activities for children, parents and residents of the inner area who work outside the inner area or whose schedules make it difficult to manage the situation. In short, the school and primary and secondary centres are planned as meeting points to address and increase knowledge about local, cultural and innovation issues for different people with different needs.
Moreover, in the educational and training sphere, some projects aim to bring students together through exchanges with entrepreneurs and companies from the local area and beyond, as well as educational hubs and research centres. Innovation, mechanics, mechatronics, energy efficiency, and the development of entrepreneurial profiles are at the forefront of these projects.

As regards healthcare, the main topic of intervention is 'increasing services aimed at taking care of people with chronic and frail conditions by the social and health care system and improving conditions for social inclusion' (Comune di Taceno, 2018, p. 25). Local development projects align with the improvement and application of the Territorial Social and Health Centre, or 'Presidio Socio-Sanitario Territoriale' (PreSST) model. In the province of Lecco, the PreSST model will operate in Bellano, serving the municipalities closest to the lake, and in Introbio, serving those in the mountains or valleys. The dynamics for the Province of Como are in line

with services at a hospital located in Gravedona ed Uniti. There are actions to construct an integrated network with telecare and telemedicine services.

The local strategy understands that in order to provide education and health services in person and build a more connected inner area that can develop socio-economically, it is crucial to have good mobility conditions, especially accessibility between municipalities – regardless of geographical location. To this end, the main goal is 'increasing the level of accessibility of the area in relation to the specific geographies defined by the local public transport system and territorial nodes' (Comune di Taceno, 2018, p. 24). In this context, the projects seek to strengthen local public transport (LPT) services along the main routes but at the same time on secondary routes – improving accessibility to the main routes through better management and encouraging people to opt for LPT rather than private individual vehicles (usually cars). In addition, the connection and navigation services on Lake Como should be expanded to minimise the existing natural barrier aspect.

Conclusively, the local level believes that a new multidisciplinary arrangement made up of companies in the tourism field is essential for connecting the territory. The lack and the need for a logic of networking and making growth in local partnerships are competencies of a managerial and entrepreneurial nature. To this end, the expected outcome is to 'increase the tourist offer's integration level for an integrated and distinctive communication of the area and a systemic organisation of reception services and accommodation proposals' (Comune di Taceno, 2018, p. 28).Thus, tourism appears as a way of connecting the mountains to the lake, bringing more people from within the inner area and tourists with the assumption of developing the socio-economic and cultural environment of the inner area.

With regard to international cross-border cooperation, the local strategy only mentions the existence of projects between Italy and Switzerland (Interreg Italia-Svizzera). There is no project in this PP that strengthens this link or opens up new windows of cooperation.

3.3. Un'Agenda Strategica per l'Alto Lago di Como e Valli del Lario

Considering the need and objective of reversing demographic trends, the strategic agenda raises noteworthy points about this factor and makes direct links with essential public services. The absence of educational and health personnel is notable and severe, especially in the sparsely populated communes located in the mountains. In this sense, it is stated that even with the implementation of incentive policies (free rent and salary increases), this event is not being reversed. A few points help explain this situation: the attractiveness in terms of quality of life, services and financial remuneration found in Switzerland and some nearby towns. In addition, the inefficiency of public transport, difficulties due to high prices, lack of options or the poor state of repair of flats and houses reinforce this situation. As a result, the level of education is compromised and often interrupted. It leads to differences in learning between students from other locations - reinforcing the fragility of the inner area.

The existing fragmentation in terms of governance is once again exposed. In fact, these problems are related to basic public services. However, this time, they include the cultural sphere, which reduces the supply or even deprives citizens of services and activities linked to cinema, theatres and bookshops, for example. On the other hand, governance has been upgraded according to the strategic agenda. DAStU (2023a) points out that the communes, despite challenges and barriers, are moving towards greater cooperation. They use the case of the Riserva Naturale Pian di Spagna e Lago di Mezzola, where 11 communes, the two provinces

(Lecco and Como), the two mountain communities and the Lombardy Region are involved. However, the authors mention that the processes of associationism and the merging of the communes have not made as much progress.

As mentioned in the previous sections, mobility is undoubtedly a key dimension in the progress or decline of these communes. In this sense, although some improvements have been made in recent years in matters of soft (active) mobility and public transport connections, the document argues that the lack of integration, infrastructure and quality of access between the two shores of Lago di Como diminishes endogenous development and reinforces the employment and service dependence of the residents of the inner area on the external poles (Lecco, Menaggio and Morbegno).

After presenting some existing issues that partly explain the fragility of the inner area of Alto Lago di Como e Valli del Lario, some strategic lines of action that will most likely guide the definition of local development projects will be presented. They have been constructed based on the results of meetings with various local actors and following stakeholder processes. Basically, they are organised into three points that are segmented according to the nature, detail or need of the intervention area.

'Abitare l'Alto Lago' raises the issue of housing in terms of favourable conditions and housing options and in terms of keeping or attracting people to increase the number of inhabitants in the inner area. To this end, it is proposed that disused or vacant public buildings be redeveloped and reused. These intended buildings are generally found in the historic centres of the communes bordering the lake and the side valleys. Redeveloping these buildings is an option to offer more affordable (and fair) rents to health, education and public administration professionals, as well as single elderly and disabled people. Still, within this axis of intervention, there is the idea of requalifying private property as a means of directing these spaces towards recreational and tourist purposes. Lastly, bearing in mind that the municipalities bordering the lake, those on the mid-coast and in the mountains are at strategic points for accessing natural parks and trekking and cycling routes, for example, there is a third action that aims to improve people's enjoyment of the communes by strengthening the small centralities that exist in the mountains where a variety of services and activities need to be improved for both residents and visitors (bars, agro-tourism, coworking spaces, cycle workshops, tourist information offices, appointment centres for health services, among others).

The second strategic line is called 'Muoversi in Alto Lago'. The agenda begins by recognising the 2014-2020 PP projects but also mentions that more is needed through a different vision. It proposes the development of a Mobility Plan for the area that involves the various actors, institutions and organisations responsible for mobility in Alto Lago di Como e Valli del Lario at different stages of production. In this sense, the authors suggest that the plan could define an integrated mobility system that complements the current offer, which is considered precarious at different points. In short, the problems remain the same as those identified in the previous PP, but with more detail. The idea is to put a MaaS platform into practice, connecting the two shores of the lake to the side valleys via R-Link and train. There should be more connection points that encourage intermodality (i.e. taking the bike on the ferry), secondary LPT networks and cycle-pedestrian routes. Communication between existing public transport services and private services that mainly serve the tourist sector is also suggested. In addition, Bus Alpin, a system applied in Switzerland, is pointed out as a reference to follow.

'Dal Lago alla Montagna' is the third strategic axis. This line emphasises a problematic area sector: the poor connection between the lake and the mountains. Although the difference in altitude naturally imposes some barriers to access, the inner area has a concentrated territorial capital that must be unlocked and exploited sustainably, impacting the socio-economic, cultural and tourist sectors. To this end, the strategic agenda proposes that the lake should have a unitary system for tourist enjoyment and promotion that can, over the next few years, deseasonalise tourism. While most tourist accommodation is concentrated in the municipalities close to the lake, the mountains have a weak and limited infrastructure. In addition, the role of the forest and parks needs to be rethought regarding governance and accessibility.

Currently, the forests and other areas in a strategic position linking the lake to the mountains are privately owned with numerous parcels of land, making it difficult to manage them towards the common good. Finally, the historic trails must be better managed and integrated into routes. The following section looks at this issue of routes and tracks in detail and shows how various itineraries cross different municipalities, provinces, and international borders.

3.4. Il Ritratto Territoriale dell'Alto Lago di Como e Valli del Lario

The current object of analysis is the result of two workshops and contact with various local actors, following the same conceptual and organisational structure as the strategic agenda (section 3.3.). Many issues linked to cross-border cooperation are repeated in this document. Hence, this section aims to bring new analyses, such as the commuting flow analysis that shows the reasons for travelling/commuting as well as the internal and external flows touching Alto Lago di Como e Valli del Lario.

The different flows were analysed, taking into account all the municipalities belonging to Alto Lago di Como e Valli del Lario (2021-2027 PP). In this regard, it was noted that the largest internal flows (those with origin and destination within the inner area) are quite high for occasional reasons. Regarding inward movements (with origin outside the area and destination in the inner area), the data indicate very high flows for occasional reasons and quite high flows for work reasons. Outflows (with origin within the inner area and destination outside the inner area) indicate high numbers for study and work reasons, with work being the main reason for outflows. The scarcity of educational centres (primary and secondary) and the lack of dynamism in the job offer are pointed out as the leading causes for outflows.

However, when analysing the distribution of movements, the rates show that internal and inward flows are greater than outward flows. The authors understand this data in the following way: the municipalities have an internal polarisation in that the population belonging to the inner area, as well as some people from neighbouring municipalities, move to the so-called hubs in the inner area that can offer higher quality services. These centres are the municipalities that border the lake. Colico is the municipality with the highest internal flow rate and high inflow rates. Cortenova registers the highest number of arrivals. On the west side of the lake, Gravedona and Uniti have the highest outflows due to essential services. Regarding dependence on other communes for work, services and education, the most popular centres outside the inner area are Lecco, Menaggio and Morbegno.

Navigation under Lake Como was also analysed. Despite being a vital natural resource (and decisive for the socio-economic development of the southern part), Lake Como is currently seen as a barrier. In short, there is an imbalance in navigation on both shores. The Lecco shore has a discreet offer mainly in the low season months (May-October) with only five daily

weekend departures and eight destinations during the six high season months. Como's shore is far superior in this respect. There are 33 daily weekend departures, and 29 destinations (or options) are offered all year round. Data about the pre-pandemic boarding numbers (tickets bought annually) validates the shore imbalances. There were 20 thousand tickets boarded for Lecco compared to 610 thousand for Como.

Finally, the Area Strategy mentions the importance of upgrading and activating historic routes and itineraries that cross the inner area of Alto Lago di Como e Valli del Lario. In addition to encouraging tourism and soft mobility, the aim is to enhance cultural, historical, and natural heritage. North Lake Como is a tourism association that helps promote socio-cultural events that encourage internal and external tourism. The association also partners in a European project, *Le Vie del Viandante – trekking senza confini*, co-funded by Interreg Italia-Switzerland. Two important itineraries cross the inner area, Sentiero del Viandante (9) and Via dei Monti Lariani (11). In total, they are 60.5 and 144.8 kilometres long, respectively. They also serve as links to other routes to the south and north. Figure 2 demonstrates the number of existing itineraries that allow one to explore and move around the inner area, other provinces and Switzerland.

Figure 2. Itineraries crossing the inner area and neighbouring municipalities. Source: Adapted from Le Vie del Viandante[2].

4. Discussion

In this section, the preceding results and findings are discussed in order to answer the research questions related to the Inner Area of Alto Lago di Como e Valli del Lario, Northern Italy. The content follows the same order pointed out in the introduction.

[2] https://www.leviedelviandante.eu/wp-content/uploads/2021/09/Viandante_mappa_4.pdf

The four public documents examined do not explicitly state local or international cross-border cooperation, indicating that, for instance, such a municipality or administrative centre needs to work with a particular one to strengthen and improve such service or sector. A more in-depth interpretation and reflection was required. Therefore, the previous sections presented issues, problems, and situations to contextualise and elucidate the intentions, desired scenarios, goals, and local development projects.

Firstly, cross-border relations are mostly linked to essential services and governance, although tourism and entrepreneurship are also approached. Yet, it is important to state that as the municipalities in the study area have a low population rate and a shortage of services (mainly in the mountain territory), they naturally depend on others. Thus, there is already an inward and outward flow in near essential service hubs (inside and outside the inner area boundaries) due to the concentration of specific services and for work and leisure reasons. This relationship or necessity applies even before the SNAI was launched in 2014 or the local strategy was approved and signed in 2020.

Most local interventions have been defined to increase the quality of mobility, healthcare and education services and systems. The discourses and projects about interaction and cooperation between the inner area's municipalities follow the same path, that is, focused on improving the LPT infrastructure and services to provide suitable levels of accessibility in order to make use of the hospitals and other healthcare facilities, as well as educational centres. Furthermore, given the fragmented local governance, which is maximised by the inner area comprising two provinces with different interfaces and software for the administrative management of public services, the new administrative capacity-building strategies converge to more municipal cross-border cooperation. The present projects aim to train personnel of different divisions and departments to increase the quality of services and interaction and cooperation between municipalities. Additionally, the recent unions and mergers of administrative centres (found in the two provinces) increase the responsibilities and the demand for a high administrative capacity and municipal cross-border contact.

The health and education strategies and projects that foresee the improvement and centralisation of activities and services in large units prove to be adequate because, on the one hand, there is a lack of workers for the functions and the requirement of financial resources to build new facilities and maintenance and, by the other, there are many municipalities with a low population where the cost-benefit of operations is compromised. Although the SNAI mentions telemedicine and assistance projects, the local strategy has not yet stipulated concrete projects. As a result, for the centralisation of services and activities to have an excellent cross-border effect, mobility and accessibility projects need to result, essentially LPT and creative interventions to attend mountain municipalities more frequently.

The findings show that the central level did not indicate or encourage any strategy or action for collaboration between the inner area's municipalities or from the outside. Although decentralisation of government and tasks is an essential factor that enables autonomy in terms of policy- and decision-making, for example, having guidelines and recommendations from the national and regional level within the context of the inner areas would be ideal not only for the country to have coherence and assertiveness in pursuit of common goals, but also to increase exogenous development, a subject raised and emphasised during the national strategy.
In the context of the 'Strategia d'Area' (in effect), the nearby hubs of essential services (Lecco, Como and Menaggio) were rarely considered for projects linked to the inner area. Lecco was cited a few times because its educational centres naturally attract residents and students from

inside and outside Alto Lago di Como e Valli del Lario. Also, the local strategy did not make direct links with Varenna, Bellagio and Menaggio, cities with a strong tourism sector, in order to activate the northern part of the lake or at least have a synergy and regular contact to improve the navigation of Lake Como and the extension of itineraries and routes that facilitate mobility and accessibility for residents on both shores of the lake.

Clearly, the strategy needs to develop and focuses on its municipalities. Nonetheless, exogenous development is just as crucial as endogenous, considering the proximity to municipalities with better levels of socio-economic development, tourism and basic services. Varenna, for example, has been added to the Inner Area of Alto Lago di Como e Valli del Lario for the 2021-2027 PP. Yet, all the new documents so far fail to point to municipalities that could be catalysts for this 'second new development opportunity'.

Another striking issue is that at no point did the three local documents mention the existence of another inner area neighbouring to reinforce the area's socio-economic growth. When the first strategy was built, there was the 'Inner Area of Valchiavenna' (a pilot project), and nowadays, there is the 'Inner area of Lario Intelvese' and the 'Inner Area of Valli Lario Ceresio'. Both inner areas border the study area. In this sense, the commuting flow analysis showed high internal and incoming flows in Alto Lago di Como e Valli de Lario to the extent that it is quite probable that the residents of the inner areas of northern Italy and Lombardy cross the boundaries and depend (even minimally) on the municipalities belonging to each inner area. Expanding the analysis and gathering evidence on needs and activities from other inner areas seems fundamental for structuring new projects to strengthen activities, services and systems towards integrated regional development and social and territorial cohesion.

The EU instruments, such as Integrated Territorial Investment and Community-led Local Development, could be applied first because the central level (SNAI) recommended them and second, to take advantage of the financial resources and the mix of possibilities arising from the combination of more than one fund and priority axe, for example, to connect the lake to the mountain better.

The last two documents contain additional points that can be used to discuss cross-border cooperation matters. Although these contents are not projects, the statements and proposals are more coherent and are closely linked to the current problems of the study context. 'Abitare Alto Lago' is an approach that encourages and attracts people to these areas, particularly people in the health and education sectors. In those days where climate change issues are gradually critical, and quality of life has become a relevant factor in choosing where to live (leveraged by the possibility of online meetings and remote working), the natural ecosystems and the landscape of Alto Lago di Como e Valli del Lario combined with numerous outdoor activities both on the lake and in the mountains, and the relative proximity to Milan and airports may attract new residents and trigger the socio-economic development.

The navigation of Lake Como has undoubtedly received greater attention in recent workshops, resulting in new analyses, data, proposals and potential approaches. The last document points out imbalances to the extent that the western shore (Como) is much more heavily used than the eastern one (Lecco), where LPT is more widely used due to better connections and infrastructure with major urban centres (Lecco and Milan). Moreover, the agency's timetables demonstrate different combinations and destinations for crossing the lake. Hence, innovative projects are expected to advance the number of crossings that allow intermodality (bicycles and other micromobility devices) and stations with services and infrastructure for automobiles to

continue their journey. The lake must be considered the main element for the development and union of the two provinces and municipalities involved. Lakes Project brings interesting standpoints to reconsider this natural resource as a catalyst (ESPON, 2021).

The various itineraries have been treated and considered as relevant elements for cross-border cooperation and socio-economic, cultural, and local identity development purposes. Figure 2 revealed various routes, tracks, and paths for different types of activities that can be linked to tourism, preferably sustainable tourism that does not lead to reducing residents' quality of life due to the high use of local infrastructures and systems. More regular collaboration with the North Lake Como association and existing international projects seems crucial to exploit the inner area territorial capital.

Regarding the possible local cross-border effects and implications at the local level, one can argue that the production of the Area's Strategy and the accumulation of multilevel actors have undoubtedly brought more work and challenges mainly to municipal administrations to cope. It forced them to think more, be prepared and trained, and be in contact with experts, stakeholders, the local community, and companies that may share common interests but also conflicts of interest. Above all, it demanded managing and allocating funds and making critical decisions. The various funds open up opportunities, but the absence of 'Local Action Groups' (LAG) may weaken the desired scenarios (DAStU, 2023a). A suitable and responsive strategy requires technical and community expertise, regular debate, and time to identify local problems and opportunities and avoid political, public or private conflicts.

Contrarily, all these complex activities unlocked new windows of opportunity for the following years. The inner areas represent a new territorial arrangement that combines European, national, regional and municipal funds and allows dialogue and the possibility of taking advantage of the territorial capital and potential of other municipalities legally towards a territorial and social cohesion change.

5. Conclusion

The review of four official documents put into evidence the cross-border strategies, approaches, and projects currently impacting the Inner Area of Alto Lago di Como e Valli del Lario in Northern Italy.

The conclusions of this paper indicate that cross-border strategies are intensely linked to the provision of (better) essential services (healthcare, education and mobility) and projects to maximise the municipal administrative capacity, tourism and entrepreneurship weaknesses. However, this association had to be inferred because all the documents fail to make explicit indications that one municipality must work or cooperate with another (even on the same lake shore or province) to activate such an asset or system.
Independently of the level of government, the documents could be more emphatic about the theme of integrated territorial development to the extent that neighbouring inner areas could work together. Alto Lago di Como e Valli del Lario borders two inner areas, and another is quite close. The analysis made it clear that although the goals are mostly consistent with local needs and opportunities when transferred to the project sphere, it is possible to notice how difficult it is to take advantage of the inner area's territorial potential.

In conclusion, there is much to review and consider regarding the potential of each municipality and the Swiss border, where there are already European projects (Interreg). The new local

strategy for the 2021-2027 PP must take advantage of the proximity of the nearby inner areas to boost integrated regional development and better exploit the territorial capital as a way to enhance endogenous and exogenous growth and territorial cohesion.

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Core-periphery Industrial Linkages of the Metropolitan Area from the Perspective of Enterprise Linkages: The Case of Three Cities Adjacent to Shanghai

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Abstract

To explore how cross-border industrial linkages are constructed between the centre and peripheral cities of the metropolitan area, this study takes the perspective of enterprise linkages and selects three county-level cities which are adjacent to Shanghai, as cases. First, city networks in the Shanghai metropolitan area are built using enterprise headquarter-branch linkage data; then, the descriptive statistical analysis is conducted based on enterprise questionnaires. The results show that from 2001 to 2018, enterprise linkages between Shanghai and its surrounding county-level cities increased significantly. The market forces in the industrial linkages between the three cities and Shanghai have somewhat transcended administrative barriers, which is the result of enterprises' 'voting with their feet'. The key reason why enterprises are located in these three cities is that they are close to Shanghai for access to productive services, technology, labour, information and other resources while enjoying the lower rent and preferential policies of the local industrial parks.

Keywords:

City Network, Metropolitan Area, Peripheral Cities, Cross-border, Industrial Linkage

1. Introduction

Modern urban regions' development has seen a new stage marked by the deepening and restructuring of the spatial division of labor. Specifically, design, R&D, marketing, and other functions at the two ends of the value chain have become more concentrated in high-level cities, while manufacturing has been gradually dispersed and relocated to surrounding small(medium)-sized cities, which, in turn, will influence the central cities after the formation of new agglomerations on the periphery. Yet this is not necessarily

a spatial gradient of dispersion, as periphery-core linkages across geographical and administrative boundaries may be formed. This economic geography phenomenon can be explained by the 'urban network externalities' theory - the agglomeration externality from the central city extends beyond its geographical boundary, while some peripheral cities 'borrow size' from it, jointly generating externalities through the city network (Capello, 2000; Hesse, 2016). The emergence of growth poles of regional economic development in an agglomerate form of metropolises has also led to the passive and active integration of their peripheral areas. Small or medium-sized cities (towns) on the periphery of megacities face enormous opportunities and challenges, not only as carriers of their economic activities but also in their important positions in the industrial networks of the larger region.

Since China's reform and opening up in 1978 and its membership of the World Trade Organization since 2001, its economy has developed rapidly and has become increasingly integrated into the global production network, driving the evolution of the spatial organisation of local industries. This is manifested in the gradual specialisation of the division of labour among industries in the geographical space, and the frequent flow of people, logistics, capital and information among cities. As a result, large-scale urban spatial organisations such as city clusters and metropolitan areas have been formed and developed, and have become important spatial carriers for the optimisation and reorganisation of industrial chains and participation in global competition (Shen *et al*, 2023). Smaller cities around developed central cities have shown a tendency to build economic linkages across borders. The latter have also begun to actively take 'integration into metropolitan areas' as an essential strategic choice in order to enhance their position in the regional production network. For example, the practice of cross-boundary industrial co-operation in some pioneering regions, such as the Guangdong-Hong Kong-Macao Greater Bay Area and the Yangtze River Delta Region, has given rise to the mode of enclave economy, and even forms like 'reverse/two-way enclaves' have emerged (Cao and Zeng, 2022; Luo *et al*, 2023).

To verify the above phenomenon, this study takes the perspective of enterprises and uses three county-level cities, Kunshan, Taicang and Jiashan, which are adjacent to Shanghai, as examples. From a macro perspective, using the data on the headquarter-branch of enterprises at three time points, this study constructs city networks in the Shanghai metropolitan area and takes a longitudinal view of the evolution of industrial linkages. From a micro perspective, based on 144 enterprise questionnaires distributed in the three cities, the study explores the detailed expressions of their industrial linkages with Shanghai by descriptive statistical analysis, and qualitatively explains the causes. Finally, planning implications are discussed concerning the findings, i.e. how peripheral-core industrial linkages across borders should be built.

2. Literature Review

The earliest studies on the spatial organisation of industries were mainly based on the Industrial Cluster Theory (Marshall, 1890). After comparative advantages gave rise to the regional division of labour, regional industrial organizations were formed through enterprises' linkages between regions (Massey, 1984). Although the openness and outward linkages of industrial clusters have been gradually emphasised in later periods (Maskell, 2001), they are still based mainly on geographical proximity over local space. Evolutionary economic geography challenges the authoritative explanation by Marshallian externalities for the emergence and development of clusters (He, 2018). It incorporates temporal and spatial elements to reveal the mechanisms of progressive evolution in the spatial distribution of economic activities (Frenken and Boschma, 2007; He, 2018). In this regard, scholars mostly start from the entry, growth, decline and exit of enterprises and their locational behaviour to explore the synergistic evolution of enterprises, industries, networks and regions (He, 2018).

With the deepening of economic globalisation and the international division of labour, the era of global production networks has arrived (Hess and Yeung, 2006). The spatial unit used to study economic evolution has shifted from local industrial agglomerations to inter-city (region) industrial networks. Frobel (1980) was the first to introduce the concept of the new international division of labour into the study of regions, arguing that it led to a global restructuring of national or regional production structures, resulting in the formation of a metropolitan area in which the peripheral areas are closely linked to the central city. The spatial organisation of industries in the metropolitan area is differentiated under the law of market economy in accordance with the principle of optimal production efficiency, and the relationship between cities is gradually transformed from one of mutual competition and independent development to one of central city-driven hinterland and inter-city co-operation.

Scott (1982) believed that as firms grew, their production and management functions were hierarchically restructured, and a process of concentration of management and control functions in the central city and decentralisation of production functions occurred within urban areas. Not all firms within an industrial cluster are connected to each other (Giuliani and Bell, 2005), but similar location, knowledge, norms, organisations, and social ties help heterogeneous actors to form partners or engage in knowledge exchange and collective learning, and these similarities are referred to as geographic proximity, cognitive proximity, institutional proximity, organisational proximity and social proximity, respectively (Boschma, 2005). The last four do not necessarily rely on geographic proximity and can be connected beyond boundaries; in other words, these proximities depend on agglomeration in certain kinds of networks (Capello, 2000). Proximity can explain why intra-cluster networks are not homogeneous and why some firms can have more linkages with firms outside the cluster (Taylor, 2001).

Enterprises choose their location freely on the basis of the profit-maximising principle, so that their linkages are essentially more reflective of the laws of the market economy. According to the doctrine of 'transaction costs', when it is more cost-effective to carry out all types of activities within the same enterprise, a vertically integrated structure is formed within the enterprise, which is spatially reflected in the fact that the enterprise's headquarters set up branches in different places to conduct all types of activities more efficiently; when outsourcing a certain type of activities (inter-firm transactions) is less costly, it will result in the formation of inter-firm horizontal integration, which is reflected in the process of specialisation of enterprises (Liu and Ren, 2006). Thus, the self-organising power of enterprises - as 'actors' - profoundly affects the regional economic configuration and the position of cities and towns in the economic network (Liu and Ren, 2006). Influenced by Castells' (1996) theory of the 'space of flow', studies of city networks based on enterprise linkages have begun to emerge. Network analysis methods mainly include Taylor's (2002) connection network modelling method, and Alderson's corporate headquarters-branching method (Alderson and Beckfield, 2004). This type of methods has also begun to be used by some Chinese scholars in meso-level studies of city clusters and metropolitan regions (Cheng and LeGates, 2018).

To sum up, previous research on the regional industrial spatial organisation based on cross-city linkages is insufficient in the following aspects: most of the analyses use enterprise linkage data to build city networks, focusing mainly on the characteristics of regional industrial spatial structure at the macro level, but lacking in-depth discussions on the mechanisms of linkage construction and factor flows caused by enterprise behaviours at the micro level. Research on the 'centre-periphery' of metropolitan areas tends to take the central city as the study object. However, what distinguishes peripheral cities from ordinary small and medium-sized cities (towns) is that they are an important component of the regional industrial division of labour and the production chain, and they have taken on industrial functions far beyond their own. But few studies have taken peripheral cities as the entry point, making it difficult to comprehensively observe the 'centre-periphery' relationship. On the other hand, studies of city industry tend to view cities as independent systems, ignoring the fact that their industrial functions are greatly influenced by the outside world, especially by nearby metropolises.

3. Method and Data

3.1. Study Area

Three county-level cities bordering Shanghai are selected for this study (Figure 1), of which Taicang and Kunshan are administered by the Suzhou prefecture-level city in Jiangsu Province, and Jiashan is under the Jiaxing prefecture-level city in Zhejiang Province. The three cities have well-developed economies, with GDPs of 173.494 billion yuan, 514.060 billion yuan, and 90.811 billion yuan in 2023, respectively, and

a high proportion of secondary and tertiary industries; they have high rates of urbanisation (all exceeding 70% in 2023), with permanent populations of 848,000, 2,148,500 and 664,000, respectively. All three cities are within 30 minutes of Shanghai by high-speed railway and belong to the core of the Shanghai metropolitan area, with close connections with Shanghai. They have long had the key goal of connecting to Shanghai in terms of local industrial development, and have been selected in many studies as typical research cases of small and medium-sized cities in the surroundings of large cities for comparison. The Shanghai metropolitan area, located at the heart of China's eastern seaboard and the Yangtze River Delta region, is not only an important national economic growth pole, but is also growing into a city region with global influence. In recent years, with the deepening of the regional industrial spatial division of labour, Shanghai has upgraded its industrial structure and driven the economic development of its hinterland. Therefore, the industrial spatial organisation of small and medium-sized cities around Shanghai is undergoing deep changes and needs to be re-recognised from the perspective of external influences.

Figure 1. Study area: location of Taicang, Kunshan and Jiashan around Shanghai

3.2. Research Design

Firms or enterprises are the key ‘actors’ in the regional production chain. Driven by the market, guided by the government, and influenced by other actors, their behaviours and decisions (e.g. re-location, branching, transactions, cooperation, investment, etc.) build

inter-city industrial linkages; conversely, industrial linkages can be manifested through the internal and external connections, and forward and backward linkages of firms.

On this basis, the empirical study of this article takes enterprises as the perspective and is divided into two parts. The first part is a macroscopic city network study, which aims to take a longitudinal view of the overall picture of the evolution of industrial linkages in the Shanghai metropolitan area. The study area is extended to the Shanghai metropolitan area (but this is much smaller than the government-planned 'Greater Shanghai metropolitan area'). County-level zones ('municipal districts', 'counties', or 'county-level cities', which are below prefecture-level cities) are used as the analysis units, with a total of 16 units. A number of municipal districts in the Shanghai central city are merged into a single unit, while six units in the suburbs of Shanghai are retained; outside of Shanghai, in addition to the three case study cities, the other six county-level units are included in this part of the analysis for comparison.

For enterprise linkages, we obtained data from the 2001 and 2008 China Economic Census, and data from the 2018 registration by the Bureau of Industry and Commerce of enterprises[1]. This study focuses on only two categories of enterprises, manufacturing and productive services. Then, referring to Cheng's (2018) approach, we applied SQL to identify the headquarters (head office, group, etc.) and branches (branch office, sub-factory, sub-division, etc.) based on the matching of the enterprise names and thus processed them as enterprise headquarters-branch linkage pairs[2]. Next, we summarised the headquarters and branches of each link based on the units in which they are located, and then translated them into a directed matrix of 'city dyads.' Then, the city networks of the Shanghai metropolitan area were constructed by taking the analysed units as nodes and the number of 'city dyads' as the weights of the edges. Finally, these city networks were visualised in the ArcGIS platform to describe the evolution of the industrial linkages between the three cities and Shanghai.

The second part is a microscopic questionnaire data analysis, in order to explore more in-depth characteristics and causes. We distributed enterprise questionnaires in the three cities between September to November 2018, with questions on basic information about the enterprise, distribution of their upstream and downstream linkage enterprises in the industry chain, their service and technology linkages, inter-city commuting of their employees, and their choice of cities for future investment, etc. A total of 144 valid

[1] These datasets provide statistical information on all enterprises in the nation in various industries in the current year, including enterprise name, establishment time, address, city, industry category, number of employees, etc. There are differences between the two types of datasets, but due to the large sample size and comprehensive enterprise lists and information, comparative analyses are possible.

[2] Within the enterprise linkage, the headquarters implements managerial decisions and issues directives, while the branches carry out the orders, and the headquarters have a controlling role over their branches, and it can be assumed that the city in which the headquarters is located is more in control. Thus the enterprise headquarter-branch linkage is directional.

questionnaires were eventually collected (73 from Taicang, 37 from Kunshan, and 34 from Jiashan). We then applied descriptive statistical analysis method to explore the specific performance of the industrial linkages between these three cities and Shanghai. At the same time, combined with interviews with enterprise managers and other materials, we qualitatively explained the causes of the phenomenon.

4. Results

4.1. Macro Perspective: Evolutionary Characteristics of Industrial Linkages

Figure 2 illustrates the changes in city networks based on enterprise linkages in the study area from 2001 to 2018. Overall, both productive services and manufacturing networks have been increasing in density, but have diverged in terms of spatial organisation. Manufacturing enterprises have been spreading to the periphery step by step - from 2001 to 2008, the direction of linkages were mainly from Shanghai to the periphery, indicating that manufacturing headquarters remained in Shanghai and branches spread to the periphery; by 2018, however, linkages from the periphery pointing to Shanghai were even stronger, suggesting that the headquarters of some enterprises have also relocated out of the Shanghai central city or that enterprises from peripheral areas have set up branches in Shanghai. In stark contrast, although the production service industry has seen near-domain diffusion in the suburbs of Shanghai, it tends to be polarised at the metropolitan area scale, i.e., the headquarters are highly concentrated in Shanghai, and the direction of the headquarter-branch linkages mainly points to the peripheral cities from the Shanghai central city, which suggests that the Shanghai metropolitan area has formed a hierarchical network structure. To some extent, this result confirms Scott's (2001) view that highly modular manufacturing industries spread over a wider spatial area without being restricted by location, while high value-added and high-grade industries represented by productive services have a higher sensitivity to location and are more likely to form agglomerations. Embedded in the whole production chain, the productive service industry is difficult to fully divide labour, the services they offer are often intangible, and there is a need for the transmission of intentional information between enterprises and between enterprises and their customers. In order to face markets with great uncertainty, productive services enterprises choose to concentrate in central cities to reduce costs and are closely linked to each other to form flexible network systems.

Regarding the number of ‘city dyads’ between peripheral county-level cities and Shanghai, Kunshan ranks the highest, followed by Zhangjiagang, Jiangyin, Taicang, and Changshu, and even equals (or surpasses) their own prefecture-level cities or provincial capitals. It can be seen that in the regional division of labour, certain cities are gradually demonstrating their important position by taking advantage of their specialization.

In recent years, Kunshan has seized the opportunity of the accelerated inflow of international capital into the Yangtze River Delta region, actively developed export processing trade and attracted investments, and taken the initiative to share part of Shanghai's modern service functions, attracting a large number of enterprises to move in, and successfully realising the externally oriented economy and dislocation development. As early as the 2002 version of the city's comprehensive plan, Kunshan considered the development of connecting with Shanghai; in 2016, its 'Thirteenth Five-Year Plan for National Economic and Social Development' further clarified the strategic goal of 'integrating into Shanghai, complementing Shanghai and serving Shanghai', proposing to fully connect with Shanghai's functions as a centre of economy, finance, trade, shipping, and R&D. Similarly, Taicang in 2003 for the first time defined 'connecting to Shanghai' development strategy, and then in its 'thirteenth five-year plan' put forward to focus on the promotion of concepts, planning, industry, elements, platforms, transport, social services and other aspects of the integration into Shanghai in depth. On the contrary, Jiashan and Pinghu, which also border Shanghai, have far fewer linkages with Shanghai than Kunshan and Taicang, or even Zhangjiagang and Changshu, which do not border Shanghai. Although Jiashan has also been emphasising the strategy of connecting to Shanghai from the early days to the present, it has not replicated the success of Kunshan due to its development land constraints, the distance between its main urban area and Shanghai, and its failure to keep up with investment attraction.

To sum up, with the deepening of the division of labour and the upgrading of the overall economic level of the Shanghai metropolitan area, the spatial polarization of productive service enterprises has been further enhanced, while manufacturing enterprises are gradually spreading to the periphery, and the overall spatial pattern of the industry tends to be networked, and the cross-regional organization of enterprises has promoted the frequent flow of factors of production within a wider range.

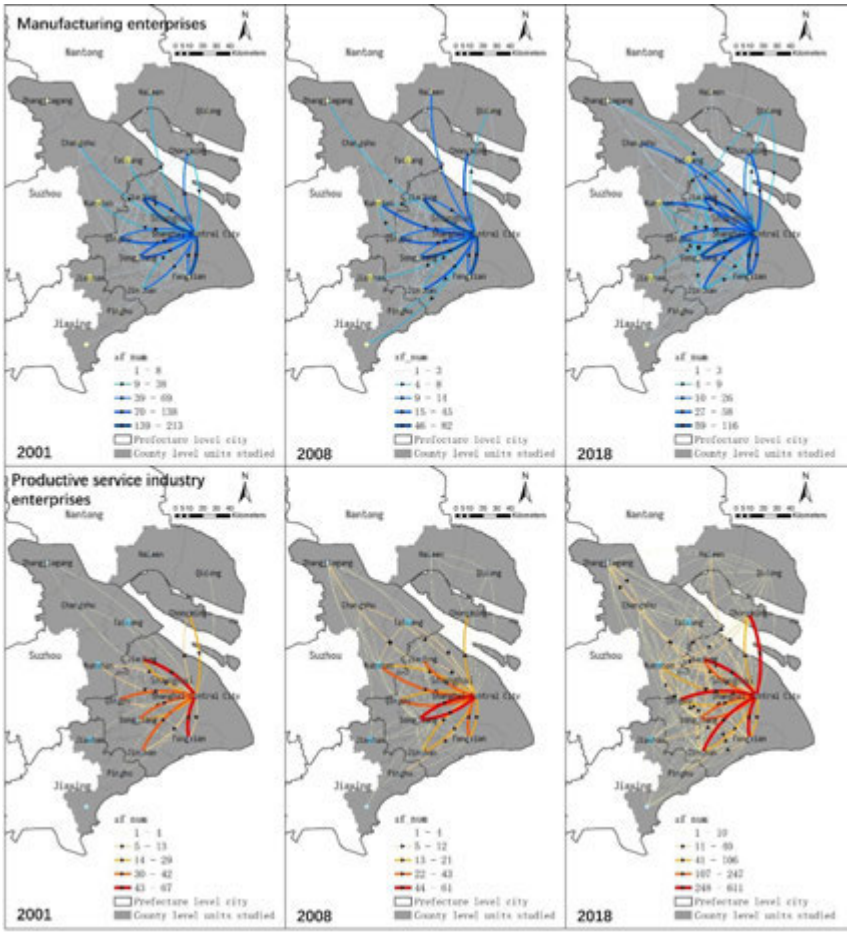

Figure 2. Headquarter-branch linkage networks of manufacturing and productive services enterprises, 2001, 2008 and 2018 (In this figure, the thicker and darker the connecting lines, the greater the number of links; the direction of the arrows represents the direction from the headquarters to the branches.)

4.2. Micro Perspective: Mechanistic Explanation of Linkage Formation

As it is difficult to contact and get permission from numerous enterprises, there are very few studies on the spatial organisation of industries using enterprise questionnaire data. This study attempts to explore more details and reasons for this through questionnaires for individual enterprises after mapping the macro data.

Firstly, we look into the basic information of the interviewed enterprises. The industry types of the interviewed enterprises in the three cities are different, but they are all

mainly in the electronic information, machinery manufacturing, new energy and new material industries. In regard to the types of enterprises, they all contain a certain proportion of foreign investment components, including foreign or Hong Kong/Macao/Taiwan investment, Chinese-foreign joint ventures or co-operative operations, etc. Kunshan has the highest proportion of foreign (or Hong Kong/Macao/Taiwan) invested enterprises, while Jiashan has a lot of Taiwan-invested enterprises due to historical factors, and Taicang has the highest proportion of privately owned and state-owned enterprises. In terms of enterprise size, they are concentrated at both ends of the spectrum - large (annual output value of 100 million to 500 million yuan) and micro (annual output value of less than 10 million yuan), with Taicang having a significantly higher proportion of small and micro enterprises, and Kunshan having a higher proportion of large and super-large enterprises. Divided by the number of employees, small and micro enterprises with less than 300 employees accounted for the highest proportion, with Taicang having the highest proportion of enterprises with less than 50 employees.

The reasons why interviewed enterprises chose to locate in the three cities are very consistent (Figure 3), with ‘proximity to Shanghai’ and ‘favourable investment incentives of industrial parks’ ranking in the top two, followed by ‘convenient transportation’, ‘proximity to upstream and downstream enterprises’, and ‘good cultural atmosphere of the city’. As to which city the interviewed enterprises are currently invested in and which city they would like to invest in in the future (Figure 4), the largest number is the provinces in which the enterprises are located, which is to be expected. But it is worth noting that the next most common city is Shanghai. Similarly, as shown in Figure 5, Shanghai is second only to their respective provinces, in terms of the location of upstream and downstream supporting enterprises (e.g., raw material suppliers, component manufacturers, sales agents, etc.), the source of productive service providers (including advertising, tax, consulting, lawyer, etc.), and technological consulting collaborators (for enterprises that do not have their own R&D centres) for these interviewed enterprises. This means that market forces have to some extent surpassed administrative barriers in the construction of industrial links between the three cities and Shanghai.

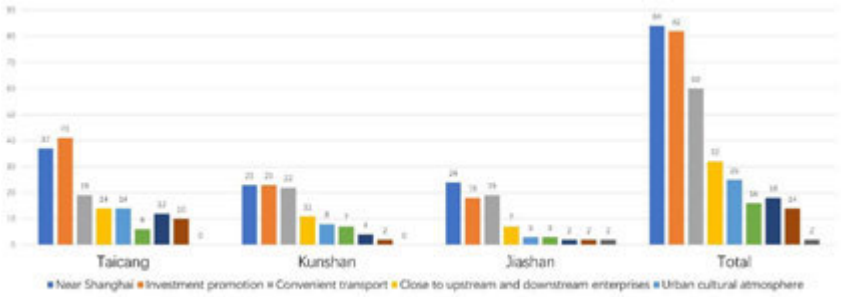

Figure 3. Reasons for locations selected by enterprises interviewed in the three county-level cities[3]

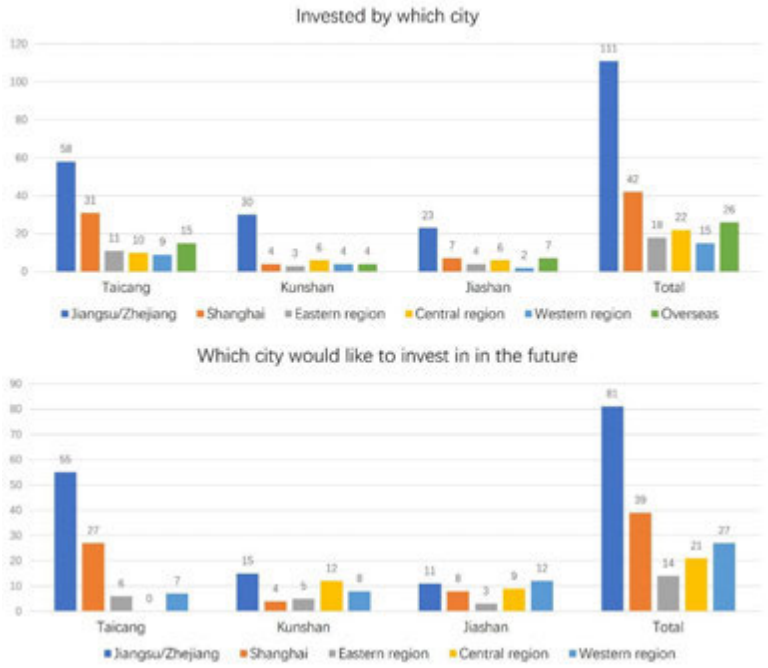

Figure 4. Main origins and future directions of investment of interviewed enterprises

[3] The reason that the total number is greater than the number of surveyed firms 144 is because this question is a multiple-choice question, and the same reason is also true for the following figures that show the same situation.

Figure 5. Locations of upstream and downstream supporting enterprises, service providers and technical consulting partners of the interviewed enterprises

With regard to the employee profile of the interviewed enterprises (Figure 6), although the vast majority of the labour force originates from and resides in the local area due to constraints on the recruitment costs of the enterprises and the cost of employee commuting, a portion of the employees still reside in Shanghai (15.3% of the total). According to Figure 7, 28% of enterprises have employees with frequent commutes to and from Shanghai, most of whom are top managers and senior technicians. This is because this group of people has settled their entire family in Shanghai in order to enjoy a high level of public services and living environment, and they also have enough financial capacity to afford the cost of extra-long-distance commuting (they usually

drive a car or take a high-speed train between their home and their workplace). Their commuting frequency concentrates on daily round trips, followed by weekly round trips on weekdays at the company and weekends back to Shanghai. This supports the existence of frequent industrial linkages and factor mobility relationships between the three case cities and Shanghai, as people flows are the concrete spatial manifestation of abstract linkages.

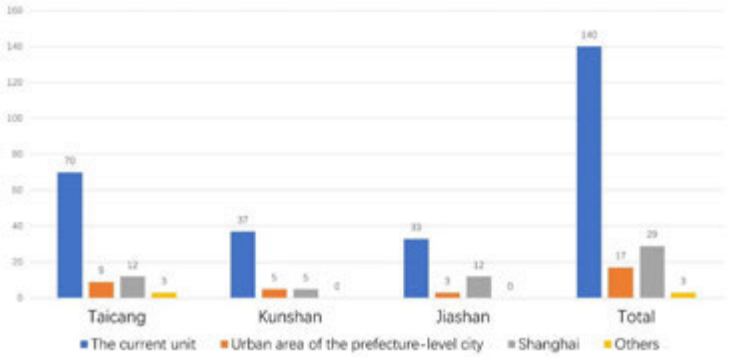

Figure 6. Location of employees' residence in the interviewed enterprises

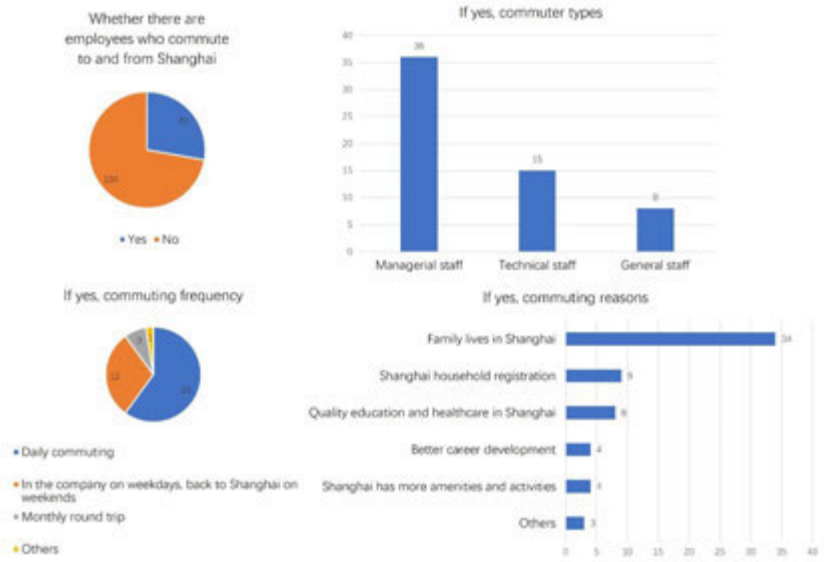

Figure 7. Employees of the interviewed enterprises commute to and from Shanghai

With regard to the satisfaction of the interviewed enterprises with various aspects of the industrial parks in which they are located, they are more satisfied with the parts on geographic location, infrastructure, social security conditions, investment and financing environment, and the efficiency and flexibility of government services, while the most dissatisfied parts concentrate on human resource supply as well as the cost of land, labour, and facilities. This suggests that the location of these enterprises is mainly based on better location and investment and production environment, and also reveals that the industrial policies of the three cities in terms of tax incentives, financial subsidies and talent attraction are still insufficient or have not met the expectations of most of the enterprises, even though these factors have been postponed by them.

The above results suggest that cross-border industrial linkages are formed as a result of independent 'voting with feet' by enterprises, and are also influenced by local government policies. The key reason why firms choose to locate in these three cities is the proximity to Shanghai for access to productive services, technology, talents, labour, information and other resources while enjoying relatively lower land rents and preferential policies in local industrial parks. Taking all factors into account, these are the options that maximise their benefits.

5. Discussion and Conclusion

5.1. Discussion

Urban competition in the era of globalisation has been transformed into city-region competition between metropolises and their surrounding areas. As engines of regional economic growth and 'fronts' for regional economic integration, metropolitan areas are no longer a collection of isolated economies, but rather a series of small and medium-sized cities with close economic ties to the central city to allocate resources together. As any node city in the network, the all-industry development model is unsustainable. The main feature of the metropolitan area economy is the centre-periphery linkage, i.e., integrated resource allocation and vertical division of labour in industries (Shen *et al*, 2023). Therefore, small and medium-sized cities in the periphery of the metropolitan area should not continue the traditional independent and self-sufficient mode, but seek to cooperate with the central city and other cities, and transform into the metropolitan area economy mode.

This paper draws the following planning implications: firstly, as shown in our city network analysis, Shanghai's economy is closely dependent on the cities in its hinterland. More precisely, the rise of Shanghai as a metropolis with international influence is behind the rise of the Shanghai metropolitan area as a whole, which relies on the joint interaction between the centre and its hinterland, and on the establishment of a close division of labour and collaboration system between cities of different levels. To develop into a global city region, the Shanghai metropolitan area needs to further

promote the optimisation and upgrading of its economic and industrial structure and segmentation of its industries, promote the concentration and heightened development of its core functions, and guide the transfer of other functions outward in an orderly manner. Cities around Shanghai should seize the opportunity of the metropolitan area's industrial spatial organisation evolution and function overflow, take into account their own comparative advantages in their development positioning, and accurately undertake the specific functions overflowed from Shanghai, so as to enhance their position in the city network.

Secondly, the regional specialised division of labour is premised on close and rational functional links between cities, so it is important to reshape the overall architecture of regional governance to guide the spatial reconfiguration of industrial organisation and the development of specialised nodes in the metropolitan area. In addition to the Shanghai metropolitan area, this also applies to other metropolitan areas regions in China. The market segmentation caused by the ‘’administrative economy‘’ model needs to be broken up, and a sound regional coordination mechanism should be established to promote the free flow of factors of production, so as to realise the overall benefit of ‘’1+1>2‘’. The governments should build a cooperation platform between cities without breaking through the administrative boundaries, coordinate the development positioning, urban planning, policy support and other issues in regional cooperation, and then guide enterprises and the society to enrich the content of cooperation through market-oriented means, and enterprises should provide timely feedback to the government for the problems existing in the cooperation to make up for the market failure and governmental failure.

Finally, returning to the perspective of small cities on the periphery of the metropolitan area, although the three case cities have attracted more and more transferring industries by their proximity to Shanghai, the results of the enterprise questionnaire analysis indicate that the survival environment of the interviewed enterprises still shows some deficiencies. In order for these small and medium-sized cities to sustainably attract high-quality enterprises to settle in, and thus truly achieve ‘integration into Shanghai’, the following two points should be considered: first, they should flexibly and purposefully optimize the preferential policies for investment incentives and the talent introduction, to optimize the soft environment for economic development through policy innovation; second, they should provide housing and a higher level of public services for the imported talents and labour.

5.2. Conclusion

The study reaches the following base conclusions: a. Comparing the changes in city networks in 2001, 2008 and 2018, the links between Shanghai and its neighboring county-level cities have increased significantly. Among them, Kunshan and Taicang have seen the most significant growth, with their links to Shanghai even equaling (or surpassing) those of the prefecture-level cities and provincial capitals to which they

belong; Jiashan, however, is a little less impressive. b. The top reason for location choice of the interviewed enterprises is 'proximity to Shanghai', followed by ' investment promotion policies of industrial parks', meaning that the formation of cross-city industrial linkages is the result of enterprises voting with their feet actively. c. Shanghai is second only to the cities in the provinces to which the three cities belong in terms of the cities in which they invested in the interviewed enterprises, the cities where upstream and downstream specialized enterprises are located, and the cities where they provide productive services, which means that the market forces in the links between the three cities and Shanghai somewhat surpass the geographic proximity and barriers of administrative factors. d. 25% of the interviewed enterprises have frequent (daily or weekly) commuters between their workplace and Shanghai (residential place), which also indicates the frequent factor flows between these three cities and Shanghai.

To summarize, although these three cities are relatively small in scale and low in rank, they have all successfully 'captured' the flowing resources in the production chain of the Shanghai metropolitan area, developed industrial interactions with Shanghai across the provincial administrative boundaries, and realized their own elevated status in the regional economic network.

The main contributions of this study are twofold: first, to provide reference for the integration planning of the metropolitan areas - to explore the industrial spatial planning and cross-city industrial cooperation paths between the center and the periphery cities in order to achieve the goal of complementarity and win-win situation. Second, to guide the industrial planning of small and medium-sized cities on the periphery of megacities - to seek connection and cooperation with the central city and to optimize their industrial space, so that they can adapt to the development direction of regional industrial linkages and transition to a metropolitan-area economy.

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Study on the characteristics of regional intergovernmental relationships network, based on the analysis of planning texts

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Abstract
Many studies have been carried out to measure the complex inter-city networks by using multi-source data. However, few studies have considered the networks of concern that local governments have with each other. In this paper, we use text analysis and social network analysis to mine the texts of government plans of 41 cities in the Yangtze River Delta to construct a network of attention among cities. It is found that the network is characterised by overall polarisation and local flattening, and that the degree of attention to each city is not perfectly correlated with its economic and population size. The study concludes with recommendations for a regional planning platform that removes administrative and institutional barriers.
Keywords: regional planning, intergovernmental relations, text analysis, social network analysis, Yangtze River Delta (YRD)

1 Introduction

With the development of the region's integration, urban economic and social development is more affected by urban network. Many scholars have conducted research on the urban network in the Yangtze River Delta (YRD) and found that the network has become much closer in recent years. Existing researches mostly focus on the civilian connections between cities by using data such as people migration, investment or traffic flow, which reveals the laws in civilian connections. However, the cooperation and competence between local municipal governments has become more intense, too, there is still a lack of research from a governmental perspective, which hinders the knowledge of local governments' demands and limits the horizon of policy research. Using linkages extracted from planning texts of 41 cities in YRD as research data and social network analysis as research method, this paper aims to find out the pattern and characteristics of intergovernmental network and the elements that influence this situation, and puts forward planning suggestions for the development of regional integration.

2 Literature review

2.1 Evolution of the regional urban network in YRD

The YRD megapolitan cluster is a region in China with a high level of economic and social development and a well-developed urban system, comprising three provinces (Jiangsu, Zhejiang and Anhui) and one municipality (Shanghai), with 41 cities, an area of more than 350,000 km², a resident population of more than 230 million, and a total economic volume of 30 trillion yuan (Figure 1). The planning and practical research on the joint development of the YRD can be traced back to the proposal of the Shanghai Economic Zone in 1982, while since then progress has been made in joint cooperation meetings, the establishment of communication mechanisms, and the making of regional plans, etc. The integrated development of the YRD was upgraded to a national strategy in 2018, and the spatial scope was expanded from Shanghai and its neighbouring cities initially to three provinces and one municipality at present, and the release of the new policies in Pudong and Hongqiao in 2021 marked the entry into the new development stage. Overall, the collaborative planning of the YRD has roughly gone through

several stages, including Shanghai leading the neighbouring cities, collaboration at the provincial level, national strategy leading, and opening up of key areas leading.

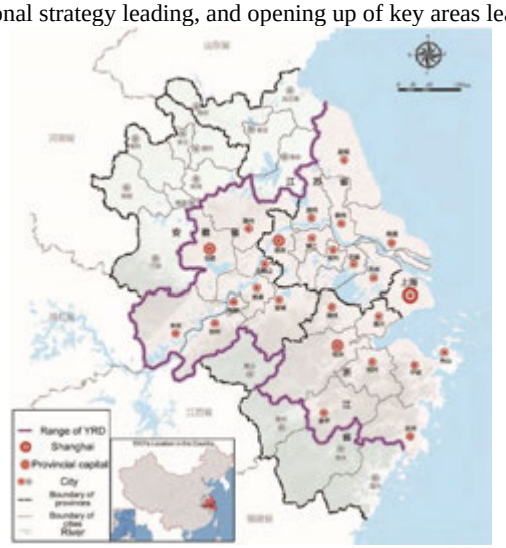

Figure 1 The scope the Yangtze River Delta megapolitan cluster

This process was initially driven by economic factors. With the implementation of fiscal reform policies in the 1990s, the subjectivity of cities in their own development has greatly increased. In terms of controlling and competing for resources, achieving economic stability and growth, and expanding the scale of benefits, local governments have indeed become special 'quasi-market entities' (Cen, 2006; Su et al., 2022; Qin et al., 2023), and therefore tend to be more specific and perceptive in the making of planning that involves their own interests, which may show a certain pattern of linkage among the collection of many individual cities. In recent years, inter-city cooperation has further expanded to ecological protection, science and technology, and social governance. Some scholars summarise it as the four stages of 'preliminary proposal-spontaneous cooperation-integration system construction-national strategy' (Cui, 2018), and some scholars point out that the two core demands and motivations for the integrated development of the YRD are national strategy and local development (Liu, Wang and Chen, 2020). Therefore, the development of the YRD city cluster is subject to both bottom-up and top-down forces.

In order to measure the development of urban networks in the YRD, many scholars have tried to analyse data from different sources, such as enterprise headquarters-branch data (Yang et al., 2021), intercity investment data (Li et al.,2024), Internet search index data (Li and Xiao, 2022), high-speed rail accessibility (Gao et al., 2019), location-based services (LBS) data (Cui et al., 2020), logistics data (Wang et al., 2018), patent cooperation data (Song and Kim, 2022), and so on. The above studies have used citizens, enterprises, vehicles, and other economically active individuals as research objects, suggesting that the civilian linkages of the YRD megapolitan cluster have formed a more complex multi-layered linkage network. Significant urban network externalities exist between Chinese cities and can influence urban economic growth (Huang, Hong and Ma, 2020; Zhang et al., 2020).

However, not many network studies have been carried out from the perspective of city governments, as data for quantitative studies are difficult to obtain. Compared to micro-actors and macro-regional planning, local governments at the meso-level represent local development aspirations and are more future-oriented, forward-looking and holistic. Local governments practice regional inter-city linkages and collaborative governance in a variety of ways, and this type of interaction among governments is called intergovernmental relationship. Competition and cooperation between local governments will influence the economic development of their cities, and these development intentions will be reflected in planning texts or policy documents that will guide the direction of development for a certain period in the future. It is therefore of value for in-depth research.

2.2 Research based on planning textual analysis

Textual analysis refers to the process of going from the surface of a text to the deeper layers of it in order to discover the deeper meanings that cannot be grasped through ordinary reading. Indeed, a number of studies have used textual analysis of planning texts, for example to assess the quality of planning texts (Brody, 2003; Song, 2015) and to make comparisons between different plans (Du, Lu and Zhang, 2019).

The Five-Year Plan is a policy plan prepared every five years by all levels of government in China, now in its fourteenth five years, for the period 2021-2025, and is comparable in that all cities in China are required to prepare it and the text is similar in length. A city's Five-Year Plan is an important overarching plan that sets out a vision for the city's development over a period of time. A study of the planning texts of several cities reveals a pattern of linkages between the cities' wills. An important part of the five-year plan is the city's strategy for integration into regional development, including the establishment of cooperative links with other cities, making it a good source of data for the study.

3 Research methodology and results

3.1 Research data and methods

This paper uses the 14th Five-Year Plan texts of 41 cities in the YRD as research data, and the source is the government website of each city. The inter-city link data is extracted from the texts using Python. The research methods used are word frequency analysis and social network analysis (SNA). Word frequency statistics refers to counting the number of times a particular word or symbol appears in text or speech data, which is used to discover the regular features of the text content; social network analysis (SNA) is a method to further reveal the social relationships by analysing the network structure of individuals, social organisations and even social events. Specifically, if city B is mentioned N times in the planning text of city A, it is counted as N links from A to B in the link matrix. Thus, the constructed link matrix is directed. Indegree represents the degree to which cities receive attention and outdegree represents the degree to which cities pay attention to other cities. Cities with a high indegree receive more attention, and cities with a high outdegree are more willing to pay attention to other cities.

1,750 links between 41 cities in the YRD are extracted from the texts of their 14th five-year plans (Figure 2). The above link matrix was entered into Gephi to compute linkage network metrics and modularity analysis, and visualised using a geo-layout.

Figure 2 The Connection Network among Cities in YRD Based on the Text of the 14th Five-Year Plan

3.2 Whole network analysis

The modularity algorithm in Gephi, which is one of the methods for calculating network topology parameters, is used to divide the nodes into a module with approximate degrees. The results are shown in the figure, where different colours represent different modules, node size represents the degree of frequency of occurrence, and connecting arrows represent the direction of contact (Figure 3). The visualisation results show that core cities are more attractive, with Shanghai, Hefei, Nanjing and Hangzhou having the highest indegrees, all above 100, and the sum of the four cities' indegrees accounting for 65% of all cities, suggesting that even at the local government level, attention to other cities remains polarised. In terms of outdegree, the situation is flat, with the maximum value of 119 for Ma'anshan. Ranking the difference between indegree and outdegree in descending order, as shown in the figure, the cities that are not negative include Shanghai, Hefei, Nanjing, Hangzhou, Ningbo, Lianyungang, Suzhou (JS), Xuzhou, Zhoushan and Wenzhou (Figure 4), indicating that these cities in the Yangtze River Delta do not receive less attention than outward attention, indicating that their development has the characteristics of attracting other cities. It is worth noting that Lianyungang and Zhoushan are not the most prominent cities in terms of economic volume or political status, but after reviewing the planning text, it is found that the main reason for their attention is the harbour, suggesting that their access to the outside world is valued by other cities.

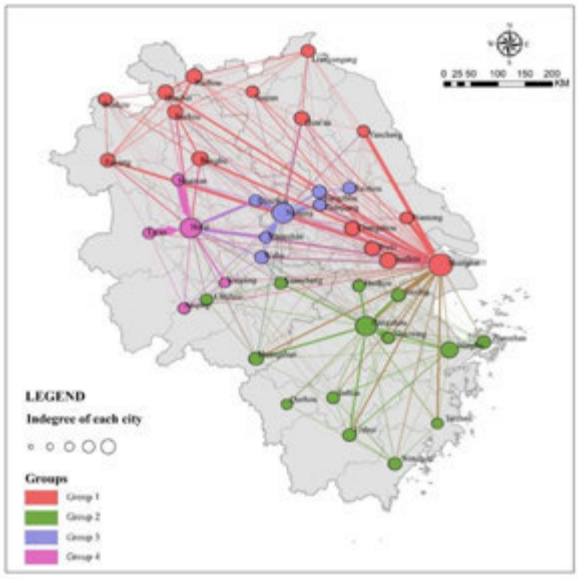

Figure 3 The 4 Groups Found by SNA

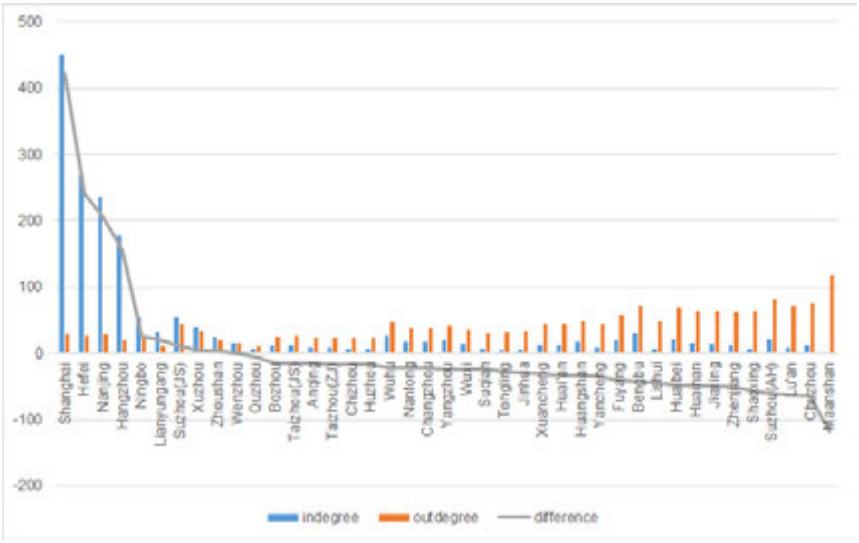

Figure 4 Difference Between Indegree and Outdegree

The results of the modularity algorithm analysis show that the 41 cities are divided into 4 modules: 15 cities led by Shanghai, 7 cities led by Nanjing, 5 cities led by Hefei and 14 cities led by Hangzhou. It can be seen that Shanghai is the core city of the YRD metropolitan cluster, and all the cities mention Shanghai in their plans; Shanghai's sphere of influence covers southern and northern Jiangsu and northern Anhui; Hefei and Nanjing's sphere of influence

mainly focuses on their neighbouring cities; and Hangzhou's sphere of influence covers most of the cities in Zhejiang Province.

3.3 Comparison analysis

To explore the relationship between the attention given to cities in the intergovernmental network and their own attributes (population and economic size), the share of attention for each city is compared with the share of population and the share of GDP in 2022, as shown in the figure.

The ranking of the difference between indegree and GDP share in descending order shows the cities that have a higher position in the network of intergovernmental relations than in the total economic volume (Figure 5). The highest ranked city is Hefei, the provincial capital of Anhui Province, due to the capital priority strategy and high-tech industry, which makes it attract more attention from cities within Anhui. There are also cities such as Bengbu, Zhoushan, Huaibei, Huangshan and Lianyungang, due to their more central role in the hinterland and their external transport links such as harbours. In contrast, cities such as Suzhou, Wuxi, Nantong, Changzhou and Ningbo in Jiangsu Province, which have high GDPs and are also generally regarded as developed among the cities in the YRD, receive less attention, suggesting a lack of features in their development that would attract other cities.

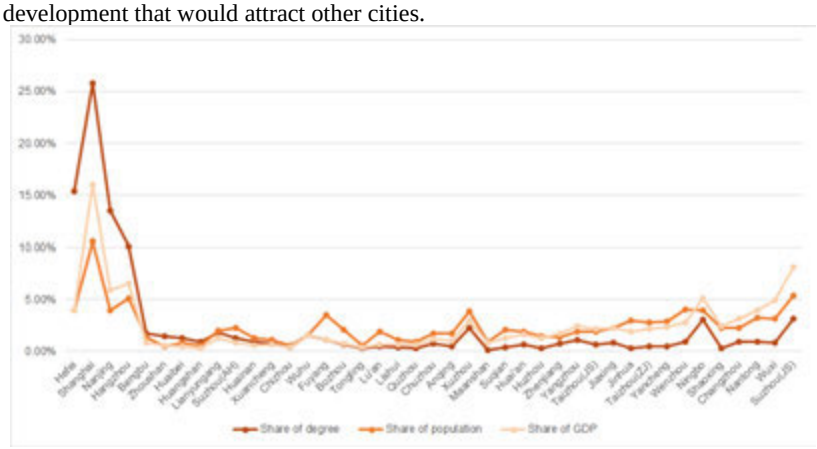

Figure 5 Comparison of the Share of Indegree, Population and GDP

4 Conclusion and outlook

4.1 Conclusions

The study found that the linkage network is characterised by the coexistence of overall polarisation and local flattening. With the convenience of transport and communication, some remote ordinary cities are also willing to directly contact high-level cities such as Shanghai, instead of only contacting high-level cities in their province. However, this flattening is only reflected in the unidirectional connection of low-level cities with high-level cities, and high-level cities hardly take the initiative to connect low-level cities. In terms of outdegree and indegree, it is largely consistent with the reality that economically underdeveloped cities have a high outdegree and economically developed cities have a high indegree, which reflects the characteristics of the outgoing nodes and the relationship between the demands of the incoming nodes on them, and also reflects the characteristics of the development of the two types of cities:

the incoming cities are rich in resources and development advantages in terms of science and technology, trade and commerce, high education, transportation, medical care and so on, and the outgoing cities actively dock with them. In the case of incoming cities, the content of docking mainly includes industrial investment, infrastructure, public services and so on.

The innovation of this study lies in the fact that the use of planning texts from local governments in the region to some extent fills the gap in the visualisation of intergovernmental relations, and facilitates the consideration of the willingness of local governments to develop in the formulation of regional planning. The study also explores the factors that influence the formation of the network of linkages, and finds that economic volume is not the only reason for linkages with other cities, providing suggestions for the integrated development of cities in the region.

It is therefore recommended that city governments should be guided by the concept of openness in removing administrative and institutional barriers. The analysis of the planning text concluded that the relationship between cities is a meso-level perspective and that it is necessary to take into account the characteristics of specific cities and think about how they can undertake and integrate macro-strategic arrangements and how to improve synergies in the development of different places, such as the possibility of forming a multi-level regional planning platform based on the linkage of intercity development.

4.2 Outlooks

However, this study has its limitations. First, urban planning is usually only one aspect of urban development, and the cooperative and competitive relationships between cities are influenced by many factors, such as geographical location, level of economic development and political environment. Therefore, it is difficult to reflect the comprehensive relationship between cities simply by extracting linkages from urban planning texts. Second, extracting linkages through urban planning is also not comprehensive, because cooperative relationships between cities are also carried out through other forms of cooperation agreements, meetings, and so on. Some scholars have also used web crawlers to obtain data, and this study provides a comparable data source and method. In order to analyse the relationships between cities more comprehensively, the introduction of other data and methods for a comprehensive study can be considered in the future, leading to more valuable conclusions.

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«The Franco-Spanish Mediterranean Strip. An Opportunity to Turn Applied Research into Trans-Border Planning»

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Abstract

This paper deals with an ongoing procedure to establish a transboundary partnership between two institutions at both sides of the Mediterranean Franco-Spanish border, between Région Occitanie (in France) and Catalonia (in Spain). It presents, on one hand, a range of methodological issues that try to link teaching, practice, and research, in order to produce applied architecture and planning according to research standards. On the other, it proposes a series of specific actions to be made, both at an institution level (such as the creation of double degrees) and from a thematic approach (such as the exploration of mid-density urban patterns). These could, by responding to the specific problems of this bi-national territory, serve as design and methodological guidelines for wider actions, such as transboundary planning.

word count: 125 words

Keywords

Trans-boundary, Pyrénnées-Mediterranée, Applied Research, Architecture, Planning

1. Introduction

Is it feasible to establish common planning strategies, with the aim of preserving the identity and evolution of a common territory, between two different countries in a trans-border situation? In this text, we will try to respond to this issue through the particular example of the region assembling the Mediterranean shores of South-East France (in the Région Occitanie), and those of North-East Spain (in Catalonia).

After describing the geographical particularities of this bi-national region, summarizing its main problems and potentialities, we will propose a particular methodology of work that assembles research, teaching, and practice, and that will lead to the completion of pilot-projects; these will allow, further on, a planning initiative at a larger scale. We will, as well, illustrate the whole picture with the partial results of our ongoing scientific and pedagogic activity, developped in this context.

2. Geographical definition

If it where a geographical tentative of definition, the territory we aim to treat can be described through four different types of limits. Two of them would be physically equivalent, and correspond to the deltas of the two main rivers that drain the Alps, in France (the Rhône) and

Figure 1: definition of the Eurorégion Pyrénnées-Méditerranée (Midi-Pyrénnées and Languedoc-Roussillon formed together later on, in 2015, the Région Occitanie) (source: Eurorégion Pyrénnées-Méditerranée)

the Pyrenees, on its Spanish southern slope (the Ebro). Dividing this 600 km. long coast line, the Pyrennees (that would be our third internal boundary) come to meet the sea in Port Bou, as an imposing perpendicular barrier with the last spurs of the Sierra de Les Alberes; they establish as well, and at its watershed, the administrative border between both countries. The fourth limit of this coastal strip becomes more diffuse, but could be assimilated, inland, to a shore plain of irregular size, always backed up by a secondary mountain range running parallel to the sea; at some points raising very close to the water (like the double Cordillera Pre-Litoral and Litoral in Catalonia), and, at some other moments a bit further away (like La Montagne Noire, or Les Cévennes, in Occitanie).

Most of the coastline in the French sector is occupied by large lagoons (around Sète, Narbonne, or Perpignan) which are less frequent in the Spanish side (deltas of Ebro and Llobregat, and at the Empordà, close to the border), that in all appears to be more abrupt and rocky. Concerning urban areas, we will find two different sizes of cities. On the one hand, and at the Northern and Southern limits, the metropolitan areas of Montpellier and Barcelona, that, although very far from being equal in size and character, contain similar problems and situations… They will thus be considered as equivalent fields of experimentation for us, since, as well, they are the cities that host both our research institutions.

On the other hand, there exist a series of small size province cities, such as (listed from North to South) Béziers, Narbonne, Perpignan, Girona, and Tarragona, which, as the biggest cities,

have an adequate balance of similarities and differences between them, able to be used in comparative exercises. Regarding the climate, although there exist slight variations due to latitude, we can consider its range to respond, at both sides of the Pyrenees, to a similar pattern, that would depend basically on the position regarding the cross section of the territory: with a high influence of the sea when close to the shore (in temperature and humidity), and a progressive more continental behaviour when approaching the backline mountain ranges. In

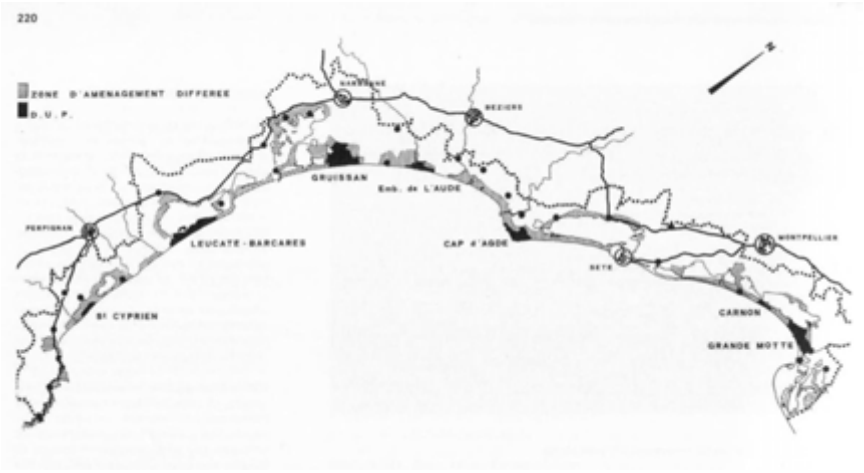

Figure 2: The mediterranean arch of the Région Occitanie, as drawn by the authors of the 'Mission Racine' (source : archives départementales de l'Hérault)

many senses, our territory can be assimilated to what Alberto MAGNAGHI has called a «bio-region» (MAGNAGHI, 2014), with quite homogeneous geographical, economical, and social issues, that transcend administrative cutting of the nations, and even the regions, that it is formed with.

3. Problems and opportunities of the trans-border region

This context has been recognized by the European Union with the creation of the EGTC (European Grouping of Territorial Cooperation) called «Eurorégion Pyrénnées-Méditerranée». Although this administrative structure has allowed a number of opportunities (such as described in VICENTE, 2021), its border, nowadays, still lacks of porosity and relations. Especially if compared with northern European cases, like those, for example, separating Germany from France (in Strasbourg) or Switzerland (in Basel), or Belgium from France (in Lille).

This resistance to a further integration can be explained by a range of different reasons. These would go from the mostly agricultural and natural character of the lands close to the border (as opposed to the cases just mentioned) to the distance between the main cities; and, probably and as pointed by certain authors (De KEMMETER, 2024), a certain distrust of the Région Occitanie towards the much more dynamic Catalonia. But the main difficulty nowadays still has to do with infrastructure; although the french A9 and the Spanish AP7 can be considered, together, as a very efficient main axis of the European highway network, a critical funnel

persists in the rail lines between Perpignan and Montpellier. This sector is nowadays the only

Figure 3: several of our activities over the last years have been centered in explaining at the other side of the border the issues of the euro-region, as with this image of Port-Leucate for a conference in Barcelona (source: the authors)

portion of a cross-european corridor, sparing from Seville to Hamburg where trains cannot run with high speed standards, and the accomplishment of the LNMP (*«Ligne Nouvelle Montpellier-Perpignan»*) is not planned to be finished before 2035, as earliest.

Concerning teaching and research, bi-national regional movement is almost non-existent, with the exception of some punctual collaborations in the fields of medicine, agronomy, or law. No visible cooperation appears, neither, on planning nor urbanism at a certain scale, except those cases linked with very practical issues close to the border line. However, common problematics arise in all the fields, that we think would be easier, and more logical, to treat and solve in cooperation.

3. Disciplinary issues

As architects and planners, we believe that many of our current challenges cannot be furthermore addressed in a classical way. This affects both methodology we use for working (that tends to be more collaborative, and further anchored to research), and the subjects we treat: these have now the necessity to be linked with major crucial issues, such as the impact of climate change in our territories. This is why we consider this trans-boundary context, with its high quality but also extremely fragile landscapes, and with its range of cities showing all of today's problematics, to be an opportunity full of potential for experiencing new protocols for acting as designers.

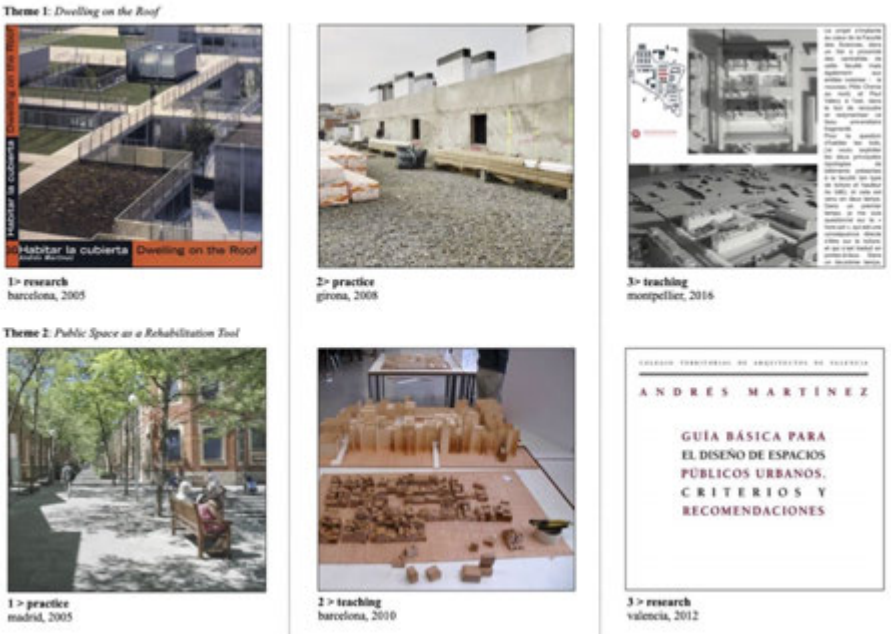

Figure 4: different orders tested for the place of teaching in the «Applied Research Triangle», as presented in Westminster in 2019 (source: the authors)

We propose to update, at this occasion, the theories of «Research by Design» (established mostly by the english school of though around applied arts) to nourish our practice from research and teaching activities. According to RUST (2007, 48),

«(...) the history of another field [of knowledge] is instructive. Medical research in the modern era began with the study of pathology in the 19th century. However that effort offered few if any 'cures' and it was only in the 1940's that a century of scientific effort began to be translated into practical progress for doctoring. At that point a new discipline of clinical research arose to provide the tools for innovation in medicine but it was a severe challenge to the medical schools of the day, and posed new ethical and intellectual questions that took decades to answer. We are so used to today's culture of clinical research that it is hard to remember that, in the lifetime of some of us, that tradition was tentative and not understood by the great majority of doctors of their teachers».

Although RUST adds that *«(...) we should recognize (...) that a research culture cannot mature overnight, and new methods cannot be expected work reliably without a period of experiment and reflection»*, we think that time has come to get into proper realizations to what, in architecture and planning, has basically been a theoretical debate. Applied to architecture, the authors that, in our opinion, came closer to what proposes RUST and what we aim to our experiment were VIGANÒ and SECCHI, and especially their analysis of the Veneto lo link the physical support, and particularly its ecological issues, to contemporary ways of living, in what

Figure 5: cartography drawn by Saverio MURATORI for the region of Grassano, Italy (source: Archivo Muratori, Biblioteca Poletti, Modena)

Franceso INDOVINA called the *«citta diffusa»* (INDOVINA, 2009), and with a methodology, according to Bernardo SECCHI, of a *«practice charged with theory»* (SECCHI, 1995).

Apart from these main references, we are also interested in our work in two other complementary approaches. On one hand, one that would consider the graphic analysis techniques developed by Saverio MURATORI to establish a complete cartography of Italian regions, that we intend to use as an inspiration for our cartographical approach to this territory. On the other hand, and with a direct application to our region, we are interested in the way the team of architects involved in the «Mission Racine» worked to plan and build, between 1960 and 1980, a series of holiday towns in the windy and sandy shores of the Languedoc-Roussillon; first, with the thorough diagnosis they made of the problems and potential of the territory and its particular sites, and later on with the capacity they had to use it for a multi-scale regional plan, sensitive simultaneously to landscape, urban, infrastructural, social, and even (if understood with the mentality of those years) ecological issues (see DELORME, 2022).

4. Structure of the trans-border partnership

Although wishing to establish basically a scientific approach, and searching for its applied results, this franco-spanish partnership aims to have an implication, in a progressive way over the years, in different formats of collaboration. We consider ourselves now capable to answer two questions we asked back in 2019 in two different scientific forums, about the role of

teaching in the creation of knowledge preceding applied research: in Westminster University,

Figure 6: the *«citta diffusa»* in the Veneto, as drawn by VIGANÒ-SECCHI (source: VIGANÒ, 2010)

we asked ourselves what came first in what, at that time, we were calling an «Applied Research Triangle» (MARTÍNEZ, 2019); in another proposal for Antwerp University, we defended the capacity of a method of teaching architectural studios that we called «horizontal», to «launch research themes» (MARTÍNEZ *et alt.*, 2019).

Five years later, we wish now to establish a permanent structure able to work in the way we proposed in those papers written back in 2019. First action in this sense, and following that «launching role» accorded to teaching, we are now able to start, in September 2024, a double degree in architecture between our two institutions: on the French side, the École Nationale Supérieure d'Architecture de Montpellier (ENSAM), and, on the Spanish side, the Escola Tècnica Superior d'Arquitectura del Vallès (ETSAV, in Barcelona).

Both schools depend on public universities, both are of similar (and reduced) size, and both have a clear experimental and metropolitan character. The aim is to deliver, together and simultaneously, two European architectural degrees, with an organization based on two main criteria: on one side, a back and forth mobility, on a semestrial basis, of the students of both nationalities, that will work always together, between the sites of Montpellier and Barcelona;

and, on the other, the existence of a binomial teaching in studio, always counting

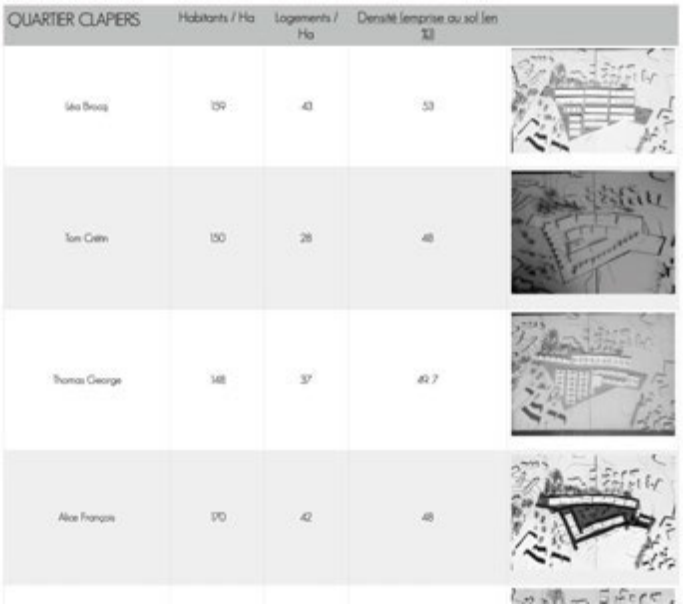

Figure 7: a «capacity test» on a mid-density neighborhood : graphic comparison of a quantitative approach measuring different parameters of density, and its consequences in urban form (source: students of S4 at ENSAM, 2020)

simultaneously with a faculty from each nationality.

We wish to insert this initiative in the roots of two declared intentions of the European Union. First, the establishment of a common European teaching and scientific space, for which the main issue, according to recent European officials declarations (NAVARRO, 2024), is the creation of common trans-national degrees; we want this double delivery of french and Spanish degrees to be considered as a first step towards that eventual European unique degree in architecture. Second, we think the importance given by Europe, for several decades now, to trans-border regions, is still very relevant nowadays. In our context, this concerns both funding (with specific programs, like the INTERREG or SUDOE), and the creation of particular administrative structures, such as the Eurorégion Pyrénnées-Méditerranée (EPM) mentioned above, that through its Eurocampus offers two different initiatives that suit well our interests: the creation of higher education partnerships (in particular the establishment of double-degrees, like the one already started in the field of Law between the universities of Toulouse and Barcelona), and the interest for common study and transformation in Environment, Climate, and Energy.

For the launching of this double-degree, we count already with the support of national french authorities, such as the Ministère de la Culture through its aid to international initiatives of

architectural schools, and the explicit support of the French foreign authorities in Spain, both through the consulate in Barcelona, and the embassy in Madrid. At the same time, we are still seeking for co-funding of regional and local authorities that would help collaborate for student and faculty mobility, such as the Région Occitanie, the Generalitat de Catalunya, and the Métropole de Montpellier.

In the structure being mounted, the teaching collaboration would only be a first step to a wider partnership involving scientific activities in our research laboratories, the «*Laboratoire Innovation Architectures et Milieux*» (LIFAM, Montpellier), and the «*Centre de Recerca i Serveis per l'Administració Local*» (CRAL, in Barcelona). On its financial side, we intend to

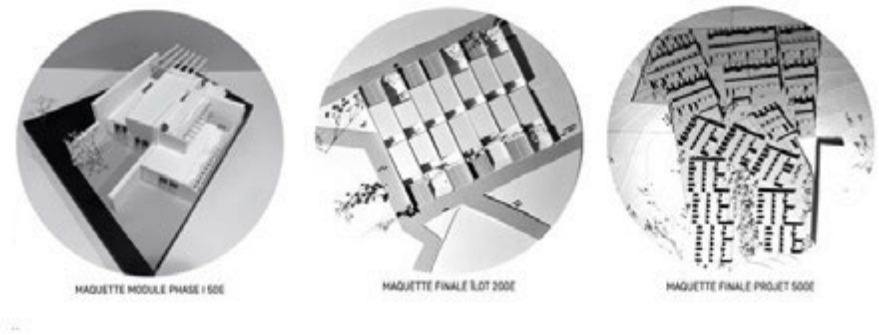

Figure 8: the three steps of the definition of a mid-density pattern: the unity, the lot, and the neighborhood (source: Théophile LEROY, student S4 at ENSAM, 2021)

respond together to a specific call for the creation of international research networks proposed by the French «*Agence Nationale de la Recherche*» (ANR), named «*Montage de Réseaux Scientifiques Européens ou Internationaux*» (MRSEI), on its call due in September 2024. We will need to be associated (as demanded by the call) with a third research institution, probably in North-West Italy, to complete geographically the western Mediterranean arch. On the institutional side, a research chair «*Pour une esthétique du changement*», is planned to start working soon. It is currently on process of being labelled by the French authorities of the Ministère de la Culture,and it will allow the entrance of private co-funding in our research activities[1].

However, the final funding aim of this partnership is to apply together to high range European programs, like the Next Generation program (and in particular its chapters dealing with renewable energies and self-sufficient communities), and those proposed by the European Research Council (ERC).

4. Specific thematic proposals

[1] translated to english: «Creation of European and International Research Networks» (for MRSEI), and «In Search of an Aesthetic of Transformation» (for «une esthétique»…)

While progressively mounting this structure, we plan to work at least in two levels of definition. The first one intends to establish an operational cartography of the bi-national territory, to be done mostly through our teaching activities. This cartographic production should be able to go further than a simple technique of analysis or diagnosis, to allow an observation of reality which

Figure 9: some of our previous publications treated the potential of the agricultural metropolitan parks as a new form of public space and heritage (in the image, Parc Agrari del Baix Llobregat, in Barcelona) (source: the authors)

is able to highlight relevant issues, by representing them through different layers to be crossed in different combinations. This could be done taking profit of the architectural drawing skills of our students students, and taking as a graphic model the experiments of MURATORI, mentioned above.

At a second level, and to be developed in the scientific axis, we intend to establish a comparative applied research by the design, and construction, of selected pilot-projects at both sides of the border, with the will to transfer the results obtained as design recommendations, first addressed to public authorities in charge of housing and planning, and further on to private developers through the form of «Market Replication Models» (MRM).

One of the research themes we propose is the creation of mid-density residential patterns (in the way these are defined by authors such as, for example, KROPF, 2013). These new forms of neighborhoods can, through the establishment of self-sufficient energetic communities, respond at the same time to problems such as the integration of renewable sources in urban tissues, the changes provoked by electric mobility, or the restoration of a balance with natural resources, considering these as a new form of public space, in the metropolitan environment.

Our intentions on this particular axis concern mostly housing and urban structure issues… but not only. We consider these questions cannot, nowadays, be treated apart from concepts such as «urban habitability» (as defined by BLANC, 2009), access to services, quality of public

space, or anything contributing to the community realm, the sense of «urbanity», and, of course, the consideration for re-use and transformation of existing patterns. This, alltogether, should allow us to properly respond, first with a local and particular approach, and further on with

Figure 9: our proposal (see MARTíNEZ, 2023) for the site of the first mid-density pilot project to be designed. In the border between an existing metropolitan urban pattern (el Prat del Llobregat, Barcelona), and the Parc Agrari del Baix Llobregat, with all its pre-existing elements. Currently planned as a high density new neighborhood, to be, ideally, modified (source: Institut Cartographic de Catalunya)

more general applications, to the challenges caused in certain European regions (like this western mediterranean basin) by climate change, the impact of renewal energies in landscape, or deep social transformations currently ongoing.

It is important for us to point out that this whole experiment is linked, and updates, a number of historic threads on housing and urban production in European history. Some of these focus on the links between building typology and urban morphology, represented mostly by the Italian school (i.e. CANNIGIA and MAFFEI, 1984); some others insist on what they call «landscapes of energy», that is all the urban fabric created, in one way or another, around production and energy (MANGIN, PANNERAI, 1999); lastly, we are also interested in those that treat the importance of housing and urban tissues built for specific communities, mostly working populations, but not only (KIRSCHENMANN and MUSCHALEN, 1980). For us, these new types of metropolitan communities could, at the same time, be considered some sort of «specific population», linked by «energetic issues», and their patterns created, in part, according to typo-morphological laws. Two other more recent questions, should, however, be considered: the one of the metropolitan landscape used as public space, that of the re-use of the existing built environment.

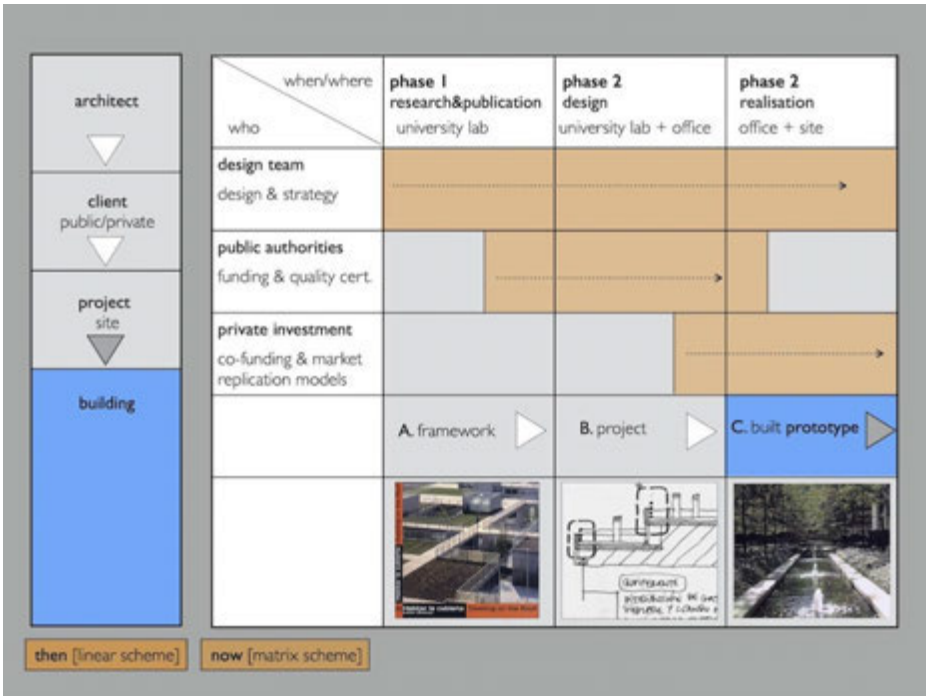

Figure 11: matrix for the organization of an applied architectural research procedure, from publication, to pilot-project, to completion in site, as presented in a congress in Stuttgart in 2009 (source: the authors)

Apart from this main theme, we keep on our backminds some other thematic proposals, that we will just name here briefly. One, for example, would have to do with the rehabilitation of social housing of the 60s formed by towers and bars, through interventions that would be both functional and spatial, rather than only technical and energetical. On the other hand, a very particular issue for this territory, that is the potential of reconversion of the architecture of mass tourism, prevalent in the shore of both countries and basically out of date in several ways. With some sectors like the one mentioned of the Mission Racine, considered among the most valuable modernist production in housing in the sencond part of the century.

5. The drift from applied research into planning

We believe this bottom-up approach (that starts on applied architecture and urban design with comparative research methods) can lead, later on, to the definition of efficient trans-border planning practices and policies, suitable across administrative bi-national divisions.

As already pointed out, there is a specific will of knowledge transfer of the results of these procedure, both to the public authorities and the market actors through MRMs. In fact, some of

the ETSAV's post-degree actions (like the Master MArq) already point in this direction, by

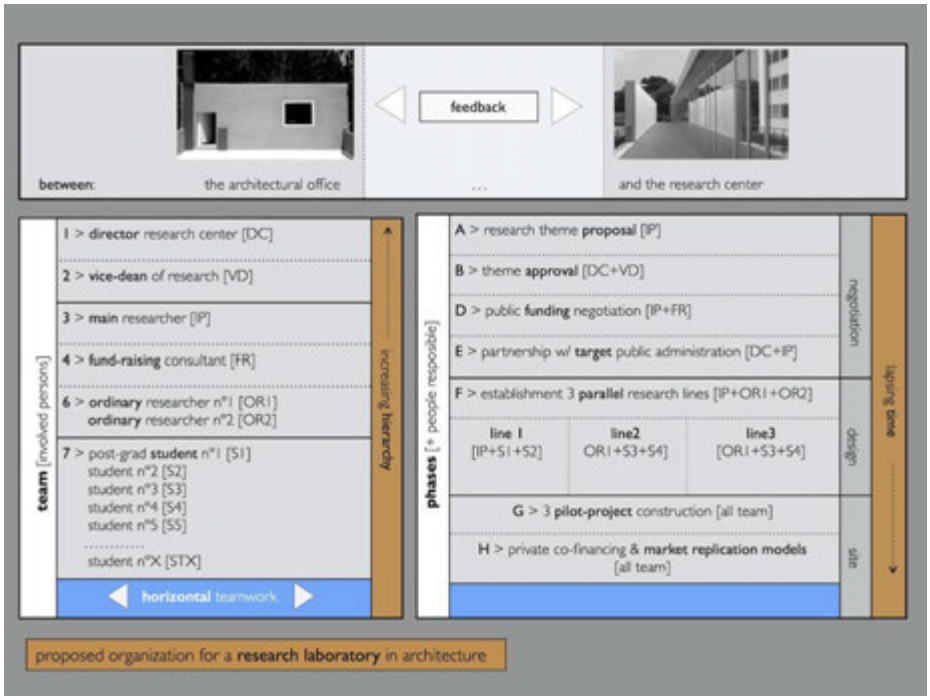

Figure 12: possible scheme of the organization of a university laboratory in applied research (source: the authors)

treating specific issues after requests of the local metropolitan authorities, and normally involving several scales of intervention, from housing formats to large landscapes.

Our contribution to this congress wishes to present this cooperation, currently under construction, to a wider audience outside our institutions or universities. In order to get, simultaneously, proper feedback before its implementation, and to contribute to the debate of turning planning into a game-changer for more just, and sustainable, regions, as proposed by the organization.

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Transit-oriented Development in asymmetrical context: Learning from cross-border paradoxes in the Great Geneva.

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Abstract

Transit-oriented Development (TOD) is hailed as a solution to sustainable urban growth; yet research often overlooks its impact in asymmetrical contexts like cross-border metropolises. This study challenges this gap, examining public transport and urbanisation projects in Great Geneva. The region, nestled between Switzerland and France, faces significant socio-economic and institutional asymmetry. While the Agglomeration Project aims for cohesion, local conflicts abound. Through critical analysis, three paradoxes emerge: the metropolitan, radio-centric, and development paradoxes. These paradoxes question TOD's agency in an asymmetrical context. Understanding these paradoxes is necessary to inform future planning in such regions beyond rhetorical discourses.

keywords: TOD, cross-border metropolis, asymmetry, planning, conflicts

Introduction

Transit-oriented Development (TOD) is pictured as a pivotal strategy to accommodate growth while ending car dependency in metropolitan areas. However, prevailing TOD research is often embedded in normative and progressive assumptions, failing to address the complexity of the model's impact in asymmetrical context such as cross-border metropolis. Meanwhile, border studies which focus on such context tend to view cross-border cooperation project, specially concerning public transport network, as a manifestation of cross-border functional and institutional integration but fail to question their impact in asymmetrical metropolitan context. This contribution challenges these gaps in sustainable development discourse by adopting a critical perspective on public transport infrastructure and urbanisation development in the asymmetrical cross-border contexts of the Great Geneva.

Nestled between Switzerland and France, the case study of the Great Geneva Agglomeration is characterised by its strong functional integration, supported by a strong socio-economic asymmetry across-the border. Since 2006, the agglomeration's institutional integration is manifesting through the definition of a cross-border territorial vision, which is nevertheless impacted by institutional asymmetry across the border. Setting a radio-centric model of coordination of new transport axes and urban development at the centre of its cross-border cooperation vision, the *Projet d'Agglomération* (PA) intention is to foster territorial cohesion in the cross-border metropolis. Nevertheless, in the last 10 years, conflicts and contestations around the implementation of this vision multiply.

Critically analyzing conflicting cases, alongside socio-spatial and economic dynamics, financing tools and legal frameworks, the study highlights three paradoxes in the current implementation of TOD model as a support to territorial cohesion—the metropolitan paradox, the radio-centric paradox, and the development paradoxe.

1- TOD in cross-border context

1.1 TOD

TOD, understood here as coordinated planning of public transport infrastructure and densification projects around station nodes, is actively promoted in international reports (OECD, UN-habitat, EEA), as a pivotal strategy reach sustainable metropolitan development (Newman and Kenworthy, 2015). Through the combination of transit infrastructure, promoting regional accessibility to employment hubs, and a mixed-use, compact, and pedestrian-friendly station environment, it intends to mitigate car dependency in suburban contexts, while stemming sprawl and reduce arable land consumption. Hence, the model actively supports metropolitan functioning while mitigating its externalities.

From this standpoint, several research studies from the American school of thought have focused on demonstrating TOD's benefits (Cervero, 2007; Renne, 2013), and assessing its performances (Renne, 2009; Bertolini, 1999). More recently, a dense body of literature has focused on "making TOD happen" (Curtis et al., 2009) though the identification of challenges and good practices of land-use and transport integration (Lierop et al., 2016). However, these contributions are marked by intrinsic normative and progressive assumptions around the implementation of the TOD model (Angelo et Wachsmuth, 2015).

Despite the wide acceptance of the benefit of the model, another branch of research stresses the singularities of both implementation processes and the impact of the TOD model in different contexts (Staricco et Vital Brovarone, 2018; Thomas et al., 2016). As some authors point out, the model generalisation went along with the development of site-specific tools and policies at both state, regional, metropolitan, and local levels, which, generated different applications and outcomes (Gallez et al., 2013). This line of research has, therefore, dived into the social-spatial, economic, and political conditions in which the model is being designed and implemented (Grillet-Aubert, 2015; Gallez et al., 2015). Such research participated to interrogate the model's role in the promotion of spatial (in)justices (Mollé et al., 2019; Derakhti et al., 2020) and showing some of the contradictions embedded in TOD discourse (Roy-Baillargeon, 2017). These input challenge TOD's ready-made normative assumptions, bringing transport and land development projects back into political spheres. To this intent, critical scholars, particularly Fillion and Keil (2016), engage and look at conflicts that emerge from this development to understand the « shortcomings of the current age».

1.2 Border Studies

As « in-between » territories (Grosjean, 2019), cross-border metropolis are particular cases, to observe TOD's agency in metropolitan construction. In Border Studies the notion of integration has been dominant to frame cross-border metropolis analysis (Van Houtum, 2000). Sohn et Walther (2009) propose a grid to articulate the institution and functional dimensions of metropolitan cross-border integration. Defining both notion as such 'functional integration then relates to the form and intensity of socio-economic interactions observed on either side of a border, through the extension of the metropolitan area, while institutional integration concerns the form and intensity of interactions between political actors possibly willing to collaborate' [1]. In their paper, imbalance between functional and institutional integration are critically reflected upon as an enabler of metropolisation process.

In the field of Border Studies, public transport lines crossing the border epitomise the institutional integration of functional integration, as their realisation demand strong cooperation from the different

[1] Authors' translation

territorial actors while aiming at facilitating functional relation between the two regions (Medeiros, 2019). As a result, a lot of contributions reflect on the obstacles to overcome and opportunities to increase these developments (Medeiros et al, 2021). However, less contributions reflect on the condition of implementation of such project and their impact. As a matter of fact, transport infrastructure is even broadly assumed to entail territorial cohesion (Lopez et al, 2008), understood in EU terms, as policies aiming to rebalance socio, economical and environment inequalities (Durán Laguna, 2024). However, asymmetries inherent to cross-border context, though often underlined (Decoville et al, 2011) are little problematised with regards to transport provision, despite empirical evidence that they support rebordering movement at the local level (Herzog et Sohn, 2014).

This contribution aims to analyze conflicts arising from the implementation of cross-border transport and urbanisation projects in the Grand Geneva metropolis. The first part examines the asymmetrical nature of functional and institutional integration in the region. The second part focuses on analyzing conflicts surrounding the implementation of the TOD model. Rather than viewing conflicts in isolation, they are contextualised within a relational perspective to transcend a narrow interpretation of these disputes. The definition of paradoxes draws on a hybrid methodology, combining quantitative and cartographic data analysis, examination of planning documents and alternative proposals, and semi-structured interviews with various stakeholders, including public and private actors and citizen associations.

2- Framing cross-border cooperation in socio-economic and institutional asymmetry

2.1 Functional integration and socio-economic asymmetry

The Grand Geneva agglomeration stands as one of the most dynamic regions in Europe in terms of the labor market. Daily, the number of workers crossing the border to work in the Canton de Genève exceeds 100,000, which represents one-quarter of Geneva's work force. In addition, according to the Frontier Observatory, the number of cross-border workers could nearly double within the next decade. This functional integration is inseparable from the cross-border socio-economical differential, which is one of the highest in Europe. As in most cross-border cases, cross-border flows are generated by enterprises and individuals utilizing the differentials across the border to maximise socio-economic opportunities.

Due to both Swiss and local conditions, including taxation mechanisms, the Geneva Canton is significantly more attractive to enterprises than the French part of the agglomeration. From an individual perspective, Swiss-based salaries are much higher than French ones for the same position, and accordingly, Swiss living costs are significantly higher than French ones. Land value and housing prices also vary significantly across the border. Geneva has one of the most expensive housing markets in Switzerland. Despite a recent rebound in housing construction, buildable land scarcity due to cantonal and federal protection laws and the accumulation of delays in housing generated a long-standing housing crisis. On the French side of the agglomeration, the entire Haute-Savoie department and the Pays de Gex have some of France's most expensive housing market. Nevertheless, the rupture at the border in terms of housing cost is clearly readable. Hence, the French neighboring region remains significantly more affordable in terms of housing than the Swiss part of the agglomeration. Finally, a much more recent and much more volatile aspect heightened each of these phonemenons in recent years. In 2015, the Swiss National Bank abolished the minimum exchange rate that pegged the Swiss franc at 1.2 to 1 euro. Consequently, the parity between the franc and the euro, in favor of the franc, had a direct impact on widening the cross-border differential between the two parts of the metropolis, as well as within French territories, between the population working within the national territory and the border population.

These asymmetrical socio-economic conditions support a metropolitan functional integration by specialisation. As demonstrated by Decoville et al. (2013), this dynamic « leads to a process of cross-border suburbanisation, involves a process of functional specialisation of space, with the centre concentrating economic activity and jobs while the periphery, which is attractive in residential terms, is relegated to the role of a dormitory area. ». As the authors point out, in such a configuration, exceptionally competitive in economic terms, functional integration feeds and is fed by cross-border socio-economical differential and, therefore, does not lead to territorial 'convergence' but digs the differential between territories (Decoville et al, 2013).

2.2 Cross-border cooperation …

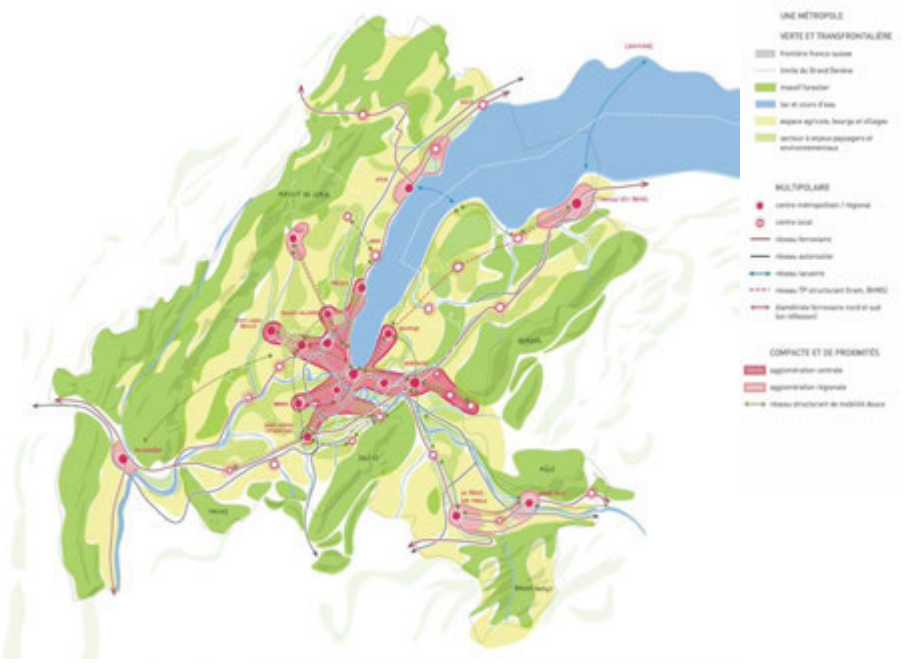


Figure 1. Vision d'ensemble de l'Agglomération, 2021. Source : Plan d'Agglomération Grand Genève (PA4), 2021.

Since 2006, cross-border cooperation in the Great Geneva metropolis took a new turn with the development of the *Projet d'Agglomeration* (PA). The PA is a Swiss planning devices developed at the agglomeration level by member entities. This tool was accompanied by the creation of the program in favor of agglomeration traffic (PTA), which allows the agglomeration, including cross-border ones, to benefit from federal funding of up to 45% to support transport projects. However, this financing is subordinated to the compliance to the federal spatial planning law (LAT) and to the coherent coordination of transport and urbanisation. Constituted into a GLCT (G*roupement Local de Cooperation Transfrontalière*) in 2012, the Grand Genève is the autonomous entity responsible for the development of these plans. The four generations of PA aim to produce a coherent vision coordinating transport, urbanisation, and environment on both side of the border. Since the very first PA, the sated goal is to promote territorial cohesion. Formally, all the plans promote the development of radio-centric transport axes from Geneva, organizing the urban development in corridors and hierarchal poles (Figure 1). Thus, model of cross-border cooperation and the modality of territorial

cross-border cohesion, understood as the rebalancing of territorial inequalities, is materialised through the radio-centric TOD model. The rise of metropolitan planning in the form of TOD, in recent years is therefore closely intertwined with the evolution of cross-border cooperation modes and mechanisms. These modes of metropolitan cross-border governance are designed and implemented by actors with diverse interests and capacities to assert them, which inevitably affects power dynamics among the various territorial. Therefore, beyond socio-economic asymmetries, understanding the current development projects necessitates an examination of cross-border institutional relationships.

2.3 …and institutional asymmetry

The PA encompasses numerous territorial entities, both intra- and supra-metropolitan. The emergence of the PA and the establishment of the GLCT contributed to the diminishing role of both national states in favor of local entities. However, the substantial proportion of funding that the Swiss Confederation allocates to the PA, coupled with a compliance examination of these plans with the Federal policies and development objectives, bestows upon the Swiss state a passive yet dominant role in the directions taken by territorial development.

At the regional level, the two primary entities are the Geneva Canton and the *Pôle Métropolitain du Genevois Français*. Despite their balanced voting capacity in the GLCT, these entities have a fundamentally unbalanced relationship depending on their legitimacy, material, and immaterial capital. The Canton of Geneva stands as an anomaly within Switzerland. As a Canton-city it has a leading role in planning, marginalizing the autonomy of municipalities. The Canton of Geneva is thus an extremely integrated and autonomous entity regarding spatial planning. In addition to the financial capital, the Canton's long planning history give it significant symbolic and knowledge capital. Lastly, the Canton possesses substantial human resources in numbers, abilities, qualifications, and experiences dedicated to its spatial development. Thus, the Canton of Geneva combines financial, symbolic, and human capital with substantial autonomy and legitimacy in planning matters.

On the French side of the agglomeration the strength and competencies of the different territorial entities are much more fragmented. The *Pôle Métropolitain* is a relatively recent entity that emerged from the *Assemblé Générale de Coopération* (ARC) in 2018. Its explicit goal is to 'elevate' the French part of the territory to the metropolitan scale to assert the French region's interests within the agglomeration.[2] However, this entity has a limited budgetary capacity as it is financed mainly by intercommunal contribution, in addition to INTERREG financial support. Hence, as a young structure with relatively low financial capacity, it still lacks sufficient expertise and human resources. The *Pôle Métropolitan* is the assemblage of eight EPCI (*Etablissement Public de Coopération Intercommunale*), each with planning competencies within their respective territories. The collaboration within the *Pôle Métropolitan* and the delegation of competencies are thus voluntary. According to French law, the designation *Pôle Métropolitain* is given to entities 'unable to become metropolises'[3], therefore, showcasing the French state's inability to recognise the existence of the cross-border metropolis, contrary to Switzerland. Furthermore, the legitimacy of the *Pôle* is far from established. As such, it competes with the departments and the region competencies, as well as their desire to be the primary interlocutor for cross-border interactions. Hence, despite the *Pôle Métropolitan* federating the fragmented French part of the agglomeration to constitute a stronger interlocutor with Geneva, its fragile assembly and challenging position in the region contributes to its marginalisation and weakening and to the asymmetry in the relationship with the Canton de Genève. Finally, the *Compensation Financière Genevoise* agreed upon in 1973, and which set a financial

[2] Statuts du Pole Métropolitain, Comité syndical, 2018. Available at. https://www.genevoisfrancais.org/wp-content/uploads/statuts-pole-metropolitain-genevois-francais-2018-1.pdf

[3] LOI n° 2010-1563 du 16 décembre 2010 de réforme des collectivités territoriales, République Francaise, 2010.

retrocession from the Canton of Geneva to French department and communes, determined by the number of cross-border workers, remains an essential agent in the subordination of French departments and municipalities to the Canton of Geneva.

Hence, the territorial project emerging from the cross-border cooperation cannot be separated from the power (im)balance and hierarchisation that characterises the metropolis. The question raised by this contribution is the agency of the current TOD project in this dynamic and its impacts.

4- Local conflicts for regional paradoxes

4.1 Metropolitan paradox: between accessibility and specialisation.

The first paradox explored pertains to the mechanism of metropolitan development in the cross-border context. The map (Figure 2) illustrates the gap between resident workforce and job provision per commune in the metropolis, more pronounced in France than in Switzerland, but reflecting the typical centre-periphery However, this gap has notably widened over the past 20 years, with job-resident ratios doubling or more in most communes of the Canton of Geneva while stagnating or decreasing on the French side of the agglomeration. Over 35% of the population in many French communes are now cross-border workers, a figure that has notably risen in those farthest from Geneva over the past eight years. Thus, the mechanism of functional specialisation remains prevalent, with job positions concentrated in the centre and the French periphery evolving into dormitory communities, despite the stated political desire to rebalance the employment-resident ratio since the first PA in 2007. As a result, there is a perpetual increase in cross-border flows in overall volume and the distances traveled by cross-border workers.

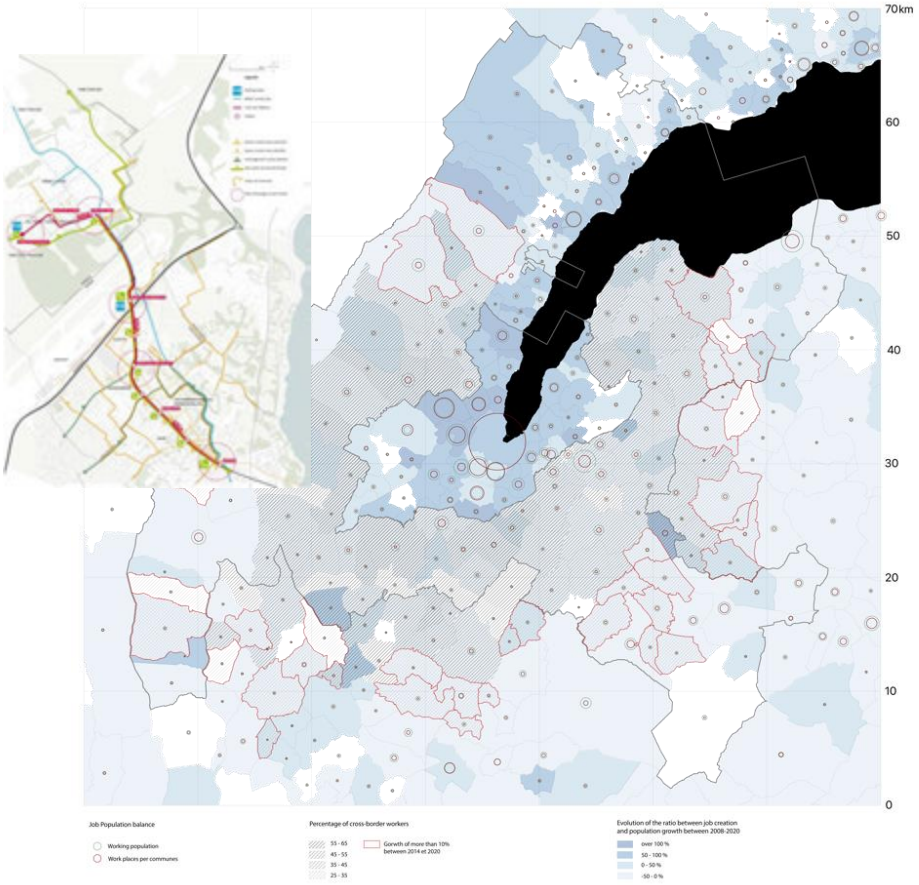


Figure 2. A specialised metropolis, author's production, 2024. Sources: INSEE-OST-ge.ch

An essential notion of the TOD model is the development of functionally diverse zones around transit nodes to foster pedestrian-friendly local community life (Ogra et Ndebele, 2014). However, diversity within the TOD framework lacks a clear spatial definition, particularly in scale and relation to the local context. Mixed land use is a challenging concept in a metropolis such as the Great Geneva where functional integration is done through specialisation.

Hence, this is where the paradox emerges when using the TOD model in the asymmetric metropolis of Great Geneva. Whiteout the capacity to rebalance the territory, the establishment of transport axes intending to alleviate the externalities associated with cross-border worker flow, reinforces, and increases the functional specialisation of each side of the metropolis and therefore transport need. This paradox will be illustrated through the cross-border development of the tram des Nations.

4.1.1 Tram des Nations : a cross-border infrastructure

Since the first PA, a structuring transport axe was imagined connecting the centre of Geneva to the municipality of Ferney-Voltaire and Gex. This project was materialised through a tramline toward Ferney (Figure 3, in red) and a BRT connecting Geneva to Gex (Figure 3, in bleu), both passing through Grand-Saconnex in Switzerland. The project's total budget is 40 million euros, with 35% funded by the Swiss Confederation and 11% by the French state. On the Swiss side, the remaining

54% on the Swiss side are covered by the canton and municipality. While no formal urban densification is tied to the Swiss project, Confederation financing requires a coherent development of transport and urbanisation. On the French side, the tram project is bundled to the development of a ZAC (*Zone d'Aménagement Concerté*), in Ferney-Voltaire. To finance and manage this coordinated development, the inter-communality of Pays de Gex established), a private law structure, *Société Publique Locale* (SPL), owned 60% by Pays de Gex Agglomeration and 40% by the Ain Department and local municipalities. Thus, Ferney-Voltaire, where the new development is located, holds a mere 5% representation in the SPL. This structure oversees the tram project and Ferney Innovation ZAC, with competencies in urban planning, property management, and socio-economic development.

Figure 3. Tram des Nation, author's production, 2021. Sources: Participer.ge.ch

Figure 4. Posters, 2022. Sources: Association Poterie Ripost

4.1.2 La ZAC de Ferney-Voltaire: Specialisation against sustainability

The municipally of Ferney-Voltaire, located next to the Franco-Swiss border, has nearly 11,000 residents. Like many in the Pays de Gex, its population has doubled in the past 25 years, with almost half its workforce commuting to Geneva. The ZAC Ferney innovation project, launched in 2012 and managed by *SPL Terrinov* since 2016, is located on the last agricultural land in the commune. Combine with the tramline expansion, it includes a mixed-use development on a 64-hectare plot, featuring 195,000 square meters of economic activity space, 63,000 square meters of leisure and cultural amenities, and 2,500 housing units (Figure 5).

Opposition to the project emerged after Ferney-Voltaire's Municipality issued the building permit in 2020. The *Poterie Riposte* association, formed by residents, mobilized against the commercial zone development within the ZAC, known as the Poterie zone. They initiated legal action, organised community protests, and raised awareness campaigns. Collaborating with local and Geneva-based architects, they also proposed an alternative project. Currently, the Poterie commercial centre project is on hold following the withdrawal of the *Altarea Cogedim group*, tasked with the development, leaving the ZAC's future uncertain. Poterie Riposte represents one of the first instances of citizen mobilisation against current urban development policies in the region, viewing the commercial centre as emblematic of an unsustainable development model geared toward Geneva. While the contestations' focus is on the commercial centre for legal reasons, the association opposes the entire ZAC project, challenging its form, function, and impact on the city's existing structure.

Opposition to the project centres on several concerns. Firstly, residents are alarmed by the planned new commercial zone adjacent to the border, designed with direct access to the customs office, expected to cause a significant increase in traffic and pollution between Ferney and Geneva, as evidenced by the planned 1,600 parking spaces. The association points out the incoherence of developing this new car-oriented specialised zone with the simultaneous significant investment in public transport. Secondly, they fear the competition this facility will pose to local activities in the city centre and the already fragile local social and economic fabric in the cross-border context,

encapsulated in the slogan ‘city-centre or commercial centre.’ (Figure 4). Additionally, discontent arises from the design of the new tramline, which diverges after the border, prioritizing access to future residential zones over Ferney’s city centre. Finally, the *international city of knowledge*, encompassing approximately 130,000 square meters of office and tertiary activity development, intended to promote employment on the French side, is seen as the project's adjustable variable according to SPL *Terrinov* and will be realised last.

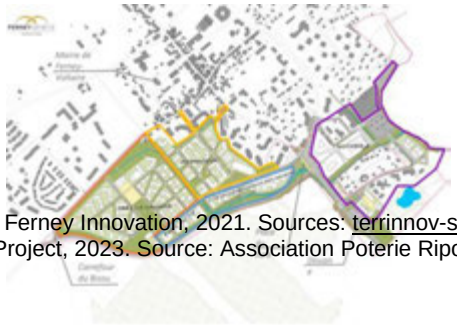


Figure 6. Left (a): ZAC Ferney Innovation, 2021. Sources: terrinnov-spl.fr, Right (b,c): Counter-Project, 2023. Source: Association Poterie Riposte

Figure 5. ZAC Ferney Innovation, 2021. Sources: terrinnov-spl.fr

For the inhabitants of Ferney, this comfort the idea of the creation of a « Ville-dortoir » aimed solely at hosting Geneva's workforce (Figure 4). The current design reinforces the perception of the project autarkic mixed zone, composed of « mono-functional fragments directed towards and for Geneva. », disconnected from Ferney's existing fabric and sacrificing local quality of life for metropolitan functionality. The association's counter project aims to reduce total square footage and prioritise space for local economic activities and workshops, alongside enhancing connectivity to the existing city centre (Figure 6.b.c). While its feasibility is questioned, the proposal underscores the importance of considering site-specific functional complementarity and diversity in the asymmetric cross-border

context.

4.1.3 Grand-Saconnex : metropolitan infrastructure vs local implications

On the Canton de Genève side, the tramline development has stirred tensions among the local population. Following the Municipality of Grand-Saconnex's approval of the project, a committee of residents, along with other local and cantonal associations, gathered enough signatures to organise a referendum opposing the tramline extension. Put to communal popular vote in 2022, the construction was narrowly approved by the Grand-Saconnex population, with 51.54% of the votes.

Figure 7. Left (a): traffic map, 2022. Right (b) : Poster, 2022. Source : enjeux.sauvegarde-geneve.ch

The referendum committee presented several arguments against the tram's implementation. Firstly, they raised concerns about the loss of municipal lands covered with a tree canopy for tram infrastructure construction. Secondly, they highlighted the transformation of the mobility scheme required for the tram's implementation and the resulting nuisances in the municipality. The tram's implantation and express cycle lanes necessitate the closure of a part of the main axis leading to Geneva, with the Tunnel des Nations constructed to redirect car traffic. However, with 22,000 vehicles crossing the municipality daily and a projected modal shift ranging from 1,300 to 6,000 vehicles per day, and the tunnel capacity of 20,000 vehicle per day, there are concerns about infrastructure saturation leading to parallel routes through neighborhoods (Figure 7b). Additionally, the opponents to the project perceives the cycle path design prioritizing major axes as detrimental to the local network. Finally, the refusal of tram development is also attributed to its perceived 'Gigantism' or the metropolitan scale of the infrastructure, reaching up to 35 meters in width. Furthermore, although not legally linked, the Confederation's financing of the tram project implies an implicit commitment from municipalities to densify around the infrastructure, which the inhabitants fear (Figure 7a). In this context, despite acknowledging the municipality's status as a 'transit city,' residents feel sacrificed to the metropolitan scale and to the preservation of the city-centre's quality.

The conflicts surrounding the development of the Nations tram highlight the paradoxes inherent in implementing a TOD-like project in an asymmetrical metropolis characterised by functional integration through specialisation. The specialisation paradox leads to escalating flows and the overflow of new infrastructure capacities, creating conflicting rationales between metropolitan and local scales. While the tram project aims to enhance local accessibility through decarbonised modes, it is perceived by both Swiss and French populations as sacrificing local quality of life in the periphery for the benefit of the centre. Consequently, the current project exacerbates divides between local and regional areas and between centre and periphery, with significant disparities on each side of the border.

4.2 Radio-centric paradox: between interdependency and autonomy.

The second paradox concerns the border relationship, formal development of the model, and functional interplay between territories, balancing interdependence, and autonomy. In Greater Geneva, the TOD model has historically taken a radio-centric form, characterised by radial connections from Geneva to residential centres in France, following major flows between employment and residential poles.

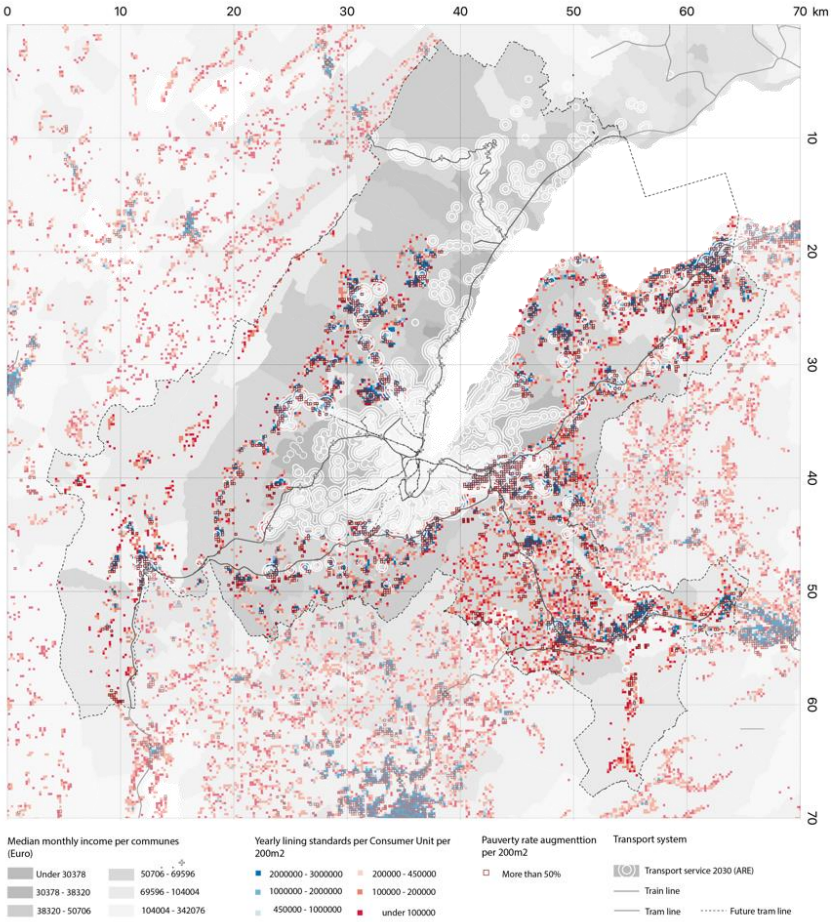
The map (Figure 8) illustrates the projected public transport service quality by the *Office fédéral de l'aménagement du territoire (LAT)* for 2030, based on planned transport axes. Implementing the radio-centric model is expected to provide good service to 54.6% of the agglomeration's population, leaving 45.4% unaffected. As the model radiates from the centre, service diminishes towards the French periphery, with only 13.7% expected to have good service and 22.3% with average service. Consequently, 77.7% of the French population will have poor or no public transport service. Logically, the bordering communes, with a high proportion of cross-border workers, are both the wealthiest and best served. However, there is significant disparity in living standards within the French part of the agglomeration. Core cities and villages, well-served areas, also have the highest living standards but are experiencing the fastest increase in poverty due to rising costs driven by cross-border worker concentration. This exacerbates the gap between French-based salaries and local living standards, correlating selective public transport connectivity with wealth disparity and poverty. Consequently, there's a structural inequality between connected and unconnected areas while at the same time increasing socio-spatial differentiation within the connected poles.

The TOD model, as advocated by Bertolini (1999), prioritises regional accessibility to employment hubs, which is perceived as inherently beneficial for supporting regional functional integration between poles. However, in the asymmetrical context of Greater Geneva, the disparity between Swiss and French salaries creates a polarisation of employment attractiveness towards Geneva. This reinforces the integration of territories and the dependence of French areas on Geneva. Consequently,

Figure 8. Living standards and connectivity. Author's production, 2024. Sources: INSEE-OST-ge.ch

French municipalities struggle to fill public service positions, leading to a decline in residents' quality of life. Moreover, the proximity to Geneva and cross-border purchasing power have led to increased living costs and rents, widening the social gap between Swiss and French employees.

Therefore, a paradox arises from the TOD model's selective nature and its formal implementation in a mono-oriented, radio-centric fashion, and the pursuit of territorial cohesion. In Greater Geneva, this



implementation, focused on connectivity via sustainable modes, results in the centre's saturation while deepening dependency and vulnerability in neighboring French territories. To illustrate this paradox, two conflicting projects will be discussed: the Autoroute du Chablais and the Mobility pricing project around Geneva. Although they are independent national projects, they underscore the two facets of the same paradox in the centre-periphery relationship within an asymmetrical metropolitan context.

4.2.1 The Chablais Highway: French Territories Seeking Autonomy.

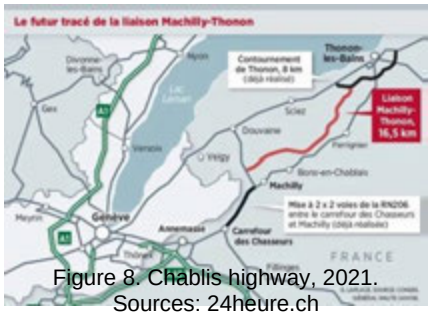


Figure 8. Chablis highway, 2021. Sources: 24heure.ch

The first project under discussion is the proposed highway connection from Thonon-les-Bains to Machilly in the French Chablais region. This highway segment aims to link existing road networks, providing an eastern bypass around Geneva (Figure 8). Initially conceived as part of the *Désenclavement du Chablais* policies since 1999, the project encountered various hurdles before being revived as an independent highway concession in 2010. In 2019, the French government declared the highway as a public utility. However, this decision sparked opposition from the cities of Geneva and Carouge, along with the French Green Party (EELV), leading to appeals filed with the French *Conseil d'Etat*.

Despite the rejection of these appeals in 2021, local authorities, favoring the project, viewed them as Swiss interference in French national territory. This conflict between Geneva and Carouge and French municipalities has escalated, resulting in the exclusion of the highway project from the 2021 PA4 plan, despite being closer to realisation than ever before.

Beyond the institutional dispute, the proposed highway project from Thonon-les-Bains to Machilly has spurred involvement from citizen associations, creating a complex debate. On one side, the association *OUI au désenclavement du Chablais* advocates for the highway's construction, while groups like *Action abandon autoroute* (3AC) oppose it. Despite appeals and demonstrations against the project, the French Constitutional Council approved it in July 2023.

The project's opponents denounce the infrastructure for its local impact, including the downgrading of agricultural land and the destruction of ecologically valuable environments. They also point out the increase in traffic resulting from the creation of this infrastructure, labeled as a 'car vacuum', and its impact on both health and climate. Conversely, residents see the highway as a solution to redirect heavy goods traffic, going towards the Arve Valley, away from village centres, benefiting community health and quality of life. On the regional scale, organisations opposing the project, as well as the Geneva Canton's authorities, argue that this new infrastructure competes with the recent connection of Thonon-les-Bains, Perrignier and Machilly to Geneva as part of the *Léman Express* network. However, these two projects do not address the same demand. For the French municipalities and local associations, supporting the project is a means to reconnect to their national territory and reduce the unique influence towards Geneva, which they hold responsible for rent increases, labor shortages, and dormitory towns development. The *OUI au désenclavement du Chablais* association supports the highway as well as all multimodal projects to develop new orientations for the region and beak away from Geneva's mono-attraction. Similar discourses reflect the municipalities' desire to create a more sustainable local economy by emancipating themselves from Geneva. However, regarding the highway associations opposing the project argue that, as a private concession despite significant public participation, the highway will support a financially selective opening of the region (Figure 9).

Figure 9: Le Chablais libéré sous caution, 2023. Sources: Le Faucigny

Thus, beyond the respective perspectives and divisions generated by this infrastructure, the project highlights functional and symbolic issues for the French regions that still need to be addressed and may even be intensified by the current radio-centric development project.

4.2.3 Urban toll: protecting the city from the metropolis.

The second project discussed here involves the Canton of Geneva's urban toll initiative, initially conceived as a response to a Swiss Confederation pilot project call in 2014. Selected for federal co-financing and legal exemptions, the project evolved into a mobility pricing strategy. The significant difference lies in the intention to reduce mobility, which no longer applies solely to individual motorised modes but to all forms of mobility during peak hours. This involves combining an entry fee for cars, applicable at all hours but higher during off-peak hours, with a discounted pricing scheme for public transport during off-peak hours. The latest studies published by the Canton de Genève

demonstrating the viability and progress of the project's deliberation. However, the future of this project remains uncertain due to recent federal political changes.

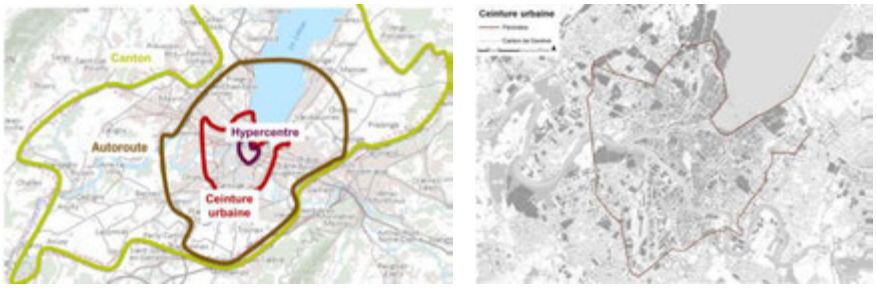


Figure 10. Left(a) four possible petimetres of the urban toll,2023 Source : Grand conseil de la République et du canton de Genève. Right : Urban toll cordon, 2022. Source : Tribune de Genève

The project entails a cordoned toll system, with fees linked to both entry and exit from the urban core. Four perimeter options were considered, with the chosen option being at the Geneva urban belt level, selected for technical reasons (Figure 10 a.b). Nevertheless, as emphasised by Geneva's Transport Office, the aim is not to restrict the entry of workers essential for Geneva's economy but to limit non-constrained mobility. The report on the matter even specifies that this scheme should not affect the economic attractiveness of the urban core[4]. Hence, the project seeks to alleviate road congestion and public transportation strain without compromising economic attractiveness. By incentivizing temporal shifting of travel demand, it addresses the centre's infrastructure saturation. At the same time, it is clearly targeted at addressing residents growing discontent with network congestion and associated nuisances. This is demonstrated by the intention to provide a discount for toll use exclusively to residents rather than frequent users as initially proposed.

The Geneva branch of the Swiss populist party (UDC) vehemently opposes the project, labeling it as discriminatory against the periphery and an infringement on the right to access the city centre. They argue that this device will contribute to the deterioration of living quality in the periphery and its construction[5]. Regarding public opinion, consultations indicate that the population is slightly favorable to the project. However, the study was conducted within a panel of French public transport user much higher than the current percentage of those with have access to public transportation[6].

This project signifies a re-enclosure of the city centre, admittedly oriented towards car mobility, but indicative of a re-division of metropolitan issues between the periphery and the centre. By implementing the urban toll and radio-centric TOD model, the centre would be able to insulate itself from metropolitan externalities while sustaining economic growth. However, in the cross-border context, such a toll system will affect Swiss-based and French-based populations differently, particularly since public transport discounts have little chance to extend to the French side. These risks exacerbating social-spatial selectivity between metropolitan populations earning Swiss and French base salaries, while further delineating the division between those well-connected by public transport and the rest of the agglomeration.

[4] Rapport du Conseil d État au Grand Conseil sur la tarification de la mobilité, Grand conseil de la République et du canton de Genève, Febuary 2023
[5] NON au péage urbain qui veut mettre Genève sous cloche!, UDC Genève, December 2022. Available at: https://www.udc-ge.ch/publication/non-au-peage-urbain-qui-veut-mettre-geneve-sous-cloche/
[6] Péage urbain à Genève: enquête auprès de la population, OCT, 2017

The debates sparked by these two projects illustrate the paradox of implementing the TOD model in a radio-centric manner. While new connections are being established from the center to the periphery, they create spatial differentiation and increase dependencies, leading to a desire for autonomy in the periphery and fortification of the center. Whether aimed at preserving areas from metropolitan externalities while maximizing economic opportunities, or mitigating socio-spatial inequities, these movements contribute to weakening territorial cohesion.

4.3 Development paradox. Between preservation and growth.

The final paradox emerges from the differing capacities for implementing the TOD model on each side of the border, shaped by distinct democratic and legal systems. These differences directly influence the development strategies of each national territory. To grasp the present context, it's crucial to dive into the historical morphological evolution of the metropolitan area. The development of the Geneva metropolitan area followed a typical process of "rurbanisation," with unique consequences due to the border and early land protection policies by the Canton of Geneva and the Confederation. As early as the 1950s, the Canton enacted laws to safeguard its rural landscape, reinforced by LAT in 1979 and the first sectoral plan for agricultural land use (SDA). With this plan, the Swiss Confederation defined a minimum area of quality agricultural land, which each Canton must preserve. These measures limited urban expansion within Geneva, leading to the export of growth to French territories. Meanwhile, French municipalities, autonomous in urban planning, were encouraged to host a growing number of cross-border populations by financial compensation. The current metropolitan structure is thus that of a core city surrounded by a rural green belt and a periphery with a predominantly rural imaginary, along with a French periphery more distant from the city centre but more assertive in its urban imagery. Today, a key aim of the Greater Geneva project is to address this growth imbalance and its associated externalities.

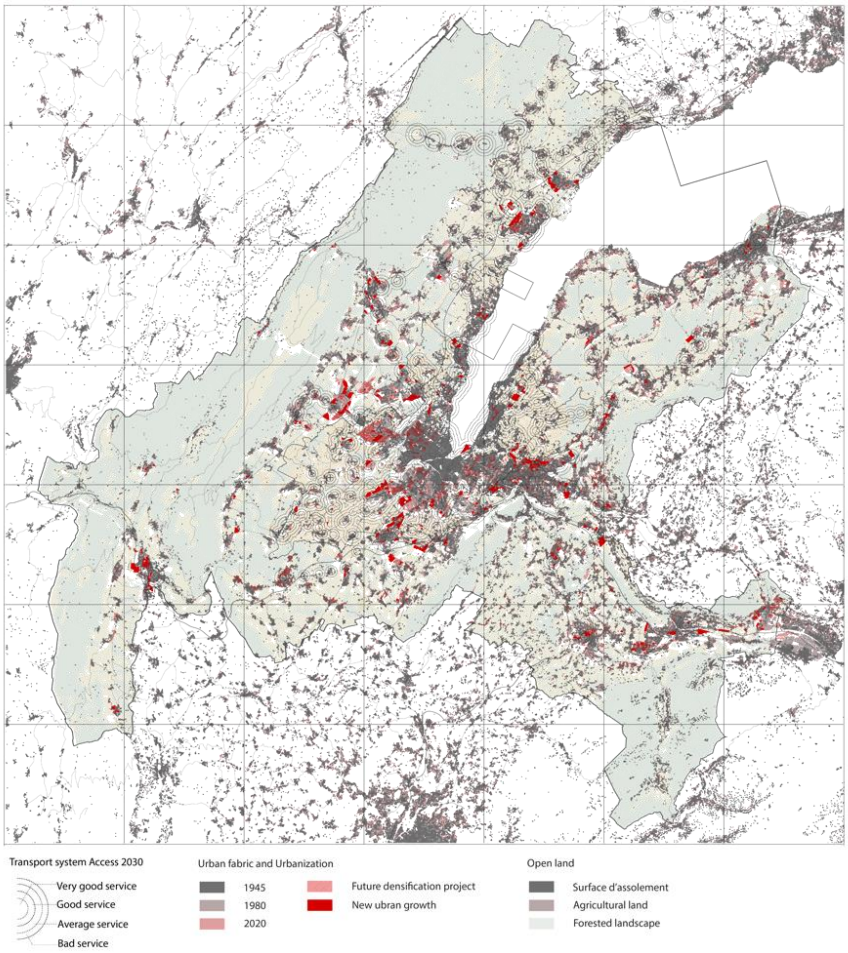


Figure 11. Development and preservation. Author's production, 2024. Sources: SITG

The map illustrates the evolution of built-up areas on both sides of the border from 1945 to 2020, incorporating future development zones outlined in the PA4. The map clearly illustrates the significant role played by densification in the French periphery since the 1950s, mainly around village nodes, forming multiple poles with little hierarchy. The cross-border vision clearly aims to evenly distribute new population growth between the Swiss and French sides, with developments oriented towards future public transport-serviced areas. However, most projects are on existing built-up areas in Switzerland and open spaces in France.

TOD model is an organisational framework of urban growth towards the periphery. Combine with green development, its effectiveness relies on developing compact urbanisation around key transport nodes along structuring axes (Cervero et Sullivan, 2011). This approach fosters new development over existing urban fabric. However, the idea that urbanisation should adapt to transportation is increasingly challenging to uphold in a context where ecological, normative, or ideological awareness tends to make ex-nihilo urbanisation less acceptable.

The limitations of this development model are exacerbated in a border context, where territories differ in their capacity to develop or preserve open spaces. The paradox lies in implementing a model centred on organizing new transport axes to redirect urbanisation, aiming for territorial rebalancing within an asymmetrical morphological, legal, and institutional framework, ultimately reinforcing development disparities on both sides of the border.

Bernex- Transport without urbanity?

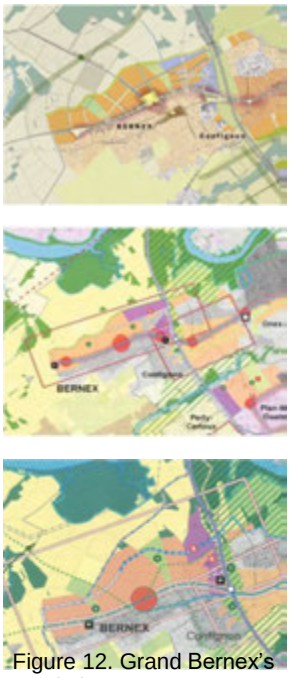


Figure 12. Grand Bernex's evolution, 2015. Source : Le Grand projet de Bernex Nord et Est, Les Verts Genève.

Bernex is a municipality of the Geneva Canton, located west of the city centre, with approximately 10,000 inhabitants. The concept of connecting the municipality of Bernex to Geneva via a tramline was initially introduced in the Canton of Geneva's master plan of 2001. The urban development initiative for Bernex emerged in the Plan Guide of 2010, subsequently confirmed as a priority project. in *Plan Directeur* of 2013 with a significantly wider footprint (Figure 12). The project aimed to establish a nearly continuous corridor of urban expansion along the tramline from Geneva's centre to the outskirts of Bernex. This entailed developing the northern part of the municipality, primarily consisting of agricultural land. The Canton envisioned the new development with intermediate to high density. Named *Grand Bernex*, the plan encompassed 150 hectares divided into two zones: Bernex-Nord and Bernex-Est. The proposed development aimed to accommodate 12,000 new residents and create 5,000 jobs by 2030, doubling the municipality's current population. Concurrently, the tramway extension, co-financed by the Confederation, commenced with the initial extension to the municipality's entrance, completed in 2011 and reached the end of the commune ten years later. As early as 2013, certain municipalities, the Green Party of Geneva, and the ASBEC (Association Qualité de vie à Bernex et Confignon) initiated opposition against the project.

The opponent of the Green Party expresses the inconsistency of attempting to transform this end-of-line municipality into a 'regional centre', envisioned to lead to suburbanisation [7]. Despite the acknowledging the need to house new populations in the Canton, the association formally opposes the excessive reclassification of agricultural land, highlighting the inherent tension between preserving open spaces and increasing density. Additionally, they criticise the municipality's car-centric development plan, particularly the construction of a new 2x2 lane road to Geneva despite the availability of direct tram access to new neighborhoods.

The approval of Geneva's *Plan Directeur* by the Swiss Confederation in 2015 came with reservations, requiring the canton to reduce the projected impact on agricultural

[7] LE GRAND PROJET DE BERNEX NORD / EST, La transformation des territoires bernésiens entre ville et campagne. Vision et orientation d aménagement. Les Vert Genève, February 2015.

land. Consequently, the footprint of planned developments, including the *Grand Bernex* project, had to be diminished. This led to a reduction in the project's size and a postponement of the Bernex-Nord development. While the reduction in parcel size occurred, the population objectives remained the same, necessitating increased density. Current plans involve the construction of 2,800 new housing units and 2,550 jobs in the Bernex-Est and Vailly sectors, with the municipality committed to completing an initial phase of 1,600 housing units and 1,600 jobs by 2030. The remaining densification is expected to be pursued after 2030 without a specific timeline. Ultimately, Bernex-Nord is still projected to accommodate 5,700 housing units and 5,700 jobs, although no timeframe has been set for this densification due to current feasibility issues.

Figure 13. First development phase, 2024.
Source: ge.ch

For the first development phase (Figure 13), every parcel for which the commune publishes a localised neighborhood plan, local associations oppose through referendums. The oppositions highlight concerns about transforming agricultural or natural land into urban development zones, objections to perceived excessive density, and criticisms of the quality of new neighborhoods. The last referendum initiated by the Association Communale Bernésienne (ACB) opposes the development of Bernex-Vailly, characterizing it as a 'hyper-urban' project in a peri-urban context. Central to the criticism are the proposed density and building height, with the suggested limit of 29 meters seen as 'destroying the villages quality'. This opposition underscores the clash between the entrenched village imagery within the municipality and the proposed urban development, despite an acknowledgment of the commune's peri-urban nature.

The current situation in Bernex illustrates a challenge where a cul-de-sac tram infrastructure intended to stimulate urbanisation faces obstacles due to the imperative to preserve agricultural land. Contribute to housing construction delays in the Canton of Geneva, this problematic emphasises the imbalanced development between both sides of the agglomeration. The case highlights the complexity of steering urbanisation through large-scale projects in the Swiss context.

Saint-Genis-Pouilly - Urbanity without transport

Saint-Genis-Pouilly is a municipality of the Pays de Gex located on the French side of the agglomeration bordering Switzerland. Since the institution of the first PA, this town, with a population of 12,000 and the triangle it forms with the municipalities of Thoiry (6,000 inhabitants) and Sergy (2,500 inhabitants), was identified as a regional centre earmarked for the development of a structuring public transportation axe toward Geneva. In 2012, with the second PA2, the GLCT reduced the project by abandoning Thoiry and a new terminus in Saint-Genis (Figure 14). Concurrently, already deferred to a horizon of 2050 in PA2, the line's rehabilitation intended to connect the municipalities of Pays de Gex disappears in the third PA. Co-funded by the Swiss Confederation, the Swiss portion of the tramway line connecting the Geneva train station to CERN

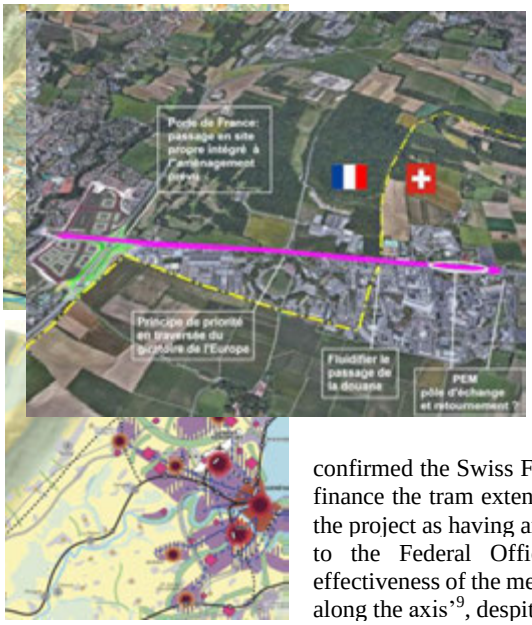


Figure 14. Top(a): PA1 extract, 2007. Bottom(b): PA2 (extract), 2021. Source : GrandGenève.org

via the Swiss municipality of Meyrin was inaugurated in sections between 2007 and 2011. As of today, the line terminates at CERN, the European research hub located 300m from the border.

In 2015, during discussions on co-financing agglomeration measures, the Swiss Confederation downgraded the tram section intended to connect CERN to the centre of Saint-Genis-Pouilly to a non-priority project. As a result, the Pays de Gex intermunicipality removed the project from its spatial development plan. Furthermore, the agreements regarding the third-generation urban development project confirmed the Swiss Federal Council's definitive decision not to co-finance the tram extension. This decision was justified by assessing the project as having an 'insufficient degree of maturity'[8]. According to the Federal Office for Spatial Development (ARE), 'the effectiveness of the measure is low due to insufficient current density along the axis'[9], despite this corridor being subject to a *contrat d'axe* since 2012. Whit the *contrat d'axe*, in exchange of the financing of the infrastructure by the Ain Department, the inter-communality of the Pays de Gex and the municipality of St-Genis-Pouilly commit to focus urban growth within a radius of 500 meters around tram stops. Hence, in addition to densification projects in the urban core, an operation involving the construction of 1,400 housing units and associated public facilities just after the customs checkpoint is currently under construction (Figure 15).

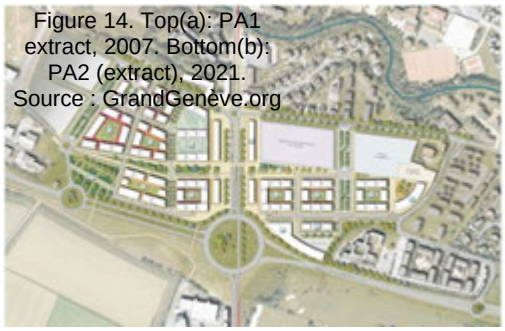


Figure 15. urban extension around the tramway, 2012. Source : RR&A

In 2015, a citizen petition led by the Franco-Swiss cross-border association, the *Groupement transfrontalier Européen*, in collaboration with the municipality of Saint-Genis-Pouilly, garnered over 3,500 signatures to contest the abandonment of the tramway project and advocate for its necessity to improve the quality of life for the city's residents. In response to this mobilisation, the Conseil Departmental de l'Ain, along with the municipalities, committed to financing the 2.1-kilometer extension of the tramline between CERN and the centre of Saint-Genis-Pouilly. However, Geneva was left responsible for completing the missing 300 meters on the Swiss side. After being repeatedly postponed due to political discord, lack of funding, and Geneva Canton's prioritisation of

[8] Accord sur les prestations entre la confédération suisse, le canton de Genève et le Canton de Vaud concernant le projet d'agglomération Grand Genève, 2e génération 2011-2012, 2012. (Authors' translation)

[9] *Ibidem*

projects on the other side of Pays de Gex, which were co-financed by the Confederation, the project was eventually scaled down. In 2019, France and Swiss representatives signed a new partnership, in which the Ain Department along with the Pays de Gex inter-communality committed to constructing a BRT connecting the border to the centre of Saint-Genis (Figure 16). Its completion is scheduled for 2026. The primary reason for this decision is budgetary since the implementation of the BRT is approximately 2.8 times less costly than the tram. Moreover, the former can be implemented with or without the Swiss connection, which was not the case with the tram. However, the Geneva Canton has committed to creating dedicated bus lanes on its side of the border. Therefore, a BRT will be delayed compared to the ongoing development, resulting in a transit rupture between Geneva and Saint-Genis.

Figure 16. BRT project, 2023. Source : Pays de Gex Agglo

The rejection of the tramway extension toward France in favor of prioritizing Switzerland's national territory and international connectivity symbolises a clear reluctance to meet cross-border metropolis needs, both from the Confederation and the Canton of Geneva, while still benefiting from its international advantages.

These examples reveal how transport and urbanisation strategies differ across the border. Cross-border cooperation fails to eliminate inequalities of treatment between national territories, with urbanisation subordinated to transportation on the Swiss side, and transportation subordinated to development on the French side. This disparity is further reinforced by disparities in citizen's capacity and institutional differences. However, in both cases the growth-oriented corridor vision, which neglects historical, morphological, and perspective contexts, shows it limits with the growing awareness toward land preservation.

Conclusion

The implementation of the current radio-centric TOD regional vision in Great Geneva reveals paradoxes that outline internal tensions within the asymmetrical cross-border metropolis between territorial cohesion discourse and metropolisation processes.

The projects discussed here illustrate discrepancies between political discourse, cross-border cooperation intentions, national priorities, and local reception. They underscore how technical and economic rationales behind the regional vision tends to overlook the bi-national and local realities, leading to the re-emergence of divides between rural and urban imaginaries, centre and periphery, and national territories, in the interplay between classic metropolitan divisions and transborder asymmetry.

These projects and their contestations demonstrate the entanglement of scales and the complex relationship between involved actors. Beyond institutional and socioeconomic asymmetry, national policies and regulatory systems significantly impact metropolitan development. Moreover, differences in democratic structures and planning expertise question the cohesive implementation of the model. Hence, conflicting political interests manifest in the metropolis in addition to different capacities among actors, leading to differences in treatment.

But more fundamentally, the paradoxes that emerge between connectivity and specialisation, autonomy and interdependence, and preservation and growth reflect conflicting ideals about the metropolis' future. They challenge the implicit hierarchical relationships and roles assigned to different metropolitan entities by the current development model. While TOD offers regional accessibility, intended to connect the different part of the agglomeration though sustainable modes of transport, its implementation supports classical metropolisation processes, growth through functional

specialization, spatial differentiation through selectivity and hierarchization. Hence, the paradoxes illustrate the role of the current radio-centric TOD model in perpetuating and even enforcing socio-spatial inequalities, rather than striving for territorial cohesion. Overcoming these paradoxes, therefore not only demand to homogenize development modalities and policies, but to address current development lack of attention to contextual dimensions and divides that are being reproduced by it.

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Track 05: Mobility

MOBILITY - Planning and change in urban mobility

Chairs:

- Benjamin Buettner, Technical University of Munich
- Patricia Lejoux, CNRS, ENTPE, Université Lyon 2
- Enrica Papa, University of Westminster, London
- Dakota McCarty, Incheon National University, South Korea

Keywords: *changes, transport modes, mobility policies, urban models, actors, South, gender, critical studies*

Our societies are currently undergoing a series of transitions: ecological, energetic and digital. This context calls for changes in mobility behaviours as well as in transport and urban planning policies. The aim of this track is to question these changes. What changes have already occurred? What changes are coming? This track welcomes contributions on ways of conceptualising, theorising, and empirically examining these changes in different geographical contexts.

Topics to be addressed include, for example:

- Changes in transport modes: what changes in car ownership and use (young people's relationship with cars, peak-car, post-car world, the future of electrification and autonomous vehicles, etc.)? Has the cycling revolution happened (where, how, for whom, etc.)? Will the pedestrian revolution happen (where, how, for whom, etc.)? What is the future of shared mobility?
- Changes in transport and urban planning policies: in recent years, new urban models have been proposed to promote sustainable mobility (Superblocks, the low traffic neighbourhood, 15-minute city, Car-free city, tactical urbanism, etc.). What did that change? What are their limits?
- Changes in mobility policies' design and implementation: new players have emerged in the mobility sector (Uber, Lime, etc.). What changes did they introduce to sustainable mobility management? Are sustainable mobility policies still designed, produced and managed in a top-down fashion? What role for bottom-up actors (diverse social actors, groups and movements) play in shaping sustainable mobility policies?
- Changes in theoretical and methodological approaches: new theoretical approaches have been developed, namely gender studies, global south studies, postcolonial studies, etc. What does it change when we study sustainable mobility from a gender perspective? From a Southern perspective? What are the benefits and limitations of

critical transport studies? What new methodological approaches are implemented to study mobilities?

Deciphering the Scaling Laws and Spatial Structure in Urban Micro-mobility: Empirical Evidence from Bike-Sharing in Shanghai

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Abstract
Micro-mobility, including bicycles and other low-speed vehicles, significantly enhances urban mobility and provides a sustainable alternative to traditional transport modes. Despite extensive research on the universal laws in urban mobility and its impacts on urban growth, the empirical distribution and allometric scaling phenomenon of micro-mobility like bike-sharing remain poorly understood. This study delves into the scaling laws and spatial dynamics specific to micro-mobility using bike-sharing data from Shanghai. The number of cycling visitation to any location in the city is inversely related to the square of the cycling distance multiplied by the frequency. This scaling relationship is controlled by a parameter that describes the attractiveness of different locations in the city for cycling. It is noteworthy that the size distribution of the spatial clusters, as determined by spatial clustering analysis of the attractiveness, conforms to Ziff's law. This implies that the spatial structure underlying the cycling is a highly ordered, hierarchical system, which coincides with the central place theory. This study provides a framework that can effectively predict the distribution of micro-mobility within a city, which can help to understand and utilize the dynamics of complex urban systems in order to promote more sustainable urban mobility solutions.

Keywords: Micro-mobility; bike visitation; scaling laws; spatial clusters; Zipf's law

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Introduction

The burgeoning field of micro-mobility has emerged as a critical component in addressing the complexities of urban transportation and sustainability (Reck et al., 2022, Abduljabbar et al., 2021, Madapur et al., 2020). As cities grapple with escalating traffic congestion and environmental concerns, micro-mobility offers an innovative solution by promoting bicycles and other lightweight, low-speed vehicles as viable alternatives to traditional motorized transport (Abduljabbar et al., 2021, Steinacker et al., 2022, Diao et al., 2021). This shift not only promises to enhance urban mobility but also aligns with broader sustainability goals by reducing carbon emissions and improving public health (Diao et al., 2021, Zhang and Mi, 2018, Abduljabbar et al., 2021). During the outbreak of the COVID-19 pandemic at the end of 2019, bike-sharing systems were responsible for more than half of urban transportation during the lockdown period (Zhu et al., 2022, Shaer et al., 2021, Hu et al., 2021, Teixeira and Lopes, 2020).

Extensive research on urban mobility has explored the scaling laws that describe how the empirical distributions of urban mobility change with various factors (Dong et al., 2022, Schlapfer et al., 2021, Song et al., 2010, Yan et al., 2013, Wang et al., 2014). For instance, it has been shown that the taxis visitation in various locations in city follows a power-law distribution (Zheng and Zhou, 2017). Studies have found that this power-law distribution is influenced by factors such as travel distance (Schlapfer et al., 2021, Zheng and Zhou, 2017, Wang et al., 2023). Similarly, research into how population density and urban form affect mobility patterns reveals that larger cities exhibit non-linear increases in travel times and transportation costs due to congestion (Louf and Barthelemy, 2014). These studies highlight the complex interdependencies between urban growth, mobility, and infrastructure. However, most existing research has focused predominantly on conventional modes of transportation, such as cars and public transit, with less attention given to micro-mobility programme like bike-sharing. Although micro-mobility offers potential sustainability benefits by reducing reliance on motorized transport, its dynamics within the urban systems remain underexplored. Furthermore, studies have investigated the relationship between the built environment and cycling activities, emphasizing how urban design factors influences cycling frequency and distance (Cervero and Duncan, 2003, Moudon et al., 2005, Cervero et al., 2009, Buehler and Dill, 2015, Xu et al., 2019). Despite the contribution of these studies, they tend to remain descriptive and static, failing to fully take into account the underlying phenomenon of allometric scaling in urban mobility (Alessandretti et al., 2020, Batty, 2013, Bettencourt, 2013). This gap highlights the need for more dynamic studies that can better explain the allometric scaling phenomenon of micro-mobility systems and their impact on urban dynamics.

This study seeks to address the gaps in understanding the specific scaling laws and spatial dynamics of urban micro-mobility, using extensive bike-sharing data from Shanghai. By analyzing cycling trajectories and usage patterns, this study confirms that cycling visitations are strongly influenced by cycling distance and frequency, exhibiting a power-law distribution, which is modulated by a parameter reflecting the attractiveness of various city locations for cycling. Notably, the size distribution of these attractiveness clusters, as determined by spatial clustering analysis, adheres to Zipf's law. This finding suggests that the spatial structure of cycling mobility in the city is highly ordered and hierarchical, aligning well with central place theory. The results underscore the importance of integrating these insights into urban planning and transportation strategies, emphasizing how micro-mobility can play a pivotal role in shaping sustainable urban growth. Ultimately, this paper advances the discourse on the universal laws of micro-mobility and contributes a novel framework for enhancing urban planning through the lens of bike-sharing data.

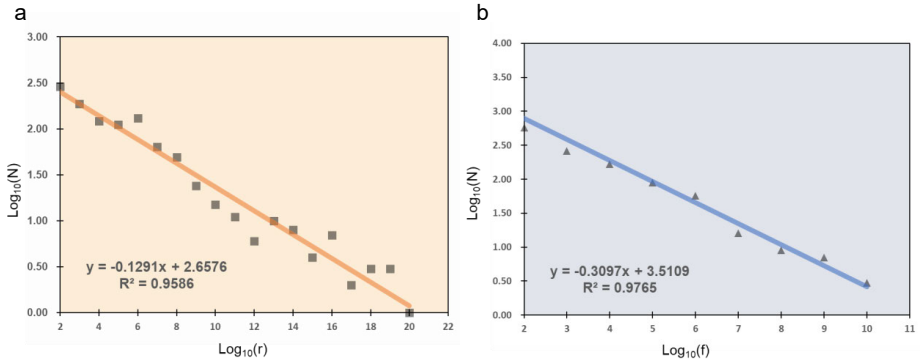
Results

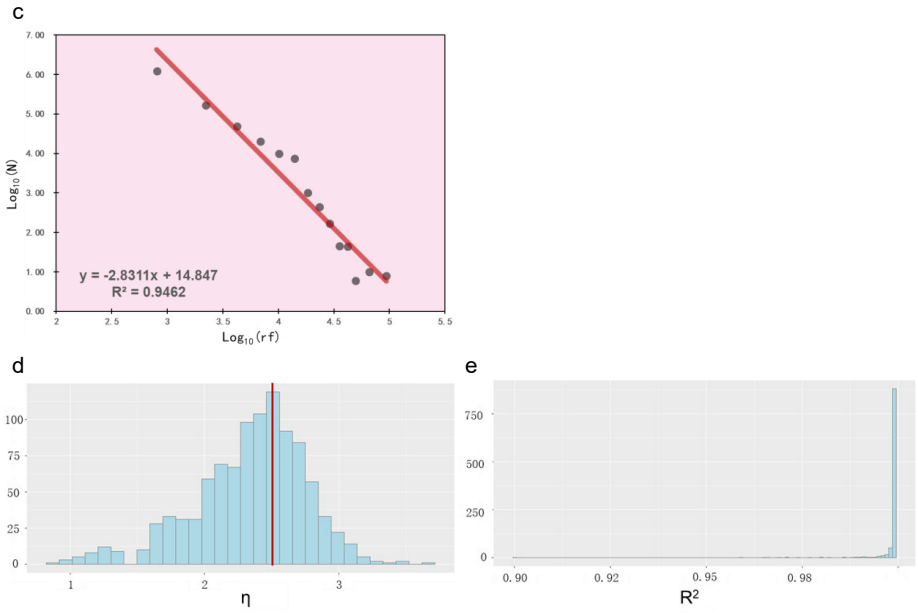
The scaling laws of Micro-mobility in Shanghai

We fitted the relationship between the number of bike visitations and the travel distance or the frequency of cyclists visiting the same location by bike in a week separately (Fig. 1a, 1b), revealing that the number of visitations N decreased proportionally with the increasing travel distance r when only considering distance. When considering the travel frequency f over a continuous week, N also decreased proportionally with increasing f for each cyclist. Similarly, when treating distance r and frequency f as a combined variable rf, the relationship between rf and N followed a power-law distribution with a fixed exponent between 2.4-2.8 (Fig. 1c, 1d). This implies that the number of bike visitations to any location in the city depends solely on the travel distance and frequency. Therefore, the relationship between the bike visitations to any location i in the city and the distance-frequency can be described as a power function (Equation 1).

$$N_i = \frac{\mu_i}{(rf)^{-\eta}} \qquad (1)$$

Since the power-law exponent η is a fixed value, the constant term μ_i determines the magnitude of bike trip attractivity at any location in the city, which can be considered as the " attractiveness" for micro-mobility. We conducted power-law fits for the top 30 grid cells with the highest bike trip attractiveness in Shanghai, and found that the power-law relationship was significant with a fitting R^2 of around 0.99 (Fig. 1e). Moreover, this scaling law of bike was not influenced by the specific spatial position of the analyzed unit, indicating its universality (Fig. 1f).

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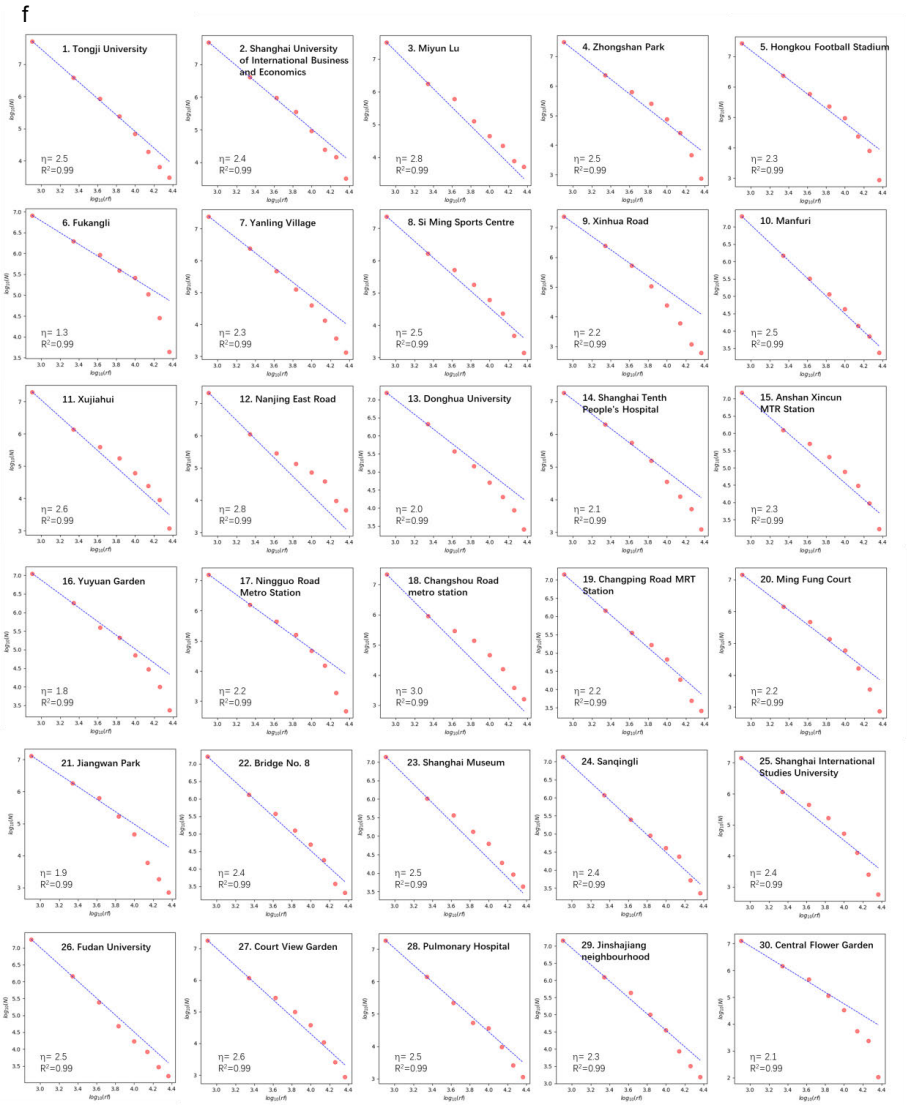

Fig.1| The scaling laws of bike-sharing visitations. a, The power-law distribution between travel distance r and bike visitations. **b**, The power-law distribution between frequency f and bike visitations. **c**, For a fixed f, the bike visitations $N_i(r, f)$, decreases with increasing r with a fixed exponent. **d**, The empirical distribution of power-law exponents η. **e**, The fitting R^2 of the distance–frequency distribution. **f**, The Distance-frequency laws of top 30 grids in Shanghai.

Attractiveness of Micro-mobility visitations and its spatial structure

As previously described, this study has derived a power-law function that indicates the bike visitation of any location in the city only depends on the constant term μ_i when the product of travel distance and frequency is constant. Therefore, the constant term μ_i in the power-law function can be considered as the attractiveness of a location for bike visitations, which

characterizes the spatial interaction of urban internal space based on bike-sharing flows (Fig. 2a).

By observing the spatial distribution characteristics of μ_i, a significant phenomenon can be observed, that is, grids with higher attractiveness tend to exhibit an agglomeration distribution, forming some larger central clusters, such as Jing'an Temple and People's Square, Shanghai. Grids with lower attractiveness tend to be clustered around these central clusters. Meanwhile, outside a certain spatial range, some smaller sub-central clusters with a larger number of grid units can be found. This spatial structure shows a strong correspondence with the central hierarchy structure in the central place theory. According to previous research on the spectrum of human flow based on mobile phone signaling data, this center-like distribution system, which is similar to a hierarchical scale, originates from the agglomeration effect of commercial and public service facilities in the city (Schlapfer et al., 2021).

To further verify the hierarchical nature of the spatial distribution of bike attractiveness, the City Clustering Algorithm (CCA) was employed to identify spatial clusters with different levels of attractiveness (Fig. 2b). The CCA involves setting a threshold for the attractiveness parameter μ and setting all values below the threshold to zero. Then, contiguous spatial locations with non-zero values are recursively merged into spatial clusters until all non-zero grid cells have been merged. Through the CCA, spatial clusters with significant differences in attractiveness can be effectively identified.

Subsequently, the size of each spatial cluster was fitted to a power-law relationship, known as Zipf's law, which is commonly used to describe the basic principle of urban size growth (Fig. 2c). The fitted results showed that the size distribution of the spatial clusters emerging from the bike flow conformed to Zipf's law, and the size-rank relationship was approximated by a power-law relationship with an exponent of 1.08. This indicates that there is a highly ordered hierarchical structure in the spatial locations towards which the bike flow is directed.

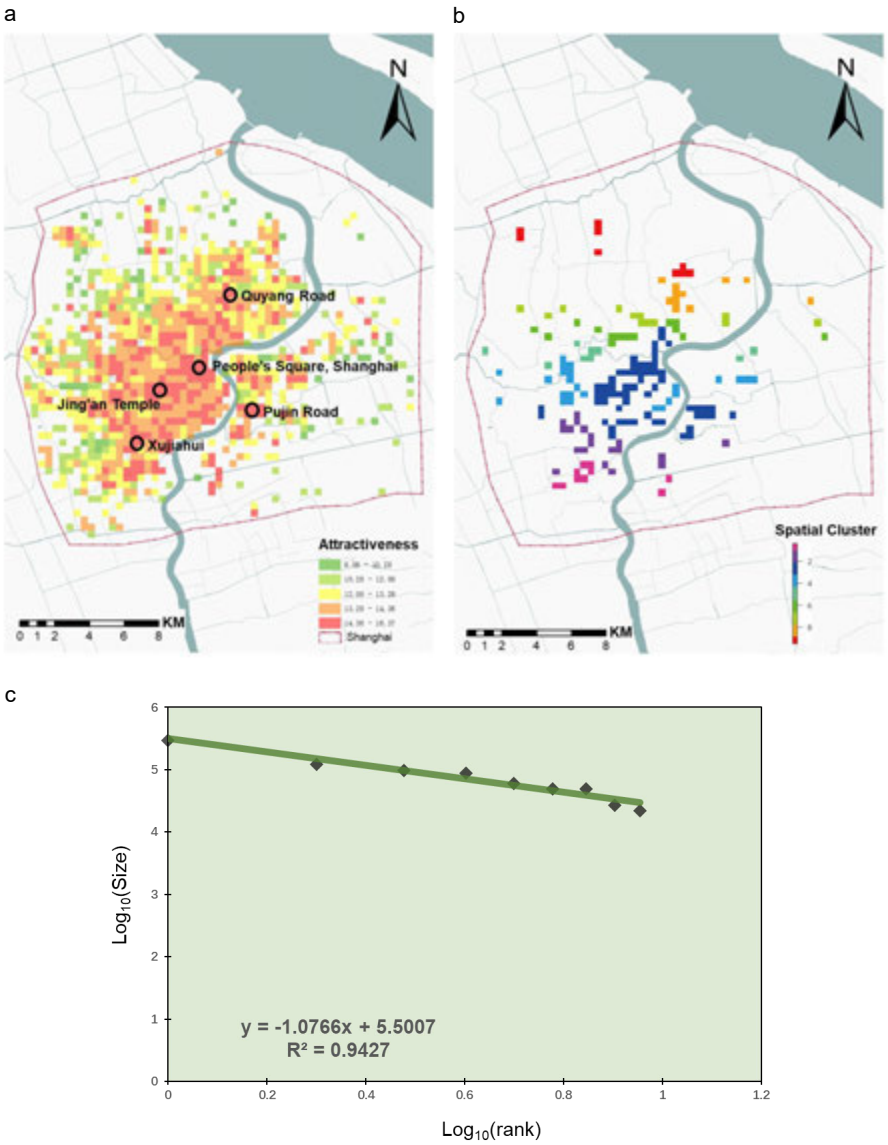

Fig.2| Spatial structure of micro-mobility attractiveness. a, Spatial distribution of the attractiveness μ_i. **b**, Spatial clusters based on City Clustering Algorithm. **c**, Rank–size distribution of the attractiveness of spatial clusters.

Discussion

The results reveal a empirical power-law distribution in the relationship between bike visitations and travel distance and frequency across varying locations in Shanghai. This finding

corroborates the existence of scaling laws in urban micro-mobility, which have been observed in other modes of transport across different urban settings (Bettencourt, 2013, Schläpfer et al., 2014, Dong et al., 2022, Schlapfer et al., 2021). Our results innovatively confirm the presence of allometric scaling phenomenon within short-distance, high-frequency micro-mobility patterns. This suggests that in urban settings, cycling activities are highly concentrated, with most cycling activities occurring over shorter, more frequent trips, while longer trips are relatively rare. The cycling power exponent discovered in this study is greater than 2, higher than the exponents for car travel found in existing studies, aligning with our understanding that micro-mobility is more sensitive to distance and frequency (Schlapfer et al., 2021). Moreover, this finding provides deep insights into the growth mechanisms of cycling networks. The presence of a power-law distribution suggests that preferential attachment and rich-get-richer effects exist within the cycling network (Fabiano L. Ribeiro, 2021). New or casual cyclists are more likely to choose cycling locations that are frequently visited, leading to disproportionate growth in activity at certain locations due to their accessible location, well-maintained facilities, or good connectivity. Over time, these areas will further consolidate their status as major cycling hubs, attracting even more cyclists. Urban planners need to consider existing cycling patterns and network effects when designing cycling infrastructure, by planning multiple attractive nodes or enhancing the interconnectivity of the entire network. Urban transport networks are dynamically evolving and require continuous monitoring and adjustment. Understanding and applying the principles of preferential attachment and rich-get-richer can assist urban planners in timely strategy adjustments to meet the changing needs of urban development and resident behavior patterns.

Furthermore, our findings indicate that the scaling phenomenon in micro-mobility is controlled by a parameter that describes the attractiveness of different locations in the city for cycling. It is noteworthy that the size distribution of the attractiveness clusters conforms to Zipf's law. This implies that the spatial structure underlying cycling mobility is a highly ordered, hierarchical system, which coincides with the central place theory. This orderliness likely stems from the varying influence of urban services and facilities provided at different sites (Schlapfer et al., 2021). At the micro-scale, typically where micro-mobility occurs, there are still multiple attractive nodes within the city that play central roles in driving mobility. These nodes may correspond to cultural facilities, commercial areas, parks, and other public spaces (M Batty, 1989, Tian et al., 2015). This pattern indicates that even at micro scales, the city structure exhibits fractal characteristics; that is, every part of the city, regardless of size, may reflect the structural features of the entire city. Such ordered spatial distribution suggests that the form and function of the city maintain consistency and continuity across different scales, with each community or neighborhood acting as a microcosm of the city structure. These findings not only enrich our understanding of the spatial structure at the micro-scale within cities but also provide valuable theoretical and empirical support for urban planning and sustainable transportation development. This insight emphasizes that even at the local scale, the design and planning of urban spaces must consider their complexity and inherent orderliness.

In conclusion, this study presents novel evidence regarding the empirical distribution and allometric growth of intra-urban micro-mobility. It is demonstrated that this short-distance, low-speed sustainable mode of transportation is subject to scaling laws, in a manner analogous to other forms of mobility. Furthermore, the study reveals the underlying spatial structure that governs the scaling law of micro-mobility. This structure is characterized by a highly ordered and hierarchical spatial configuration, influenced by factors such as "preferential attachment" and the "rich get richer" effect. This study provides urban planners and policy makers with a robust analytical framework that can effectively predict the distribution of micro-mobility

within a city. This framework can be used to understand and utilize the dynamics of complex urban systems in order to promote more sustainable, efficient, and convenient urban mobility solutions. For future research, it is essential to conduct longitudinal studies to assess the temporal stability of these scaling patterns and delve into the causative mechanisms behind the observed power-law distributions and spatial clustering. Such studies will enrich our understanding of how urban micro-mobility systems evolve over time, offering insights that could refine current urban planning and policy strategies.

This study acknowledges several limitations. First, the temporal scope of the bike-sharing data used is confined to a single week. This short duration may not adequately represent the distance-frequency distribution of cycling trips over a more extended period, potentially limiting the generalizability of the cycling visit patterns observed. Second, while this study introduces an attractiveness parameter, its mathematical and practical significance, along with its correlation with the characteristics of the built environment, requires further exploration to fully understand its implications. Lastly, as the analysis focuses solely on central city of Shanghai, the applicability of the findings to other urban settings, both within China and globally, may require additional validation.

Data

This study utilizes large-scale bike-sharing data to explore the universal laws of cycling visits across various districts within Shanghai. The focus is specifically on the city center, defined as the area within the Outer Ring Road. This region, spanning approximately 660 square kilometers, includes the historically established urban districts of Huangpu, Xuhui, Changning, Yangpu, Hongkou, Putuo, and Jing'an, as well as the Inner Outer Ring Road areas of the Pudong New Area (Fig. 3a). Shanghai's location at the eastern edge of the Yangtze River Delta provides relatively flat terrain and a climate favorable for cycling. As one of the pioneering cities in adopting bike-sharing systems, Shanghai boasts a fleet of over 1.3 million bicycles, facilitating frequent usage among a relatively stable user base.

The data utilized in this study is the Shanghai shared bike order dataset provided by Meituan. This dataset encompasses over 4.6 million shared bike orders from over one million anonymous users over the course of a single week (June 17th, 2019 to June 23rd, 2019). The data includes order number, user number, bike number, start time, start location latitude and longitude, end time, end location latitude and longitude, and other pertinent information.

The preprocessing of the bike-sharing dataset in this paper is comprised of three distinct steps (Fig. 3b). In the initial stage of the study, the area under investigation is divided into a regular grid comprising square cells of uniform dimensions, with a side length of 500 meters. A total of 2,551 grid cells were obtained within the central city of Shanghai. Subsequently, the bike-sharing trip data with spatial and temporal location information were intersected with the regular grid in ArcGIS, and the bike-sharing data with obvious anomalies were excluded. In the second step, the set of individuals who have accessed the cycling network in each grid cell is identified. For each grid cell, this paper calculates the weekly frequency of cycling visits to the grid cell within a consecutive week's time span. Concurrently, the distance traveled by cyclists is calculated based on the starting point of their journey. In the third step, the riding visits are obtained by calculating the riding distance and riding frequency, respectively. The initial distance for the riding distance grouping is set at 800 metres, with the riding visits within each distance group calculated sequentially with an equal distance bin of 300 metres.

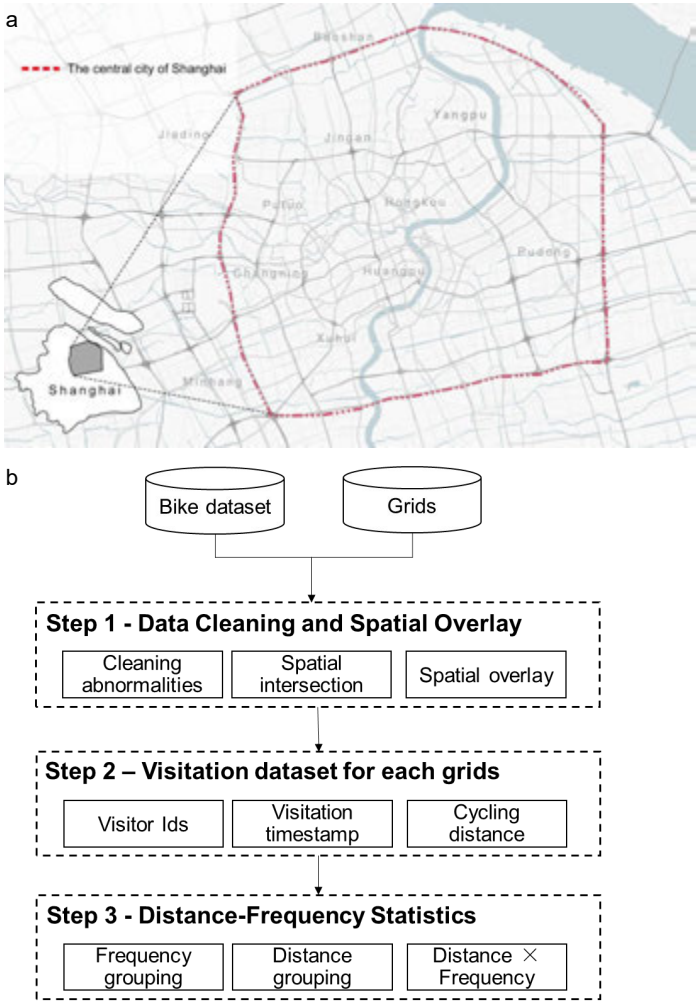

Fig.3| Data. a, Study area. **b**, Data pre-processing.

Methods

Scaling laws are known to exhibit power law distributions, which can reflect self-similar features in the process of urban scale growth or scaling of human travel behavior. This phenomenon has been observed in various studies, including those by Batty (2019), Schläpfer et al. (2021), Gong et al. (2021), Batty et al. (1989), Rybski et al. (2019), and Longley et al. (1989). In this paper, we employ the power function form of the scaling law to fit the relationship between cycling and distance and frequency. This reflects the quantitative scaling relationship between cycling visits and cycling distance and frequency. The functional form is as follows (Equation 2).

$$N = Y_0 X^{\eta} \qquad \text{(Equation 2)}$$

Where, the number of bike visitations to any location in the city, denoted by N, is a function of the travel distance, frequency, and the product of distance and frequency, which is represented by N. The parameters of the power function, denoted by Y_0 and η, influence the scaling factor, which is typically fixed (Batty, 2015, Batty et al., 2008). The coefficient, Y_0, influences the power-law relationship. The simultaneous application of logarithms to both sides of Equation 2 yield the linear functional form (Equation 3).

$$LogN = \eta LogX + logY_0 \qquad \text{(Equation 3)}$$

Where, the slope of the fitted straight line for a linear function represents the power exponent of the power function, denoted by η. Consequently, the logarithmic approach to fitting was employed in this study (Equation 3).

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Exploring the Assessment and Strategies of Street Inclusivity in Suzhou, China

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ABSTRACT

Nowadays, the concept and significant value of inclusive development are widely recognized globally, making it a fundamental principle in urban planning. Simultaneously, urban spatial development has transitioned from incremental expansion to stock renewal. From strict separation between market blocks to integrated, there is a trend of diversity and inclusion in the spatial form and functionality of streets. Guided by this principle, street design aims to accommodate people of different genders and age groups, thereby promoting more profound face-to-face communication and social activities. In the context of advocating for a fair, diverse, and inclusive urban spatial renewal, it is essential to exploring how to better accommodate various social activities, functional layouts, and the experiences of stakeholder. Creating a friendly and integrated street environment is crucial to further enhance urban inclusivity and social openness. This effort holds significant practical importance.

As one of Chinese pilot cities for urban renewal, the city of Suzhou boasts a rich array of distinctive characteristics and historical streets. This paper selected four representative types of streets in Suzhou, using multiple sources of data such as street scenes,Point of Interest(POI) and Location-Based Services (LBS). A street inclusiveness assessment system was constructed to interpret street factors from three dimensions: spatial comfort, functional convenience, and human activities.This study analyzed the correlation between indicators, and uses the Analytic Hierarchy Process (AHP) to determine indicator weights and standardized values. The assessment of inclusive scores for the four streets were calculated. For the measurement of certain indicators, the study adopted the GSAM (Grounded Segment Anything Model) to segment and recognize objects. This model has the capability to automatically segment objects in images or videos, generate high-quality labels, and produce measurement results for the factors with a single click. The total score for inclusivity assessment of the four streets is ultimately determined through a combination weighting method.

The results of street inclusive assessment indicated that: (1) "Historical Character Streets" presented good performance across various indicators.This marked them suitable for creating highly inclusive and vibrant gathering spaces. (2) The high street penetration rate and density of store facilities demonstrated the potential for inclusive vitality of "Lifestyle and Culture Streets". (3) "Modern Distinctive Streets" performed better in terms of sky openness and pedestrian friendliness,but have a lower greenery ratio. (4) "Lifestyle Landscape Streets" had a higher quality of greenery and accessibility to other parks, but they showed lower inclusion attributes towards functional formats and human activities. Correlation analysis founded that as street building enclosure increases, the proportion of cultural facilities distribution also increases accordingly, providing a wider range of cultural activities. The indicators of accessibility to park and greenery spaces revealed a positive correlation with the proportion of business facilities, indicating a preference for environmentally superior areas among commercial establishments. In terms of inclusion assessment scores, "Historical Character Streets" and "Lifestyle and Culture Streets" received higher evaluation scores , while "Modern Distinctive Streets" and "Lifestyle Landscape Streets" exhibited lower values in this regard. Accordingly, based on the specific presentation of

indicators for these four types of streets, the study proposed corresponding renewal strategies, aiming to assist the relevant authorities in improving the inclusion and vitality of streets. It will enhance the quality and happiness of community residents.

KEYWORDS: Street Inclusion ; urban space; Streets classification; Assessment of Inclusivity; scenario strategies

1. Introduction

Currently, urban development in China has shifted its focus from expanding the quantity of cities to updating existing areas[1]. Streets, as a crucial component of urban space, play an indispensable role in city renewal and have garnered widespread attention. The transformation from strictly separated market districts to integrated street life reflects a diverse and inclusive trend in the form and function of street spaces. Enhancing inclusivity from all aspects has gradually become a focal point for evaluating streets' ability to better meet various social activities, functional formats, and people's experiences while creating a friendly and harmonious environment. This is also one of the critical directions for street renewal work. However, during recent years' urban renewal processes, there has been homogenization in street space design with insufficient consideration for inclusivity resulting in inadequate attractiveness of streets. Based on this issue, this paper establishes an inclusive evaluation system for streets and selects four distinctive streets in Suzhou City as empirical case studies to explore ways to enhance vitality and inclusivity during urban street renewal work.

The concept and value of inclusive development are widely recognized globally at present[2]. The inclusiveness of urban streets is reflected in their capacity to accommodate buildings and facilities on both sides, as well as in their design concepts that promote equilibrium in areas such as economy and culture[3]. Guided by this principle, street design aims to cater to individuals of diverse genders and age groups, thereby fostering more profound and varied face-to-face communication and activities[4]. In the field of urban planning, streets refer to roads within urban areas primarily utilized for daily life services and social activities for residents, encompassing elements such as ground-level shops, open spaces, and service facilities connected to the streets; all these elements can impact street inclusiveness[5]. Simultaneously, inclusive development necessitates comprehensive consideration of the needs of vulnerable groups while seeking consensus through negotiation to resolve potential conflicts between different group demands and avoid excessive polarization. Currently advocating for harmonious livable modern cities entails not only meeting basic functional requirements in urban street facilities but also adhering to a "people-oriented" value perspective[6].

In theoretical terms, the concepts of 'inclusive design' and 'universal design' were proposed in the 1990s[7]. By studying the changes in elderly people's perception of outdoor environments, the book 'Inclusive Urban Design - Living Streets' puts forward six design principles and provides detailed discussions[8]. At the level of urban public space design, starting with inclusive design for families with children, creative transformations are made to public spaces such as streets to meet

different population characteristics and regional requirements[9]. Inclusive design for older people needs to adhere to principles of hierarchy, accessibility, safety, and psychological well-being[10]. Additionally, vibrant spaces can better integrate multiple functions, purposes, and choices[11].

In terms of quantitative analysis, previous studies have primarily focused on examining the impact of inclusive pedestrian facilities and proposed a novel model (PLOS) for evaluating and enhancing the influence of street infrastructure on pedestrian service levels[12]. In order to realize an all-encompassing vision for streets, a comprehensive questionnaire survey and logistic regression analysis were conducted in Singapore to assess six dimensions of urban street design: accessibility, connectivity, streetscape, safety, vibrancy, and greenery[13]. The evaluation of sociality in commercial streets revealed that spatial accessibility significantly influences user participation in street activities[14]; mixed-use formats and favorable pedestrian experiences positively contribute to the creation of inclusive social spaces[15]. Furthermore, it was found that the urban street vitality and inclusivity is closely intertwined with their external representation as well as constituent elements.

The external representation primarily encompass crowd gathering intensity and commercial activity frequency. For instance, mobile signaling data is utilized to investigate the spatiotemporal distribution of crowds, aiming to explore the correlation between waterfront spaces and vitality[16]. Simultaneously, it delves into the deficiency of vitality in commercial pedestrian areas to comprehend users' evaluations of nodal spaces, buildings, and crowd activities[17]. In terms of constituent elements, diverse research methods are employed including establishing a vitality system for historical block public spaces based on dimensions such as spatial accessibility, spatial quality, and attributes[18]. Factors like sidewalk width and ground floor interface transparency exert influence on staying behavior within commercial pedestrian areas[19]. The examination of factors like social functional density and functional mix enables an exploration of the relationship between environment and citizen activities while enhancing street space quality. Furthermore, the study highlights that ground-level commercial facilities impact attractiveness while transportation convenience relies on spatial structure accessibility[20].

Currently, research on the assessment of street inclusivity primarily focuses on theoretical foundations, design strategies, and evaluations of vitality composition. However, there is a lack of analysis that combines urban street vitality and inclusivity assessment with quantitative indicators. Existing studies on specific types of streets are still too general and require more detailed classification to reflect their characteristics and diversity. In this study, we conducted feature analysis on pedestrian-oriented streets in Suzhou City and identified outstanding historical value, strong sense of life, and distinctive architectural styles from different eras as the basis for classifying these streets. The streets under investigation are categorized as follows: firstly, "Historical Comprehensive Streets" (Pingjiang Road) which possess significant historical and cultural heritage, serve as tourist attractions with intellectual property functions, offer comprehensive commercial services, and attract a substantial number of tourists; secondly, "Historical Life Service Streets" (Fengmen Hengjie) primarily focusing on life service functions while exhibiting a strong local atmosphere influenced by market trading activities; thirdly, "Modern Comprehensive Streets" (Huaihai Street) characterized by high commercial density and closely arranged shops with a modern style and distinctive ambiance; fourthly, "Modern Life Service Streets" (Xietang Old Street) featuring beautiful landscape environments while predominantly serving life service functions. By assessing the inclusiveness level of these four

types of urban streets, our aim is to effectively harness their inherent potential in order to enhance residents' quality of life.

2. Study area and Methodology

2.1 Research scope

As one of the pilot cities for urban regeneration, Suzhou has diverse historical and cultural districts with distinctive characteristics, forming streets that exhibit diverse historical and modern styles. This study primarily relies on high-frequency street vocabulary from social platforms such as Xiaohongshu and Dianping, along with popular check-in streets from hotlists, for the purpose of identifying 44 frequently mentioned "internet-famous" streets in the urban area of Suzhou. Based on their main features, these streets were manually reviewed and classified into four types: "Historical Comprehensive Streets", "Modern Comprehensive Streets", "Historical Life Service Streets", and "Modern Life Service Streets" (refer to Table 1). Among these, "Historical Comprehensive Streets" encompass historically significant cultural streets in Suzhou, characterized by high cultural value, diverse functions, and strong tourist attraction. "Modern Comprehensive Streets" are distinguished by high levels of commercial development, spaciousness , and well-equipped facilities. "Historical Life Service Streets" are often influenced by market trading hours and emanate a strong local atmosphere of bustling life. "Modern Life Service Streets" boast beautiful landscapes and a serene atmosphere, with unique street styles. Based on the results of classification, our study ultimately selected Pingjiang Road, Huaihai Street, Fengmen Heng Street, and Xietang Old Street as four representative examples of streets (as shown in Figure 1), and evaluated their inclusiveness from specified perspectives and data indicators

Table 1 The classification and screening of Suzhou city streets

Classification	Street
Historical Comprehensive Street	Pingjiang Road, Shantang Street, Wusha Road, Taohuawu Street,etc
Modern Comprehensive Street	Huaihai Street, Gongyuan Road, Zhongjie Road, Jinfan Road, etc
Historical Life Service Street	Fengmen Heng Street, Daoqian Street, Pishi Street, Dongzhong Market, etc
Modern Life Service Street	Xietang Old Street, Dashitou Alley, Ximei Alley, Yangyu Alley, etc

Figure 1 Street location map of this study

Pingjiang Road, recognized as one of the first historical and cultural streets in Suzhou, spans approximately 1606 meters. It exhibits a delicate texture and a street pattern resembling fish bones. Adorned with grey tiles and the style of a water town, Pingjiang Road displays its unique charm and rich cultural heritages. While the natural landscape along the street is commendable. It serves as an important tourist attraction and a prominent symbol of Suzhou. Huaihai Street, known for its Japanese-style charm, is designated as a "national-level famous and characteristic commercial street." The present architectural texture is relatively orderly, with clean street interfaces and spacious pedestrian areas. However, it suffers from a lack of greenery and a sense of hierarchy.

Fengmen Heng Street, with its quaint and humanistic appeal, attracts many visitors with its traditional style and local market culture. The present architectural texture of Fengmen Heng Street exhibits relative fragmentation. It is essential to improve street cleanliness as well as greenery. Xietang Old Street creates a kind of antique leisurely life atmosphere, and the good natural environment provides a good place for local people to walk and relax.

Figure 2 Investigation on plane texture and present statuses of four streets

2.2 Construction of an inclusive assessment

This study involved manual selection of objects and on-site inspections, utilizing handheld cameras to capture street view images aligned with the line of sight, along with points of interest (POI) data and LBS data etc, for analysis and review. The study examined streets from three dimensions: spatial inclusivity, functional inclusivity, and social inclusivity. Sixteen indicators were selected.

Spatial inclusivity primarily reflects the pursuit of high standards of comfort. The space permeability reflects the street's capacity and friendliness. Street greenery emphasizes the perceived environmental quality. Sky openness contributes to improving urban microclimates and alleviating the pressure of individual living and working. Enclosure indicates the degree to which buildings, walls, and other structures enclose public spaces. A good enclosure degree provides a comfortable and shaded feeling. Street width-to-building height ratio and building width-to- street width ratio have significant effects on spatial behavioral cognition, especially when the street width-to-building height ratio is less than 1[21]. In narrow spaces, the sense of enclosure is strong, leading to feelings of oppression and affecting the walking experience.

In the dimension of social inclusivity., our study concentrates on the diversity of street businesses, considering living and public service facilities (such as telecommunication services and public toilets), catering facilities (such as restaurants and tea houses), and cultural facilities (such as art galleries and museums) within the street space. These functional venues not only meet people's basic needs but also stimulate consumer behaviors, thereby positively impacting the inclusiveness of the street. Commercial density reflects the intensity of urban development and the convenience of daily life. A higher degree of street business aggregation indicates a higher level of mixed-use, which is beneficial for shortening distances to destinations.

In terms of social inclusivity, the study indicators cover the accessibility of green spaces, public transit, pedestrian-friendliness, and the average density of crowds on weekdays and holidays. Accessibility to green spaces is related to the well-being of residents around the street, as these green areas serve as primary recreational spaces for daily activities, thereby attracting more foot traffic to nearby streets. The accessibility of public transit reflects the friendliness of people reaching the street, with well-developed public transportation providing more efficient and convenient commuting options for street stakeholders. Pedestrian-friendliness reflects the connectivity of the pedestrian traffic network, which can promote commercial and social activities. Crowd density reflects the real-time concentration of people and their activities on the street.The assessment of inclusive street is shown in Table 2.

Target Layer	Criterion Layer	Factor Layer	Data Collection
Assessment of Street Inclusivity	Spatial Inclusivity	Space permeability	$I_{sp}=\frac{S_{\text{ground window}}+S_{\text{ground door}}}{S_{\text{all}}}$ [22]
		Street greenery	$I_{green}=\frac{S_{green}}{S_{\text{all}}}$
		Sky openness	$I_{sky}=\frac{S_{\text{sky}}}{S_{\text{all}}}$
		Enclosure	$I_{en}=\frac{S_{\text{building}}+S_{\text{wall}}+S_{\text{fence}}+S_{\text{pole}}}{S_{\text{all}}}$
		Street width-to-building height ratio	$A_r=\frac{Sw}{Bh}$
		Building width-to- street width ratio	$A_r=\frac{Bw}{Sw}$
	Functional Inclusivity	Degree of business aggregation	$H=-\sum_{i=1}^{S}(P_i \ln P_i)$
		Proportions of living and public services	
		Proportion of catering facilities	$f_n(x)=\frac{1}{n\pi h^2}\sum_{n=1}^{n} K\left(1-\frac{(x-x_i)^2-(y-y_i)^2}{h^2}\right)$
		Proportion of cultural facilities	

	Commercial density	$D_{poi} = \frac{N_p}{L_r}$
Social Inclusivity	**Green space accessibility**	$D_{green} = \min d_{\text{green}}$
	Public transit accessibility	$D_{pt} = \min d_{\text{pt}}$
	Pedestrian friendliness	$I_{pf} = \frac{S_{\text{sidewalk}}}{S_{\text{all}}}$
	Average Crowded density on weekdays	$Density = \frac{1}{(radius)^2}\sum_{i=1}^{n}\left[\frac{3}{\pi}\cdot opp_i\left(1-\left(\frac{dist_i}{radius}\right)^2\right)^2\right]$, For dist_i <radius [23]
	Average Crowded density on holidays	

Table 2 The assessment of inclusive streets

2.3Methods

After specifying the research objects, this paper utilizes the deep learning technique: Fully Convolutional Network (FCN) model along with relevant methods to perform semantic segmentation recognition on the street image data in scenery surveys[24]. It extracts relevant elements and calculates the area proportions of each element in images. Simultaneously, the Grounded Segment Anything Model (GSAM) is employed to detect and extract target elements required for calculating the space permeability on the street[25]. This model can automatically segment object types in images or videos, generate high-quality labels, and derive element calculation results. The model employs street images of our study for calculation and analysis to ensure accurary and quality of data sources. In additional, the research quantifies relevant indicators through the Argis analysis and represents the crowd density level with heatmaps illustrating the population distribution.

In the process of weighting statistical indicators, this study initially employs the Analytic Hierarchy Process (AHP) to allow professionals to score the relative importance of indicators and calculate subjective weights through consistency tests.[26] Subsequently, the entropy weight method is utilized to determine objective weights by assessing indicators' relative degree of change in order to establish their weights within the overall system. Indicators with a greater degree of relative change are given greater weights to accurately reflect their importance in the overall system. Finally, a combination weighting method based on game theory is employed to calculate optimal weights for comprehensive subjective and objective indicators, thereby obtaining an inclusiveness score for the street. Due to data sources encompass multiple dimensions such as street view images, LBS and POI data with inherent differences in nature and measurement units, standardized processing of data becomes necessary. Additionally, descriptive analysis and correlation matrices are conducted on these indicators while revising and optimizing detection methods to enhance the efficiency and accuracy of results. This facilitates the credibility and correction of problems.

3. Assessment Result of Street Inclusivity

3.1 The determination of weight value

According to the evaluation system framework, this paper first employs the Analytic Hierarchy Process (AHP) to categorize the elements associated with evaluation decision-making into three levels: target, criteria, and factor layer. This includes one target layer, three criteria layers, and sixteen factor layers. Qualitative and quantitative analysis are conducted based on this framework. In this process, our study invited nine experts in architecture and urban planning as well as eleven relevant professionals to score the relative importance of indicators and calculate the results of subjective AHP weight values (Table 3), confirming that the judgment matrix meets consistency requirements.

On the other hand, the entropy weight method is an objective weighting approach used for determining indicator weights by evaluating their relative degree of change[27]. Sixteen factor-layers (X_1~X_{16}) are standardized, and within each indicator category, we calculate the proportion of each standardized value to all standardized values for that specific indicator (p_{ij}).

$$p_{ij} = \frac{X_{ij}^*}{\sum_{j=1}^{n} X_{ij}^*} \quad (1)$$

Subsequently, the entropy value(e_i) for each indicator is calculated.

$$e_i = -\ln(n)^{-1} \sum_{j=1}^{n} p_{ij} * lnp_{ij} \ \ (\text{if} \ \ p_{ij} = 0 \ , \ \ e_i = 0 \ ) \quad (2)$$

Finally, based on the entropy value(e_i) , the study determined the weights w_i(Table 3). for each indicator using a formula.(w_i)

$$w_i = \frac{d_i}{\sum_{i=1}^{17} d_i} \ (d_i = 1 - e_i) \quad (3)$$

The combination weighting model based on game theory aims to minimize the discrepancy between the optimal weight and the various weights of each indicator, ultimately obtaining the optimal evaluation weights for both. Thus, following the calculation of the subjective weight (AHP) value and objective weight (Entropy) value, a more reasonable weight value is obtained through the game theory combination weighting method. The specific calculation steps are outlined as follows[28]:

The basic weight vector, denoted as w_k, represents the set of weights determined by the weight calculation method. $w_k = \{w_{k1}, w_{k2}, \dots, w_{km}\}$ k=1，2...L. Here, m represent the number of indicators. Since this study selects 2 weighting methods and 16 indicators, we have L=2 and m=16.

If $a = \{a_1, a_2\}$ is considered as the linear combination coefficient, then any linear combination of two vectors determines the comprehensive weight vector w for assessment:

$$w = \sum_{k=1}^{L} a_k \cdot w_k^T \ \ (a_k>0) \quad (4)$$

The weight vector a_k was optimized according to the minimization of the range between w and w_k, resulting in the optimal weight value w^*. The optimization objective function is as follows:

$$\min_{a_k>0} \left\| \sum_{k=1}^{2} a_k \cdot w_k^T - w_k \right\|_2 \tag{5}$$

In this formula: K=1 or 2.

The corresponding linear equations are derived from the differential properties of the matrix.

$$\begin{bmatrix} w_1 \cdot w_1^T & w_1 \cdot w_2^T \\ w_2 \cdot w_1^T & w_2 \cdot w_2^T \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} = \begin{bmatrix} w_1 \cdot w_1^T \\ w_2 \cdot w_2^T \end{bmatrix} \tag{6}$$

Finally, the values of the combination coefficient a_1, a_2 can be determined through mathematical calculation of the determinant. Standardization processing is necessary in order to ensure that sum of weights equals 1. After standardization, the final combination weight based on game theory can be calculated using the following formula.

$$w = a_1^* w_1^T + a_2^* w_2^T \tag{7}$$

Table 3 The weighted value of three methods

Target Layer	Criterion Layer	Factor Layer	AHP Weighted value	Entropy weight method	Final Combination weight
Urban Street Inclusivity	**Spatial Inclusivity**(0.382)	Space permeability	0.038	0.037	0.037
		Street greenery	0.062	0.069	0.065
		Sky openness	0.078	0.074	0.077
		Enclosure	0.054	0.039	0.048
		Street width to building height ratio	0.085	0.040	0.069
		Building width to street width ratio	0.112	0.038	0.086
	Functional Inclusivity(0.234)	Degree of business aggregation	0.010	0.036	0.019
		Proportions of living and public services	0.033	0.082	0.050
		Proportion of catering facilities	0.040	0.083	0.055
		Proportion of cultural facilities	0.037	0.055	0.043

	Commercial density	0.046	0.106	0.067
Social Inclusivity(0.384)	Green space accessibility	0.075	0.103	0.086
	Public transit accessibility	0.139	0.046	0.107
	Pedestrian friendliness	0.081	0.067	0.076
	Average Crowd density on weekdays	0.019	0.051	0.030
	Average Crowd density on holidays	0.091	0.075	0.085

From the perspective of the criterion layer, social inclusivity, representing the street's service target intuitively, carries the most prominent weight, while spatial inclusivity is considered a fundamental micro-perception of the street, significantly affecting its inclusiveness. The impact of functional inclusivity is relatively insignificant. From the perspective of factor layer, effective public transit ensures the arrival of diverse social groups to the street, making accessibility of public transit occupy a dominant position in terms of weight. The accessibility of green spaces, with significant weight proportion, is measured by the average distance from the center of the street to the surrounding parks and green spaces. As the primary venues for residents' daily recreational activities, green spaces attract more residents and other stakeholders, fulfilling their basic living needs. The average crowded density on holidays also carries significant weight, as bustling streets often attract more people, reflecting diverse inclusiveness.

Regarding spatial inclusivity, the building width to street width ratio significantly has a greater impact on people's visual perception of the street and holds the highest weight in terms of comfortable inclusiveness in public space. Additionally, sky openness, street greenery, and the street width to building height ratio also carry relatively high weights. Open skies and green views have a soothing effect on pedestrians. In contrast, the degree of business aggregation, concerning functional inclusivity, is deemed to have a relatively low impact on inclusiveness among factors. Predominantly, various customer groups on the street prioritize catering, residential, and cultural facilities, relegating other functions to a lesser role in enhancing inclusiveness.

3.2Descriptive statistics of indicators

The calculation results of indicator data in the study reveals significant differences in spatial, functional, and social inclusivity among four representative types of streets: Pingjiang Road performs excellently in all three dimensions. Fengmen Heng Street, representing grassroots cultural streets, excels in functional inclusivity. Huaihai Street, in its endeavor to establish a model of modern-style streets, exhibits relatively weak consideration for social inclusivity. Xietang Old Street, a newly constructed commercial street with a New Chinese style in recent years, requires further development in terms of social inclusivity.

In the dimension of spatial inclusivity, Fengmen Heng Street performs the best in space permeability owing to its open ground floor storefronts. Xietang Old Street has a much higher

street greenery compared to the other three streets, indicating effective landscaping and greening efforts. Given that the greenery of streets in ancient cities is constrained by narrow layouts, often limited to decorative interstitial spaces between buildings, this constraint may contribute to the lower street greenery observed on Pingjiang Road and Fengmen Heng Street. Meanwhile, Huaihai Street, a modern commercial street frequently employs billboards and neon lights on store facades to attract merchants and customers, potentially impacting street greenery. Pingjiang Road, Fengmen Heng Street, and Xietang Old Street demonstrate comparable levels of sky openness, suggesting similar degrees of openness in their vistas. In terms of the building width to street width ratio and street width to building height ratio, Pingjiang Road performs satisfactorily in both aspects, not only ensuring visual aesthetics but also efficiently utilizing limited space to accommodate more commercial stores, cultural venues, and community service facilities. Simultaneously the building width to street width ratio of Huaihai Street provides a comfortable spatial scale, contributing to the attraction of pedestrian flow. Pingjiang Road and Xietang Old Street feature relatively low enclosure, promoting a sense of spaciousness and enhancing positive psychological experiences.

In terms of functional inclusivity, the higher Commercial density in Fengmen Heng Street reflects the frequent commercial activities in the area, affirming its potential for future development. Higher degrees of business aggregation lead to greater convenience for citizens. The relatively low degree of business aggregation on Huaihai Street indicates a weaker diversity of functions and a lower degree of service concentration in the area. The remaining three streets display similar degrees of business aggregation. The proportions of living and public services, catering facilities, and cultural facilities reflects the quantity of services provided in a particular function within the street. A higher proportion indicates greater service opportunities for diverse people. Pingjiang Road, representing historical streets, features a relatively high proportions of living and public services, as well as catering facilities, reflecting a coexistence of lively and commercial atmosphere. On the other hand, the higher proportion of cultural facilities in Fengmen Heng Street reflects its unique vibrant grassroots cultural atmosphere.

Regarding social inclusivity, Baidu's heat map provides real-time information on crowd gathering and street space utilization, displaying the spatiotemporal intensity of different locations. This study collected heat map data for October 2nd, 3rd, 6th, and 14th, as well as October 7th, 10th, 11th, and 13th, 2023, calculating the average heat value representing the average crowd density during holidays and workdays respectively. The results show that regardless of whether it is workdays or holidays, Pingjiang Road exhibits a high density of crowd distribution, reflecting its high tourism value and attractiveness to people. Conversely, Xietang Old Street ranks at the bottom of the four streets in terms of average crowd density on both holidays and workdays, indicating its limited appeal to crowds and its current state of relative inactivity. In terms of pedestrian friendliness, Huaihai Street provides great convenience for pedestrians and non-motorized vehicles owing to its systematic, rational, and spacious road layout, creating a pedestrian-friendly environment conducive to promoting activities and enhancing social inclusiveness. Pingjiang Road is surrounded by abundant ancient city parks and verdant areas. Moreover, its central location enables it to offer high levels of accessibility to green spaces and public transit, thereby attracting a diverse range of customers.

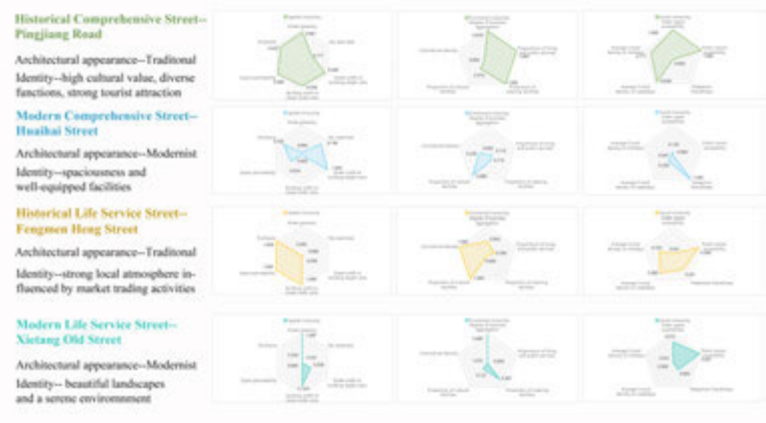

Figure 4 Four representative street inclusion indicators radar map

3.3Total assessment score of street inclusivity

The standardized numerical values obtained from the statistics of each indicator in the assessment are multiplied by their respective final combination weights. The inclusivity assessment scores for the four representative streets can be obtained by adding and summing these values for each item. The resulting scores (table 4) are as follows：

Table 4 Total assessment score of street inclusivity

Representative	Pingjiang Road	Huaihai Street	Fengmen Heng Street	Xietang Old Street
Assessment score	0.581	0.343	0.394	0.243

Pingjiang Road, representing the "Historical Comprehensive Streets", clearly outperforms in the inclusivity assessment. This is evident from high-weight indicators such as street greenery, average crowd density, public transit accessibility, and green space accessibility, aligning with its expected role as a significant protected street in Suzhou's cultural district and ancient city area. Fengmen Heng Street, representing the "Historical Life Services Streets", and Huaihai Street, representing the "Modern Comprehensive Streets", closely follow. These streets exhibit excellent indicators in space permeability, enclosure, and commercial density, indicating potential to achieve higher inclusivity quality. In comparison, Xietang Old Street, representing the "Modern Life Services Streets", displays a lower level of inclusiveness compared to the other representative streets. Thus, it is essential to update and optimize strategies to enhance its spatial, functional, and social inclusiveness

Based on a comprehensive analysis of various indicators, Pingjiang Road, as a representative old street in Suzhou, demonstrates diverse functionality and bustling popularity. Its assessment values in all dimensions are relatively high, and it attains the highest level of overall inclusiveness. Therefore, when updating its design, it requires only minor optimization without excessive

interference. However, in recent years, despite meeting contemporary demands in terms of architectural scale and accessibility, the newly renovated Huaihai Street and Xietang Old Street have lower indicator values for public transit accessibility, average crowd density, and the proportions of living and public services. As a result, their attractiveness to people is limited, leading to lower overall inclusiveness

4. Renaissance strategies

After considering the inclusivity assessment results of the four types of streets, it is evident that Pingjiang Road emerges as the most inclusive street. However, it still encounters challenges such as a low proportion of cultural facilities and pedestrian-friendliness. In order to address these issues without compromising the existing comfortable street greenery, it is recommended to appropriately increase the commercial density, enhance the proportion of cultural facilities, and enrich cultural experiences and historical heritage functions. For instance, establishing a Water Town Cultural Academy can effectively stimulate pedestrian flow and elevate inclusiveness quality on this street.

For the remaining three streets with low inclusivity assessment scores, namely Fengmen Hengjie representing traditional local culture, Huaihai Street showcasing modern fashion, and Xietang Old Street reflecting contemporary urban life, based on the data results of the evaluation system, corresponding update strategy suggestions are provided from the perspectives of specific population groups, functions, and spatial inclusivity dimensions. These strategies aim to be applied to streets with similar attributes in order to achieve inclusive and diverse characteristics.

The revitalization of Fengmen Hengjie, a representative market culture street, should address the evolving daily life needs of its inhabitants and overcome the current limitations resulting from an exclusive focus on catering to a single customer group. (1) In terms of social inclusivity, enhancements can be made to pedestrian walkways to improve their user-friendliness and facilitate access to surrounding park greenery, thereby addressing the issue of inadequate pedestrian amenities. Moreover, regular hosting of diverse events and festive temple fairs can attract visitors from various backgrounds and interests by showcasing historical intangible cultural heritage, culinary delights, shopping opportunities, etc. (2) With regards to spatial inclusivity, careful attention should be given to building layout and space design in order to ensure ample lighting conditions and incorporate natural landscapes. Given the limited street greenery, ecological challenges, and compact nature of the street's space constraints; garden-style designs could be implemented within microspaces at street corners or intersections. (3) In terms of functional inclusivity, it is imperative to enhance the proportion of living and public services and catering facilities in order to diversify people's options on the streets. By augmenting the street greenery, we can also elevate the design aesthetics of ground floors, thereby attracting a greater number of businesses to establish themselves and meeting diverse consumer needs through differentiated distribution of functions, thus fostering Fumen's inclusivity.

The preservation and promotion of distinct cultural features and unique architectural styles should be prioritized in the renovation of modern streets like Huaihai Street, aiming to create an appealing place that is both inclusive and compatible with individuality for residents and tourists. (1) In terms of social inclusivity, artistic interactive devices could be installed on specific sections

of walls along the street to provide visitors with opportunities for interaction while showcasing its history. These artistic interactive devices can take various forms such as photo spots, as well as projection games or musical performances, attracting a more diverse clientele while addressing concerns regarding lower crowd density. (2) In terms of spatial inclusivity, Huaihai Street exhibits a high degree of sky openness and relatively tall building enclosure; however, the street greenery is low. During the renovation process, it is necessary to adjust the building width-to- street width ratio while transforming monotonous and dull walls into refreshing and comfortable vertical greenery. Considering sustainable development, diversity and hierarchy can be enhanced through combinations of different materials and colors in storefront designs. (3) In terms of functional inclusivity, based on the issues identified in the inclusivity assessment, it is necessary to further diversify the types of businesses on Huaihai Street. This can be achieved by adding more daily retail stores and organizing regular market activities to meet residents' purchasing needs for daily necessities. Enhancing openness in building facades will not only increase attractiveness but also infuse vitality into modern-style streets, creating a street space with rich experiential qualities.

The revitalization of modern urban streets, exemplified by Xietang Old Street, should prioritize enhancing and refining the functional layout while introducing a greater array of cultural amenities to infuse more vitality into the area. (1) In terms of functional inclusivity, Xietang's long-established street with its chessboard arrangement of streets and lanes is characterized by densely intertwined open courtyards and interlacing pathways. Building upon the issues identified in the comprehensive evaluation, efforts can be made to address relatively low commercial density, distribution ratio of living and public facilities, and proportion of cultural facilities in Xietang. For future development, support can be extended to small businesses and entrepreneurs to encourage them in opening new storefronts thereby increasing shop density and attracting more creative and small-scale retail enterprises. Simultaneously, methods such as hosting large-scale cultural themed festivals can also be employed to augment the distribution ratio of cultural facilities providing residents and tourists with an expanded range of choices. （2）In terms of spatial inclusivity, Xietang Old Street exhibits a notable disparity in street permeability compared to other streets. This discrepancy primarily stems from the prevalence of tea houses and small shops, resulting in a lower population density. To address this concern, it is imperative to adjust the street width-to-building height ratio and augment the incorporation of residential and cultural amenities while enhancing the diversity and hierarchical nature of storefront design. However, Xietang Old Street claims the top spot among the four streets in terms of Street greenery, signifying its immense potential for development.

4.5. Conclusion

The contemporary urban street research is gradually shifting its focus towards "diversity and inclusivity" and being more "people-oriented", while also emphasizing objectivity and precision. Drawing on multi-source data, this article constructs a comprehensive street inclusivity assessment system comprising 16 indicator factors such as street greenery and sky openness. Four typical streets, namely Pingjiang Road, Huaihai Street, Fengmen Hengjie, and Xietang Old Street are selected for inclusivity assessment. The evaluation results reveal the following: (1) Pingjiang Road excels in various indicators and is well-suited for creating a highly inclusive vitality gathering place. (2) Huaihai Street performs admirably in terms of sky openness and pedestrian friendliness but has a lower street greenery. (3) Fengmen Hengjie exhibits great potential for

inclusive development due to its high street permeability and commercial density. (4) Xietang Old Street retains its old-fashioned style with alley layout but falls slightly short in terms of commercial density, proportion of living and public facilities, cultural facilities, etc. In the correlation analysis of indicator factors, it was observed that higher enclosure degrees of street buildings corresponded to an increased proportion of cultural facilities distribution, thereby offering a more diverse range of cultural activities. In design, the street greenery is often compromised to accommodate commercial and cultural facility requirements. Regarding inclusivity assessment scores, Pingjiang Road representing "historical style streets" exhibits the highest inclusivity, while Huaihai Street representing "modern style streets" and Fengmen Hengjie representing "community culture streets" demonstrate lower levels of inclusivity. Xietang Old Street representing "modern life streets" ranks last in this regard. Consequently, corresponding strategies for inclusive updates are proposed for each category. For future urban street updates, it is crucial to comprehend the key elements influencing street inclusivity and consider them comprehensively from dimensions such as spatial layout, functionality, and user groups on the street.

In the process of quantifying relevant indicators, this paper introduces the GSAM model for calculating street permeability index. Compared to previous methods, the GSAM model is more efficient and convenient, capable of rapidly processing a large number of image elements. However, when applying it to calculate indicators, there are interferences that can affect measurement accuracy such as complex clipping of multi-story buildings, pedestrians on streets, distances between buildings, and window patterns. These interferences need to be eliminated in order to enhance result accuracy. Additionally, further explanation is needed regarding the integration and entry points of quantified research on street inclusivity and traditional street vitality. The construction of an inclusivity evaluation system lacks indicator innovation and requires breakthroughs in subsequent research to explore more quantitative assessments of micro-level inclusive qualities.

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Urban Peripheries and the 15-Minute City: A comparative study on proximity-based strategies for the transformation of suburban and periurban areas

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Abstract
Urban areas are responsible for more than 60 percent of greenhouse gas emissions. As the global urban population increases, future growth will happen primarily in urban peripheries. This raises the question if proximity-based approaches such as the 15-minute city (FMC) can be applied for the sustainable transformation of urban peripheries. Therefore, this study comparing the long-term strategic vision of Melbourne, Portland and Vancouver investigates if these visions address strategies for transformatinng of urban peripheries and if those strategies align with the FMC concept. The study reveals, that the visions, although relying on important points of the FMC, deviate from the original concept regarding the allocation of workspaces: While the urban function of working isn't necessarily a part of complete or 20-minute neighbourhoods, it is one of the essential functions named in the original FMC concept. This is due to challenges which occur when applying proximity-based approaches such as the FMC to urban peripheries which cannot provide the building and population density needed in order to make the provision most daily essentials viable inside a 15-minute walking distance. This poses a dilemma as promoting walking as the main mode of transit is of utter importance for the FMC concept.

Keywords: urban peripheries, 15-minute city, complete neighbourhoods, Zwischenstadt, proximity, mobility

1. Introduction

Since its introduction in 2016, the 15-minute city (FMC) (Moreno 2020; Moreno et al., 2021) has become a popular model for urban planning and urban design (Pozoukidoi and Chatziyiannaki, 2021, p. 3). This is mainly due to global challenges such as climate change and the Covid-19 pandemic as the FMC concept is aimed at reducing greenhouse gas (GHG) emissions and improving city dwellers' quality of life by providing all daily essential within a 15-minute walk from home (Allem et al., 2022, p. 2). There is an urgent need for transformational urban models as well as strategies and policies for their implementation as 55 percent of the global population already live in urban environments (UN Habitat, 2020) and urban areas are responsible for more than 60 percent of global GHG emissions (United Nations, 2020). In their second white book (livre blanc) Moreno and his team at Chaire ETI list several cities such as Ottawa, Melbourne, Portland, Barcelona, Milano, Nantes and Mulhouse which are considered pioneers in implementing the FMC as the basis for their urban planning- and urban design strategies (Chair ETI, 2020, pp. 20-45). As the share of the global population living in urban areas is expected to grow up to 68 percent by 2050 (UN Habitat, 2020) it is worth mentioning that "urbanization in the twenty-first century is increasingly occurring in the peripheral areas outside the city" (Wu and Keil, 2022, p. 11). Regarding the previously mentioned list of cities, it is striking that the majority of these so-called pioneer cities are

metropolises of national or even international importance which already profit from dense and mixed-use urban structure: Siedentop and Gerten (2023, p. 2) estimate that the majority of people living in the central and middle parts of large cities already profit from living in a FMC. However, as Bremer (2022, p. 33) points out the majority of people in western industrialised countries does not live in compact urban centres, but in disperse, low-density settlement-structures for which Thomas Sieverts (2013) coined the term *Zwischenstadt*. Bremer estimates, that up to 75 percent of the German population live in Zwischenstadt-like areas according to their mobility patterns (Bremer, 2022, p. 33). As Sieverts Zwischenstadt (2013) is a collective term which can be referred to as a fuzzy concept, one can argue about the exact definition and delimitation of the settlement structures it includes. Regardless of the exact delimitation and proportion of people living in Zwischenstadt-like environments it is needless to say that developing guiding principles for the transformation of these Zwischenstadt-like areas in order to reduce GHG emissions, improve social cohesion and increase it climate resilience can play an important role for the sustainable transformation of the built environment (Sieverts, 2005, p. 29). As a response to these needs Carlos Moreno suggests to extend the FMC concept to semi- or less dense areas. This adaptation of the FMC will be called 30-minute territory (*territoire de la démi heure*) and could provide a new territorial framework for urban planning and design, according to Moreno (2020, pp. 127f.).

2. Methods

The aforementioned subjects in section 1 raise two general questions: If and how are transformational urban strategies which are based on proximity and active mobility such as the FMC or 30-minute territory applied on Zwischenstadt-like urban peripheries? Second, what is the image of the FMC or 30-minute territory in terms of urban form, typologies and urban design, especially in Zwischenstadt-like urban peripheries?

For this reason, in this study the long-term strategic visions of Melbourne (Plan Melbourne 2017-2050), Portland (2035 Comprehensive Plan) and Vancouver (Vancouver Plan 2050) will be compared regarding the following questions: First, are urban peripheries addressed at all and which significance is given to them? Second, which strategies for the transformation of urban peripheries have been developed and how do these correlate with the thematic pillars of the FMC. And third, which significance is given to work as a social function and the allocation of workplaces?

2.1 Spatial framework

Sieverts' Zwischenstadt is a fuzzy concept which does not provide an exact definition and delimitation of the settlement structures included. It acts as a collective term subsuming areas which can be described as ruralised cities or urbanised countryside at the same time and, therefore, can't be clearly categorised into town or countryside (Sieverts, 2013, p. 14). It comprises large infrastructure facilities, suburbia as well as commercial- and industrial zones which are typically found in the peripheries of cities, but also later phenomena which occur in larger agglomeration areas, such as post-suburbia, exurbia, edge-cities and technoburbs. As this study compares three metropolises and their agglomeration areas it will focus on the transformation of low-density suburbs as well as commercial and industrial areas in the peripheries of these cities. For this reason and, as the German term Zwischenstadt is hard to translate into English and could interrupt the flow of reading, in the following sections I will refer to those urban structures which are subject to the investigation as *urban peripheries*.

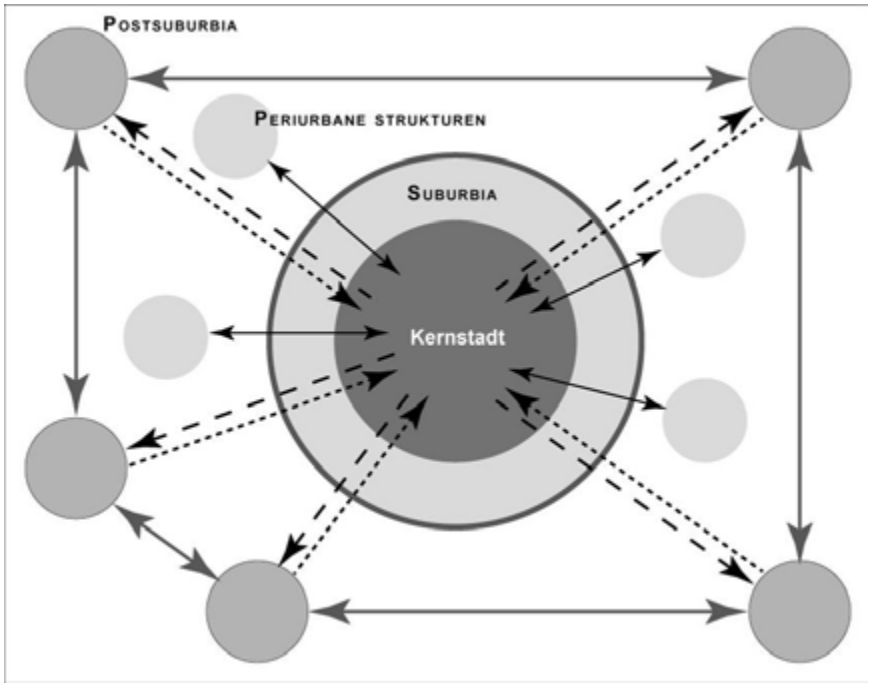


Fig. 1: Different phenomena as part of Zwischenstadt and their relations

2.2 Sample

The cities of Melbourne and Portland have been chosen, because they have repeatedly been mentioned in the writings of Carlos Moreno and Chaire ETI as pioneer cities of the FMC (Chaire ETI, 2020, pp. 20-45; Moreno, 2020, pp. 118f.). Additionally, Vancouver made its dedication towards the FMC concept clear on several occasions (City of Vancouver, n.d.). Furthermore the cities have provided one document coherently presenting their long-term strategic vision which makes a comparison possible without carrying out a meta-analysis of a variety of strategic planning documents. Finally, as they are all cities which consist to a large extent of suburbs, their urban structure is fairly comparable among each other and it is more likely to identify strategies pursuing the transformation of urban peripheries.

2.3 Analytical framework

Moreno's FMC concept is based on proximity and active mobility (Abbiasov et al., 2024, p. 445) and integrates several previous urban models, such as the neighbourhood unit, urban villages and transit-oriented design (Pozoukidou and Chatziyiannaki, 2021, p. 2) as well as the compact city, the walkable city and the green city (Allam et al., 2022, p. 2;) Therefore it suggests a number of goals and strategies in order to transform our built environment into FMCs such as prioritisation of active mobility (Moreno, 2020, p. 51), the redesign of streets (Moreno, 2020, p. 70) and placemaking (*topophilie*) (Moreno, 2020, pp. 116f.) together with the idea of a continuous, defragmented urban fabric with a minimum density and mixture of urban functions (Moreno, 2020, p. 51) in order to provide the needed proximity to the essential six urban functions which are living, working, education, supply, health and green (Moreno, 2020, p. 120). These strategies can be summarised under the following four thematic pillars on which the FMC concept is build: *Urban form, mobility, placemaking* and *climate resilience*.

3. Comparison of long-term strategic visions

This comparative study will identify for each sample if and how urban peripheries are being addressed and which strategies are being pursued for their sustainable transformation. The strategies will be summarised and compared following the thematic pillars of the FMC: *urban form, mobility and placemaking*. Climate resilience will be no part of the comparison as this study is focussed on the built environment and the allocation of urban functions in urban peripheries. Later these findings will be summarised and compared to the original FMC concept.

3.1 Plan Melbourne 2017-2050

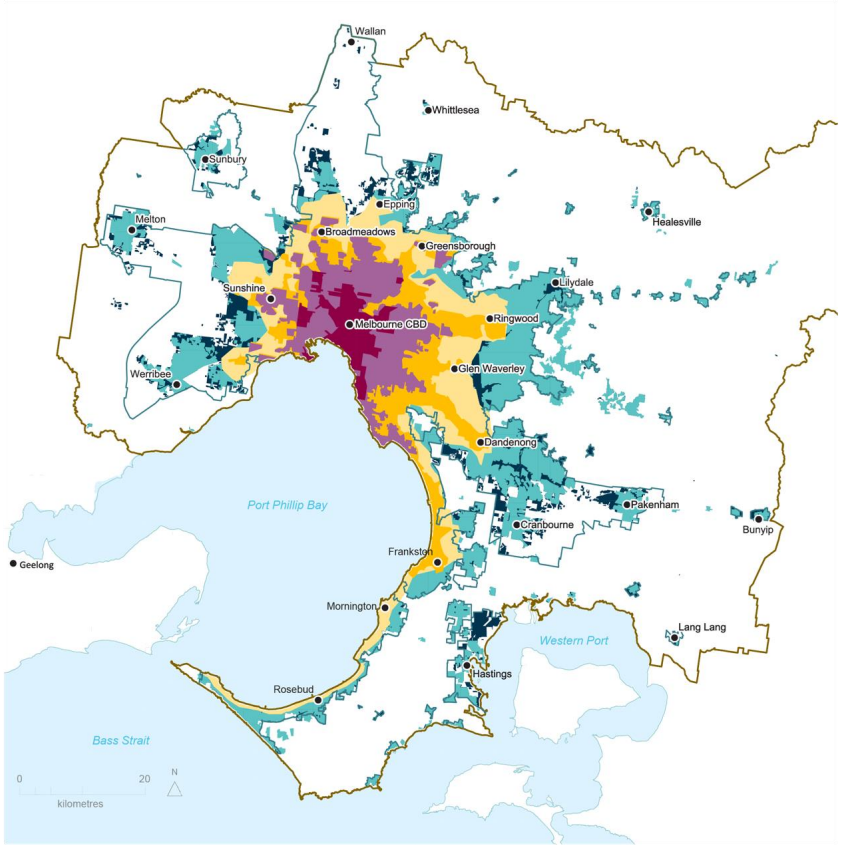
Melbourne is one of the cities which have adapted their official planning policies to the concept of the 15-Minute city (Moreno, 2020, p. 118f.). Plan Melbourne 2017-2050 is the central strategy in order to „manage growth in the city and suburbs to the year 2050“ (DELWP, 2017, p. 3). In this subsection Plan Melbourne 2017-2050 will be analysed.

3.1.1 Structure and main goals of Plan Melbourne 2017-2050

Melbourne's main challenge is to manage population growth over the coming years without further sprawling (DELWP, 2017, p. 6). For this reason it is bases on "9 principles that underpin a long-term vision for Melbourne“ and structured around „7 outcomes to drive Melbourne as a competitive, liveable and sustainable city, 32 directions setting out how these outcomes can be achieved [and] 90 policies outlining how each outcome will be approached, delivered and achieved“ (DELWP, 2017, p. 3). These principles include the creation of 20-minute neighbourhoods and a network of centres (DELWP, 2017, p. 10).

3.1.2 Strategies related to urban peripheries

Plan Melbourne does not directly address urban peripheries with Zwischenstadt-like features, but it identifies several zones with shared morphological features such as the Central Business District (CBD) as well as inner, middle and outer suburbs (DELWP, 2017, p. 36) which are repeatedly addressed in different policies and directions. There is no map or list provided to make clear which parts of the city are categorised as inner, middle or outer suburbs. Compared to the phases of Melbourne's urban development (*Fig. 2*) these zones can be partly assigned to different development phases as the CBD and those suburbs which have evolved before the rise in private car ownership have a more compact structure and are therefore more walkable. There are several inner and middle suburbs which already fulfil the criteria of a 20-minute neighbourhood and middle and outer suburbs which don't (DELWP, 2017, p. 47). This means that urban peripheries are most likely to be found in these middle and outer suburbs. Therefore, the following analysis will outline strategies aiming at transforming those structures into complete and walkable 20-minute neighbourhoods.



Map 1

Melbourne's urban growth

Year
1883
1927
1954
1971
2001
2015

Urban growth boundary (2016)
Metropolitan Melbourne region

Source: Department of Environment, Land, Water and Planning

4

Fig. 2: Melbourne's urban growth

3.1.3 Strategic approaches to transforming urban peripheries

Urban form. Melbourne is a city of suburbs (DELWP, 2017, p. 5). Therefore the authors of Plan Melbourne intend to manage future population growth by urban planning and urban design in order to avoid sprawl and transform these suburbs into compact, walkable 20-minute neighbourhoods. Those are supported by a network of centres which has different levels of hierarchy: „Metropolitan activity centres are supported by a network of major and neighbourhood activity centres of varying size, role and function." (DELWP, 2017, p. 47). It is intended that Melbourne's growth is focussed around these existing functional cores and nodes which means introducing middle- and high-density housing, especially in middle-ring suburbs which are already well served with jobs and services (DELWP, 2017, p. 47). In other locations the value of existing infrastructures shall be optimised by increasing population density (DELWP, 2017, p. 49). For growth areas the authors seek to avoid to „[…] recreate the 'dormitory' suburbs of the post-war boom" (DELWP, 2017, p. 45). Therefore, "the guidelines support planning for local jobs, local town centres rather than car-based shopping centres, better access by walking and bikes, and a healthy environment." (DELWP, 2017, p.49). As the following quote reveals, inner and middle suburbs which already are compact and walkable neighbourhoods act as a role model for Melbourne's 20-minute neighbourhoods: „Planning will be undertaken to ensure that the best parts of Melbourne are maintained and the benefits experienced in established inner and middle suburbs of Melbourne from compact, walkable neighbourhoods can also be realised in middle and outer areas" (DELWP, 2017, p. 47). This also includes Transit-Oriented-Development (TOD) as well as offering mixed-use developments with density and greater housing diversity close to employment and transport which will create opportunity and choice for medium- and low-income households (DELWP, 2017, p. 47). One strategy which is also worth mentioning is densification of middle and outer suburbs by greyfield development which means replacing detached single-family homes on large lots with mixed-use multi-family buildings after they have reached their designated lifespan (DELWP, 2017, p. 51).

Mobility. One recurring strategy which repeatedly appears in different chapters of Plan Melbourne is reducing car-dependency (DELWP, 2017, p. 123) not only by transforming the urban structure, but also by improving infrastructure for walking, cycling and public transport (DELWP, 2017, p. 100).

Placemaking. The authors of Plan Melbourne do not solely address the promotion of walking and cycling on the level of infrastructure but also emphasise that „Streets are both places to pass through and destinations" (DELWP, 2017, p. 81) and thus, placemaking practices need to be integrated in road design practices (DELWP, 2017, p. 81). According to the authors, making walking and cycling more enjoyable by attaching importance to placemaking practices and the design quality of the built environment can improve social cohesion the local economy (DELWP, 2017, p. 99).

The concept of the 20-minute neighbourhood integrates these different strategies aiming at improving the inhabitants' quality of life and at reducing greenhouse gas emission: „The 20-minute neighbourhood is all about 'living locally'—giving people the ability to meet most of their everyday needs within a 20-minute walk, cycle or local public transport trip of their home. If 20-minute neighbourhoods existed across Melbourne, it could reduce travel by nine million passenger kilometres and cut Melbourne's daily greenhouse gas emissions by more than 370,000 tonnes." (DELWP, 2017, p. 98).

3.1.4 Alignment with the 15-minute city concept

Plan Melbourne includes several strategies which are part of the FMC concept: First, Plan Melbourne suggests the transformation of existing middle and outer suburbs into compact, walkable 20-minute neighbourhoods where most of the residents' daily needs can be met within 20 minutes of walking, cycling or public transport. This is a strong reference to the concept of hyper-proximity in the 15-minute city, although 20-minute neighbourhoods rather pursues a accessibility-based approach than a proximity-based approach. Second, Plan Melbourne intends to reduce car-dependency and make walking, cycling and riding public transport more enjoyable and safer by investing in the needed infrastructure. Promoting active mobility is likewise an important part of the FMC concept (Moreno, 2020, pp. 33, 70). Third, the authors of Plan Melbourne address placemaking and the design qualities of the built environment in order to improve social cohesion. This strategy aligns with a concept which Moreno calls „topophilie" (Moreno, 2020, pp. 116f., 123) which can be translated into *love for your city*.

It is worth mentioning that Plan Melbourne's 20-minute neighbourhood deviates from the 15-minute city concept in several respects: In Moreno's description of the FMC working is one of the six social urban functions which need to be accessible in 15 minutes by walking or cycling from where one lives (Moreno, 2020, p. 120). The authors of Plan Melbourne, on the other hand, make it very clear that „[due] to the specialised and diverse nature of many people's work, access to employment will often be outside the 20-minute neighbourhood." (DELWP, 2017, p. 99). They clearly point out that „[the] distribution of jobs across Melbourne is uneven" (DELWP, 2017, p. 36). Despite generally intending to provide more jobs closer to where people live (DELWP, 2017, p. 37) the strategy to resolve the uneven distribution of jobs across Melbourne is the decentral centralisation of jobs in so-called Metropolitan Activity Centres (DELWP, 2017, p. 14). This approach aligns with the strategy of creating a network of centres (DELWP, 2017, p. 10) and Transit-Oriented-Development (DELWP, 2017, p. 100). It is noteworthy that, concerning urban peripheries in the middle and outer suburbs, Plan Melbourne does not pursue a strategy of transforming urban peripheries into a continuous mixed-use urban fabric, but to create a network of centres whose mesh size is defined by a 20-minute isochrone. Future development and densification will primarily take place around existing centres and in established neighbourhoods (DELWP, 2017, p. 47). On the one hand, this can be an adequate strategy to avoid sprawl. On the other hand, focussing on existing centres and established neighbourhoods will not improve access to jobs and services in neighbourhoods which already are underserved. However, the plan identifies several hallmarks for 20-minute neighbourhoods: One of them is „A 20-minute neighbourhood must […] deliver housing/population at densities that make local services and transport viable" (DELWP, 2017, p. 98). This is interesting regarding urban peripheries, because the statement implies that there is minimum population density threshold under which providing local services and public transport is no longer viable. This means that, according to Plan Melbourne, transforming underserved neighbourhoods in urban peripheries into 20-minute neighbourhoods means increasing density until it exceeds the minimum density to make local services and public transport viable.

3.2 Portland 2035 Comprehensive Plan

In their second whitebook Moreno and his Team at Chaire ETI list several cities which are pioneers in implementing the 15-minute city concept. Portland is one of them (Chaire ETI, 2020, p. 29-31). Portland has started to implement the FMC concept in its urban planning policies by adopting the 2015 Climate Action Plan aiming at significantly reducing greenhouse gas emissions by transforming its urban form, promoting active mobility and creating vibrant 20-minute neighbourhoods (Chaire ETI, 2020, p. 29). Since then the city has updated the 2035 Comprehensive Plan (BPS, 2023a) and complemented it with an Urban

Design Direction (BPS, 2023b). In this subsection the 2035 Comprehensive Plan will be analysed.

3.2.1 Structure and main goals of Portland's 2035 Comprehensive Plan

The 2035 Comprehensive Plan is Portland's central planning strategy to manage growth by guiding land use development and public facility investment (BPS, 2023a, p. 41). It is based on five guiding principles (BPS, 2023a, p. 7) and divided in ten thematic chapters which include, among others, urban form, housing and transportation (BPS, 2023a, p. 5). Its main goal is to manage the expected growth in order to avoid sprawl and to „expand access to employment and great neighborhoods" (BPS, 2023a, p. 8). Another important goal of the plan is that by 2035, 80% of Portland's inhabitants live in so-called complete neighbourhoods (BPS, 2023a, p. 90). The Comprehensive Plan defines a complete neighbourhood as follows: „A neighborhood where people have safe and convenient access to the goods and services needed in daily life, which include a variety of housing options, grocery stores and other commercial services, high-quality public schools, and parks. Complete neighborhoods are also easily accessible by foot, wheelchair, bike, and transit for people of all ages and abilities." (BPS, 2023a, p. 296). As a tool to achieve that goal Portland's Bureau of Planning and Sustainability (BPS) has „developed the 20-minute neighborhood index to measure access to community amenities, products and services." (BPS, 2023a, p. 36). The strategies aimed at transforming Portland's neighbourhoods into complete 20-minute neighbourhoods are spread across the 10 chapters of the Comprehensive Plan.

3.2.2 Strategies related to urban peripheries

Portland's 2035 Comprehensive Plan does not directly address urban peripheries, but it defines five distinctive pattern areas including Rivers, Central City, Inner Neighbourhoods, Western Neighbourhoods and Eastern Neighbourhoods (BPS, 2023a, p. 110). Additionally, the authors point out that the urban structures inside the Inner Neighbourhoods Pattern Area already have the desired qualities of complete neighbourhoods (BPS, 2023a, p. 114). The Western neighbourhoods are largely shaped by the mountainous terrain (BPS, 2023a, pp. 115f.) whereas the Eastern Neighbourhoods are characterised as mainly suburban, a low building density, wide street corridors and gaps in the network of pedestrian and bicycle paths (BPS, 2023a, p. 115). For these reasons it can be assumed that the Eastern Neighbourhoods Pattern Area matches most with the characteristics of urban peripheries and this analysis will focus on strategies aiming at transforming the Eastern Neighbourhoods into complete neighbourhoods.

3.2.3 Strategic approaches to transforming urban peripheries

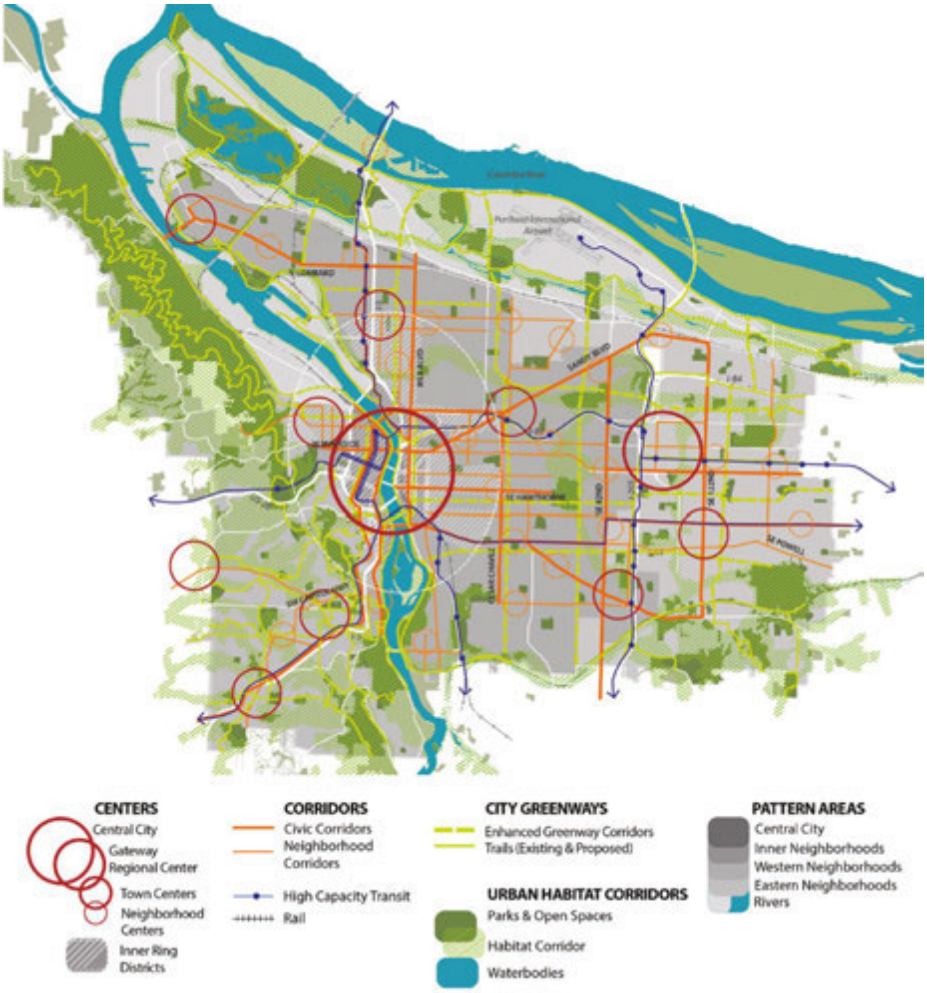


Fig. 3: Portland's urban development strategy depicting center, corridors and pattern areas

Urban form. The authors of the Comprehensive Plan assume that „[how] people live and get around is partly determined by the location of services and other destinations and the arrangement and design of buildings and connections provided by streets, trails, and other public spaces." (BPS, 2023a, p. 90). That is why a whole chapter of the document is dedicated to the topic of urban form. One superordinate strategy for all pattern areas is to create a network of centres on different hierarchical levels connected by corridors. Centres and corridors act as anchors for complete neighbourhoods (BPS, 2023a, p. 90).In general centres are described as „compact and pedestrian-oriented urban places [which] are connected to public transit and active transportation networks" (BPS, 2023a, p. 98). There are four types of centres which are Central City, Regional Center, Town Center and Neighbourhood Center (BPS, 2023a, p. 99). Regarding the transformation of the Eastern Neighbourhoods, mainly town centres and

neighbourhood centres are of increased interest. Additionally the Gateway Regional Center which shall act as a „an employment and community service hub within the area and region“ (BPS, 2023a, p. 295) in order to reduce pressure on the central city is located in the Eastern Neighbourhoods. High density housing and public places which enable vibrant public life shall be added here (BPS, 2023a, p. 101).

As the names imply, neighbourhood centres mainly serve the surrounding neighbourhood. They are characterised by multi-level, mixed-use buildings with up to four floors (BPS, 2023a, p. 102). Neighbourhood centres also act as local transportation hubs, but aren't necessarily connected to rapid transit (BPS, 2023a, p. 233). Town centres have a larger catchment area and „provide a full range of commercial and community services, high-density housing, mid-rise commercial and mid-rise mixed-use buildings (typically up to five to seven stories in height), are served by high-capacity transit connections, and have a substantial employment component“ (BPS, 2023a, p. 295). This means that town centres play an important role for decentralising work location and creating work locations closer to where people live. Neighbourhoods are connected among each other and to other parts of the city and central city by corridors. There are larger civic corridors and smaller neighbourhood corridors. The authors of the comprehensive plan intend to redevelop corridors order to cater to their surrounding neighbourhoods by providing public transit, stores, housing and office spaces (BPS, 2023a, p. 104). As linear centres they play an important role in covering peripheral areas without 20-minute access to a town- or neighbourhood centres with service and work locations. Therefore, they need to offer a minimum building and population density which makes public transport and services viable (BPS, 2023a, p. 104). A look on the map indicating the results of Portland's 20-minute neighbourhood index or completeness score reveal that the areas with the lowest score are primarily located in the western and eastern neighbourhoods which do not have a regular network of neighbourhood centres compared to the inner neighbourhoods. This is another indicator for the important role which corridors could play especially for transforming urban peripheries into complete neighbourhoods.

Mobility. The central idea of complete neighbourhoods is to reduce car dependency and the need for mobility in general by providing services and facility within a distance of a 20-minute walk. Furthermore, the authors clearly pursue a strategy of prioritising active mobility (BPS, 2023a, p. 234). This strategy also includes the redesign of streets and to „[encourage] walking as the most attractive mode of transportation for most short trips, within neighborhoods and to centers, corridors, and major destinations, and as a means for accessing transit.“ (BPS, 2023a, p. 237).

Placemaking. The authors of the Comprehensive Plan point out that streets are part of the transport infrastructure, but also places for social interactions and should, therefore, integrate both functions (BPS, 2023a, p. 236). Therefore, civic corridors shall be enhanced as distinctive place which offer an attractive pedestrian environment (BPS, 2023a, p. 105). In general, the comprehensive plan pursues a strategy of integrating strategies and measure related to the topics of active mobility, street design and placemaking in order to enhance the pedestrian experience (BPS, 2023a, p. 132). At the same time, it is questionable if the strategy of enhancing public life around civic and neighbourhood corridors which basically are major streets can be successful. Without a substantial reduction of car traffic the attractiveness of these places will be limited by noise and air pollution.

3.2.4 Alignment with the 15-minute city concept

Portland's 2035 Comprehensive Plan includes several strategies which are also part of the FMC concept: First, the authors of the Comprehensive Plan suggest to transform Portland's existing neighbourhoods into complete, walkable 20-minute neighbourhoods. Complete neighbourhoods or 20-minute neighbourhoods rely on accessibility to daily needs which is an important part of the FMC concept. Second, the Comprehensive Plan pursues the goal of reducing car-dependency and to promote walking as the most important mode of transport together with a prioritisation of active mobility including the redesign of streets and placemaking practices. The prioritisation of active mobility and especially walking as the main mode of transport is an important part of the FMC concept. Third, in the Comprehensive Plan strategies and measures related to the topics of mobility and placemaking heavily integrated. This can be seen as an interpretation of the term *topophilie* as part of the FMC concept.

However, there is a striking difference between complete neighbourhoods and the 15-minute city concept: Working which is one of the six essential functions which are part of the FMC is not necessarily a part of complete neighbourhoods. Although the plan pursues a strategy of decentralising work locations it does so by promoting decentral centralisation of work locations as new commercial spaces are concentrated in regional- and town centres. Based on the strategy of creating a network of centres and corridors in combination with transit-oriented development, densification and diversification around these corridors could be helpful to create jobs closer to where people live. The Comprehensive Plan does not suggest to create a continuous mixes-use urban fabric, but a network of centres and corridors. Future growth is concentrated around centres, corridors and transit stations.

3.3 Vancouver Plan 2050

The Vancouver City Council has approved the Vancouver Plan 2050 in 2022 as their „visionary long-range land use plan to guide growth and change over the next 30 years" (City of Vancouver, 2022, p. 7). One important goal of the Vancouver Plan is to develop complete, connected neighbourhoods „using the '15-minute city' principle" (City of Vancouver, n.d.). In this subsection the Vancouver Plan 2050 will be analysed.

3.3.1 Structure and main goals of the Vancouver Plan 2050

The Vancouver Plan outlines the long-range strategic vision for Vancouver's urban development for the next 30 years (City of Vancouver, 2022, p. 7). It is based on a vision and three foundational principles as well as three big ideas. Additionally, the plan presents vision statements for several policy areas, such as housing, transportation and public space, together with policy directions and policies to achieve the desired states for each policy area (City of Vancouver, 2022, p. 27). Another important part of the Vancouver Plan is the land-use strategy which show how the policy directions and policies of the plan can be realised in a spatial dimension (City of Vancouver, 2022, p. 27). Complete neighbourhoods are part of the vision and the three big ideas (City of Vancouver, 2022, pp. 22, 40) which makes them a core concept of the Vancouver Plan. The authors of the plan pick up on Vancouver's strategy to embrace „compact urban forms, walkable neighbourhoods, and sustainable transportation modes as critical solutions to combat climate change and maximize liveability" (City of Vancouver, 2022, p. 15). Further important topics which are addressed in the plan is the spatial mismatch between jobs and housing and the underutilisation of residential neighbourhoods with low building and population densities: More than half of Vancouver's jobs are located only on 10 percent of the land, but at the same time more than half of Vancouver's area is used for only 15 percent of its homes (City of Vancouver, 2022, p. 9).

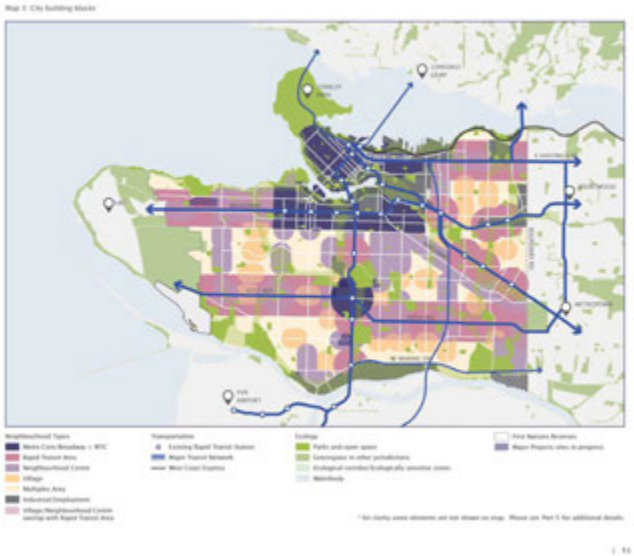


Fig. 4: Urban development strategy for Vancouver depicting different neighbourhood types

3.3.2 Strategies related to urban peripheries

The authors of the Vancouver Plan 2050 do not directly address the transformation of urban peripheries, but they point out several problems related to urban peripheries: „[more] than one-third of residential neighbourhoods do not have enough people living in them to support local businesses. Over half of Vancouver residents live in neighbourhoods without walkable access to daily needs such as food and services“ (City of Vancouver, 2022, p. 9).SEP Additionally, the plan lists different types of neighbourhoods such as rapid transit areas, neighbourhood centres and villages for which different strategies and policies apply. Although the term village might be misleading, because it is widely associated with rural life, the term refers to low-density neighbourhoods with a lack of public transport and services (City of Vancouver, 2022, p. 50). Therefore, this analysis will focus on strategies to transform these low-density neighbourhoods into complete neighbourhoods. For low-density neighbourhoods, the plan suggests a strategy of densification and diversification of housing choice.

3.3.3 Strategic approaches to transforming urban peripheries

Urban form. The main goal of the Vancouver Plan is to become a city of complete neighbourhoods. Therefore, the authors pursue a strategy to create a network of centres, each catering to a complete neighbourhood (City of Vancouver, 2022, p. 54). To achieve that goal, existing centres shall be strengthened by providing more opportunities for people to live close by. In underserved areas new neighbourhood centres shall be created by locating shops, amenities and public transport close together (City of Vancouver, 2022, p. 54). For that reason rapid-transit areas play an important role for creating new neighbourhood centres and „vibrant, mixed-use neighbourhoods providing more opportunities for purpose-built rental and social housing, childcare, community infrastructure, and arts and culture uses“ (City of Vancouver, 2022, p. 60).

The authors point out that a minimum building density is needed to provide for rental and social housing (City of Vancouver, 2022, p. 62). Therefore, the plan suggests to add so-called middle-housing around neighbourhood centres, rapid-transit areas and low-density neighbourhoods. Middle housing comprises ground oriented solutions such as multiplexes and townhouses as well as low-rise apartment buildings and mixed-use low-rise buildings (City of Vancouver, 2022, p. 60). The plan recommends multiplexes as a „new type of ground-oriented housing as a similar but more affordable and sustainable option to single-detached homes“ (City of Vancouver, 2022, p. 60). These are an effective measure to increase and diversify housing choice, but also to include small-scale mixed-use buildings to provide more job space, and local serving shops and services especially in low-density neighbourhoods labelled as villages in the land-use strategy (City of Vancouver, 2022, p. 62).

As already mentioned the authors of the plan also address the spatial mismatch between housing and jobs. Therefore the plan suggests to decentralise work locations by providing office space in neighbourhood centres (City of Vancouver, 2022, p. 54). Additionally and noteworthy, is the strategy to implement compatible light-industrial uses in rapid-transit areas and neighbourhood centres (City of Vancouver, 2022, p. 62). Examples for compatible light-industrial uses can be artist studios and maker spaces (City of Vancouver, 2022, p. 97). Furthermore the plan suggests to explore compatible uses to be added such as commercial and cultural facilities to industrial areas (City of Vancouver, 2022, p. 96).

Mobility. One core feature of Vancouver's complete neighbourhood is that they are walkable (City of Vancouver, 2022, p. 40). City-wide high-quality networks for walking, cycling and public transport are „the backbone of complete neighbourhoods“ (City of Vancouver, 2022, p. 47). Therefore, the Vancouver Plan suggests to „[create] people-first streets that are safe, attractive, and support people walking, rolling, biking, and taking transit“ (City of Vancouver, 2022, p. 45).

Placemaking. The authors of the Vancouver Plan emphasise that complete neighbourhoods „provide more opportunities for social interaction as people meet and connect on the street, at their favourite coffee shop, local playground, and during everyday activities like walking to get groceries“ (City of Vancouver, 2022, p. 52). For that reason the plan pursues a strategy of providing attractive public spaces to enhance public life as „[public] space is fundamental to participation in public life“ (City of Vancouver, 2022, p. 132).

3.3.4 Alignment with the 15-minute city concept

The Vancouver Plan 2050 includes several strategies which are also part of the FMC concept: First, at the core of the plan is a strategy to transform low-density residential suburbs into walkable complete neighbourhoods. The plan identifies several areas across the city which can be transformed into so-called multiplex areas. It is noteworthy that Vancouver's definition of a complete neighbourhood also includes „flexible work spaces“ (City of Vancouver, 2022, p. 154). This strategy relates to the concept of *hyper-proximity*, which is an important part of the FMC concept. Second, for the authors of the Vancouver Plan also pursue complete neighbourhoods to reduce car-dependency, and to prioritise active mobility in order to enhance public life and social cohesion as well as the health of its residents (City of Vancouver, 2022, p. 52). Third, the Vancouver Plan integrates topics related to mobility and placemaking as the authors emphasise the importance of walking, local services and public spaces in general for social interaction. This strategy relates to the term *topophilie* and

Moreno's emphasis on the meaning of public space for social interaction and urban culture (Moreno, 2020, p. 70).

The Vancouver Plan promotes a strategy of creating a city of complete neighbourhoods which are anchored to a network of centres which are connected by a high quality network for pedestrians, cyclists and public transport. It does not necessarily suggest to create a continuous mixed-use urban fabric, but the authors lay great emphasis on decentralising work. They pursue that goal not only with a strategy of decentral centralisation of work locations in town- or neighbourhood centres but suggest to add flexible work spaces and compatible light-industry to neighbourhoods and also to add compatible uses in industrial and commercial areas. Furthermore the authors developed an alternative typology to the now dominant single-family detached house: The multiplex which still offers ground-oriented housing, but at higher building and population densities that support local shops and services.

4. Discussion

The comparative analysis of the long-term strategic vision of Melbourne, Portland and Vancouver reveals that each city developed strategies which are to a great extent based on the 15-minute city concept developed by Carlos Moreno and his Team at Chaire ETI. The analysis further reveals that each city developed an own interpretation of the FMC concept based on its distinctive conditions. This also means that planners in Melbourne, Portland and Vancouver do not necessarily mean exactly the same when referring to the term *complete neighbourhoods* or *20-minute neighbourhoods*.

In section 2.3 three thematic pillars have been named as the analytical framework for the comparative study: *Urban form, mobility and placemaking*. *Fig. 5* shows strategies mentioned in the writings of Moreno and his team related to the four pillars or central topics as well as for the three cases.

Thematic Pillars and Strategies	FMC	Melbourne	Portland	Vancouver
Urban Form				
- spatial continuity and defragmentation	x			
- decentralisation of densities	x			
- avoid sprawl		x	x	x
- create a network of centres		x	x	x
- densification (housing + mixed-use) in and around existing functional cores and nodes		x		
- densification of low-density neighbourhoods				x
- transit-oriented development		x		
- decentralisation of work locations		x		
- create jobs closer to where people live	x	x		x
- add further functions to industrial and commercial zones				x
- add small scale commercial spaces in neighbourhoods				x
Mobility				
- reduce the need for mobility by providing everything needed in walking distance	x	x	x	x

- walking as the main mode of transport for short trips	x	x	x	x
- prioritisation of active mobility	x	x	x	x
- redesign of streets / reallocation of street space	x	x	x	x
- reduce car-dependency	x	x	x	x
Placemaking				
- enhance public life	x	x	x	x
- provide attractive public spaces and high design quality of the built environment in general	x	x	x	x
Climate Resilience				
- provide green spaces across the city	x	x	x	x

Fig. 5: Comparison of transformational strategies included in the FMC concept and the three samples

The table shows that there are some strategies with a great degree of agreement among the original FMC concept and its adaptations such as strategies concerning a mobility turn, placemaking and increasing climate resilience by providing green spaces across the city. Concerning urban form, the concept of complete- or 20-minute neighbourhoods differs from the original FMC concept: First, working is one of the six social urban functions of the FMC, but not necessarily of complete- or 20-minute neighbourhoods.

Second, in *Droit de cite* Moreno (2020, p. 51) relates to a continuous mixed-use urban fabric. The analysed examples, however, have a very different background and urban structure with extensive low-density residential suburbs. Therefore, their planners suggest to fight sprawl and create complete neighbourhoods by creating a network of centres and to strengthen existing centres with densification, and connections between those centres. In Portland these connections, referred to as corridors, play a more important role as in Melbourne and Vancouver. The Vancouver Plan lays more emphasis on the decentralisation of work as flexible work locations and small commercial spaces shall be provided in compact neighbourhoods. It is worth mentioning that in another paper, Moreno and his team refer to “different urban nodes [that] could be accessed within 15-minute walk or via cycling” (Allam et al., 2022, p. 2) which is closer to the network-of-centres-strategy than a continuous mixed-use fabric. It appears as if the promoters of the FMC haven’t agreed on the urban form for the 15-minute city, yet.

Third, another important difference between the three cases is that in Melbourne and Portland, planners suggest to create complete neighbourhoods by densification around existing centres and in order to profit from existing infrastructure. The Vancouver Plan, however suggests the comprehensive densification and functional diversification of low-density neighbourhoods by introducing a new typology called to multiplex. According to the Vancouver Plan, low-density urban peripheries shall be transformed into multiplex areas.

In all three cases the authors assumed that a minimum population density is needed to make local shops, public transport and services viable. This points in the direction that promoting an incremental redevelopment of urban peripheries by increasing building density, housing choice and introducing small, mixed-use buildings could be an efficient strategy for their sustainable transformation.

Furthermore, the case study reveals that not all long-term strategic visions which claim to build on the FMC, really implement all aspects of the FMC concept. Concerning the urban form of complete neighbourhoods and the allocation of workplaces there are significant deviations from the original concept. These strategies of Melbourne and Portland deviate from the original FMC concept to an extend which raises the question if their strategies truly are an application of the FMC concept or just established concepts and strategies such as the compact, walkable city and transit-oriented development assembled under a new label.

5. Conclusions

The 15-minute city has become a popular urban model and extensively discussed among planners and scholars. It is based on proximity and active mobility (Abbiasov, 2024, p. 445) while pursuing the goal of providing convenient access to the goods and services needed in daily life in a walkable distance (Moreno, 2021, p. 101) But in contrast to previous urban models based on the concept of accessibility by public transport, such as transit-oriented development or settlement axes, the FMC promotes an approach of physical proximity (Siedentop and Gerten, 2023, p. 2). This aligns with the assessment of Pozoukidou and Chatziyiannaki (2021, p. 3) that „the main difference in relation to other neighborhood centered approaches is that FMCs intend to bring activities to the neighborhoods and not people to the activities, restoring the urban planning concept of proximity“. Additionally, they emphasise the importance of the allocation of workplaces „[as] the trip from home to work comprises the main and most inelastic everyday trip, localizing workplaces appropriately is imperative“ (Pozoukidou and Chatziyiannaki, 2021, p. 4).

Despite the fact that Vancouver's vision is more elaborated when it comes to strategies for decentralising work places, Melbourne and Portland do not include working into the urban functions which should be accessible within a 20-minute walking distance, at all. In another comparative study of *Plan Melbourne*, *Portland's 2035 Comprehensive Plan* and *Paris en Commun*, Pozoukidou and Chatziyiannaki (2021, p. 21) came to the conclusion that they adopt a mentality that is closer to the notion of accessibility rather than proximity which can be confirmed by this comparative study. The comparative study further reveals that operationalising the FMC concept into planning strategies, especially for the transformation of urban peripheries comes with certain difficulties: Pozoukidou and Chatziyiannaki (2021, p. 13) question if the required market range and threshold populations can be reached for all facilities included in the six social urban functions included in the FMC. According to them, these threshold populations and market ranges rather lead to a hierarchical system of centres with different centralities (Pozoukidou and Chatziyiannaki, 2021, p. 4). These findings align with a study of EIT Urban Mobility (2022) which identified several challenges that come with redesigning cities according to the FMC concept (Olivari et al., 2023, p. 3): Especially in suburban contexts the FMC concept faces morphological challenges as their density might be too low to make local shops as well as public transport and services viable (EIT Urban Mobility, 2022, pp. 21f.). Siedentop and Gerten (2023, p. 2) conclude that for disperse and low-density settlement-structures outside of established centres the promise of a *local lifestyle* will be hard to realise. The long-term strategic visions of Melbourne, Portland and Vancouver confirm this assessment.

6. Outlook

The success of the term *15-minute city* shows that catchy terms can increase public interest in strategies for sustainable urban planning and design. Providing proximity or accessibility to most everyday needs and promoting attractive environments for walking and cycling together with attractive public places are promising transformation goals for urban peripheries: Thomas Sieverts who initially promoted the term *Zwischenstadt* pointed out that walkability plays a key role in transforming urban peripheries (Sieverts, 2013, p. 39). A study investigating the correlation between the "accessibility of amenities within a 15-minute walk from home and the usage of these amenities" (Abbiasov et al., 2024, p. 451) found out that there is a strong positive correlation. This means that walking can only be the primary mode of transport if there are destinations to reach within a convenient timespan. Unfortunately, this goal is especially hard to achieve for urban peripheries with large monofunctional low-density residential neighbourhoods which poses a dilemma. For the sustainable transformation of urban peripheries this could lead towards two different conclusion: First, if urban peripheries cannot provide the population density needed to make most daily essentials viable inside the area of a 15-minute walk, proximity-based approaches such as the FMC should be let aside in favor of accessibility-based approaches aiming at making these amenities reachable by the use of different modes of transport in a certain timespan. Second, if the central quality of the FMC is not the physical proximity of most daily essential but merely the sufficient condition for walking and social cohesion, especially for urban peripheries new strategies to promote walking and improve social cohesion in low-density environments should be explored.

Further research on the 15-minute city and the 30-minute territory and the transformation of urban peripheries should therefore investigate: First, which existing settlement structures in urban peripheries already meet the criteria of the 15-minute city or 30-minute territory and by which morphological features the structures are characterised? Second, how public life and public space correlate with meeting the criteria and perhaps distinctive morphological features? Third, if and how European cities apply the FMC concept on urban peripheries. And fourth, which typologies can provide the building and population density needed to make local shops, public transport and service viable based on their different catchment area and population threshold?

7. References

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8. List of Figures

Fig. 1: Different phenomena as part of Zwischenstadt and their relations
Source: Borsdorf, Axel (2009) Zwischenstadt – Stadtland oder nur noch Stadt? Zur Entwicklung im Stadt-Land-Verbund. GW-Unterricht 116, p. 12. [Online] Available from: https://www.researchgate.net/publication/258517330_Zwischenstadt_-_Stadtland_oder_nur_noch_Stadt_Zur_Entwicklung_im_Stadt-Land-Verbund Accessed [12/05/2024]

Fig. 2: Melbourne's urban growth
The State of Victoria Department of Environment, Land, Water and Planning (DELWP) (2017) Plan Melbourne 2017-2050. Metropolitan Planning Strategy, p. 4.
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Source: City of Portland Bureau of Planning and Sustainability (BPS) (2023a) 2035 Comprehensive Plan, p. 9.
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Source: City of Vancouver (2022) Vancouver Plan 2050, p. 51
[Online] Available from: https://vancouverplan.ca/wp-content/uploads/Vancouver-Plan-web-version-spreads-2023-2.pdf Accessed [05/05/2024]

Fig. 5: Comparison of transformational strategies included in the FMC concept and the three samples. Source: own illustration.

Form Follow Mobility: A Method to Identify Potential Urbanization Area in the Over-Rail Plane under the Orientation of Station-city Integration and Pedestrian Priority

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Abstract
Under the people-centred approach, some areas have begun to abandon the network configuration that prioritises vehicles over walking, and create many pedestrian priority zones. In recent years, a new kind of pedestrian priority areas called over-rail plane has emerged with the concept of station-city integration. However, real examples show that not all developments with over-rail plane have been successful, and there is a need to make full use of pedestrian mobility and efficiently layout urban functions. This paper explores a methodology that can help to judge the functional potential within over-rail plane before formal design, and provides a reference for formal design: firstly, the wool algorithm is modified to generate paths with the shortest detours according to the requirements of over-rail plane; and then SDNA tool is applied to identify its flow potential and divide different potential zones for urban function. Taking Chongqing Shapingba Station as an example, this article evaluates the potential of implanting urban functional within over-rail plane and verifies the effectiveness of the method by comparing it with the real design; taking Shenzhen North Station as an example, the article identifies the high-potential areas in the current over-rail plane that can be embedded with additional functions.

Keywords: Over-rail Plane; Pedestrian-Priority Area; Identify Potential Urbanization Area; Wool Algorithm; SDNA tool

1 Introduction

1.1 Background

Under the people-centred approach, some areas have begun to abandon the network thought that prioritises vehicles over walking, and create many pedestrian priority zones when necessary. In recent years, a new kind of pedestrian priority areas has emerged in railway station areas with the introduction of the concept of station-city integration: Some railway stations add *covers above and around the railway yards which is called over-rail plane* (Fig. 1) and implant urban functions in this new substrate to fix the fragmentation between the railway station and the city. Shapingba Station has applied the strategy and achieved good development efficiency. However, not all railway stations with over-rail plane are successful. Some of them are oversize and lack of urban function to support people's staying and relaxing, therefore lack of vitality, such as Shenzhen North Railway Station and Guangzhou East Railway Station (Fig. 2). Therefore, for these railway stations which adopt the strategy of adding over-rail plane, *it is crucial to efficiently and rationally implant urban functions after determining the broad scope of over-rail plane*. On the other hand, over-rail plane development is an extremely complex design process. Therefore, *how to judge the potential of various areas for implanting urban*

functions within over-rail plane before the formal design, especially the high-potential area, becomes a problem worth exploring.

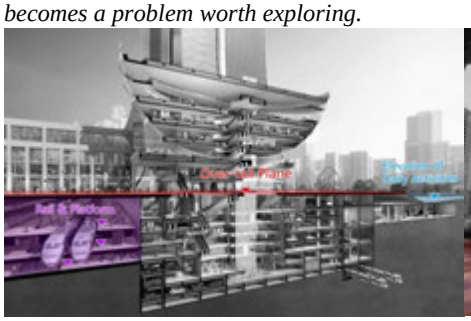

Fig 1.Over-rail Plane of Shapingba Station
Source: Drawn by Author

Fig 2.Over-rail Plane of Guangzhou East Station
(Source: Drawn by Author)

1.2 Literature Review

Existing studies on mobility can be classified into three categories according to the transport modes involved: the first is to assess the ability of citizens to travel at large or medium scales based on rapid modes of transport such as cars, rail, buses and so on, the second is to assess the ability and priority of slow transport at small and medium scales based on walking, and the third is to assess the efficiency of the connectivity between different modes of transport. The second one is related to this research. Related studies mainly focus on the pedestrian network attached to carriageway roads (Jin R, 2023). Only a few studies focus on pedestrian mobility within pedestrian priority zones. Table 1 compiles a number of studies related to pedestrian priority: Allan Andrew (2010) proposes a number of benefits brought about by advocating pedestrian priority; GwangYa Han (2011) points out that pedestrian mobility and node organisation influences the outcome of the piazza as a pedestrian priority zone using the example of Roman squares, and he further proposes a system of urban design elements to improve the quality of pedestrian-oriented suqares in Rome; Bilgehan (2018) constructs an evaluation index system for urban squares based on pedestrian mobility. In addition to these studies, there is another kind of studies related to pedestrian priority zone in the table. They use the term “Pedestrian Priority” as well (Han Sangjin, 2013, 2021; Pahk So-Hyang, 2021; Jeon Woo Hoon, 2022). But these studies are looking for zones with higher pedestrian priority in the pedestrian network attached to the vehicular traffic, which is still essentially vehicular priority.

Overall, the above studies mainly focus on pedestrian priority zones such as at-grade pedestrian walkways and plazas, failing to pay attention to an emerging category of pedestrian priority zones in recent years – over-rail plane. This paper explores a methods for pedestrian network organisation and urban function arrangement in this area under the orientations of station-city integration and pedestrian priority, which is expected to fill the gap of existing studies on this area.

Table 1.Research Related to Pedestrian Priority

Time	Author	Title	Object

2010	Allan Andrew	Pedestrian Priority Addressing Car Dependency - Purposes and Benefits	/
2011	GwangYa Han; HeeWon Lee	Typological Design Language of Urban Public Space: An Analysis of Pedestrian-oriented Piazzas in Rome	Pedestrian-oriented Squares
2013	Han Sangjin	Selection of Primary Pedestrian Road Network in Pedestrian Priority Zone	Pedestrian-priority street
2018	Bilgehan Çakmak; Mehmet Topçu	An evaluation of urban open spaces in Historical City Center of Konya in the context of pedestrian mobility	Historical Squares
2021	Han Sangjin; Chang Justin S.	Identifying Priority Crosswalk Locations in Urban Road Networks	Pedestrian-priority Crosswalk
2021	Pahk So-Hyang; Gidong byun; Ha Mikyoung	A Study on the Observation Characteristics and Pedestrian Safety in Pedestrian Environment - Focusing on the Pedestrian-priority street and Shared street	Pedestrian-priority street
2022	Jeon Woo Hoon	Priority-Setting Methodology of Qualitative and Quantitative Analyses for Pedestrian Road Construction: Case Study of a National Highway in South Korea	Pedestrian-priority street

Source: Drawn by Author

2 Methodology

2.1 Research Object and its Character

The research object of this paper is over-rail plane, which can be classified into two kinds: with urban functions already implanted(Fig. 3), and to be implanted (Fig. 4).

For the first kind of research objects, the article applies the relevant methods to divide the functional potential areas in the over-rail plane, and compares the results with the actual design results to check the reasonableness of this method. This article selects the over-rail plane of Chongqing Shapingba Station as an example of this type of object (Fig. 3).

For the second kind, the paper applies the method to predict the high-potential areas in which urban functions can be implanted in the over-rail plane of the station. In this paper, the over-rail area of Shenzhen North Station is selected as an example of this type of object (Fig. 4).

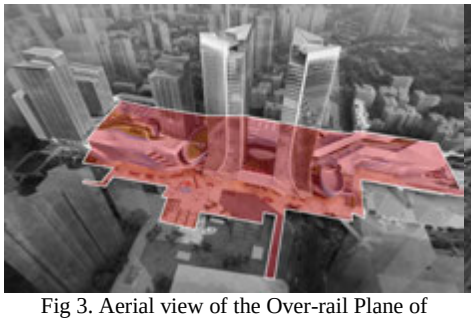

Fig 3. Aerial view of the Over-rail Plane of Congqing Shapingba Station
Source: Drawn by Author

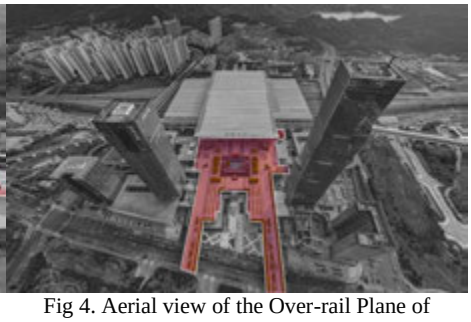

Fig 4. Aerial view of the Over-rail Plane of Shenzhen North Station
Source: Drawn by Author

There are several requirements in over-rail plane, in decreasing order of priority:

The first requirement is the priority of the railway yards and station buildings. Railway is development driver of the railway station area. The arrangement of the railway station building precedes other urban functions in the two selected cases and the arrangement of the railway station building is a constraint for subsequent decisions.

The second requirement is the priority of walking. Apart from little logistical transport, walking is the only mode of transport within the over-rail plane, and walking should be encouraged and prioritised in this area. What's more, railway station is a area for large pedestrian gather and leaving, which requires efficient pedestrian circulation as well.

The third requirement is station-city integration. Stations bring in a large number of people, and fully utilising the potential of pedestrian mobility in over-rail plane is conducive to improving functional performance and increasing functional output.

These requirements will be combined with specific method in following text.

2.2 Methods

The potential for implanting urban functions in the over-rail plane is mainly determined by the structure of the external connections. The location of the external pedestrain sources determines the possible walking paths within the over-rail plane as well as the flow potential of the corresponding paths, which will cut out several zones, and the potential of the paths adjoining these zones will determine the potential for implanting urban functions in this area, determining whether they are vibrant nodes suitable for commercial development, or or whether they will be used as logistical spaces, equipment spaces and other large-scale auxiliary spaces. According to the above understanding, two main methods should be selected and used in this paper: *method one is used to generate potential internal paths under external pedestrian flow conditions, and method two is mainly used to evaluate the pedestrian potential of these paths.*

2.2.1 Path Generation: Wool Algorithm

The methods and theories about path generation were first explored by Frei Otto in 1990s (Chenyuan Li,2021). He gave three different forms for pedestrian paths: 1. direct path network (Fig 5-a), 2. shortest path network (Fig. 5-b), and 3. shortest detour network (Fig. 5-c). The direct path network, where all destinations are directly connected, is the most direct and simplest path, however this network is not the shortest. Therefore he studied the second shortest path network. Soap bubbles will form a morphology with the smallest surface area in a stable environment, whereby Frey-Otto obtained the shortest path network with the total length of the paths being the only minimum fixed value, and the result of the morphology taking on a dendritic shape. However, the above two algorithms are more extreme and have their own advantages and disadvantages in terms of total path length and degree of detour, so he investigated a third shortest detour network. This network was obtained by the wool experiment(Fig 5-d): dry wool connecting various destination points adsorbed together after wetting because of water tension, and some of the paths aggregated into a new path. This method, called the wool algorithm, reduces the total length of the paths at each destination point while keeping the winding factor in a relatively low range. The wool algorithm is also used in the Kartal Pendik masterplan: the designer treats the roads on the periphery of the design area as emergent points of pedestrian flow, connects the emergent points to the opposite emergent points (Fig. 6-a), and performs morphology simulation operations through the wool algorithm

(Fig. 6-b) to get the initial road network of the urban design (Fig. 6-c); ultimately, a number of curves can be extracted from it to optimise the network (Fig. 6-d).

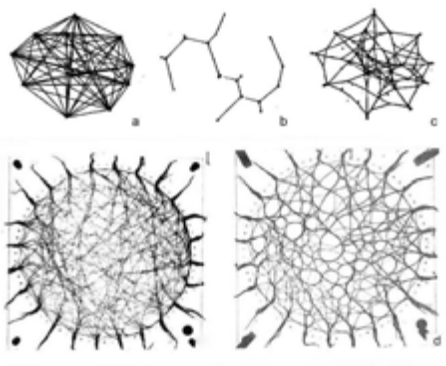

Fig 5. Frei Otto's Three Pedestrian Paths Source: Ninglin, liu and Peng Tang (2018) Research on the Path Generation Method of Composite Functional Spatial Paths of Cities and Buildings Based on Minimum Detour Networks (Conference paper), 2018 Chinese Academic Symposium on Teaching and Research on Architectural Digital Technology in Architectural Faculties.

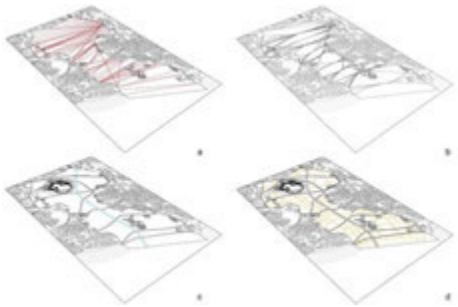

Fig 6. Use of wool algorithm in Kartal Pendik masterplanning (Source: Chengyuan, LI (2021) *Research on the application method of parametric shaping in architectural design*(Master thesis), Tianjin, Tianjin University.)

Ninglin Liu (2018) has compared the three path generation methods given by Frei Otto, pointing out that relative to the direct path network, the shortest path network makes the total length shrink by about 70%, and the third minimum detour network is 25%-35%; the minimum path network makes the number of paths between any two points drop to 1, and the minimum detour network controls its shrinkage by 30%-60%; the minimum path network makes the number of spaces is reduced by more than 70 per cent, and the minimum diversions network reduces it by about 25 per cent. Accordingly, she believes that the second network is suitable for the situation of obtaining the only shortest path, but the accessibility between any points in the site is poor, the reference value of spatial delineation is low, and the adjustment parameter is less flexible; whereas, the third network is more suitable for architects and urban designers to generate path prototypes on a daily basis. Considering the research object of this paper – over-rail plane, the construction of paths need to consider whether to meet the following needs: reasonable reduction of the total length of the path, to ensure convenient accessibility to any location within the site and the organic organisation of the path division space. On this basis, further combined with Liu 's research, the shortest detour network is suitable as the path generation method in this paper, and its specific generation algorithm is the wool algorithm.

However, the classical wool algorithm has several shortcomings in practical use that limit its application. The first one is that the classical wool algorithm cannot adapt to non-convex spatial contours (Fig. 7). Its generation results often go beyond that type of contour. The second one is that the generation results of the classical wool algorithm cannot avoid internal obstacle regions (Fig. 8). The two specific cases covered in this paper happen to involve these two conditions, so this paper will provide ideas for improved application of the classical wool algorithm, which is one innovation of this paper.

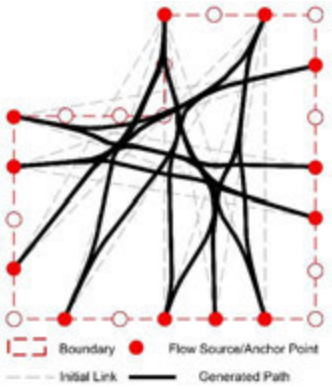

Fig 7. Result of Wool Algorithm Overflow the Non-convex Boundary
Source: Drawn by Author

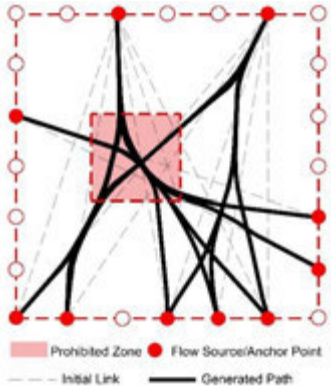

Fig 8. Result of Wool Algorithm Fail to Avoid Internal Obstacle
Source: Drawn by Author

2.2.2 Path Analysis and Zoning：Spatial Design Network Analysis Tool（SDNA）

Regarding the existing path analysis methods, there are Depthmap and SDNA (Spatial Design Network Analysis Tool) which is mature. Among them, Depthmap is mainly used for evaluating the planar network, which is not perfect in analysing the three-dimensional network, while SDNA is a tool developed specifically for three-dimensional network analysis. Since the relationship between the over-rail plane in this paper is three-dimensional, SDNA is chosen for the analysis. The specific tutorial on the use of SDNA can be found in its manual (https://sdna-plus.readthedocs.io/en/latest/). Regarding the selection of specific analysis indexes, this part is elaborated in conjunction with specific cases since different cases have different situations.

2.2.3 Integration of Methods

In this research, the modified wool algorithm is used to generate the initial pedestrian network, and the SDNA analysis tool is used to evaluate the potential of pedestrian flow and the path hierarchy. On this basis, the potential of different areas for implanting urban functions is judged. The specific steps are as follows:

(1) On-site research to determine the sources of pedestrian inside and outside the site;

(2) Establishing direct paths between sources of pedestrian;

(3) Simulate the process of the wool experiment to generate a pedestrian network pattern with minimal meandering;

(4) Converting the generated paths into segment according to analysis requirement and modelling the peripheral and underground pedestrian network;

(5) Evaluate the pedestrian potential of different paths using the SDNA analysis tool and classify the paths accordingly;

(6) Determining different potential areas of the over-rail plane that can be used for arranging urban functions according to the hierarchy of paths.

Among them, step 1, step 2, and step 3 are completed in GRASSHOPPER, and the full diagram of the program is as follows (Fig. 9); step 4 is completed in RHINO; and step 5 and step 6 are completed in ARCMAP.

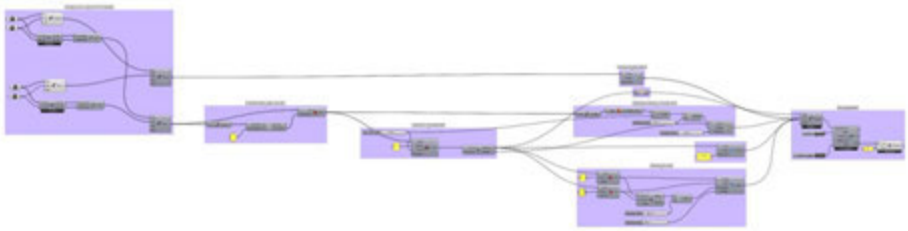

Fig 9. Wool Algorithm Programme Based on the Grasshopper Platform
Source: Drawn by Author

3 Application

3.1 The Over-rail Plane of Chongqing Shapingba Station

3.1.1 Determining Primary Source of People

Through on-site research, there are mainly three kinds of source of people in the over-rail plane area of Chongqing Shapingba Station:

(1) Entrance to the railway station building, as shown at point 1 in Figure 10, where a large number of train passengers enter or leave the covered area.

(2) Footbridge entrances and exits connecting to the neighbourhood, e.g. Points 2 - 12 in Figure 10, from which people from the neighbourhood enter or leave the over-rail plane.

(3) Major vertical transport facilities such as those leading to the metro station, e.g. Points 13 - 16 in Figure 10, from which citizens or travellers may enter or leave the covered area.

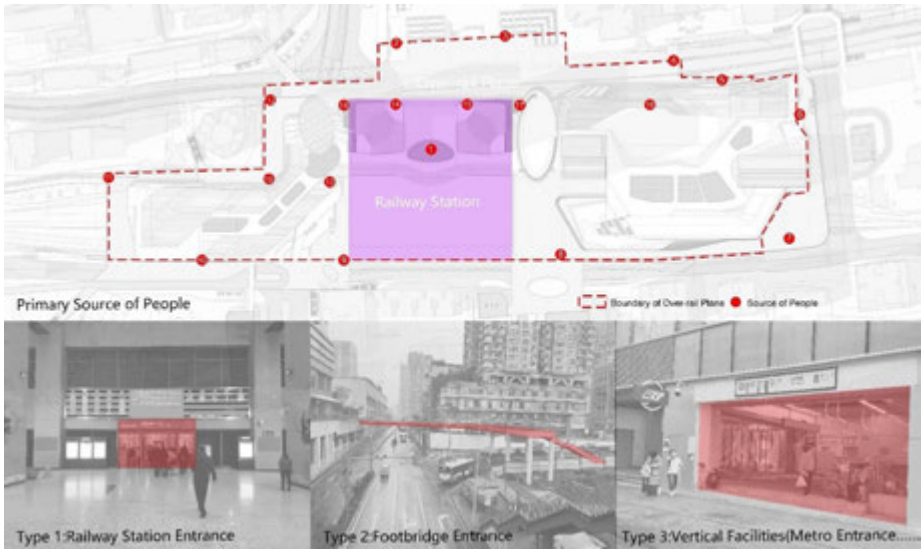

Fig 10. Primary Source of People and its Typical Types in the Over-rail Plane of Shapingba Station, Chongqing, China (Source: Drawn by Author)

It is also important to note that the railway station building has a higher priority than the pedestrian in the over-rail plane, and the generation result of the point placement as described above will show a result that pedestrian flows go through the railway station building. However, this area requires ticket checking and has security requirements in reality, and does not allow the public to freely enter and exit without a ticket. In order to avoid this situation, the wool algorithm needs to be improved. Since the railway station building is not free to pass through, citizens who originally planned to pass through this area will instead go around the outer contour of the railway station building, making the corner space of the railway station building a meeting point for pedestrian flow (Fig. 11). Therefore, this research set two pedestrian intersections at the corners of the railway station house (point 17 and point 18 in Fig. 10) when the wool algorithm was used to generate the walking network, and this modification could avoid the generation of paths that cross the railway station house as an obstacle area. Similarly, the irregular shape of the upper cover plate leads to a similar phenomenon (Fig. 12), and the intersection points of foot traffic are set at the corners of the contours (point 19 of Fig. 10).

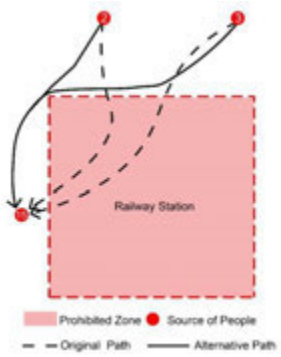

Fig 11. Changes in Path Affected by Railway Station
Source: Drawn by Author

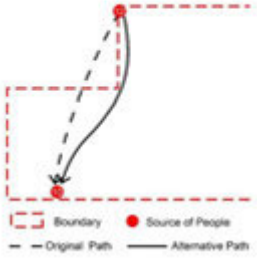

Fig 12. Changes in Path Affected by Concave Corners
Source: Drawn by Author

3.1.2 Generation and Evaluation

After completing the selection of pedestrian sources, the link between them is added according to reality and the wool algorithm is initiated aggregate the paths to obtain the shortest meandering walking path (Fig. 13). The resulting network is simplified to a segment model according to the analysis requirements of SDNA tool, and the peripheral and underground pedestrian network is built to obtain a complete pedestrian network model (Fig. 14). In Figure 14, red is the ground pedestrian network along the carriageway, grey is the next level of red one, blue is the over-rail pedestrian network to be assessed for its potential, and the other colours such as green and brown are the underground pedestrian network that supports the over-rail network. The above networks are imported into Arcmap and the analysis is carried out following the steps of the SDNA tool.

In this case, BtH (Hybrid Betweenness) is selected as the index for path evaluation. It is a measure of intermediation/penetration is an indicator of pedestrian potential, equivalent to Choice index in spatial syntax. The larger the value means the higher the potential for pedestrian flow. BthX indicates that the flow potential is calculated considering X meters as the distance, and Bth500/Bthn is generally chosen according to the needs. In the evaluation results of this case, there is some correlation among the three indicators of Bth500, Bth750, and Bthn, and Bth750 has the most outstanding effect for visualisation, so Bth750 is chosen to visualise the analysis result. Figure 15 shows the global visualisation results. Since this is a three-dimensional model, resulting in a serious superposition of above and below ground in the plan view which seriously affect the judgement. So the visualisation results related to the over-rail plane are extracted separately (Fig.16).

On the basis of Fig.16, we can determine the level of each path: the green and blue paths in Fig. 16 are classified as ordinary paths, these paths have low potential for pedestrian flow and are indicated by thin lines in Fig.17, which can be adjusted according to the needs of the subsequent design; the paths in other colours in Fig. 16 are classified as high-potential paths for pedestrian flow, these paths have high potential for pedestrian flow and are indicated by bold lines in Fig.17. With the help of the high-potential paths and little low-potential paths, we divided a number of zones (Fig.17): the zones adjacent to two high-potential paths are judged to be areas with high potential for implanting urban functions and are shown in red; the zones adjacent to

one high-potential paths are judged to have medium potential for implanting urban functions and are indicated in yellow; and the zones away from the high-potential paths are judged to have low potential for the implantation of urban functions and are showed in blue. The red zone is suitable for implanting functions that require high pedestrian flow, such as commerce. And the blue areas are prioritised for layout of equipment space, logistic space, large anchor shops, etc.

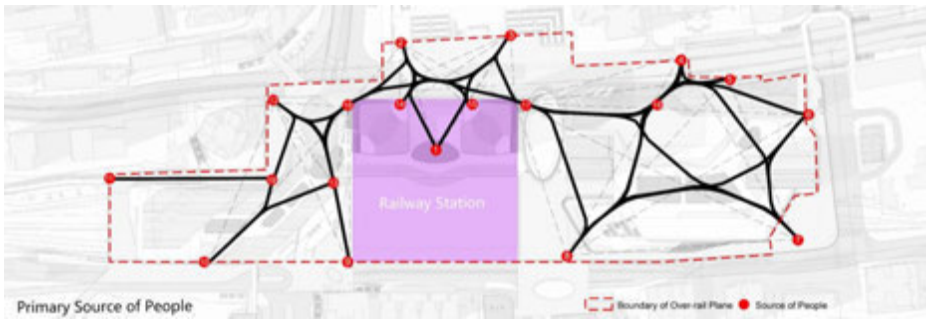

Fig 13. Network Morphology Generated by Wool Algorithm
Source: Drawn by Author

Fig 14. Pedestrian network in station area
Source: Drawn by Author

Fig 15. SDNA Calculation (all)
Source: Drawn by Author

Fig 16. SDNA Calculation (part)
Source: Drawn by Author

Fig 17. Identification of the Potential of Path and Regions (Source: Drawn by Author)

3.1.3 Overlay Comparison with Existing Design Results

In order to verify whether the above results are sufficiently effective in guiding subsequent design practice, the article compares the results with the design outcomes. Considering that the Chongqing Shapingba Railway Station Complex has produced some modifications during the implementation process due to management and other factors, the author chooses the first

version of the complete text of the programme, which has a text marking time of June 2018, to compare with this case. The analysis was carried out by means of a stacked comparison, in which Figure 17 and the layout plan for the over-rail plane were superimposed to obtain Figure 18.

The following phenomena can be observed from Figure 18:

1. the shapes of the functional areas are regularised considering the efficiency of plane utilisation, indicating that the path generated by the wool algorithm is still flawed. It only considers the performance and potential of the paths and ignores the regularity of the regions formed by the path cuts, which is a direction that can be further optimised in the future.

2. The types of functions and the potential of the area show some consistency: in the red area, there are a large number of small and medium-sized shops that bring vitality, with only a small amount of back-office space; in the yellow area, the number of medium-sized shops is beginning to increase, with a certain amount of back-office space and traffic space; in the blue area, there are mainly large warehousing spaces (the supermarket) and vertical traffic space.

This demonstrates the effectiveness of the methodology to a certain extent, but there is potential for further optimisation.

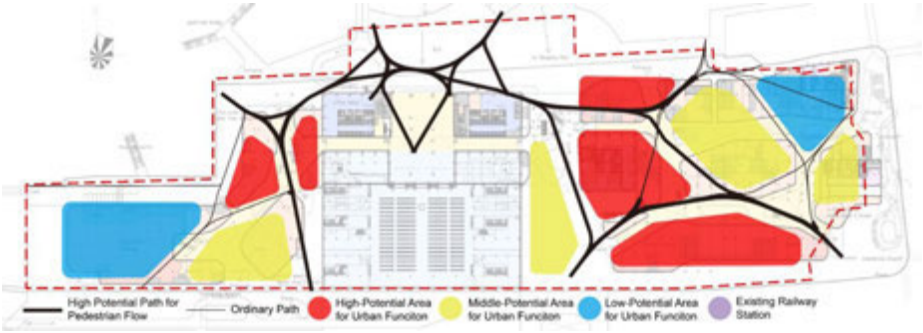

Fig 18. Overlay of Analyses and Actual Design Results
Source: Drawn by Author

3.2 The Over-rail Plane of Shenzhen North Station

3.2.1 Determining Primary Source of People

In the over-rail plane of Shenzhen North Railway Station, the following types of entrances and exits become the source of pedestrian (Fig. 19):

(1) Entrance to the railway station building, as shown at Point 1-3 in Figure 19, where a large number of train passengers enter or leave the covered area.

(2) Footbridge entrances and exits connecting to the neighbourhood, e.g. Points 4-5 in Figure 19, from which people from the neighbourhood enter or leave the over-rail plane.

(3) Major vertical traffic such as escalators to the MTR station, e.g. Point 12-15 in Figure 19, citizens or travellers are likely to enter or leave the covered area from this portion.

(4) Office buildings, commercial buildings, and transport facilities located at the edge of the over-rail plane, such as Points 6 - 11 in Figure 19, where points 6 and 9 are entrances and exits of commercial buildings, points 8 and 11 are entrances of office buildings, point 7 goes to the taxi stand, and point 10 goes to the bus stop.

In addition, since some of the points are too close to each other, it is considered to combine these neighbouring points to reduce the amount of computation, e.g. Point 3 is actually a collection of railway station entrances and two adjacent vertical facilities leading to the metro.

What's more, the current situation in the over-rail plane needs to be considered. Since the existing sunken courtyard is not freely accessible, people who had planned to pass through this area will instead follow the outer contour in a roundabout way, making it a pedestrian intersection. Therefore the research sets four pedestrian intersections at the corners (point 16-point 19 of Fig. 19) in order to avoid generating paths through the courtyard. This is similar to the way dealt with previously (Fig. 10).

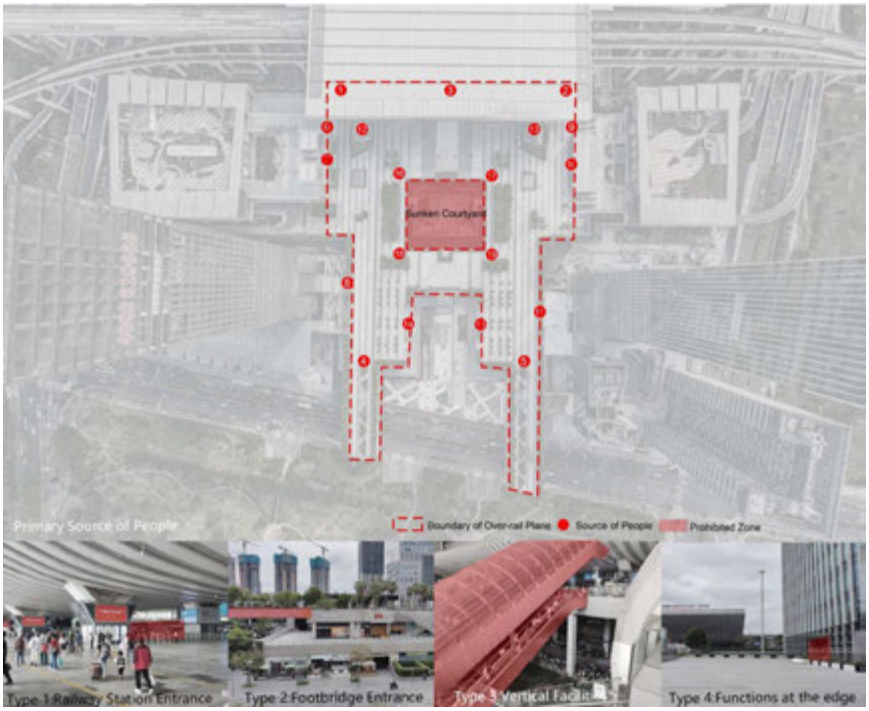

Fig 19. Primary Source of People and its Typical Types in the Over-rail Plane of Shenzhen North Station, Guangdong, China (Source: Drawn by Author)

3.2.2 Generation and Evaluation

The analytical application process for this case is essentially the same as the previous case, where differences are highlighted in italics:

In this case, the wool algorithm is also used to obtain the shortest meandering walking paths (Fig. 20), and the resulting network is simplified to a segment model in accordance with SDNA

analysis requirements. After supplementing with the peripheral and subterranean walking network, the SDNA tool is used to analyse as well.

In this case, Bth (Hybrid Betweenness) is also selected as the indicator for path evaluation. *During the path evaluation process of this case, three indicators, Bth500, Bth750 and Bthn, are used to be visualised, but the effect was not outstanding, indicating that the* over-rail plane *of Shenzhen North Station is not closely connected with the surrounding area, and its centrality of the station area is not strong. Therefore Bth300, which reflects centrality in smaller scale, is used for the visualisation.* Figure 21 shows the global visualisation results. Similarly, the visualisation results related to the over-rail plane are extracted separately (Fig. 22).

On the basis of Figure 22, the article determines the hierarchy of paths (Fig. 23, with exactly the same criteria and methodology as in the previous case). With the help of high potential path for pedestrain flow, *we selected a number of high potential areas (Fig. 23) according to two criteria: firstly, they are adjacent to three or more high potential paths, and secondly, they have a regular shape, which will facilitate a more efficient use of the planes in the case of smaller planes.*

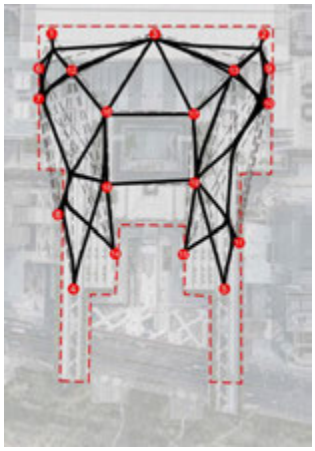

Fig 20. Network Morphology Generated by Wool Algorithm Source: Drawn by Author

Fig 21. SDNA Calculation (all)

Fig 22. SDNA Calculation (part) Source: Drawn by Author

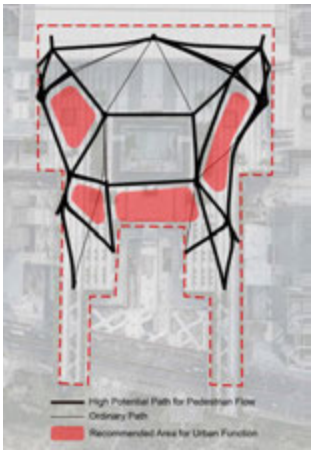

Fig 23. Identification of the Potential of Path and Regions (Source: Drawn by Author)

4 Discussion and Summary

This paper combines the wool algorithm and the SDNA analysis tool to explore a method to generate paths and divide potential functional zones in the over-rail area, and its innovations are mainly as follows:

(1) This paper improves the classical wool algorithm: firstly, it can be adapted to the existence of non-convex space after improvement; secondly, its generation results can avoid the internal obstacle zones, which expands the application possibilities of this classical algorithm.

(2) Focusing on an emerging kind of pedestrian priority areas – over-rail plane, we summarise the points inside and outside this class of areas that may become sources of pedestrian flow, and provide a method to organise its pedestrian system based on the sources of pedestrian flow and delineate the functional potential areas.

At the same time, we also found that the method has some shortcoming that deserve further enhancement:

(1) The wool algorithm can not be directly used to generate pedestrian networks, but only provides reference for path generation. Because it only considers the performance of paths and ignores whether the sites generated by path cutting are suitable for the embedding of urban functions. In the future, the regularity of the shape generated by cutting can be further taken into consideration to make it closer to the final design ;

(2) The research on the effectiveness of the current method is a qualitative comparison of the stacked maps, and more quantitative studies are to be conducted by introducing elements such as poi (point of interest).

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Stepping towards a sustainable future with TOD: Evaluating the Potential of the Lahore city for a Regional Policy Reform

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Abstract

This study investigates the potential of Transit-Oriented Development (TOD) in Lahore, Pakistan, a developing city in South Asia, to address its pressing transport and environmental challenges. Recognized as the world's most polluted city in 2022, Lahore confronts urgent issues exacerbated by urban sprawl and automobile dependency. Despite the introduction of a mass transit system, the city lacks robust urban planning strategies to effectively utilize these services. Our research seeks to bridge this gap by evaluating the TOD potential at 95 transit stations across four transit lines, using Geographic Information Systems (GIS) and Spatial Multicriteria Analysis (SMCA). The findings contribute to a sustainable urban planning framework, aiming to assist planners in making informed decisions for the development, funding, and implementation of TOD strategies, as outlined in the Master Plan for Lahore Division (MPLD-2050). This comprehensive approach will act as game changer, rejuvenating Lahore's urban center and promoting sustainable urban growth in emerging economies.

Keywords: Developing City, Game Changer, Sustainable Urban Planning, South Asia Transit-Oriented Development (TOD)

1. Background

According to the United Nations (UN, 2018), 55 percent (55%) of the global population currently resides in urban areas, a figure expected to double by 2050. This urban expansion is driven by population growth and migration to cities. Urban centers, as economic powerhouses, generate over 80 percent (80%) of the world's Gross Domestic Product (GDP), as reported by the World bank (2020). However, cities also consume approximately 70 percent (70%) of the world's resources, positioning them as major consumers of energy and significant contributors to greenhouse gas (GHG) emissions. The trends of urban sprawl and increased reliance on automobiles exacerbate these issues. Consequently, there is a growing advocacy for investment in public transport as a means to counteract low density development and rejuvenate urban environments. Such investments promote sustainability by enhancing convenience, encouraging active travel, improving air quality, reducing congestion, and mitigating climate shifts.

In this context, cities in developing countries encounter significant difficulties in maximizing prospects foe eco-friendly urban planning. These challenges stem from immediate transportation needs, disjointed organizational structures, problems with interdepartmental coordination, and stringent administrative environments. Many major cities in Asia are currently making significant investments in public transport networks, oscillating between transit-oriented models and auto-centric, traffic-congested urban forms. Moreover, transforming city structures and strengthening teamwork within the transportation sector consistently pose considerable challenges. This is particularly evident in Lahore, the cultural capital of Pakistan, which has recently initiated a mass transit system as a step towards sustainability. However, there is an urgent need for effective planning approaches to utilize these services effectively as tools for urban revitalization.

Transit-Oriented Development (TOD) has garnered increasing recognition among scholars and professionals for integrating transportation with urban development, spatial planning, and design to provide comprehensive solutions to contemporary urban challenges globally. TOD encourages walking, cycling, and the use of public transit over cars by fostering the development of multi-

functional communities near transport nodes, characterized by average to high density levels and walker-friendly zones. While much of the research demonstrating TOD's practical implementation comes from developed countries (Singh *et al.*, 2017; Hamid and Saadi, 2018; Li *et al.*, 2019; Teklemariam and Shen, 2020), there remains a notable gap in its applicability and evidence for developing nations, which compel the formulation of bespoke action plans.

This research seeks to bridge existing gap by conducting focused research on the potential for TOD in Lahore, Pakistan—a developing city in South Asia facing significant challenges related to its transportation sector and associated environmental and urban issues. Lahore, often in the global spotlight as the 'World's most polluted city,' has endured years of severe smog conditions(IQAir, 2022). Moreover, the new Master Plan for Lahore Division (MPLD-2050) proposes TOD principles for major transit corridors, but falls short on proactive implementation steps. This research aims to evaluate the TOD's potential in Lahore as a sustainable strategy that could revolutionize its comprehensive issues, thus marking a progressive step towards a sustainable future. Additionally, it seeks to develop a framework for sustainable urban planning that enhances emerging economies through the effective utilization of transit services like BRT and LRT.

2. Literature Review

Achieving sustainable urban growth is a primary goal of transportation-linked urban strategies, despite their inherent contradictions. Throughout the 20th century, as cities expanded, transportation systems both supported urban development and posed challenges to economic, social, and environmental sustainability (Banister, 2005). Sustainability is commonly interpreted through the concept of sustainable development, defined by the World Commission on Environment and Development (WCED, 1987) as meeting the needs of the present without compromising the ability of future generations to meet their own. Understanding 'sustainable urban development' is critical when exploring the interplay between cities and sustainability (Dizdaroglu and Yigitcanlar, 2016). This involves a continuous alignment of resource use, investment, technological progress, and institutional change with the needs of both present and future populations.

This narrative is especially pertinent in Asia, where bustling cities and robust economic growth are marred by significant sustainability challenges. According to the Asian Development Bank (ADB, 2017), 80 percent (80%) of new economic growth in Asia will stem from urban areas, leading to urban sprawl and an increased reliance on vehicles (Jenks, Kozak and Takkanon, 2008). These dynamics contribute to traffic congestion, environmental pollution, and unequal access to services, exacerbated by inadequate urban planning and limited transportation alternatives. To address these issues, many Asian cities have escalated their investment in mass rapid transit systems. From 2001 to 2010, the majority of these systems were constructed in Asia, with half being built in China alone. This trend is expected to continue, with approximately 30 cities in China, including Beijing and Shanghai, and nearly 20 in India, such as Delhi and Mumbai, alongside several in Southeast Asia like Bangkok and Jakarta, actively expanding their transit infrastructures. According to ADB projections (2017), emerging Asia will require $26 trillion in infrastructure investments from 2016 to 2030 to sustain growth and address climate change, with $8.4 trillion earmarked for the transport sector (Abiad, Farrin and Hale, 2019).

In South Asia, however, the trajectory of urban transport development has diverged significantly from other regions. Major cities here have followed a delayed development path compared to global cities such as Tokyo, Paris, and London, which had established extensive rapid transit networks before the advent of mass motorization (Barter, 2018). South Asian countries initially prioritized increasing road capacity to alleviate traffic congestion, fostering auto-oriented urban planning standards. Consequently, air quality in South Asia remains critically poor, with countries like Bangladesh, Pakistan, and India featuring among the top five most polluted nations as per the 2019 World Air Quality Report by IQAir (IQAir, 2019). Furthermore, a study of 114 countries worldwide indicates that economic and population growth have been significant drivers of increasing global CO2 emissions over recent decades, with urban centers at the heart of this trend (Pani and Mukhopadhyay, 2010).

Dense urban planning is essential for managing energy consumption and reducing carbon emissions, achievable through strategies like TOD and mixed land-use. Research indicates a strong correlation between urban development density and CO2 emissions: areas with low-density expansion tend to have higher emissions compared to those with compact urban growth (Glaeser and Kahn, 2010). Moreover, implementing TOD strategies can significantly lessen Vehicle Miles Traveled (VMT) and related greenhouse gas (GHG) emissions (Haas and Miknaitis, 2010). Additionally, mixed-use designs can lower carbon emissions by minimizing travel distances and reducing reliance on automobiles (Fong *et al.*, 2008).

(Calthorpe, 1993) outlined best practices for smart city planning through eight design principles, including enhancing walkability and bicycle systems, developing dense networks of streets and pathways, promoting mass transit, zoning for mixed land-use, aligning density with transit capacity, fostering compact regions with short travel distances, and optimizing mobility by managing parking and road space. These principles align well with the features of TOD, emphasizing compact growth, pedestrian and bicycle friendliness, and the integration of public spaces around transit stations, which are designed as community hubs (Thomas *et al.*, 2018). TOD's success in promoting urban and transportation sustainability is notable. Originating in the 1980s to address urban issues in U.S. cities, the approach has gained global recognition, particularly in developing countries grappling with rapid urbanization and increasing traffic congestion. This concept resonates with the challenges described in South Asia, where there is a critical need for sustainable infrastructure to accommodate burgeoning urban populations and mitigate environmental impacts.

Since the 1990s, TOD has become a key term among urban planning circles worldwide. It has gained recognition from scholars and professionals for its approach to integrating the transport sector with urban development, spatial planning, and design to address contemporary urban challenges comprehensively. Although TOD initiatives have been implemented globally, it has become apparent that their outcomes can vary significantly. This variability underscores that the results of any given plan depend on a complex array of factors, methods, and interactions. Consequently, after practical applications, global literature has offered various critiques of TODs, particularly from American, European, and Australian contexts. These critiques often highlight how many projects have evolved into Transit Adjacent Developments (TAD) without the necessary supportive conditions.

Integrating TOD planning across various levels is essential to effectively address transportation challenges. The TOD approach can be viewed from two perspectives: one at the station level, involving prescriptive guidelines for development, and another at the regional level, which allows for a more flexible approach to urban growth (Hrelja *et al.*, 2020). First, TOD requires high-quality rail transit services that connect municipalities and must be planned, managed, and financed at the metropolitan or regional level. Second, station areas along transit lines can differ significantly in their current development status and potential for growth, as well as their balance between being a node and a place. Regional planning is crucial in evaluating the specific role each station plays within a broader territorial framework, thereby guiding local decision-making to align with larger-scale objectives.

A substantial body of literature on TOD assessment incorporates both quantitative and qualitative analyses. Various scholars have proposed numerous indicators to establish empirical or theoretical foundations within specific contexts. Calthorpe (1993) introduced the '3D' approach to TOD, encompassing Density—with a high concentration of housing, population, workplaces, and recreational sites; Diversity—featuring mixed land uses; and Design—promoting compact urban forms and pedestrian-friendly environments. Building on this foundation, Cervero and Kockelman (1997); Ewing and Cervero (2010) and Renne (2016) expanded the definition by adding three additional dimensions: Distance to transit stations, Terminus Accessibility, and Demand Management of urban car traffic. Furthermore, Knowles (Knowles, 2012; D. Knowles and Ferbrache, 2016) identified High-frequency transit service as another critical requirement for successful TOD.

Researchers have employed various methodologies to analyze transit station areas, utilizing spatial analysis, spatial statistics, and simulation techniques. Notably, Evans and Pratt (2007) and Singh *et al.* (2014) developed a TOD index to quantify existing levels at transit stations. Higgins and Kanaroglou (2016) used the latent class method to classify 372 stations in Toronto into distinct TOD typologies, while Shirke *et al.* (2017) applied a discrete choice model to assess the impacts of TOD along Mumbai's Metro Line-1. Further advancing TOD assessment, Mirzahossein *et al.* (2022) utilized the Analytic Hierarchy Process (AHP) to devise an interactive transit system in and Iranian city. The integration of both qualitative and quantitative methods has been prevalent, enhancing TOD evaluation(Nagari, Suryan and Pratiwi, 2020; Millard-Ball, 2021; Mohamad, Fahmy-Abdullah and Masrom, 2021; Liu *et al.*, 2022; Maheshwari, Grigolon and Brussel, 2022). The evaluation of a TOD involves integrating factors related to Transportation, Orientation and Urban Growth, which may differ in scope and can be spatial or non-spatial, often demanding Multiple Criteria Analysis (MCA) for an inclusive valuation. Spatial Multi Criteria Analysis (SMCA) is particularly favored for identifying priority interference areas, thus deepening insights into regional TOD levels. In a recent example, Ibrahim *et al.* (2023) used SMCA to evaluate TOD potential in Alexandria, Egypt . This interconnected approach highlights the evolving complexity and precision in TOD research, emphasizing the importance of multifaceted assessment techniques to inform urban planning and development strategies.

Although the aforementioned studies have made significant contributions to evaluating TOD in various contexts, most TOD research and implementation examples are derived from developed countries. This has resulted in a noticeable gap in knowledge and practical application for developing cities. Consequently, we have chosen to employ the 3D criteria to assess the extent to which TOD supportive characteristics exist in Lahore and identify areas that require improvement

to steer the city towards sustainable growth. The selection of criteria and relevant indicators is grounded in a thorough review of pertinent literature and the availability of data within the context of developing countries. This approach ensures that our methodology is both informed and adaptable to the specific challenges and resources of these regions.

3. Research Approach and Case Study Background

3.1 Research Approach

We worked on 3Ds criteria established by Cervero and Kockelman (1997) which includes density, diversity and design. Higher density around stations promotes public transit usage, while greater diversity attracts visitors to use BRT/LRT services and explore the area on foot. Pedestrian-friendly designs further encourage walking near these transit stations. The selection of indicators for each criterion is guided by specific reasons and the availability of data. The detailed methodology is illustrated in the Figure.1, and the Table.1 outlines the final selected variables, providing descriptions and the data sources utilized for this study.

Before evaluating TOD, it is crucial to delineate the "TOD area" around each transit node, usually defined by a walking distance of 400m to 800m. In Lahore, the typical walking distance to access public transport is around 600m(JICA, 2012). Stations along transit lines are strategically placed about 1km apart, supporting an optimal walking distance of 500-600m. For this study, we have considered a 500m radius (equivalent to a 5-minute walk) as the basis for measuring indicators within the areas surrounding the four transit lines (Figure 2).

Population density is calculated as the ratio of population to land area, as shown in Equation (1). For this analysis, the WorldPop open population repository (WOPR) provided population data set for Pakistan in 2020, with a resolution of 100 meters. This dataset, in Geotiff format, was processed more using ArcGIS to compute the population density within each demarcated zone.

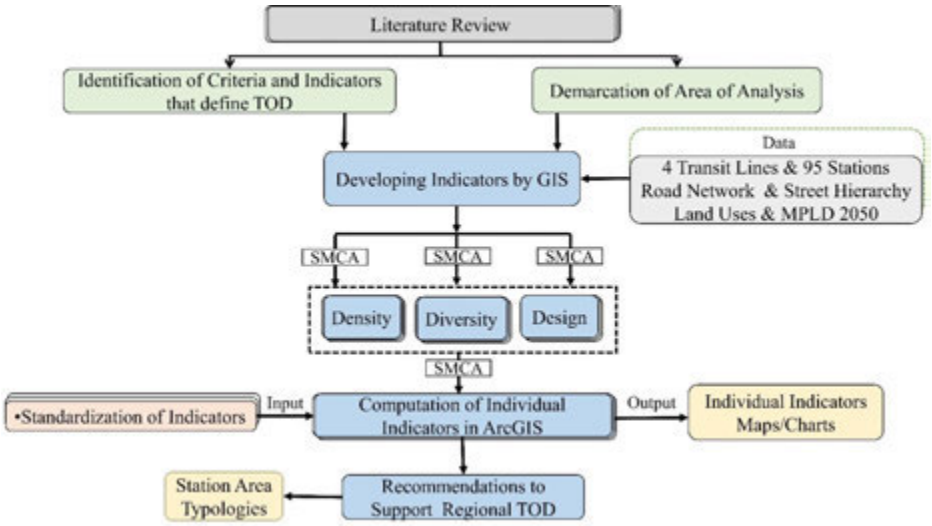


Figure 1. Research Framework

Table 1 Criteria and indicators

Criteria	Indicators	Description	Data Source
Density	Population Density	Number of people/sqkm	WorldPop
Diversity	Land use Diversity	Entropy index	Computed with ArcGIS
Design	Open Space Ratio	Area of open spaces and parks	Computed with ArcGIS
	Landuse Mixedness	Ratio of residential land use with non-residential land uses	Computed with ArcGIS
	Intersection Density	Number of intersections per km2	Computed with ArcGIS
	Walkable/Cyclable paths	Aggregate length in meters of walkable and cyclable routes	Computed with ArcGIS

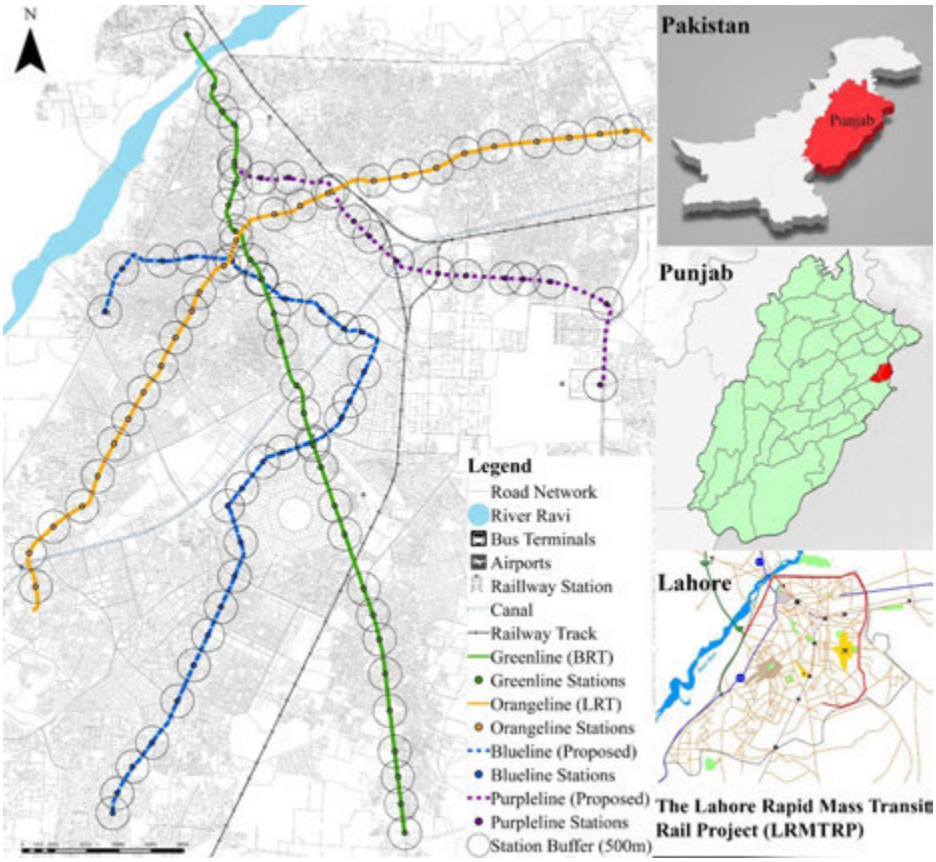


Figure 2. Transit lines in LRMTRP with demarcated TOD Area

$$Population\ Density = \frac{\text{No. of People}}{\text{Buffer Area}} \quad (1)$$

Building on the analysis of population density, the study also examined land use diversity, which evaluates the spatial variety of various land use categories in accessible proximity. This diversity in land usage addresses various needs of residents, thereby encouraging the use of transportation services during off-peak times and on holidays. Among several methods considered, the entropy method was chosen to quantify land use diversity. The specific formula employed is detailed below.

$$Entropy\ Index = \frac{-\sum_i Q_{lu_t} \times \ln(Q_{lu_t})}{\ln(n)} \quad (2)$$

where

$lu_t = land\ use\ class\ (1,2,\ldots\ldots,n)\ within\ analysis\ area\ t$

Q_{lu_t} = Propotion of particular land use within area of analysis t

S_{lu_t} = Overall spatial extent of the designaed landuse in area t

S_t = Total area of analysis t

Design plays a crucial role in creating accessible environments that promote walking, an essential component for TOD. Moreover, design is not merely linked to travel choices; it also forms a vital connection in the spatial layout between residents and stations, facilitating the development of high-quality open spaces. Under this criterion, indicators such as land use mixedness, walkable and cyclable pathways, intersection density, and the ratio of open spaces have been selected.

The objective of assessing land use mixedness is to determine how well-suited an area is for walking and cycling. This concept is distinct from diversity index as it explicitly measures the integration of residential areas with other land uses. A good blend of residential and other land uses supports a higher number of non-work-related trips that can be made by walking or cycling, as indicated by various studies (Jacobs, 1961; Evans and Pratt, 2007). Therefore, we calculated mixedness using a formula developed by Zhang and Guindon (2006):

$$\text{Land use Mixedness} = \frac{\sum_{nt} S_c}{\sum_{nt}(S_c+S_r)}\ \forall t \text{ a} \qquad (3)$$

S_c = Aggregate area of non − residential urban land uses

S_r = Total area of residential landuse within (t)

The length of walkable and cyclable paths is computed in meters. Data related to roads network is employed in ArcGIS (version 10.8) to compute intersection density, depicted as the number of intersections per square kilometer within each station buffer area. Furthermore, this study utilizes the open space ratio as an indicator of walkability. Research by McCormack et al. (2010) demonstrated that high-quality green spaces and parks encourage walking within neighborhoods. Koohsari et al. (2013) also found that the size and quality of these areas positively influence pedestrian activity. Further supporting this, studies by Zhang et al. (2020) and Zlot and Schmid (2005) indicated that neighborhoods with abundant parks are generally more walkable. In this study, we employ the following formula to calculate the open space ratio.

$$Open\ Space\ Ratio = \frac{Area\ of\ open\ spaces\ and\ parks\ (sqm)}{Total\ catchment\ area\ of\ a\ station\ (sqm)} \qquad (4)$$

After developing individual indicators in ArcGIS, further step is spatial multi-criteria analysis (SMCA). It involves standardizing values reflecting indicators to compare and aggregate. This standardization is crucial due to the diverse units of measurement used in computing these indicators. In this study, among the various methods available, we employ the "maximum" method. Under this approach, the highest attained indicator value is assigned a value of "1". All other values are then proportionally assigned a value between 0 and 1, based on their ratio to this maximum value.

3.2 The Case Study Background

Lahore, Pakistan's cultural capital and one of the top thirty most populated cities globally, is a key center for economic, political, transportation, entertainment, and education. According to the 2017 census, its population stands at 11 million with an annual growth rate of 4.07 percent (4.07%) since 1998 (PBS, 2018). Contributing 13.2 percent (13.2%) to Pakistan's GDP, Lahore ranks 122nd worldwide in economic output (Ali et al., 2020).With a history that spans over two millennia, the city is celebrated for its significant architectural heritage and vibrant cultural scene.

Once governed by the Mughal Empire and later under British colonial rule, Lahore became the Islamic Republic of Pakistan following its freedom in 1947. Known for its historical architecture, including mosques, temples, churches, tombs, and parks, Lahore is a vibrant destination for tourists. Its urban landscape is characterized by a densely populated walled city and more expansive urban and outlying regions to the south and southeast (NESPAK, 2004). As a major metropolitan center, Lahore offers a variety of commercial and trade opportunities and is becoming a key player in the technology sector. Historically referred to as the "Mughal city of gardens" (Naz and Anjum, 2007)and the "Paris of the East," the region has seen significant transformations over the past few years through urban rejuvenation, heritage conservation, renovation initiatives, and extensive infrastructure improvements. Transitioning from the "City of Gardens" to the "City of Concrete," Lahore faces ongoing challenges such as urban decay, escalating land prices, and infrastructural concerns (Abubakar, 2016).

A significant undertaking is the Lahore Rapid Mass Transit Rail Project (LRMTRP), encompassing 97 kilometers of rail lines to deliver sustainable transport in Lahore. The project is divided into two stages: Phase I features the Greenline (MBS), operational since 10 February, 2013, and the Orangeline, operational since October 2020. Phase II proposes two additional lines: the blue and purple lines. However, a noted issue with these infrastructure projects is their isolated development, often disregarding the city's character(Rana, Bhatti and e Saqib, 2017).A research on Greenline by Anwar et al. (2020) also noted that transport infrastructure dominance alters the city's overall character. Further confirmation was found regarding the neglect of social considerations during the design and construction phases. Attention was exclusively directed towards physical infrastructure, neglecting softer elements such as community development, socio-cultural values, and people-centric design (Anwar, Leng and Ahmad, 2024).

Numerous urban green spaces in Lahore have been converted into pavement for infrastructure projects such as flyovers, underpasses, and road expansions, often at the expense of the city's green belts. Furthermore, the construction of the Greenline and Orange Line has negatively impacted the city's environment and cultural identity. While Lahore has made significant strides in infrastructure, it continues to face numerous challenges. Many of these major projects are executed in isolation, without an integrated plan or strategic framework (Alam, 2015).

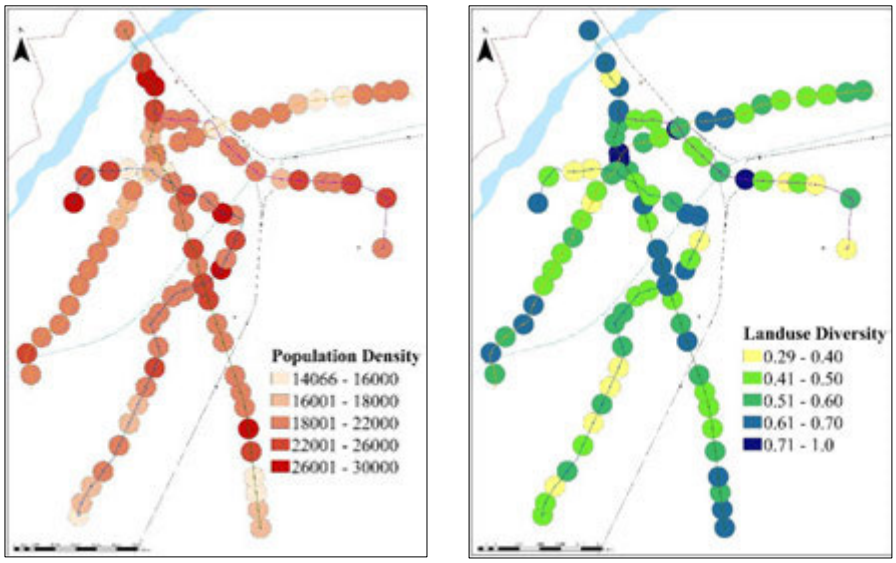
Despite these issues, Lahore has taken a step towards sustainability by implementing a mass transit system. However, the city still struggles to find effective planning approaches that can transform these services into tools for urban renewal. Once known as a garden city, Lahore is now in a phase of urban transformation, and is eagerly awaiting sustainable initiatives to bridge these developmental gaps.

4. Results and Discussion

Utilizing population density as a benchmark is pivotal for assessing transit areas, as regions around transit stations with high population densities typically see increased public transit ridership and spur urban development. Thus, areas of high-density development not only suggest substantial travel demand but also indicate a strong alignment with TOD principles. Figure 3a visually represents the population density within specific zones around each transit station. Notably, the highest population densities occur near Azaadi Chowk Station and Timber Market Station, due to the tightly packed and densely populated residential parcels. In contrast, the areas near Canal and Liberty Station exhibit higher densities due to multistory building structures. This variation underscores the influence of residential patterns and architectural styles on the population density surrounding transit stations.

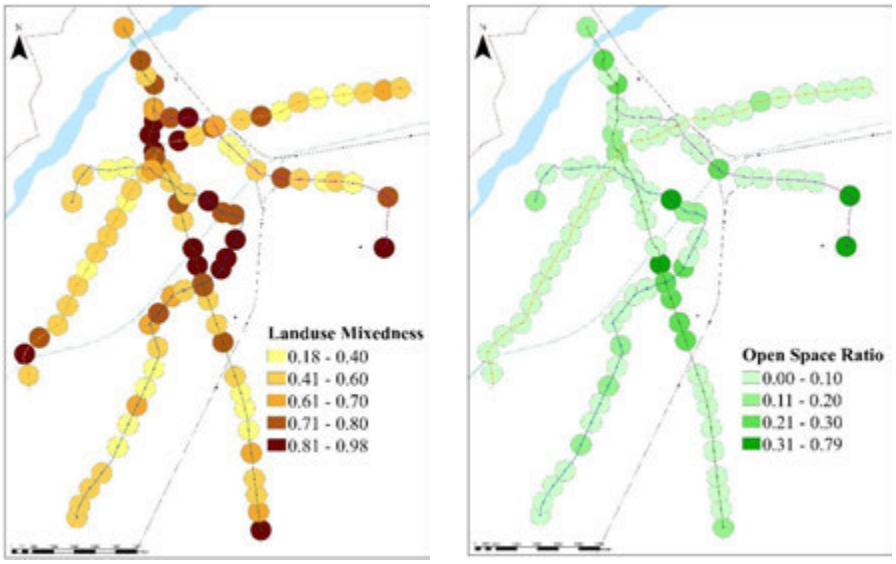
The entropy method was adopted to evaluate land use diversity, and parcel-level land use data was compiled in vector format using ArcGIS 10.8. This dataset includes a 500-meter radius around each station and incorporates data from surveys, Google Earth, OpenStreetMap, and extensive field trips. The analysis covered diverse types of land uses including commercial, educational, healthcare, institutional, industrial, religious, parks and green spaces, leisure zones, graveyards, underutilized or vacant plots, residential areas, utilities, and transportation facilities. Figure 3b illustrates the land use diversity surrounding each node. The calculated measure ranges between 0 and 1, with higher values indicating increased land use diversity and improved TOD effectiveness. Notably, the highest levels of land use diversity are observed near Railway Station, Dharampura Station, Lake Road, MAO College Station, and Shama Station. These locations serve as central hubs for a variety of businesses that cater to the entire city. Conversely, the lowest diversity values are found at Samanabad Station, Shamnagar Station, NFC Society Station, Askari IX Station, and Airport Station, predominantly due to the prevalence of residential neighborhoods. This comprehensive approach underscores the complex nature of urban development and its potential to support TOD.

In the same context, figure 4a displays the land use mixedness for all 95 stations in the area. This mixedness also spans from 0 to 1, where 0 indicates no residential usage and 1 denotes exclusively residential areas. A mixedness value of 0.5 represents a balanced mix of residential and other land usage, suggesting a harmonious blend. Subsequently, the open space ratio is calculated and presented in Figure 4b.



(a) (b)

Figure 3. (a) Population density (b) Land use diversity



(a) (b)

Figure 4. (a) Landuse Mixedness (b) Open Space Ratio

Intersections significantly enhance walkability and cyclability by reducing travel distances. A higher density of intersections provides more route options for pedestrians and cyclists, effectively shortening their travel paths. This phenomenon is demonstrated across 95 stations of the LRMTRP, as illustrated in Figure 5. The highest intersection density is observed around Bhaati Chowk Station, Janazgah Station, Lakshmi Chowk Station, Samanabad, and Ichra Station. These areas benefit from old, organic development in the city core, characterized by small land parcels. In contrast, the lowest densities are observed around Liberty Chowk Station, Canal Station, and Gulberg College Station—areas of newer planned development—as well as Airport Station and NFC Society Station, which are characterized by vacant land parcels.

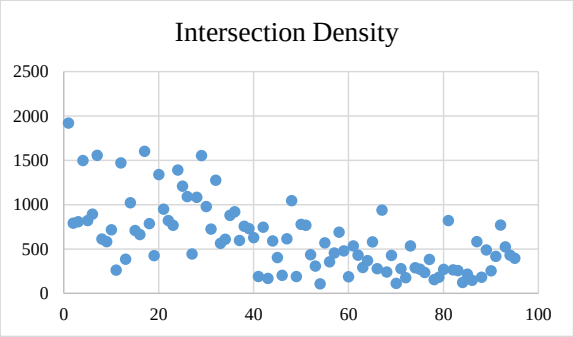


Figure 5. Intersection density around 95 stations of LRMTRP

Similarly, the total length of pathways, measured in meters using ArcGIS, varies significantly, as depicted in Figure 6. Pathway lengths range from 0 to 36,573 meters. Stations such as Samanabad, Bhaati Chowk, Timber Market, Lakshmi Chowk, and Chungi Amra Sidhu report the highest measurements, corresponding to their locations in the dense, inner core of the city. Conversely, stations like Liberty Chowk, NFC Society, Marrian Stop, and Gulberg College, situated in newly developed areas, report the shortest pathways. Additionally, Boharwala Chowk Station exhibits lower values due to its proximity to railway infrastructure. This distribution highlights how urban planning influences pedestrian and cyclist accessibility.

After computing all indicators, their results are standardized for spatial multi-criteria analysis (SMCA). The standardized results for all indicators around the 95 stations of the LRMTRP are displayed in Table 2. Using these values, stations can be compared to identify which criteria require improvements based on the context and location of each station within the region. For instance, a standardized value of 1 for intersection density at Bhaati Station shows that this area has the highest intersection density among all stations. There is a necessity to focus on individual stations by enhancing their low-scoring criteria to contribute to TOD for a sustainable future. Radar charts

have been created for three sample stations located in varied city zones—urban, suburban, and greenfield—to highlight areas for improvement based on their standardized values (Figure7).

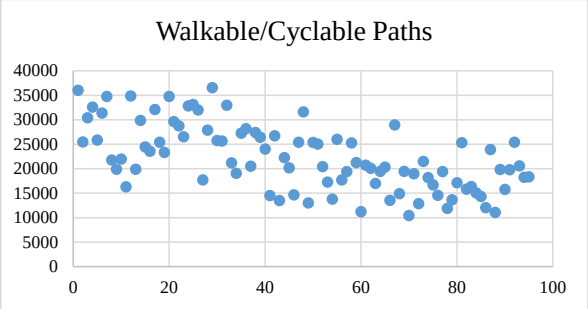


Figure 6. Walkable/cyclable paths

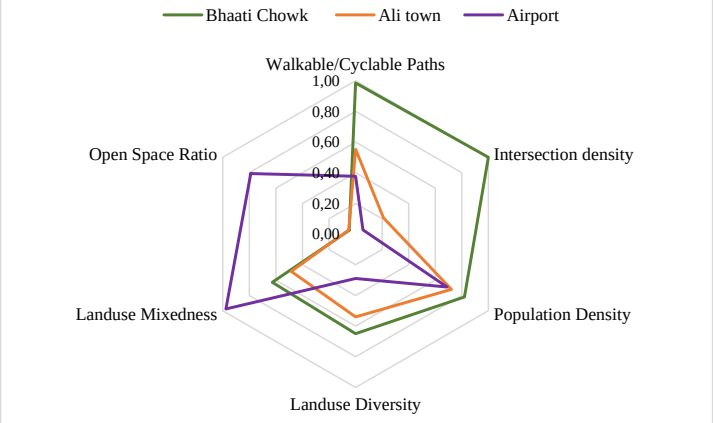


Figure 7. Radar Charts for 3 Sample Stations

5. Conclusion and Recommendations

Research on practical TOD implementation has traditionally been conducted in developed countries, leaving a gap in evidence and experience regarding its applicability in developing cities. To address this gap, this study focuses on TOD application in Pakistan, specifically examining planning parameters critical for implementing TOD as a sustainable transport strategy in mega cities. The case study of Lahore is particularly highlighted to provide context-specific insights.

The results indicate that TOD is feasible in Lahore. It suggests that each node, whether existing or proposed, must be tailored stemming from its unique features and difficulties to effectively implement TOD. The recent master plan for the Lahore Division (MPLD 2050) recommends densification along the existing public transport corridors of the orange and green lines, as well as along major structural plan roads (Figure 8).

Table 2 Standardized values of all Indicators around 95 stations of LRMTRP

Sr. No.	Station Name	Population Density	Landuse Diversity	Open Space Ratio	Landuse Mixedness	Intersection Density	Walkable/ Cyclable
1	Bhaati Chowk (Greenline)	0.82	0.65	0.05	0.63	1.00	0.99
2	Azaadi Chowk	1.00	0.67	0.25	0.75	0.41	0.70
3	MAO College	0.66	0.72	0.19	0.81	0.42	0.83
4	Ichra Station	0.72	0.49	0.02	0.56	0.78	0.89
5	GPO	0.69	0.56	0.03	0.92	0.43	0.71
6	Lake Road	0.64	0.73	0.15	0.71	0.46	0.86
7	Lakshami Chowk	0.63	0.47	0.00	0.56	0.81	0.95
8	Shahdara	0.76	0.67	0.11	0.66	0.32	0.60
9	Railway Station	0.58	0.76	0.07	0.71	0.30	0.54
10	Katchehry	0.68	0.59	0.08	0.92	0.37	0.60
11	Thokar Niaz Baig	0.81	0.68	0.05	0.88	0.14	0.45
12	Timber Market	0.96	0.38	0.03	0.46	0.77	0.95
13	Kalma Chowk (Greenline)	0.87	0.67	0.13	0.73	0.20	0.54
14	Bund Road	0.62	0.49	0.01	0.49	0.53	0.82
15	Niazi Chowk	0.83	0.64	0.25	0.77	0.37	0.67
16	Shama Station	0.74	0.70	0.03	0.76	0.35	0.64
17	Janazgah	0.55	0.51	0.00	0.64	0.83	0.88
18	Qartaba Chowk	0.64	0.52	0.01	0.62	0.41	0.69
19	Canal Station (Greenline)	0.80	0.65	0.09	0.83	0.22	0.64
20	Chungi Amar Sidhu	0.76	0.43	0.04	0.38	0.70	0.95
21	Qainchi Station	0.77	0.54	0.02	0.53	0.49	0.81
22	Salahudin road	0.72	0.52	0.06	0.53	0.43	0.79
23	Wahdat Road	0.73	0.62	0.04	0.52	0.40	0.73
24	Baghbanpura	0.74	0.46	0.01	0.35	0.72	0.90
25	Ghulshan-e-Ravi	0.68	0.46	0.07	0.41	0.63	0.91
26	Kamahan	0.95	0.41	0.03	0.32	0.57	0.88
27	Civil Secretariate	0.63	0.58	0.16	0.94	0.23	0.48
28	Shalimar Gardens	0.56	0.57	0.18	0.48	0.56	0.76
29	Samanabad	0.59	0.33	0.01	0.29	0.81	1.00
30	Sultanpura	0.76	0.65	0.05	0.50	0.51	0.70
31	Awan town	0.72	0.5	0.07	0.43	0.38	0.70
32	Ghazi Chowk	0.67	0.42	0.00	0.37	0.66	0.90
33	Atari Saroba	0.79	0.54	0.00	0.62	0.29	0.58
34	UET	0.69	0.67	0.06	0.75	0.32	0.52
35	Chauburji (Orangeline)	0.55	0.59	0.04	0.54	0.46	0.75
36	Khatm-e-Nabooat	0.74	0.48	0.03	0.42	0.48	0.77
37	Hanjarwal	0.68	0.65	0.01	0.58	0.31	0.56
38	Sabzazar	0.74	0.42	0.03	0.35	0.39	0.75
39	Salamtpura	0.70	0.49	0.00	0.57	0.38	0.72
40	Islam Park	0.69	0.53	0.00	0.63	0.33	0.66
41	Gajjumata	0.62	0.69	0.11	0.98	0.10	0.40
42	Nishter Colony	0.49	0.67	0.03	0.59	0.39	0.73
43	Ittefaq Hospital	0.74	0.67	0.26	0.78	0.09	0.37
44	Dulu Khurd	0.59	0.62	0.00	0.66	0.31	0.61
45	Ali town	0.72	0.54	0.05	0.48	0.21	0.55
46	Qaddafi Stadium	0.71	0.65	0.39	0.80	0.11	0.40
47	Dera Gujran	0.75	0.58	0.07	0.54	0.32	0.70

Sr. No.	Station Name	Population Density	Landuse Diversity	Open Space Ratio	Landuse Mixedness	Intersection Density	Walkable/ Cyclable
48	Mahmood Booti	0.55	0.43	0.00	0.37	0.54	0.86
49	Canal View	0.74	0.6	0.01	0.70	0.10	0.36
50	Pakistan Mint	0.54	0.48	0.08	0.37	0.40	0.69
51	Youhanabad	0.50	0.59	0.00	0.56	0.40	0.69
52	Model Town	0.81	0.48	0.29	0.54	0.23	0.56
53	Naseerabad	0.66	0.55	0.29	0.50	0.16	0.47
54	Airport	0.69	0.29	0.79	0.98	0.06	0.38
55	Akbar chowk	0.77	0.40	0.06	0.37	0.30	0.71
56	Ameer Chowk	0.75	0.44	0.12	0.36	0.19	0.48
57	Askari IX	0.77	0.29	0.05	0.18	0.24	0.53
58	Babu Sabo	0.91	0.61	0.19	0.59	0.36	0.69
59	Bhaati Chowk (Purpleline)	0.80	0.65	0.05	0.63	0.25	0.58
60	Boharwala Chowk	0.55	0.59	0.07	0.69	0.10	0.31
61	Brandreth Road	0.64	0.42	0.05	0.89	0.28	0.57
62	Butt Chowk	0.62	0.39	0.09	0.32	0.22	0.55
63	Canal purple	0.76	0.53	0.27	0.52	0.15	0.46
64	Central flats	0.69	0.53	0.18	0.49	0.19	0.53
65	Chauburji (Blueline)	0.58	0.53	0.03	0.70	0.30	0.56
66	Dharampura	0.63	0.74	0.04	0.75	0.14	0.37
67	Double Sarkan	0.83	0.46	0.01	0.42	0.49	0.79
68	Faisal Town	0.70	0.53	0.06	0.65	0.12	0.41
69	Garhi Shahu	0.73	0.43	0.01	0.36	0.22	0.53
70	Gulberg College	0.71	0.67	0.18	0.72	0.06	0.29
71	Guldasht Colony	0.83	0.52	0.40	0.71	0.14	0.52
72	Hafeez Centre	0.69	0.43	0.01	0.86	0.09	0.35
73	Jora Pull	0.79	0.35	0.02	0.36	0.28	0.59
74	Kalma chowk (Blueline)	0.89	0.65	0.23	0.72	0.15	0.50
75	Lahore College	0.78	0.47	0.02	0.42	0.14	0.46
76	Lajhna Chowk	0.62	0.55	0.08	0.65	0.12	0.40
77	Mini Market	0.90	0.35	0.03	0.88	0.20	0.53
78	NFC Society	0.56	0.31	0.01	0.60	0.08	0.33
79	Punjab University	0.77	0.49	0.03	0.66	0.09	0.37
80	Services Hospital	0.65	0.60	0.43	0.90	0.14	0.47
81	Shamnagar	0.54	0.32	0.09	0.23	0.43	0.69
82	Valencia	0.50	0.44	0.06	0.48	0.14	0.43
83	Barkat Market	0.75	0.50	0.04	0.49	0.13	0.45
84	Canal (Blueline)	0.98	0.64	0.11	0.76	0.06	0.41
85	Engineering Society	0.57	0.41	0.08	0.47	0.11	0.39
86	Liberty	0.95	0.65	0.24	0.88	0.08	0.33
87	M Ali Chaudhry Chowk	0.77	0.39	0.11	0.33	0.30	0.65
88	Marrian Stop	0.69	0.53	0.05	0.76	0.09	0.30
89	Mayo Gardens	0.73	0.48	0.03	0.40	0.25	0.54
90	Military Accounts Society	0.66	0.53	0.09	0.47	0.13	0.43
91	Qartaba Chowk (Blueline)	0.66	0.46	0.01	0.44	0.22	0.54
92	Rajgarh	0.79	0.37	0.05	0.26	0.40	0.70
93	Saddat Chowk	0.86	0.50	0.01	0.41	0.27	0.56
94	Shah Alam Chowk	0.72	0.44	0.04	0.78	0.22	0.50
95	Zarrar Shaheed	0.67	0.47	0.02	0.45	0.21	0.50

These lines currently operate at nearly 40% below their projected capacity, surrounded by low-density areas near major stations. To combat this, a 500-meter radius around each station has been designated for regeneration and densification. This approach aims to enhance accessibility and walkability, fostering an urban environment conducive to TOD. The typical building height in these areas is currently 2 to 3 floors. There is a proposal to increase the permitted building height between 8 and 12 stories within this 500-meter radius around the main transit stations, which is expected to increase the population density to approximately 350 to 400 persons per hectare. This adjustment highlights Lahore's potential to adopt TOD as a sustainable strategy.

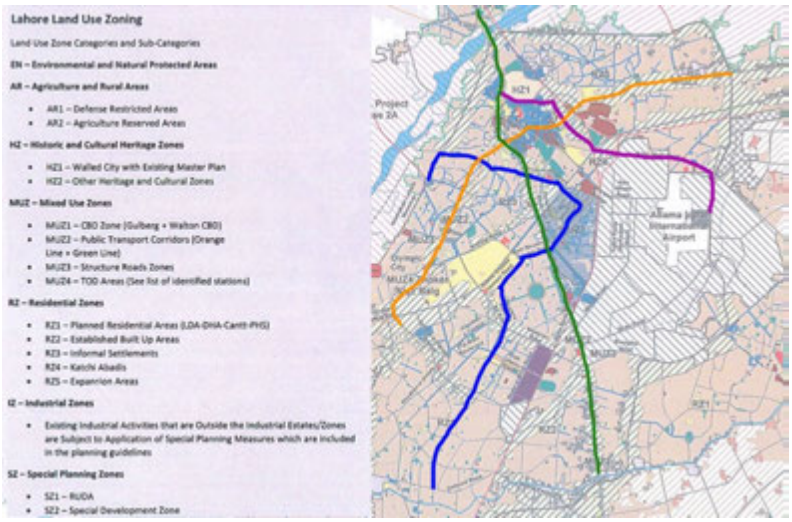


Figure 8. Transit lines of Lahore in Master Plan of Lahore Division (MPLD-2050)

This study assessed the existing characteristics of Lahore's urban landscape around transit nodes to evaluate the potential for adopting TOD. Our findings reveal that variations in different indicators across various transit nodes are due to their distinct contexts within the region. A significant issue in implementing TOD is the application of uniform Floor Space Index (FSI) or Floor Area Ratio (FAR) across the city, which overlooks local nuances such as existing infrastructure. The cornerstone of effective TOD is context-specific design, which considers factors like transit capabilities, lot dimensions, street sizes, and infrastructure capabilities.

To pave the way for urban redevelopment, a gradual and necessary process through democratic means is essential. Instead of granting higher FSI universally, it should be market-responsive, awarded selectively to those contributing to urban development. This approach prevents "Transit Adjacent Development" (TAD), which merely accumulates floor space near transit stations without necessarily increasing public transit ridership. Moreover, challenges such as lengthy timelines for

urban development, uncertain demographic shifts, and difficulties in achieving a jobs-housing balance pose substantial obstacles.

As Lahore continues on its urban development path, addressing these challenges and opportunities will be vital in shaping a sustainable and inclusive urban future. Based on the results from various indicators, all 95 stations across four mass transit lines have been categorized into three types, reflecting their development context as illustrated in Figure 9. Additionally, associated possibilities, challenges, and representative stations have been compiled in Table 3. These outcomes offer a valuable diagnostic tool for planners, policymakers, and governmental authorities, enabling them to assess and compare the efficacy of TOD attributes in both existing and proposed neighborhoods. Moreover, incorporating TOD principles into urban planning frameworks, such as the MPLD 2050, can guide future transit projects and promote sustainable urban growth in Lahore, other cities in Pakistan, and other emerging nations aspiring to implement public transport networks. This comprehensive approach will act as game changer, rejuvenating Lahore's urban center and promoting sustainable urban growth in emerging economies.

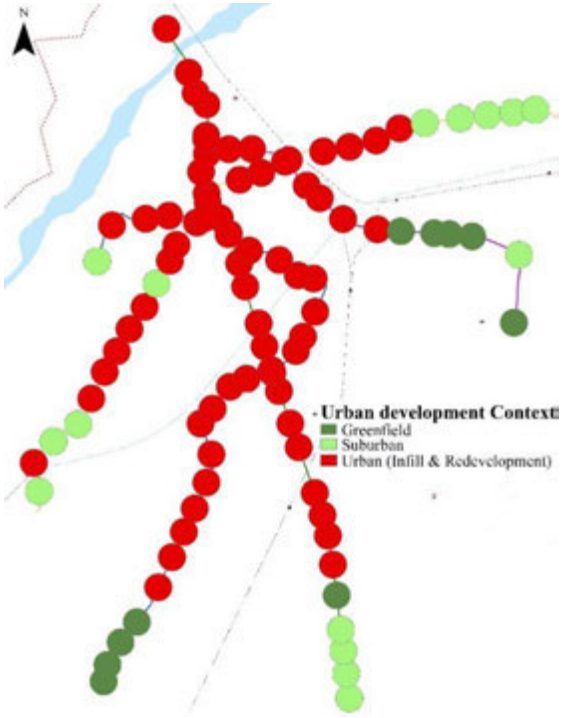


Figure 9. Development Context of all Stations

Table 3. Urban Development Context of all Stations of LRMTS

Urban Development Context	Opportunities	Challenges	Representative Case
Greenfield	Abundance of government lands New communities can be master planned around transit Lower land costs Increased financial resources available Construction of higher capacity infrastructure is feasible Strong political backing Minimal regulatory barriers Road safety is emphasized through systematic concepts	Long timeline for city development. Uncertain population composition. Challenges in achieving jobs-housing balance initially. Weak public transport connectivity promotes sprawl. Developers may lack risk appetite.	Askari IX, Zarrar Shaheed, Jora Pull, Saddat Chowk, Valencia Town, Engineers Society, NFC Society, Military Accounts Society, Atari Saroba, Airport
Suburban	More spots are at hand for transformation. Chance to enhance transit access in low-density areas. Lower land costs.	Sprawled lower density growth pattern. Singular land uses. Poor mobility connections, prioritizing automobiles over pedestrians, public transport, and non-motorized options like walking and cycling.	Ali Town, Canal View, Hanjarwal, Dulu Khurd, Gajjumata, Guldasht colony, Dera Gujran, Islam Park, Babu Sabu, Bund Road
Urban	Proximity to major transit routes and business hubs. Greater utilization of active travel modes, especially in low and middle-income areas. Potential for enhancing transit accessibility. Chances for redevelopment of aging buildings.	Multiple ownership complicates land assembly. Varying property dimensions and layouts. Current land uses are often not transit-friendly. Large block sizes hinder accessibility. Inadequate and risky pedestrian and bicycle infrastructure. Narrow or limited pathways.	Chungi Amar Sidhu, Canal (Green), Canal (Blue), Niazi Chowk, Garhi Shahu, Mayo Gardens, Barkat Market, Baghbanpura, Sultanpura, Janazgah, Shama, GPO, Lakshami Chowk, Brandreth Road, Shah Alam Chowk, Katchehry, Civil Secretariate, MAO College, Lake Road, Railway Station, Kalma Chowk (Green), Kalma Chowk (Blue), Bhaati Chowk (Green), Bhaati Chowk (Purple),

Qartaba Chowk (Green), Qartaba Chowk (Blue), Chauburjii (Blue), Chauburjii (Orange), Boharwala Chowk, Ittefaq Hospital, Ghazi Chowk, Ichra, UET, Qaddafi Stadium, Azaadi Chowk, Lajhna Chowk, Faisal Town, Marrian Stop, Punjab University, Gulberg College, Services Hospital, Lahore College, Shalimar Gardens, Pakistan Mint, Dharampura, Shahdara, Thokar Niaz Baig, Qainchi Station, Liberty, Hafeez Center, Main Market, Salamatpura, Mahmood Booti, Ameer Chowk, Butt Chowk, M Ali Chaudhry Chowk, Akbar Chowk, Central Flats, Rajgarh, Shamnagar, Double Sarkan, Youhanabad, Naseerabad, Kamahan, Model Town, Nishter Colony, Timber Market, Awan Town, Gulshan-e-Ravi, Khatam-e-Nabooat, Salahuddin Road, Samanabad, Sabzazar, Wahdat Road

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Layout Patterns and Crowd Flows of Commercial Space in High-Speed-Rail Station Complexes

-- Take three Chinese high-speed-rail station complexes as examples

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Abstract

The commercial space in the high-speed railway station area is a key factor in stimulating the vitality of the crowd in the station area, and the station complex can maximally convert the transport value of the station area into comprehensive functional value. In the era of ordinary railways, the high-speed railway station was only regarded as a passenger transport hub. The commercial space was only used as a supporting facility to serve the transport interchange activities, which failed to attract the crowd to stay for long. Still, with the gradual increase in the proportion of short-distance and commuter passengers, however, as the proportion of short-distance and commuter passengers grows gradually, the commercial space in station complexes that have appeared in recent years has also failed to take into account the needs of both passengers and citizens. In this paper, based on the block layout relationship between commercial space, station access space, and urban transport space, we construct a "node-path" network of commercial space entrances and exits with high-speed rail station entrances and exits as well as urban traffic entrances and exits, analyse the correspondence between the commercial space layout pattern of the station complexes and the flow of crowds, and explore how different commercial space layout patterns influence the flow of crowds. It also discusses how different commercial space layout patterns affect the behavioural activities of the crowd. Finally, it concludes that: 1. Appropriately narrowing the distance between the commercial space and the station space of small and medium-sized passenger stations, especially placing underground space between the two, can stimulate the consumption potential of transport-oriented passengers who transfer to the underground. 2. The entrance and exit settings of the commercial space and the distribution of the flow of people are affected by the layout of the commercial space. 3. The commercial space entrances and exits related to the movement lines of underground passengers are also affected by the layout of commercial space blocks. 4. The entrances and exits of commercial spaces related to the moving lines usually have higher pedestrian flow. This study can provide new perspectives and methods for analysing the layout patterns of commercial space in station areas and offer design suggestions for improving the use of commercial space in station complexes.

Keywords

Station-city Integration; Station Complex; Commercial Space; Crowd Flow; Layout Design

1. Introduction

The high-speed railway station is an important transport intersection in the overall layout of the region, gathering a large amount of internal and external traffic in the city. However, the urban station hub area is not only a mobility node in the transport network but also an aggregation place in the city, and it is a waste of the value embedded in the circulation to use it only as a transport hub for the collection and distribution of human flow. Relying on the traffic advantage of the high-speed railway station to create urban functions such as commerce, business, exhibition, leisure, and so on in the surrounding area and organically integrating the traffic function (switching to articulation) with the urban function (commerce, office, leisure,

etc.) (Peng Qiyuan *et al.,* 2017), in addition, it can make full use of the transport value of high-speed rail stations, explore the urban place attributes of high-speed rail stations, and promote the linked development of high-speed rail stations and cities.

The commercial function is one of the main functions of utilising the overflow effect of station traffic effectively, and commercial space has rich spatial forms and types of business, that can meet the consumption needs of different groups of users. In China's high-density cities, where urbanisation is accelerating and land resources are relatively scarce, the joint development of station hubs and commercial facilities can realise the spatial connection between the two sides of the station and the city and promote the integrated development of the station and the city in the traffic hub area. For example, New York's Grand Central Station, London Bridge Station, and Tokyo's Shibuya Station have become important urban business and commercial centres.

As a comprehensive transport hub, the high-speed railway station in the high-density city centre has strong transport value and a functional development basis. It can closely connect with and interact with the neighbouring urban space, so it can rely on the transport advantage to enhance the comprehensive urban functional value of the station area, especially the commercial function that drives the area's economic growth. It is necessary to introduce commercial functions reasonably and appropriately, taking into account the needs of consumption activities of station passengers and neighbouring citizens, and to establish a close connection with other spatial elements in the station area to create a synergistic effect between the station and the city.

However, in the current practice of construction of commercial space in the high-speed railway station area, it is obvious that there is insufficient consideration of the user groups and their needs, especially since the resources of people flowing from both the station and the city are not fully utilised at the same time. In the era of ordinary railways, the commercial space of high-speed railway station complexes in China was mainly a supporting facility serving fast-passing passengers. With the gradual growth of the proportion of short-distance and commuter passengers, the user groups in the station area not only demand the station's internal and external traffic functions but also pursue higher-quality consumption and leisure functions. However, the commercial space of station complexes that have appeared in recent years, despite emphasising the integration of commercial space with the station and the city in terms of spatial form, still presents the result of mainly serving the use of part of the group, producing a large number of unused and inefficient commercial spaces. The practical exploration of creating station-city integrated commercial space is still in its infancy and lacks effective supporting theories and assessment methods.

The station complex mentioned in this study refers to a complex system that contains station space, urban transport space, and commercial space and has great potential to develop into a regional public centre. Compared with the single passenger transport function of a traditional station, a station complex contains more comprehensive urban functions that are closely linked to the station space, and the urban transport space is placed between the station space and the urban functional space, playing a transitional role in linking the station and the city, while the urban functional space crosses the red line of the station site and is laid out close to the station space (Fig. 1). Due to the high degree of integration of various functional spaces,

clear and convenient spatial organisation and flow guidance are required to ensure basic passenger distribution and transfer functions while avoiding mutual interference and influence between functional spaces.

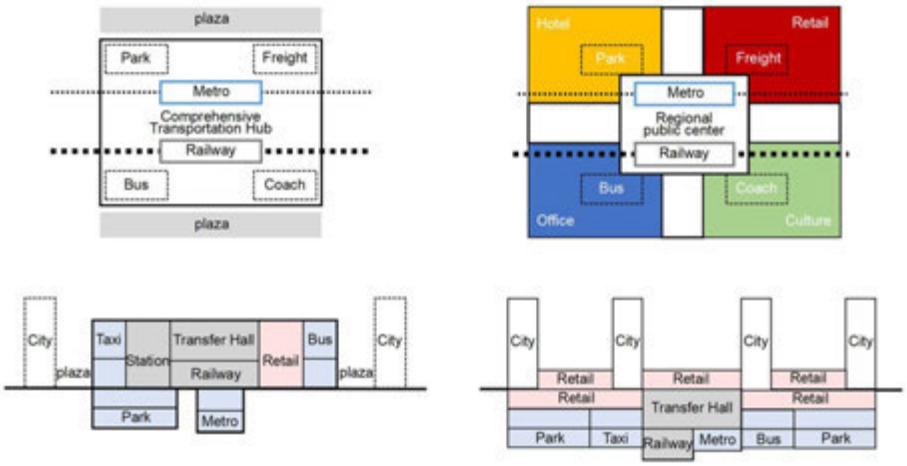


Fig. 1: Spatial pattern diagram of traditional stations and station complexes

Established studies have focused on the general organisation of station areas (Qi Guangping and LU Guanyu, 2019; Dai Yizheng *et al.*, 2018). Some studies have analysed the coupling relationship between commercial space and other spatial elements of traffic interchange activities (Gui Wangyang *et al.*, 2023; Yu Baofei and Ren Jun, 2021; Chen Binbin *et al.*, 2021). Few studies have focused on the fine-grained design of commercial space in high-speed rail station complexes from the perspective of passenger-citizen behavioural activity characteristics. On the one hand, existing studies have paid insufficient attention to the specific morphological design of commercial space in station complexes, lacked effective morphological analysis methods for commercial space layout, and have not yet answered the question of how the commercial space in station complexes should be linked to the station and the city, respectively. How should the commercial space of the station complex link the station and the city, respectively, and what role will other urban transport elements play? On the other hand, the existing studies have not deeply explored the influence of the layout of commercial space in station complexes on the flow of people, such as what kind of spatial use results will be brought about by different layout patterns.

This study selected Guangzhou East Railway Station, Chongqing Shapingba Railway Station, and Shenzhen North Railway Station, located in the centre of high-density cities in China, as the research samples. The commercial spaces of the three sample stations are similar in terms of industry composition but completely different in layout pattern. Among them, the layout pattern of the commercial space of the high-speed railway station complexes is broken down into two levels: block layout and node layout, and the crowd flow characteristics are mainly based on the data of pedestrian flow at the entrances and exits of the commercial space.

This study focuses on the layout of commercial space in high-speed railway station complexes. It builds a "node-path" network of commercial space entrances and exits with high-speed railway station entrances and exits and urban traffic entrances and exits based on the block layout. In addition, this study will classify the passengers and citizens in the commercial space of the station complex according to the purpose of travel and different types of urban transport, graphically present the behavioural activity chains of different groups, and explore the correlation between the behavioural activity characteristics of different groups in the station complex and the layout pattern of the commercial space.

The subsequent chapters are arranged as follows: Section 4 demonstrates the correspondence between the layout patterns of the commercial space of the sample station complexes and their crowd flow characteristics, Section 4.1 summarises the relationship between the commercial space of the sample stations and the block layout of the station space and urban transport spaces, corresponds the block layout characteristics of the commercial space of the sample station complexes to the total flow of people at all entrances and exits and analyses the impacts of different commercial space on the proportion of commercial space use. The impact of different commercial space layout patterns on the percentage of commercial space use is analysed. Section 4.2 abstracts the three types of functional blocks into multiple functional nodes, draws the behavioural activity chain of passengers and citizens going to the commercial space, respectively, constructs the relationship between commercial space entrances and exits with station entrances and exits as well as other urban traffic entrances and exits, corresponds the characteristics of the node layout of the commercial space of the sample station complexes with the flow of people at all entrances and exits, and analyses the effect of different node layouts of commercial space on the convergence of pedestrian flow at all entrances and exits. The influence of different commercial space node layout patterns on the gathering effect of pedestrian flow at each entrance and exit is analysed. Section 5 summarises the layout patterns of the commercial space of the sample station complexes, puts forward optimisation suggestions for different patterns, and proposes the commercial space layout suggestions of the high-speed rail station complex based on the characteristics of passenger-citizen behaviours and activities.

2. Literature Review

2.1 Study on the layout of commercial space in station areas

Theories related to functional space layout in station areas. TOD theory focuses on developing and constructing functional spaces that are closely linked to transport nodes. (Calthorpe Peter, 1993) Based on the study of high-speed railway station areas in Germany, France, Japan, and other countries, Schutz et al. were the first to put forward the circle structure model of the station area, i.e., with the increase of the distance from the station, the correlation between each functional space and the station gradually decreases and eventually forms a functional circle centred on the station. station-centred functional circles (Schütz Elmar, 1998). This theory initially explores the layout pattern of functional spaces in station areas. The commercial space of the station complex concerned in this study is located in the first circle,

which can take advantage of the traffic spillover effect of the railway station. The node-place model proposed by Bertolini is an analytical model for evaluating transport nodes from the perspective of public transport and land use based on the theory of the transport-land use feedback loop (Bertolini Luca, 1999; Bertolini Luca, 1996). The node-place model is an analytical model based on the theory of traffic-land use a feedback loop to evaluate transport nodes from the perspectives of public transport and land use (Bertolini Luca, 1996, 1999), in which the value of place is reflected in the development progress and development of the area around the high-speed railway station, and the use of commercial space is one of the indicators to measure the value of place in the station area, and the model can partly reflect the characteristics of the layout of the functional space and the effect of the use of station area.

Research and methodological tools for commercial space layout in station areas. Scholars have already classified commercial space in station areas into three categories: station commercial, station peripheral commercial, and peripheral area commercial, of which station commercial is commercial space developed integrally with station stations and transport facilities (Li Chuancheng *et al.*, 2016), which is consistent with the scope of commercial space that this study focuses on. Some scholars have also categorised commercial space as profitable building space and have analysed the coupling relationship between commercial space and elements of transport space and public space, proposing the layout patterns of tandem, adjacent, interspersed, composite, and cascading (Qi Guangping and LU Guanyu, 2019). In addition to conventional graphical analyses and qualitative descriptive methods, studies have been conducted to quantify the spatial organisation of station areas using urban spatial analysis tools such as Depth Map, such as exploring the correlation between the spatial integration degree of station peripheral areas and the functional layout of land (Du Qianyu and Zhang Fan, 2019). For example, to analyse the integration, connectivity, and comprehensibility of the underground interchange space of high-speed rail stations (Gui Wangyang et al., 2023), some studies abstract the complex urban spatial structure into graphical relationships based on urban morphology and building typology (Wang Zhendong & Wang Yindong, 2011). (Wang Zhendong and Wang Yinpu, 2015). The spatial structure of the station area is more complex, and it is difficult to determine a unified spatial reference point, but the connecting relationship between spaces can be expressed in diagrammatic form.

The distribution of crowd flow in the station area directly affects the use of commercial space. Still, few studies have analysed the connection between commercial space and other spatial elements in the station area from the perspective of crowd flow. Based on the above relevant theories, existing studies, and methods, this study will analyse the layout pattern of commercial space in station complexes from the two spatial floors of blocks and nodes by mapping the crowd flow in commercial space and summarising the layout pattern and expected usage effect of commercial space in station complexes.

2.2 Study on the crowd activity in station areas

Types of people who use the functional space in the station area. Studies have classified station users into two categories, namely "traffic transfer users" and "destination users" (Zhuo Weide *et al.*, 2022). For example, the destination segment is divided into four categories:

business, commuting, visiting relatives, and shopping (Wang Shaojian *et al.,* 2021). Other studies have analysed the functional space needs of different groups, such as short- and medium-distance passengers who are highly time-sensitive and have higher requirements for the accessibility of commercial space, long-distance passengers who are more likely to be price-sensitive and concerned about the type of commercial space, and citizens from the urban end of the city, who are more likely to have higher requirements for the quality and accessibility of commercial spaces (Wang Li, 2015).

Research and methodological tools for crowd activities in commercial space in station areas. Studies have used pedestrian simulation software to obtain complete data on crowd activities in station areas that cannot be collected in short-term studies, such as using AnyLogic software to simulate peak passenger flows in the distant future (Chen Binbin et al., 2021). For example, AnyLogic software is used to simulate the transfer situation of passengers leaving the station and to analyse the problems of the transfer space in the station based on the two indicators of transfer time and regional passenger density (Yu Baofei and Ren Jun, 2021). The problems of station transfer space are analysed based on two indicators: transfer time and regional passenger density. A large number of studies have also focused on the use of commercial office space in railway station areas, using field research, observation point counting, and other methods to obtain data such as the average number of people entering the shop per hour and the path flow of people to comprehensively evaluate the performance of the use of commercial space in the area of the railway station (Zhang Lingzhu *et al.,* 2019; Zhuang Yu and Yao Yiqian, 2016). This study mainly analyses the impact of the layout pattern of commercial space in station areas on crowd use, i.e., treating multi-floor commercial space blocks as a whole and ignoring the differences in the number of people entering the shop within the commercial space so that the use of the commercial space can be simplified to the flow of people converging to the entrances and exits of the commercial space.

Existing studies have mainly focused on transport interchange activities in station areas. Still, few studies have analysed the distribution among activities of different groups, or separately transport interchange activities and destination leisure activities, and the interweaving and transformation phenomenon of the dynamic lines of the two types of activities. In this study, according to the basis of traffic transfer and destination leisure groups and taking into account the different starting points of activities of tourists and citizens, the population using commercial space is classified into three categories: leisure citizens, traffic tourists, and leisure tourists, and the commercial space of the station complex is taken as the core to analyse the origin, flow, and process of the three categories of people converging to the entrances and exits of the commercial space in the station area.

3. Methods

3.1 Sample Selection

Since the urban location of the station affects the use of commercial space, this study selects high-speed rail stations located in the centre of high-density cities in China (Fig. 2) as samples among the station complexes that have been built and operated for many years and

have well-functioning commercial space: Guangzhou East Railway Station, Chongqing Shapingba Railway Station, and Shenzhen North Railway Station, which are located no more than 10km away from the city centre and represent different commercial space layout patterns of the station complexes. The scope of the study is the station access space, the multi-floor commercial space, and the urban transport space between them. Among them, urban traffic space which is far away from commercial space and does not have a spatial connection is not considered. The entrances and exits of the commercial space are set as the junction between the space of each floor and the external space. The vertical connection within the commercial space is not taken into account, i.e., multiple entrances and exits located at the same position in the commercial space of each floor are all connected with the external space of the ground floor through the vertical connection. Only the entrances and exits on the ground floor of the position are taken into account.

Fig. 2: Urban location of the sample stations

3.2 Layout analysis of commercial space in station complexes

First, the overall layout of the commercial space of the station complex is analysed. Through field research on the layout relationship between commercial space, station access space, and urban transport space, the "space-block" relationship of the three types of functional space is extracted. The second is to analyse the layout of the entrances and exits of the commercial space. Abstract the three types of functional spaces into corresponding functional nodes, take the entrances and exits of commercial space as the core, draw the footpaths of passengers and citizens who may pass by commercial space and whose destinations are commercial space, and construct a "node-path" network. In terms of the spatial object of the research, only the floors of commercial space that have a close spatial connection with the station entry and exit spaces are selected.

3.3 Pedestrian flow analysis of commercial space in station complex

The first is to compare the pedestrian flow in the station space and commercial space, and the proportion of the pedestrian flow in the commercial space to the total pedestrian flow in the station core area. The footfall in the station space is the total footfall entering and exiting the station; the footfall in the commercial space includes all the footfall passing through the

commercial space and the footfall destined for the commercial space; and the total footfall in the station core area is the footfall entering all the functional spaces. The second is to compare the pedestrian flow of each entrance and exit of the commercial space of the station complex. The research time is selected on weekdays, and taking into account that shops basically start the business at 10:00 a.m., the two time periods of lunch peak and evening peak are selected, and each time the people flow statistics lasts for 5 minutes.

4. Results

4.1 Layout and use of blocks of commercial space in station complexes

In the planning and design stage of a station complex, the number of passengers in the station influences the layout patterns of the functional space (Suo Chao and Zhang Hao, 2015). Considering the impact of the rapid in-and-out passenger flow of the station on the commercial space, the commercial space of the high-speed railway station complex will be appropriately far away from the in-and-out space of the station, and after the station complex is put into use, the location of the body layout of the commercial space usually significantly affects the overall use of the commercial space (Li Chuancheng et al., 2016).

4.1.1 "Space-block" layout of commercial space in station complexes

The commercial space of the station complex is usually chosen to face the external urban space, taking into account the accessibility of the public to the commercial space and the potential for passengers to pass through the commercial space on their way, including the urban transport space of the metro and motor vehicle loading and unloading points, which is usually laid out between the commercial space and the entrance and exit space of the railway station, i.e., forming a horizontal layout structure of external urban space, commercial space, urban traffic space, and station entrance and exit space. The passenger scale of Shenzhen North Station, Guangzhou East Station, and Chongqing Shapingba Railway Station decreases in turn, so the potential for integrating the commercial space of the station complex with the station space increases in turn. The average daily arrivals and departures of Shenzhen North Station are more than 0.2 million; the average daily arrivals and departures of Guangzhou East Station are about 0.05 million; and the average daily arrivals and departures of Chongqing Shapingba Railway Station are less than 0.01 million. The "space-block" layout characteristics of the commercial space of the three sampled station complexes are: far away from each other, overlapping, and overlapping, respectively (Fig. 3).

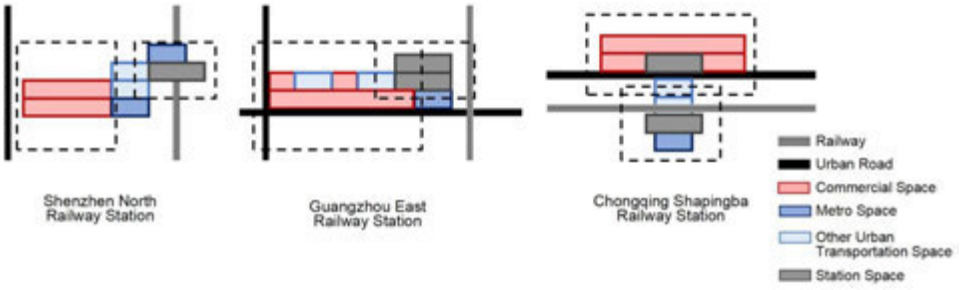


Fig. 3: Schematic layout of commercial space with station space and urban transport space

The commercial space of Shenzhen North Railway Station is completely separated from the station entrance and exit space, and between the two is an urban transport space integrating metro, buses, and taxis. The commercial space of this station complex consists of two floors with no vertical dislocation; the plan form is a U-shape facing south; and the concave space on the south side is a continuous outdoor promenade. The commercial space on the ground floor is connected to the metro station hall, and the commercial space on the second floor is connected to the transfer hall for buses and taxis. The city-facing area of the commercial space is adjacent to only one city road, with city roads farther away in the other two directions (Fig. 4). The shop formats are mainly catering, retail, and lifestyle services.

The commercial space of Guangzhou East Railway Station is intertwined with the station access space, and the urban transport space is embedded between the two. The commercial space of this station complex has four floors, and this study only considers the ground floor and the first underground floor, which are closely connected with the station space and the urban transport space. These two layers of commercial space are in the shape of a ladder; the ground-floor commercial space is located on the south side of the station space; between the two is the motor vehicle lane and drop-off area; the ground-floor commercial space is deep below the station space; and the underground station hall is below the station space. The city-facing area of the commercial space is adjacent to three city streets with plenty of pavements and overpasses (Fig. 4). The shop formats are mainly catering, retail, and life service, with the ground floor mainly for fast food, the first basement floor mainly for retail business, supplemented by a small number of catering businesses, and life service businesses and hypermarkets located in the second and third basement spaces.

The commercial space of Chongqing Shapingba Railway Station is completely superimposed with the station access space and urban transport space, and all kinds of urban transport space are spaced out from the station access space, and the commercial space is located above the two, adjacent to the station access space. The main part of the commercial space of this sample station complex is five floors, and the local part is seven floors, only the ground floor and the first floor, which are closely connected with the station space and urban transport space, are considered in this study. These two floors of commercial space are located entirely on the ground, and the plan form is a dumbbell shape distributed on both sides of the

station building, and the east and west sides are connected through the aerial connecting corridor that spans above the station space with the commercial space on the ground floor. The commercial space is close to several urban roads and overpasses (Fig. 4). The shop formats are equally dominated by catering, retail, and lifestyle services.

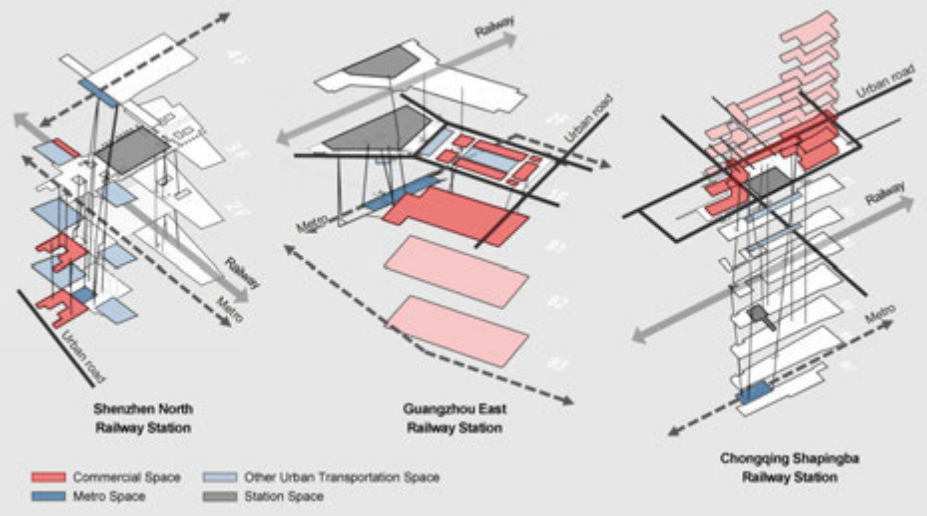


Fig. 4: General layout of commercial space in the sample station complexes

4.1.2 Total footfall of commercial space in station complexes

The pedestrian flow in the station space is usually proportional to the size of the station passenger flow, while the pedestrian flow in the commercial space is jointly influenced by the size of the passengers and the layout location of the commercial space. Based on the passenger scale of the station, the influence of the layout location of the commercial space of the station complex on the flow of people is analysed by comparing the relative size of the commercial space flow of the sample station to the station space flow of people and the proportion of the commercial space flow of people to the total flow of people.

As shown in Fig. 5, the percentage of commercial space use in Guangzhou East Station, Chongqing Shapingba Railway Station, and Shenzhen North Railway Station decreases in turn. Guangzhou East Station has a higher commercial space footfall than its station space; Chongqing Shapingba Railway Station and Shenzhen North Railway Station both have a lower commercial space footfall than station space footfall; and Chongqing Shapingba Railway Station has a relatively small gap between commercial space footfall and station space footfall. Among them, Guangzhou East Station, which has a medium passenger size, has the highest pedestrian flow of commercial space in its staggered layout, while Chongqing Shapingba Railway Station, which has a smaller passenger size, does not have a pedestrian flow of commercial space in its overlapping layout that exceeds that of Guangzhou East Station. In addition, although the pedestrian flow in the commercial space of Chongqing Shapingba Railway Station is lower than that of Shenzhen North Railway Station, the total pedestrian flow

of the former is much smaller than that of the latter, and thus the commercial space usage ratio of Chongqing Shapingba Railway Station is still higher than that of Shenzhen North Railway Station, which also shows that the calculation of the respective commercial space usage ratios of the sample stations can be used to make effective comparisons between the stations.

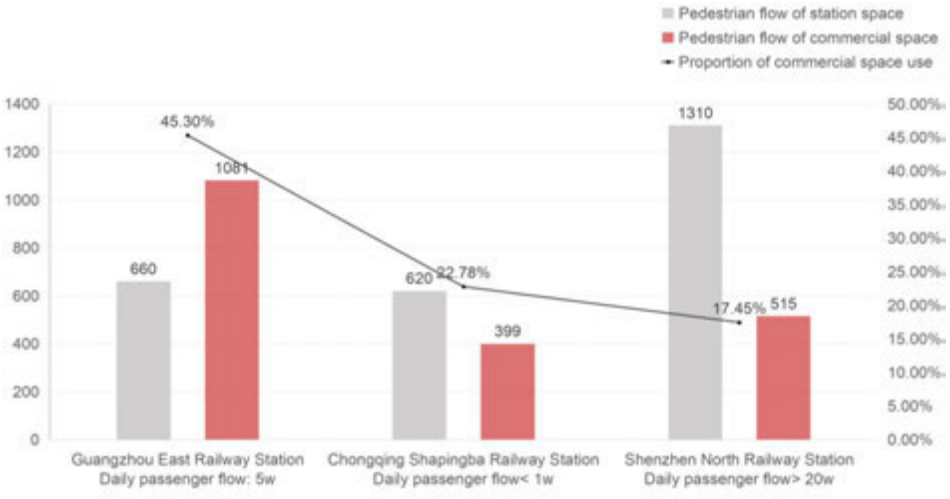


Fig. 5: Total footfall in commercial space of the sample station complexes

4.2 Nodal layout and use of commercial space in station complexes

In addition to the above commercial space block layout, the actual use of commercial space in station complexes is also affected by the more microscopic layout of entrances and exits. The node layout relationship between the commercial space of the station complex and the station entrance and exit space and urban transport space affects the origin, flow, and convergence of people travelling to and passing through the commercial space, and the "node-path" layout is reflected in the flow of people through the various entrance and exit nodes of the commercial space.

4.2.1 "Node-path" layout of commercial space in station complexes

The main users of commercial space in the station complex are leisure citizens (citizens who specially go to and use commercial space within the radius of the station), traffic passengers (passengers who pass through the commercial space in the process of entering and exiting the station by railway), and leisure passengers (passengers arriving by railway and especially go to and use commercial space), and the urban transport means to be chosen are underground, taxi, bus, and so on. The starting point of the passenger's movement is the station entrance and exit node, while the starting point of the citizen's movement is the various urban transport nodes, which are usually located between the commercial space entrance and exit

node and the station entrance and exit node. The movement of the two groups will cross and overlap, and there are commercial space entrances and exits shared by both the passengers and the citizens.

As shown in Table 1-3, the entrances and exits of the commercial space of Guangzhou East Station are mainly distributed at the end near the station, and only two ground-floor entrances and exits are set up in the city-facing area; the 16 entrances and exits of the commercial space of Chongqing Shapingba Railway Station are located at the ground floor and above; the entrances and exits of the commercial space of Shenzhen North Railway Station are set up both at the near-station end and the near-city end, of which eight entrances and exits are set up in the near-city area, and six entrances and exits are set up in the near-station area. The "node-path" layout of the commercial space of the three sample station complexes takes into account both passengers and citizens and has the potential to attract transport and leisure passengers in addition to serving as leisure shopping destinations for citizens in the vicinity.

The commercial space at Guangzhou East Railway Station can attract transport-oriented passengers transferring to the metro, and most of the entrances and exits of the commercial space are exclusively for passengers or citizens. Passengers who choose to transfer to the metro and citizens who take the metro to the commercial space are distributed in the same area, but the two movements do not interfere with each other. Passengers transferring to the metro will pass through Entrance 6/7/9 in the process, while citizens arriving by metro will enter the commercial space through Entrance 5 or Entrance 7, and Entrance 7 will be shared. People choosing buses, taxis, and walking will enter the commercial space through Entrance 2, Entrance 1/8, and Entrance 1/2/3/4/8, respectively. Leisure passengers travelling exclusively to the commercial space will mainly enter through Entrance 1/6/9. Entrance 1 will be shared by taxi-only citizens and leisure passengers, so Entrance 2/3/4/8 will be the exclusive entrance for citizens entering the commercial space, and Entrance 6 and Entrance 9 will be the exclusive entrance for passengers entering the commercial space.

The commercial space at Chongqing Shapingba Railway Station is not able to attract transport-oriented passengers entering and leaving the station, and its commercial space entrances and exits are only partially shared. People who choose the metro to go to the commercial space enter through Entrance 1/2/6/7, those who choose buses and taxis enter through Entrance 1/2, those who choose private cars enter through Entrance 4/5/12, those who choose to walk can enter through Entrance 1/2/3/6/7/8/9/10/11/12, and leisure passengers who go to the commercial space exclusively enter through Entrance 1/2/4/5, i.e. Entrance 6/7, which is directly accessible from the metro station hall on the seventh floor of the underground, and Entrance 6/7, which is directly accessible from the metro station hall on the seventh floor of the underground, as well as Entrance 6/7, which is directly accessible from the metro station hall on the seventh floor of the underground. Entrance 6/7, which is directly accessible from the MTR station hall on the seventh basement floor, and Entrance 3/6/7/8/9/10/11/12, which is accessible on foot from the city road, are the entrances and exits of the commercial space for public use.

The commercial space of Shenzhen North Railway Station attracts transport passengers entering and leaving the station on foot and the public walking to the commercial space, and their entrances and exits to the commercial space are shared by both passengers and the public.

Traffic passengers who choose to enter the station on foot and citizens who walk to the commercial space enter through Entrance 1/2/8/9/10/11/12/13/14 facing the city, while traffic passengers who choose to leave the station on foot, leisure passengers who go to the commercial space exclusively, and citizens who choose the metro, buses, and taxis enter through Entrance 3/4/5/6/7/12/13/14 adjacent to the station. There are no entrances or exits to commercial space exclusively for the public.

Table 1: Node-Path Layout of Commercial Space in Guangzhou East Railway Station

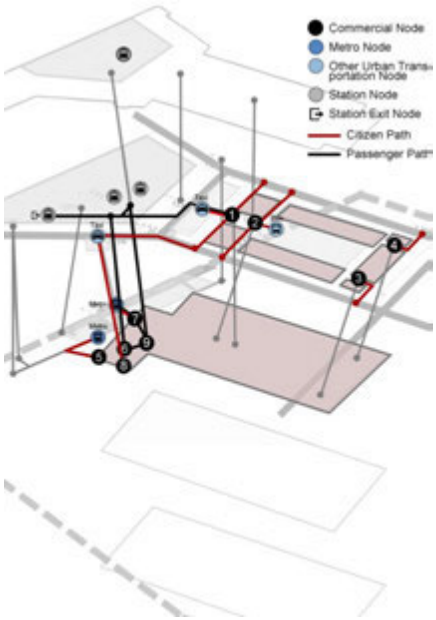
	Traffic Passengers (through commercial space)	Entering the station by metro	Metro --- E7 --- E9 --- E6 --- Entrances
			Metro --- E7 --- E9 --- Station
		Exiting the station by metro	Station --- E6 --- E9 --- E7 --- Metro
			Station --- E9 --- E7 --- Metro
	Leisure Passengers (to commercial space)	Station --- E1 / E6 / E9	
	Leisure Citizens (to commercial space)	By metro	E5 / E7
		By bus	E2
		By taxi	E1 / E8
		On foot	E1 / E2 / E3 / E4 / E8

Table 2: Node-Path Layout of Commercial Space in Chongqing Shapingba Railway Station

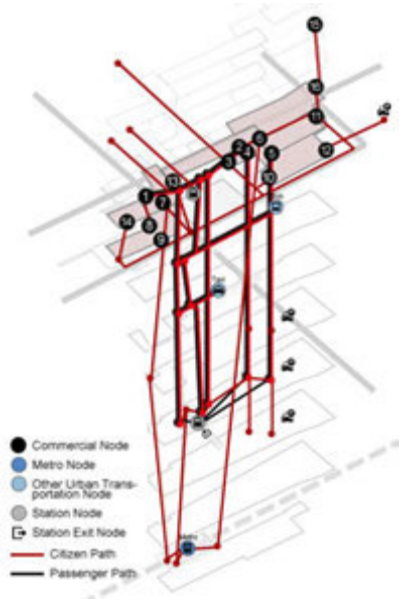
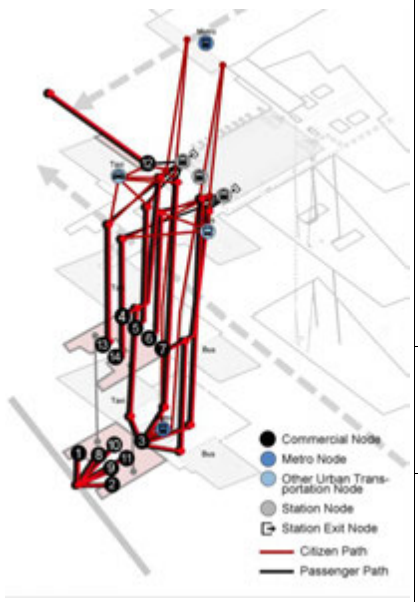
	Leisure Passengers (to commercial space)	Station --- E1 / E2 / E4 / E5	
	Leisure Citizens (to commercial space)	By metro	E1 / E2 / E6 / E7
		By bus	E1 / E2
		By taxi	E1 / E2
		By private car	E4 / E5 / E12
		On foot	E1 / E2 / E3 / E6 / E7 / E8 / E9 / E10 / E11 / E12 / E13 / E14 / E15 / E16

Table 3: Node-Path Layout of Commercial Space in Shenzhen North Railway Station

	Traffic Passengers (through commercial space)	Entering the station on foot	Urban road --- E1 / E2 / E8 / E9 / E10 / E11 / E12 / E13 / E14 --- E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14 --- Station
		Exiting the station on foot	Station --- E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14 --- E1 / E2 / E8 / E9 / E10 / E11 / E12 / E13 / E14 --- Urban road
	Leisure Passengers (to commercial space)	Station --- E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14	
	Leisure Citizens (to commercial space)	By metro	E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14
		By bus	E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14

		By taxi	E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14
		On foot	E1 / E2 / E8 / E9 / E10 / E11 / E12 / E13 / E14

4.2.2 Pedestrian flow at entrances and exits of commercial space in station complexes

The pedestrian flow at the entrances and exits of commercial space in station complexes reflects the convergence effect of the "node-path" chain with different attributes. By comparing the average flow of people at the entrances and exits of the commercial space in the sample station and the flow of people at each entrance and exit, we analyse the influence of the node layout of the commercial space in the station complex on the flow of people.

As shown in Fig. 6-8, the number of entrances and exits in the commercial space of Guangzhou East Railway Station is the lowest, but the flow of people at each entrance and exit is more than 50, and there are two entrances and exits with higher than average flow of people, and the difference between the highest flow of people and the lowest flow of people reaches 164 people. Chongqing Shapingba Railway Station has six entrances and exits with higher-than-average passenger flow, and the difference in passenger flow between them is relatively small. Shenzhen North Railway Station has four entrances and exits with higher than average passenger flow, and the difference in passenger flow between the entrances and exits is in the middle.

Among the entrances and exits in the commercial space of Guangzhou East Railway Station, the ones with higher than average flow rates are Entrance 7 and Entrance 9 on the basement floor. Entrance 7 is common, and the flow rate is much higher than the other entrances and exits. It is directly opposite to the main axis of the commercial space on the basement floor, and it is the necessary entrance and exit for the traffic passengers who are transferring to the metro and for the leisure passengers who are taking the metro (Fig. 9). Entrance 9 is a special entrance for the passengers and is connected to the ground floor through the staircase facility. Entrance 9 is one of the entrances for passengers, connected to the ground floor through the staircase facility, and is close to the station access space on the ground floor, which can be used by leisure passengers and transport passengers transferring to the metro.

Among the entrances and exits of the commercial space of Chongqing Shapingba Railway Station, the ones with higher than average pedestrian flow are Entrance 1, Entrance 2, Entrance 4, Entrance 6, Entrance 7, and Entrance 11 on the ground floor. Entrance 1, Entrance 2, and Entrance 4 are shared entrances and exits, which are accessed by leisure citizens who choose to take the underground, bus, taxi, and walk, as well as by leisure passengers who travel to the commercial space exclusively (Fig. 10), and Entrance 4 is connected by a straight staircase to the station exit space and private car garage at the fourth basement floor, which is shared by leisure passengers and those who choose to travel by private car. Entrance 4 connects the station exit space on the fourth basement floor and the private car garage on the ground floor via a

straight staircase, which is shared by leisure passengers and leisure citizens who choose to travel by private car. Entrance 6, Entrance 7, and Entrance 11 are dedicated entrances for citizens, with Entrance 7 mainly carrying leisure citizens travelling on the underground, and Entrance 11 being one of the entrances for citizens to walk into the commercial space.

Among the entrances and exits of the commercial space of Shenzhen North Railway Station, the ones with higher than average pedestrian flow are Entrance 1, Entrance 3, Entrances 4+7, and Entrance 12, which are across the three floors of the commercial space. Both passengers and citizens share these five entrances and exits. Entrance 12 is close to the station space and leads to the commercial street adjacent to the station's entrance and exit space, which has the highest flow of people and is one of the shared entrances and exits for all passengers and citizens (Fig. 11). Entrance 1 is close to the city road and mainly accommodates transport passengers entering the station on foot and citizens walking to the commercial space. On the other hand, Entrance 3 and Entrances 4+7 are located in the area close to the station space and are used by transport-oriented passengers who choose to walk out of the station, leisure-oriented passengers who travel exclusively to the commercial space, as well as citizens choosing the metro, buses, and taxis.

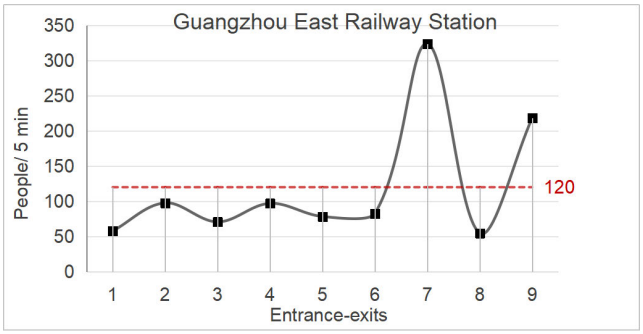


Fig. 6: Nodal pedestrian flow in commercial space of Guangzhou East Railway Station

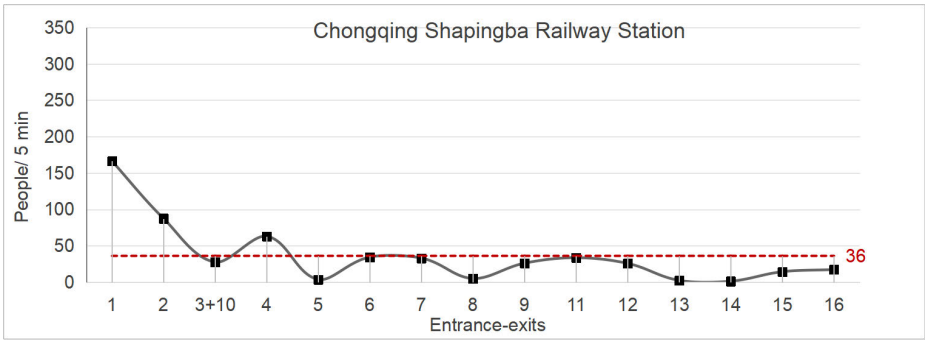


Fig. 7: Nodal pedestrian flow in commercial space of Chongqing Shapingba Railway Station

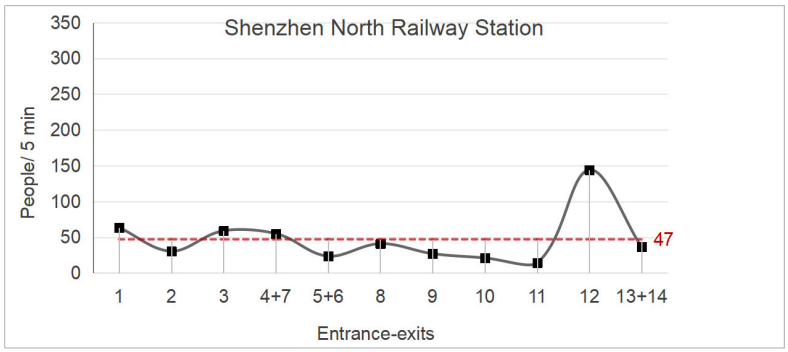


Fig. 8: Nodal pedestrian flow in commercial space of Shenzhen North Railway Station

Fig. 9: Pedestrian flow at E7 of Guangzhou East Railway Station

Fig. 10: Pedestrian flow at E1 of Chongqing Shapingba Railway Station

Fig. 11: Pedestrian flow at E12 of Shenzhen North Railway Station

5. Conclusions

The circle structure of centre agglomeration is usually regarded as an ideal model for the high-density development of high-speed railway station areas, while this study is based on the walking line of two types of groups, tourists and citizens, to refine the deduction of the design of the layout form of the commercial space of the high-speed railway station complex, which includes two aspects, namely, the layout of the body of the commercial space and the layout of the nodes at the entrances and exits.

Firstly, the correlation law between the block layout of the commercial space of the station complex and the total pedestrian flow. There is no positive correlation between the distance of commercial space from the station space and the use of commercial space, and the commercial space with the closest and the farthest distance from the station space shows a lower percentage of commercial space traffic, while the commercial space with the station space in a staggered layout and with the distance between the two in the middle of the commercial space, on the contrary, has a higher percentage of commercial space traffic. The reason is that the interlocking commercial space and station spaces have strong spatial connections, and the metro space is embedded between them, which attracts a large number of transport-oriented passengers to pass through the commercial space.

The proportion of long-distance passengers in the core area of China's high-speed railway stations is very large, and passengers' demand for rapid transportation is much larger than their demand for leisure consumption; therefore, the people who use the commercial space of station complexes are mainly leisure-oriented citizens in the surrounding area, and the number of leisure-oriented citizens > the number of transport-oriented passengers > the number of leisure-oriented passengers. Therefore, in the process of planning and laying out the commercial space of station complexes, attention can be paid to stations with small and medium-sized passenger scales, appropriately shorten the distance between their commercial space and station entrance and exit space, and create a staggered space for guiding traffic passengers, especially by placing

underground space between the two and stimulating the recreational potential of traffic passengers who transfer to the underground, whereas, in stations with large-scale passengers, the distance between their commercial space and station entrance and exit space needs to be maintained to provide a more comfortable and comfortable environment for the passengers. For stations with a large passenger scale, the commercial space and the station access space need to be kept at a distance for the use of the neighbouring citizens and a small number of passengers.

Second, the node layout of the commercial space of the station complex and the correlation law of the entrance and exit pedestrian flow. Firstly, the setting of entrances and exits of commercial space and the distribution of people flow are influenced by the layout of commercial space blocks. Located in the commercial space on the side of the station space, its entrances and exits are distributed in the area close to the station and facing the city, and there is a big gap between the flow of each entrance and exit. Located in the commercial space directly above the station space, its entrances and exits are distributed on the ground floor where the two are intersected, and because these entrances and exits are facing the surrounding city, the gap between the flow of each entrance and exit is relatively small. Secondly, the entrances and exits of the commercial space that are connected to the metro line usually have high pedestrian flow. Among them, the passenger-citizen shared entrances and exclusively for public use entrances and exits with a direct spatial connection with the underground line have a higher flow of people, while the entrances and exits exclusively for leisure passengers have a higher flow of people close to the station entrances and exits. Therefore, in the process of planning and laying out the commercial space nodes of the station complex, it is necessary to enhance the spatial connection between the entrances and exits of the commercial space, the metro space, and the station entry/exit space based on the block layout form of the commercial space.

Then, the layout pattern and optimisation suggestions for commercial space in the sample station complexes are:

Guangzhou East Station and Shapingba Railway Station are stations with small and medium-sized passenger scales. The commercial space of Guangzhou East Station is interlaced with the station space, with metro space embedded between the two, and the entrances and exits of the commercial space are separated for the exclusive use of passengers or citizens, especially the special entrances and exits set up for the transport-oriented passengers who change to the metro, so that the commercial space of this station complex can attract a large number of transport-oriented passengers changing to the metro while accepting citizens from the surrounding areas. The passenger scale of Shapingba Railway Station is relatively small, and its commercial space is completely superimposed with the station space, between the two there are urban transport spaces such as buses, rentals, and private garages, while the underground is located below the station exit space, and most of the entrances and exits of the commercial space are shared by citizens and passengers, and only a small number of entrances and exits are for the exclusive use of the citizens who take the underground and go to the commercial space on foot, and the commercial space of this station complex mainly serves the peripheral citizens, and only accepts a small number of leisure-type passengers. citizens, and only takes on a small number of leisure-type passengers. However, Shapingba Railway Station does not attract traffic passengers who must pass through the commercial space, and the passenger flow of the station is mainly concentrated in the ground floor entrances and exits, and the flow of people inside the

commercial space lacks traffic power, so it is possible to increase the commercial space and adjust the position of the entrances and exits of the commercial space between the station exit space and the underground to accept the traffic passengers who transfer to the underground.

Shenzhen North Railway Station is a station with a large passenger capacity. Its commercial space is completely separated from the station space, and between the two, urban transport spaces such as metro, bus, taxi, and private garage are integrated in a three-dimensional way, with entrances and exits to the commercial space shared by passengers and citizens, and a separate commercial street is set up in the area adjacent to the entrance and exit of the station, which is supplemented by the use of leisure-type passengers. Citizens choosing either mode of transport share all entrances and exits to the commercial space with leisure passengers who visit the commercial space exclusively and transport passengers who enter and exit the station on foot. Due to the large area of interchange space and station square between the station space and the surrounding urban roads, the number of transport passengers walking in and out of the station is minimal. The commercial space is far away from the station space. Even if it is close to the entrances and exits of the station space, the accessibility is low, so leisure passengers will choose to go to the commercial street, which is close to the entrance and exit of the station. The citizens who go on foot will also go to the commercial street, so the area gathers a large number of passengers and citizens. Therefore, the area gathers a large number of passengers and citizens. However, the distance between this commercial street and the two-floor commercial blocks is relatively far, so the vertical connection between the two commercial spaces can be increased appropriately so that the pedestrian flow of the commercial street can be directed to the entrances and exits of the commercial blocks below.

Finally, additional research is needed on the factors and indicators that influence the use of commercial space in station complexes. For example, the use of commercial space in station complexes is also affected by the organisational structure of various types of urban transport spaces and the urban transport sharing rate of different stations. In addition, this study focuses on analysing the layout of commercial space in station complexes from the perspective of "node-path", and abstractly expresses the use of commercial space as the total flow of people at all entrances and exits and the flow of people at all entrances and exits, which is only one aspect of measuring the effect of the use of commercial space, and can be measured by choosing more detailed indicators such as the flow of people entering stores. metrics such as inbound foot traffic to measure, and can also be supplemented with weekend foot traffic data for comparative studies with weekday usage. In addition, if the number of traffic-type passengers is increased excessively, it may affect the efficiency of passengers entering and leaving the station, and in the actual planning and design process, it is necessary to consider the balance and conversion of both traffic dispersion and commercial agglomeration.

References

The Evaluation on Walkability in an Aging Society: the Case of Senri New Town, Japan

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Abstract. This study aimed to enhance urban environments for the elderly by assessing walkability in the Takanodai area of Senri New Town, Japan. Seven indicators for walkability were selected through a literature review, and a quantitative evaluation using the seven indicators was conducted. The results are presented in a heat map of walkability, and shows that pedestrian-only paths scored lower than roadways in detached house residential areas. This suggests that slopes and stairs of pedestrian-only paths were not considered obstacles at the time of construction of the new town, and have remained unchanged over time. It is possibly due to a low level of awareness on addressing barrier-free issues by whom? in the past. In contrast, pedestrianized street in public housing zone scored higher than others. The reason for this may be that the public housing zone was designed with better green space and sidewalks. The study's findings could inform improvement areas for future urban development for creating walkable cities accessible to all citizens.

Keywords: walkability, elderly, slopes and stairs, Newtown, urban development

1.Introduction

In recent years, Japan has experienced a rapid aging of society with a declining birthrate, and there has been growing interest in the concept of compact cities, where urban functions are concentrated, and in the development of cities where people can reach daily amenities on foot. Against this social background, there is a need to develop urban environments that focus on the lifestyles and health promotion of the elderly. In Japan, however, there are still few studies on developing walkability index focusing on the elderly, and only a few of them focus on the evaluation of regional characteristics and real estate values, or on health promotion (Hanibuchi, 2011).

In Japan, the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) has begun to pursue the applications for "Walkability Promotion Cities" to encourage the development of

cities where people can walk to their daily needs from 2019. The program encourages a shift from the car-centered society of recent years to the creation of a walkable city. This initiative is expected not only to create a rich, people-centered living space, but also to increase local consumption and investment, increase tourism, extend healthy life expectancy, prevent loneliness and isolation, and solve various local problems and create a new value for healthy living. The number of walkable cities is increasing every year, and by April 2024, 372 cities nationwide will be designated as walkable cities (The Ministry of Land, Infrastructure, Transport and Tourism, 2024).

The purpose of this study is to obtain key factors that will contribute to the development of urban environments for the elderly in preparation for an aging population in the future. As the first step, walkability indices in previous studies are reviewed, and an index for evaluating walkability for the elderly is developed for this study. Next, using the selected indicators, we evaluate walkability in the Takanodai area of Senri New Town, which has one of the most aged populations in Japan.

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2. Literature review of previous studies

2.1 Recent Previous Studies

In this chapter, we conduct a literature review based on recent previous studies and create a simple and objective walkability index for the elderly. In order to develop the walkability index for the elderly, five recent studies were selected and the indices used in each study are summarized. We have selected these five studies because these studies introduced the walkability indices related to factors such as slopes and stairs influencing on the walkability of the elderly. Four of the five papers are published by Japanese authors and it was useful for us to look into previous work which addressed specific Japanese contexts and pointed out the issue of applying walkability indices developed in western countries for Japanese built environment.

Alves et al. (2020) aimed to create a walkability index for the elderly, focusing on "slope" and "stairs". The authors divided the three major categories for qualifying factors of public space into urban tissue (e.g. pedestrian surface quality, sidewalks existence and width, etc.), urban scene (e.g. existence of trees, vegetation, urban furniture), and safety (e.g. street lighting quality, diversity of information signs), and assigned appropriate weights and scores to each of these axes. They also focused on “slope” and “stairs” as factors that affect the ease of walking for the elderly. In order to evaluate the walkability of each street, a set of positive evaluation factors that increases walkability and negative evaluation factors that decreases walkability have been established. The three positive evaluation factors are related to urban tissue, urban scene, and

safety, while the two negative evaluation factors are slope and stairs.

The three positive evaluation factors were selected based on a literature review of previous studies identified by Alves et al. (2020). The weighting of the three indicators is also determined based on their work: 60% of the total walkability index is allocated for urban organization, 24% for urban landscape, and 16% for safety. For the two negative indicators, slope and stairs are identified as factors that hinder walking activities for the elderly, and the criteria for the angle of the street slope are classified into three patterns: less than 5%, between 5% and 8%, and more than 8% (e.g. 10% is expressed as a rise of 1 meter after advancing 10 meters). The authors also developed a corresponding index for stairs, which was incorporated into the slope criteria rather than being considered separately from slope.

Morioka et al. (2021) pointed out in their study that walking behavior is classified into three categories based on previous research: 1) "necessary activity" that occurs due to necessity in public areas, 2) "voluntary activity" that occurs based on the individual's positive intention, and 3) "social activity" that occurs when others intervene in necessary or voluntary behavior. The "voluntary activities" are studied in this paper. Unlike "necessary activities," "voluntary activities," require an environment that is not only "easy to walk", but also "makes people want to walk" as a factor that induces walking behavior. The authors have identified "density," "facility density," "street form," "human scale," "landscape," and "public transportation" as urban indicators related to walking behavior based on a literature review of previous studies, and used the five indicators, while "public transportation," was excluded in their study. Of the five indicators, "density," "facility quality," and "street form" are used as environmental indicators that makes it “easy to walk”, while "human scale" and "landscape" are used as promoting factors to walk.

Kato and Kanki (2017) proposed a shift to "smart shrinking," in which residents themselves maintain an independent living environment by promoting community development that makes their own neighborhoods more attractive. As the first step to realize a smart shrinking, the concept of walkability has been developed mainly in the field of public health and used to create a regional evaluation index. From the index, they adopted the four elements of "household density," "convenience of local facilities," "road connectivity," and "local safety," which can be easily obtained by geographic information systems, from among the indicators used in previous studies. In their study, all of the indicators used to calculate walkability are on the scale of the city block, which can be easily processed by a geographic information system.

Shimizu (2020) aimed to develop a walkability index for the Japanese context. The Walkability Index developed by Shimizu (2020) is a 100-point scale that measures the

concentration of urban amenities within walking distance of a given point. Urban amenities include convenience stores and drugstores, restaurants and cafes, and bookstores and cultural facilities. This study is similar to the Walk Score®, a well-known index developed in the U.S (Walk Score, 2024). The Walk Score® is a weighted score of neighborhood facilities based on their necessity and distance from a certain point, and is used to measure the neighborhood environment from the viewpoint of walkability. Walk Score® is widely used as an objective index to measure the neighborhood environment in terms of walkability. They have identified "property search," "community development," "real estate strategy," and "survey research" as scenarios for utilizing this index, and has succeeded in creating an intuitive and easy-to-understand index by displaying a heat map of the Walkability Index.

Itoh et al. (2021) classify the elements of walkability into three stages. The first stage is the urban environment and structure, the attributes of individuals (e.g. presence of sidewalks, crosswalk, etc.) and their purposes for walking, the second stage is the effects of the contents of the first stage on the quality of walking and the promotion of walking, and the third stage is the effects of the second stage on the city and individuals. Furthermore, when applying the Walkability Index developed by Frank et al. (2005) in the Japanese context, it is necessary to consider the relationship between the urban environment and structure and the quality of walking. The paper then identified three key indicators of walkability quality: "accessibility," "comfort," and "safety," and examines their relationship to the urban environment and urban structure, respectively.

Based on the above walkability indices used in these previous, we selected several appropriate ones for the elderly and adopted them as the walkability indices in this study.

2.2 Results of Indicator Selection

The following table is a summary of the indices used in the above previous studies (Table 1). We have identified four categories (Street conditions, Land utilization, Landscape, and Safety) which are drawn upon most frequently used indicators from the five studies we reviewed. Then, one or more indicators were adopted from each category Presence of sidewalks, pavement condition, stairs, slopes, and street lighting can hinder the elderly from walking. In contrast, park space and green space can have positive effects for the elderly, as they are encouraging them to walk.

In this study, the following seven items are decided to form a walkability index (Table 2) in order to create an objective and simple walkability index and to evaluate the walkability of each street.

Table 1. Results of the literature review and indexes used in this study

	Street conditions							Land utilization					Landscape		Safety			
	presence of sidewalks	pavement condition	width of a street	stairs	distance to public transportation	Intersection density/road accessibility	slopes	population density/household density	medical and welfare facilities	educational facilities	commercial facilities	park space	green space	percentage of water surface	urban furniture	street lightning	information sign	crime and accident rate	amount of traffic
Alves et al. (2020) Walkability Index for Elderly Health	○	○	○	○		○	○						○		○	○	○		
Morioka et al. (2021) A Study on Walkability grasped from Environment both of "Easy to Walk" and "Encouragement to Walk" that supports Walking			○						○	○	○	○	○	○					
Kato and Kanki(2017) Development and Verification of Indicator about Regional Evaluation based on walkability in Residential Area			○					○	○	○	○	○						○	
Shimizu(2020) Development of Walkability Index					○				○	○	○	○							
Itoh et.al. (2021) A Study on the Conceptual Framework of Walkability and Issues for its Application in Japan						○													○
Indices adopted in this study	○	○		○			○					○	○			○			

Furthermore, the following walkability index and its criteria are defined and applied in one case study area in Senri New Town. The walkability index developed for this study is defined as the average of the scores of all seven items: presence of sidewalks, pavement condition, stairs, slopes, park space, green space, and street lighting. Each item is rated from 1 to 3 points according to conditions identified in Table 2. For example, different scores are given to the presence of sidewalk: 1 for “no sidewalk on both sides of road”, 2 for “only on side walk” and 3 for “sidewalks exist on both sides of the road or street is pedestrianized”. All streets were surveyed using Google Street View. For streets not supported by Google Street

View, the survey was conducted on site by Aida. It is therefore noted that the research is based on a subjective view of the researcher.

Table 2. Indices and Walkability Score

Indices		Criterion	Score
Street conditions	presence of sidewalks	no sidewalk on both sides	1
		on one side only	2
		exists on both sides / pedestrians only	3
	pavement condition	bad coditions	1
		some steps or obstacles	2
		good conditions	3
	stairs	some stairs exist	1
		no stairs exist	3
	slopes	less than 5%	1
		more than 5% and less than 8%	2
		more than 8%	3
Land utilization	park space	Parks are available for rest while walking	1
		no parks to rest while walking	3
landscape	green space	less than 20%	1
		more than 20% and less than 25%	2
		more than 25%	3
safety	street lighting	no lighing on both sides	1
		on one side only	2
		exists on both sides	3

For the selection of the reference value for “slopes,” in the previous study by Alves et al. (2020) was used. The selection of the reference value for “green space” was based on the results of a social experiment conducted by the Ministry of Land, Infrastructure, Transport and Tourism (2005) and the evaluation criteria used at the Voluntary Simplified Assessment Site (2014). According to these studies, more than 25% green space of the total area space of

a city is sufficient to be considered to have an attractive urban environment, while less than 20% is considered as insufficient.

3. Application of walkability index in the Takanodai area

3.1 Site Selection

In this study, Takanodai 2-chome, a neighborhood of within Senri New Town the Suita City, is selected as the site for the field survey.

Senri New Town was the first large-scale new town in Japan, which was planned to cope with the housing shortage caused by population growth in the postwar 1950s. To prevent urban sprawl caused by housing shortages and to provide inexpensive, high-quality housing to the public, Osaka Prefecture began development of Senri New Town in 1960 in the Senri Hills in the northern part of the prefecture. The planned site was 1,160 hectares, which spanned the current cities of Toyonaka and Suita, and had a planned population of 150,000 people. A major feature of the project was the emphasis placed on creating a favorable living environment. The entire new town is surrounded by green areas, and parks and schools are systematically located based on the neighborhood residential area theory systematized by Clarence Arthur Perry (Discover Senri, 2022) in the 1920's. The coverage of green area of the new town is more than 20% of the total area space.

In addition, the walking environment for residents was comprehensively developed. In the early stage of the development, the separation of pedestrians and cars was achieved by arranging cul-de-sacs according to the Radburn method (Discover Senri, 2022), and in the late stage of the development, the separation of pedestrians and cars was achieved by using pedestrian bridges following the idea of Buchanan report (Buchanan, 1963). To contain traffic and segregate cars from pedestrians, the planning of the new town took advantage of the undulating topography of the Hokusetsu area where the main part of the new town was planned.
In the Takanodai area, the current challenges are to cope with the aging of housing and to provide a variety of housing styles. Furthermore, the proportion of elderly residents is particularly high in Senri New Town, with 14.4% of the residents are aged between 65 and 75and 24.5% are older people aged 75 and over, for a total of 38.9% in the 2020 survey. The Takanodai area consists of the highest proportion of elderly residents among all 12 residential districts in the new town. This ratio is much higher than the average of all 12 residential districts in Senri New Town, where 11.7% of the residents are aged between 65 and 75 and 18.1% are older people aged 75 and over, for a combined ratio of 29.8%. Among them, 2-Chome (a small district within a neighborhood) maintains a diversity of urban amenities with a moderate

number of schools and detached houses, and is not limited to residential function of public housing. For these reasons, the area was considered to be as mixed-used area and an appropriate case for applying the walkability index.

Fig.1 shows a street map of Takanodai 2-Chome area. The area can be divided in two zones according to housing styles: A zone shows the public housing zone (predominantly medium and high-rise apartment blocks), and B zone shows the detached housing zone.
In order to conduct the survey systematically, we have decided to assign a point number to the intersection of streets in Takanodai 2-Chome. The streets connecting the two numbered points are given names. (e.g. The street connecting points “m” and “n” is named "Rm,n".). ‘R’ indicates roads.

Figure 1. Street Map of Takanodai 2-chome (Source: Aida, 2024)

3.2 Walking Environment in the Takanodai Area

The Takanodai area was one of the first residential areas developed in Senri New Town, and was planned to be separated from pedestrians and vehicles by a cul-de-sac and a pedestrian footpath. A cul-de-sac is a type of street design to prevent through traffic. The cul-de-sac was extensively used in the early development areas of Senri New Town to separate vehicles from pedestrians. The Takanodai area is one of typical applications of the cul-de-sac design.

Figure 2 below shows a street planned as a pedestrian footpath called *Suita-Takanodai private line*. These footpaths were constructed in March 1984, so approximately 40 years have passed from the start of their use. The streets that include these exclusive footpaths are R3,5, R6,9, R6,15, R7,9, R7,10, R10,11, R10,14, R14,21, R16,17, R17,37, R21,23, R21,24, R51,52, R53,54, and 14 street connecting points in total.

In addition, there are streets in the public housing zone (Zone A) that are pedestrianized streets because vehicles cannot enter, and these are shown in Figure 3. These streets include R18,27, R19,26, R26,27, R26,31, R30,36, R31,32, R31,35, R32,36, R32,44, R35,39, R36,42, R37,38, R39,45, R40,43, R41,42, R42,44, R47,50. The 17 streets are applicable.

Figure 2. Street Classification in Takanodai 2-Chome area (Source: Aida, 2024)

4. Results and Discussion

This chapter discusses analysis results from the walkability index applied in selected streets within the Takanodai 2-Chome.

4.1 Results

The following figure shows a heat-map display of the overall Walkability Score. There are different types of streets within the studied areas and ‘short pedestrian streets’ and ‘streets with driveways’ are found in the public housing zone. In contrast, two-lane large streets and streets pedestrian lanes are typical examples in the detaching housing zone (Figure 3).

footpaths in the public housing zone	streets with sidewalks in the public housing zone
two-lane large streets with sidewalks in the detached housing zone	footpaths in the detached housing zone

Figure 3. types of streets in different studies areas (Source: all photos by Aida, 2024)

Figure 4. the overall Walkability Score

Figure 4 shows that the streets with high walkability are footpaths in the public housing zone (R18,27, R26,31, R30,36, R35,39), streets with sidewalks in the public housing zone (R34,38), two-lane large streets with sidewalks in the detached housing zone (R1,2, R2,4, R14,22, R20,24,

R24,28, R28,43), footpaths in the detached housing zone (R6,9, R14,21, R17,37).
Figure 5 - Figure 11 below shows a heat map of all 73 streets in respect of each of the seven stems in the walkability index.

Figure 5. presence of sidewalks

Figure 6. pavement condition

Figure 7. stairs

Figure 8. slopes

Figure 9. park space

Figure 10. green space

Figure 11. street lighting

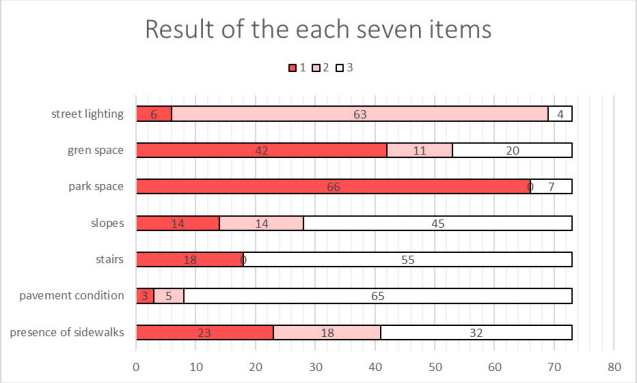

Figure 12. Total results from each of the seven items

The above figures show in terms of green space and park space, the majority of streets studied scores at the lowest (42 streets and 66 streets out of 73 studied). For slopes, stairs and pavement condition, the majority of streets scored with a higher point. Therefore, in Takanodai 2-Chome, there is an urgent need to increase green space and to prepare parks along the streets.

4.2 Discussions

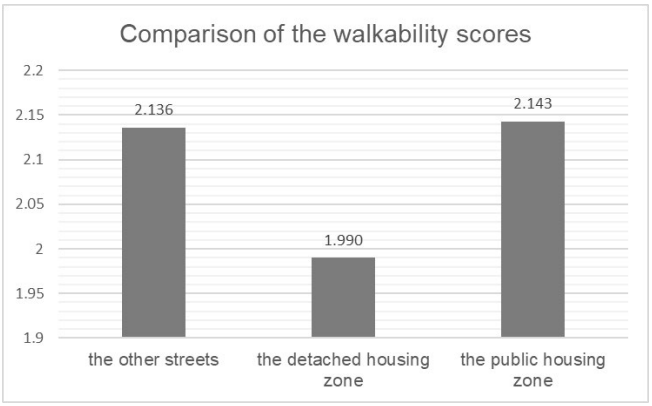

Figure 13. Comparison of Walkability Scores by different study areas

Figure 13 shows that the walkability scores of pedestrian footpaths in the Suita-Takanodai detached housing zone are lower than the other streets which are not footpaths, but streets shared by vehicles and pedestrians (see Figure 2).
On the other hand, average walkability for pedestrianized streets in the public housing zone tended to be slightly higher than the overall.

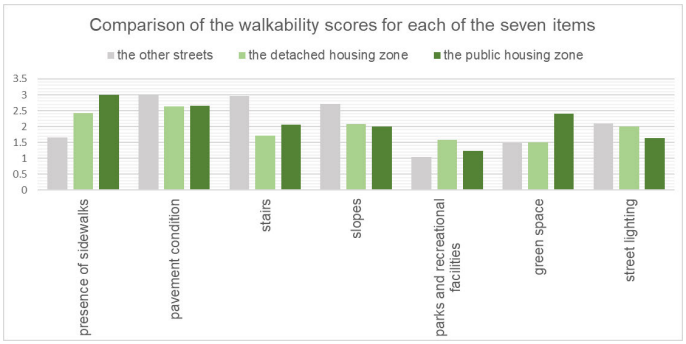

Figure 14. Comparison of scores for seven items by street characteristics

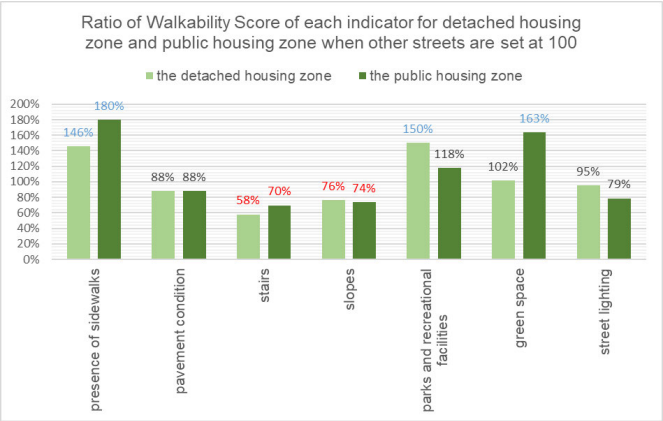

Figure 15. Ratio of Walkability Score of each item for detached housing zone and public housing zone when other streets are set at 100

Figure 14 shows the Comparison of scores for seven items by different study areas, and Figure 15 shows the Ratio of Walkability Score of each indicator for detached housing zone and public housing zone when other streets are set at 100. From these results, two possible factors for the low scores of walkability index in the detached housing zone are the presence of stairs and the slopes. Also, two possible factors for the high scores of walkability index in the public housing zone are the presence of sidewalks and the green space.

Figure 15 shows that stairs and the slopes are the main causes of reduced walkability scored in the detached house zone. Therefore, the walkability score was recalculated using the five indicators excluding the stairs and the slopes, and the result is shown in Figure 16 below.

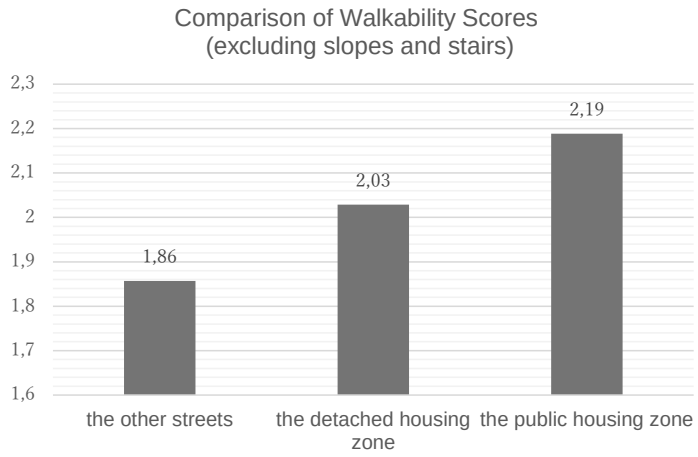

Figure 16. Walkability Score Comparison (excluding stairs and the slopes)

From Figure 16, when walkability scores were calculated for the indicators excluding stairs and the slopes, the results were as follows: pedestrianized streets in the public housing zone scored higher than the other streets. This indicates that all indicators except stairs and the slopes have high scores in the both public housing and detached housing zone compared to those in the other streets.

This suggests that the *Suita-Takanodai private line*, which was developed approximately 40 years ago as a footpath based on the idea of separating vehicles and pedestrians, may have a slightly lower walkability score than the other streets today. This may be related to the age group of residents who moved in at the time of the development of Senri New Town. In the 1970s, when Senri New Town was first developed, many residents were families with small children, and the aging rate in Senri New Town was low compared to the national average. This was due to the fact that the majority of residents were relatively physically healthy in terms of walking at that time. However, the rapid aging of the population in Senri New Town has made streets problematic for the elderly in terms of walking activities, which resulted in low walkability scores in this study. On the other hand, in the public housing zone, apartments surrounded by green spaces, and the entire zone is covered with greenery. Therefore, the amount of green space is considered to be high and the landscape is considered to be well kept.

More than 60 years have passed since the opening of New Town, and there are still problems such as aging public housing and lack of facilities for the elderly. At the time of the opening of the town, there was a shortage of elementary schools due to the large number of people

with children moving in at the same time, and after the children became independent and moved out from home, the demand for senior citizen facilities rose dramatically due to the aging of the remaining residents. In 2007, the population of Senri New Town dropped from 129,860 to a minimum of 89,212. The Senri New Town Revitalization Liaison Council was established consisting of the six organizations (Osaka Prefecture, Toyonaka City, Suita City, Urban Renaissance Agency, Osaka Prefectural Housing Supply Corporation, and Osaka Prefectural Urban Development Promotion Center) in order to revitalize Senri New Town for the future. The six organizations have formulated the “Senri New Town Revitalization Guidelines 2018 (Osaka prefecture, 2018),” to maintain and develop the vitality of the town.

In particular, the seventh of the sixteen revitalization policies for New Town, as shown in the Senri New Town Revitalization Guidelines 2018 (Osaka prefecture, 2018), is to "enhance the transportation environment to create a town where people can live comfortably on foot". In particular, the seventh point in the policy is to "enhance the transportation environment to create a walkable town." As explicitly mentioned, ‘walkability’ in the policy document, it describes the development of safe and comfortable walking spaces from the viewpoint of barrier-free access and signage for wayfinding in order to create a town where residents can live with peace of mind.

As described above, in Senri New Town, several municipalities and organizations are collaborating in various efforts to improve New Town under the initiative to revitalize the town in response to the recent declining birthrate and aging population.

However, the results of this survey showed that the pedestrian footpaths in the detached housing zone, which should have been rated higher, were rated low, and the other streets in the district were rated higher. This suggests that when Senri New Town was developed in 1970, people were not as conscious of barrier-free access as they are today and regulations on barrier-free were not introduced by public authorities. Therefore, it is possible that the slopes and the slopes were not considered to be an obstacle to walking, especially for younger residents, which may have remained unchanged and unimproved up to today. Otherwise, the score of walkability of footpaths in the public housing zone should have been rated higher. This is because public housing zone have a well-developed green environment and a thorough separation of vehicles and pedestrians. However, the both zones have low scores for slopes and stairs, and it will be a challenge for the Takanodai area to improve these obstacles in the future, given the hilly topographic condition.

5. Conclusion and Future Prospects

When evaluating the walkability of an area, the characteristics of its residents and the process of street structure and design can be taken into account. By calculating walkability scores for individual streets that are used only by pedestrian-only or shared with vehicles, it is possible to appropriately identify certain streets that require some development. In addition, the walkability evaluation can visualize the walkability of each street by displaying the numerical values on a heat map, making it possible to create intuitive and easy-to-understand maps. These maps can serve as evidence in discussing improvement areas.

A walkable city for the elderly is also a walkable city for people of other ages. Therefore, walkability evaluation index developed for the elderly can be used as an indicator for the creation of walkable neighborhoods for everyone. We believe that the application of any walkability indices, including this study, is a useful method that will help create walkable cities for all citizens in the future.
As a prospect for future research, we believe that a more multifaceted walkability evaluation can be conducted by combining this research with studies focusing on the relationship of walking time and walking routes. This is especially an important point to be considered in the walkability of older people since their walking speed would reduce by ageing.

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Guiding principles for the 15-minute city in peripheral areas: the emc2 model.

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Abstract
The 15-minute City (15mC) is a novel urban planning approach aiming at affordable and sustainable mobility while enhancing urban life. Implementing this concept in car-dependent outskirts and suburbs poses significant challenges due to their lacking essential morphological features. Cities, especially in metropolitan areas, function as interconnected networks rather than standalone walkable neighbourhoods, complicating the implementation further. The Evolutive Meshed Compact City (emc2) offers a networked pedestrian-based 15mC model suitable for many European peripheries. The model relies on a set of guiding principles and detailed specifications, which are interrelated across different scales. To evaluate its potential in European metropolitan peripheries, a research design is proposed, focusing on its ability to facilitate a successful transition to a 15mC. Additionally, the paper compares the emc2 model with other proposed 15mC solutions.

Keywords
15-minute City, Suburbs, Networked Densification, Pedestrian-Friendly Urban Form

1. Introduction: challenges for the 15-minute City in metropolitan peripheries

Developing a 15-minute City (15mC) represents a novel planning strategy aimed at fostering affordable and sustainable mobility. However, its objectives extend beyond mere transportation goals, encompassing the enhancement of overall city life and the prioritisation of human needs in urban planning. Indeed, the concept of the 15mC aligns closely with the Sustainable Development research agenda, which seeks to enhance quality of life while facilitating the energy and ecological transition of 21st-century cities. By promoting pedestrian-based proximity, the 15mC aims to enable inhabitants and city users to access destinations that fulfil most of their daily needs within a short walking distance (Moreno et al., 2021; EIT Urban Mobility, 2022). This shift is expected to reduce reliance on motorised traffic and render retail and services viable at a local scale.

Pedestrian-based proximity should not be narrowly interpreted solely in terms of short distances that are easily traversed on foot. Two additional considerations must be integrated into the framework. Firstly, the 15mC must recognize the multi-scalar nature of urban life by accommodating both short- and long-distance movement patterns. Secondly, it must ensure that pedestrian and non-pedestrian movement respects the well-being of pedestrians, both while walking and when stationary. This entails that the 15mC should harmonise functional considerations regarding pedestrian accessibility to destinations across different scales with the

broader affordances of public space to address a variety of human needs that arise from its usage.

Compact European cities have already implemented 15mC solutions with notable success, as evidenced by Paris and Barcelona. However, the transition to a 15mC is considerably more challenging in post-war car-dependent outskirts and suburbs due to stringent prerequisites concerning urban form and spatial organisation, aspects often overlooked in much of the European literature on the subject. In contrast, North American cities exhibit greater attention to retrofitting suburbia, as highlighted by the work of Duhnam-Jones and Williamson (2011). For instance, the city of Portland has tailored its 15mC policy to suit its diverse urban forms, including the retrofitting of suburbs with small retailers through accessory commercial units. We contend that European cities possess significant untapped potential to intervene in the physical form of their outskirts and suburbs and to implement ambitious 15mC policies.

In both Europe and North America, car-dependent outskirts and suburbs often lack several key morphological prerequisites for the 15mC: centrality, density, proximity to services and public transport, mixed land use, quality walking and cycling infrastructure, and attractive public spaces. These prerequisites significantly influence people's behaviours through intermediate concepts such as walkability, sense of place, ease of access, and vibrancy (Gehl, 2011; Dovey et al., 2017). We believe that interventions solely focused on improving pedestrian accessibility, without addressing these underlying morphological challenges, will struggle to successfully implement the 15mC in peripheral areas. What is required is a new coherent framework to guide interventions across the various facets of the 15mC.

Moreover, to successfully implement the 15mC concept in outskirts and suburbs, it's crucial to acknowledge that cities operate as open networks rather than as collections of self-sufficient "walkable neighbourhoods" or "urban villages." This is especially true in a metropolitan context, where multiple centres at different scales interact through infrastructural networks. These networks profoundly influence the localization of retail and services, which are only viable where human flows concentrate within a movement economy (Hillier, 1996).

The Evolutive Meshed Compact City (emc2) is being developed to offer a workable urban model capable of ensuring the necessary coherence of a 15mC strategy in urban peripheries. The model suggests distributing compact urban form as corridor development along pre-existing main roads connected to wider-range mobility options, thereby forming a meshed structure across the metropolitan area. This necessitates smart densification along these streets, which are further redesigned for pedestrians to transform into lively main streets. Presently, the emc2 model is the subject of a coordinated research effort by the authors and will be the focus of this paper.

The paper is structured as follows: Section 2 will delineate the emc2 model through its five overarching guiding principles. Section 3 will outline a research design aimed at evaluating the potential of the emc2 model in European metropolitan peripheries and identifying its strengths and weaknesses. This analysis aims to discern where the model is most effective in facilitating a successful transition to a 15mC in peripheral areas. Finally, Section 4 will conclude by examining the emc2 model in relation to other overlapping or sometimes competing models for organising urban space.

2. The emc2 model through its five guiding principles

The emc2 model is a model of a networked pedestrian-based 15mC well adapted to the prevailing conditions of many peripheries and suburbs in European metropolitan areas. The model can be specified through the implications of a few guiding principles. Each principle, it

its turn, will allow us to identify more detailed specifications. Principles and detailed specifications imply each other, across scales and within a given scale. This systemic view of the organisation of urban space could eventually give rise to an even more detailed pattern language (Alexander et al. 1977; Mehaffy et al. 2020) for the 15mC in European metropolitan peripheries, which could serve as guidelines for decision makers, planners and urban designers.

Principle 1. A meshed foreground network of main streets is the backbone of an uninterrupted system of pedestrian public space, enhanced by multimodality.

The main components of the emc2 model are main streets, i.e. streets concentrating urban activity and pedestrian public life (Gehl, 2011). They correspond to what are normally identified as high streets in the UK, where they remain a central element even in a suburban context (Vaughan, 2015). This concept of main street should not be confused here with the one used in traffic engineering, corresponding to an arterial road, with high traffic capacity and long-range significance. At the same time, it is only by applying all the founding principles of the emc2 model that the concept of the main street can be understood. Every principle will add a new facet to it. Within this first principle, main streets will be barely defined as important elements of the street network and of the urban mobility system, characterised by a high potential of pedestrian flow.

Specification 1.1. Foreground mesh of main streets. The foreground network within an urban street system is the set of the streets with the highest levels of configurational centrality across various scales (Hillier, 1996). As such, it is characterised by the configurational properties imparted to each street by the overall topology of the street network, regardless of the functions they serve. As noted by Hillier, streets with the highest configurational centrality are directly interconnected, forming a fully connected network. Typically, in large urban areas, a system of hubs and spokes emerges, where accessibility extends not only to the central hubs but also to the spokes, which channel ‘through movement'

However, to maintain consistency with the principles of the 15-minute walking city, the foreground network within the emc2 model will intentionally exclude motorways and similar roads that prohibit pedestrian access and building entrances. Although these roads often possess high configurational centrality values at the metropolitan scale, they lack the frequent connections necessary to increase configurational centrality at smaller scales (Berghauser Pont et al. 2019). Research in space syntax and other configurational approaches indicates that defining a foreground network in this manner provides valuable insights into the distribution and intensity of pedestrian flows (Lerman et al. 2014; Berghauser Pont et al. 2019), which, in turn, correlates with the level of activity in adjacent buildings, particularly for retail and service establishments benefiting from increased pedestrian traffic.

The spatial structure of the foreground network is of paramount importance in the emc2 model. Firstly, to ensure continuity in pedestrian movement and in the distribution of pedestrian-based activities, the foreground network must be completely connected even when motorways are excluded from it; otherwise, car-based mobility becomes a necessity even for connecting relatively close places. Secondly, the network should be as meshed as possible, avoiding long tree-like structures, to create redundancy of connections and minimise spaces where pedestrians are too far away from a main street. Main streets in traditional central urban areas create meshes of around 400 metres in length (Mehaffy et al., 2010). This could serve as an objective for the most densely populated peripheral areas covered by the emc2 model. More realistically, in suburban and peri-urban peripheries, the sides of the meshed structure could be up to 1000-1500 metres long, while still keeping most of the inner area within a 10-minute walk from

several main streets. The foundational idea of the emc2 model for the peripheral 15mC is to place inhabitants and city users, wherever they are, at close walking distance from main streets.

Specification 1.2. Uninterrupted public space system with pervasive pedestrian multimodality. The interconnected and meshed foreground network could not serve as the backbone of the 15mC if it were not integrated within a wider system of public spaces for pedestrians. Uninterrupted public space is necessary throughout the urban area: all main streets should be walkable, along with the ordinary and capillary streets that feed into them, as well as the plazas, squares, and parks connected to them. Multimodality, especially transit and cycling, must be considered as options to enhance pedestrian accessibility beyond the 15-minute threshold and should not presuppose car use to access their networks. The ease of using cycling and transit for longer trips will reduce suburban areas' dependence on cars for integration into the metropolitan area (Newman and Kenworthy, 1999).

Pedestrian-based multimodality recognizes the necessity of long-distance travel within the contemporary city. However, whenever possible, both short- and long-distance patterns of movement within the city are supported by the same foreground street network. Transit options compatible with the main streets (such as streetcars and buses) can be integrated within them, as well as bicycle paths and some residual car traffic. The goal is to reinforce the centrality of main streets with transit routes without sacrificing pedestrian space within them. Over the last forty years, many European cities have used streetcar projects as means for the requalification of public space (MVG, 2008). While some of the most central axes have become completely pedestrianised (except for the presence of streetcar tracks), more peripheral streets have been able to accommodate requalified sidewalks, cycle paths, as well as residual space for car traffic. From this perspective, European projects differ from many North American counterparts, where light railway transit has been preferred to streetcars: the distance between stops is normally greater, speeds are higher, and, as a consequence, tracks are often physically protected from pedestrian crossing, thereby becoming, along with much more generous space for car traffic, a major obstacle to the pedestrian functioning of the street.

Principle 2. The network of main streets develops synergies with ecological networks and with far-range mobility corridors and keeps its structure over time.

The contemporary metropolis is, as a networked space, in need of a network urbanism (Dupuy, 2008). Following this premise, we see the network of main streets as one of the many networks of contemporary urbanisation, albeit the most important of them. As such, it should develop synergies (and avoid conflicts) with ecological networks (namely blue and green networks) and with far-range mobility corridors (highways, railways). From this principle, the network of main streets also gets the role of main intermediary structure between different networks of the contemporary metropolitan area.

Specification 2.1. Green and blue ecological networks are interconnected corridors of undeveloped land of ecological significance, as well as water bodies near them. Urban green spaces have the potential to provide crucial ecosystem services that lower health risks, increase the resilience and ecological integrity of cities, improve the health of residents, and create more equitable living spaces across the socioeconomic spectrum. Enough nearby green space benefit the physical and mental health of residents and can strengthen communal cohesion and belonging via a myriad of pathways (Hartig et al., 2014; WHO, 2016; Braubach et al., 2017; Dizdaroglu, 2021).

However, for such positive effects to occur, both the quantity and the qualities of such space must be sufficient. It is recognised that the ecological quality is also a function of the multiple

connections existing among the different green and blue areas. Accordingly, the attention is presently more on the creation of networked corridors of rich natural life than on the sheer size of urban parks. Indeed, green and blue corridors can count on specific topographic features structuring their continuity (a talweg, a ridge, the coast of a large waterbody). Renaturalization actions are sometimes needed to ensure continuity. More attention is also given to further connecting other green areas (public and private gardens, playgrounds, etc.) to the main ecological corridors, even if in a lighter way (through street trees and hedges, road crossing devices for small animals, etc.). Indeed, isolation of ecological patches seems to be more hampering than loss of contiguity: fragmentation per se could even have moderate positive effects (Fahrig, 2019) when ecological patches are not completely isolated.

Availability of connected green and blue areas in the suburbs doesn't imply accessibility to them. Synergies are created when easy connections are made for pedestrians to access these ecological corridors with pathways leading to the main streets, which remain the most accessible elements for inhabitants and city-users alike. Crossings and overlays are also possible but taking care of not disrupting neither the ecological functions of green space nor the human usage of public space.

Specification 2.2. Mobility corridors are necessary to ensure long-distance connections within a metropolitan area and beyond it, with further destinations. These corridors are made of motorways and railways serving the main centres of the metropolitan area. As such, they are a main concern of national and regional planning policies. Necessary as they are, they are made of infrastructural elements which are hardly compatible with pedestrian-friendly public space. There is ample research on the barrier effects of far-range transport infrastructure for pedestrian-based local street networks (for a review see Van Eldijk et al. 2022). The main point is the inter-scalar nature of mobility systems. Car and railway infrastructure aim at decreasing the impedance (travel time) to access destinations on the national and regional scales. But this infrastructure often does so by introducing physical barriers in mobility systems on a more local scale, increasing impedance for walking and cycling, to access destinations within neighbourhoods or among neighbourhoods. The emc2 model aims at minimising these disruptions, above all when they concern the most essential elements of the human-centred city: main streets. Whenever the latter enter in conflict with transportation infrastructure, overpasses and tunnels should be foreseen for these extra-urban elements, leaving the ground floor always for pedestrian main streets. The positioning of main streets and transportation infrastructure also need attention: parallel positioning in close proximity is problematic as it severs the main street from its pedestrian shed. Similar conflicts arise between ecological and mobility corridors, necessitating appropriate solutions, but with less compelling requirements (tunnels and overpasses can sometimes be acceptable for ecological continuity, as well as parallel positioning in proximity if the necessary connections are foreseen).

Mobility corridors and main streets can also develop synergies. By creating multimodal synapses with city streets (railway stations, park & ride facilities, multimodal hubs) in a pedestrian-friendly environment, mobility corridors can feed the pedestrian flows on main streets and the use of their embedded transit and cycling systems. As a result, their movement economy is enhanced beyond the flows linked to their configurational potential within the street network. Specific design patterns are needed to ensure pedestrian-friendly connections between multimodal synapsis and main streets.

Specification 2.3. Structure preserving development. All networks evolve over time: the network of main streets, green and blue networks, mobility corridor networks and even the network of ordinary streets serving new urban developments. Based on simple considerations of resource parsimony or on more theoretical considerations of system wholeness, complexity

and resilience (Gunderson and Holling, 2002; Alexander, 2003; Salingaros, 2005; Mehaffy and Salingaros, 2013), these developments have to be structure-preserving, adding new elements incrementally to old ones as much as possible. Research in urban morphology has already pointed out that urban development always combines permanence and change (Hanson, 1989; Panerai, 2013; Romice et al., 2020, Fusco et al., 2024): the street network and the plot system are the main morphological infrastructure, changing relatively slowly over the decades and even the centuries. Supported by this infrastructure, faster cycles of building construction and reconstruction can take place without losing the apparent continuity of a given settlement. Within this overarching consideration, the permanence of high streets is considered as an even more compelling principle. Not only the layout of main streets is rarely modified, but when new main streets add to the old ones, they do so by intensifying or widening the spatial extent of the foreground network and without degrading the status of the old main streets. Of course, despite this general rule, urban history presents cases of demoted main streets, sometimes happening when a new parallel street absorbs its functions (Caniggia and Maffei, 2017). In the fragile suburban contexts, the emc2 model recommends extreme caution when allowing such shifts in centrality, suggesting taking stock of all the potential of established main streets.

Principle 3. Locally, the main street acts as an accessible, dense, and diverse centre for a neighbouring area.

One of the most notable aspects of the emc2 model is its vision of main streets as central elements within suburban and peri-urban peripheries. This approach shifts the focus away from a collection of suburban villages acting as central points for their immediate surroundings and instead emphasises the interconnection of central axes across different villages to create a more distributed and linear centrality in metropolitan peripheries. This concept, described by Hillier (1996) as pervasive centrality, firmly establishes main streets as key components of the socioeconomic functioning of the suburbs.

Specification 3.1. Main Street as an accessible linear centre. We have already established that main streets are integral components of the foreground network at a broader scale, yet they are also easily accessible locally. This dual accessibility implies that main streets possess high configurational centrality, facilitating movement both at a mesoscale (beyond the 15-minute walking distance, through their connections with other elements of the foreground network) and at a more local scale (within the 15-minute walking distance, through their connections to ordinary streets and other local public spaces). This multi-scalar network centrality is crucial for generating business opportunities across various activities within the movement economy (see below).

The central role of main streets within a pedestrian shed is analysed by Mehaffy et al. (2010) in their examination of traditional urbanisation, and it is envisioned as a significant pattern in their new pattern language (Mehaffy et al., 2020). As a matter of fact, several post-war developments in European cities have struggled to maintain the vitality of their main streets and squares due to inadequate accessibility and multi-scale centrality within their layout and the larger urban area where they are situated. For a main street to function effectively as a local node within a broader centrality network spanning the entire metropolitan area, it must also serve as a bridging tie within the conurbation system, facilitating connections between neighbourhoods. This capacity, derived from their configurational properties, positions main streets as pivotal locations within the grid, acting as bottlenecks for most movement flows and thus suitable for catalysing the coalescence of local densification processes.

Specification 3.2. Main street as a dense and diverse linear centre. The favourable pedestrian accessibility of main streets, coupled with the presence of easily accessible

transportation connections, positions them as focal points for both spontaneous market-driven and planned selective densification. Main streets typically exhibit higher built-up densities than their surroundings and host a diverse range of activities and services. Public-receiving activities such as retail, public and private services, etc., are primarily situated along the main street or on plazas and squares connected to it. These activities on and around main streets benefit from the movement economy (Hillier, 1996; Berghauser Pont et al., 2019; Bobkova et al., 2019; Araldi, 2020; Froy, 2023): flows, concentrated on the main axes by the configuration of the street network, create opportunities for socioeconomic interaction and are a primary driver for the presence of retail and market-driven activities. The presence of these activities, in turn, enhances the utilisation of public spaces on main streets, fostering opportunities for additional services. Consequently, activities on main streets form a dense network (Salingaros, 2005; Mehaffy et al., 2020), with close spacing between them (multiple activities per 100 metres) and good intervisibility, well-suited to the fluidity of pedestrian movement within the walkable space.

In suburban areas, where car dependency undermines the pedestrian flow potential of main streets, locating public facilities such as administrations and schools on main streets within a pedestrian-friendly environment can enhance pedestrian flows and stimulate activities within the movement economy. However, in these suburban contexts, some degree of car access to these activities may still be necessary to maintain their local concentrations on main streets. Addressing car access raises concerns about mitigating the negative impact of car flows on main streets and identifying parking options that are compatible with pedestrian spaces on main streets.

Principle 4. The main street is pedestrian-friendly and enhances public life.

This principle ensures that main streets remain human-centred environments, fostering social interaction and well-being. Pedestrian-friendliness of main streets encompasses both ease of pedestrian movement (walkability) and opportunities for pedestrian stay, interaction, and a strong sense of place. Guidelines for designing street public spaces with a focus on human-centeredness exist (Ståhle et al., 2022; ADEME, 2023), along with experiments proposing innovative temporary solutions through tactical urbanism (Bertolini, 2020; Lydon and Garcia, 2015). In what follows, we will emphasise what we perceive as the most compelling specifications, recognizing that extensive fine-tuning will be necessary to address local specificities and needs.

Specification 4.1. Active built-up frontage on the main street. Build-up frontages along main streets guide pedestrian movement, visually define perceived space, and provide opportunities for locating activities on the ground floor. The significance of visually defining the channel of movement in urban spaces has been underscored since the pioneering works of Cullen (1961) and Lynch (1959), extending further back to the contributions of Sitte (1889). Lynch (1959) posits that paths and edges are fundamental linear features that structure human perception and cognition of urban space; the former is experienced physically through walking, while the latter is primarily perceived visually. When the edge of a built-up frontage aligns with the path of a street, the imageability of the urban structure is notably reinforced, precisely the objective in the case of a main street. It is unsurprising that authors advocating for recommended urban patterns emphasise the importance of certain visual requirements. Firstly, buildings, whether adjacent or detached, align to create an urban frontage, fostering a street corridor effect (Alexander et al., 1977; Gehl, 2010). Secondly, setbacks are either minimal or absent to ensure a strong connection between the street and buildings. Lastly, terminated vistas can be employed to prevent the impression of endless peripheral axes (Mehaffy et al., 2020). To further enhance

the connection to outdoor spaces and provide pedestrians with a sheltered interface, arcades can be developed along the building frontage (Alexander et al., 1977; Mehaffy et al., 2020).

The build-up frontage also results in higher building density, offering opportunities for both living and working along main streets. A functional requirement for buildings along main streets is to accommodate activities, particularly on the ground floor. The challenges of having ground-floor residential units along busy main streets could be addressed by a simple prescription: ground floors are designated for activities. Regarding residential opportunities, an urban frontage on main streets consisting of mid-rise buildings (2 to 5-6 floors) could provide housing options often lacking in suburban areas, such as small to mid-sized flats. These options could complement the larger units found in suburban housing developments and social housing complexes. This housing shortage is well-documented in the North American context (Parolek, 2020) and is a structural barrier to achieving social and generational diversity in many European suburbs. As for high-rise buildings, they pose challenges on peripheral and suburban main streets. Outside the compact fabric of central city perimeter blocks, high-rises tend to be freestanding constructions, weakly connected to the public space of the main street and disrupting the urban frontage. Specific retrofitting strategies may be necessary to integrate existing high-rise buildings into the active urban frontage of peripheral and suburban main streets.

Specification 4.2. Main Street as a walkable environment. The focus here is on the layout and organisation of public space. Main streets should provide ample pedestrian space to accommodate groups of people walking comfortably. This entails prioritising pedestrian space, ensuring frequent ground-level pedestrian crossings that cater to all users, including children, the elderly, and the physically impaired, and incorporating street trees to offer shade and thermal comfort (Jacobs, 1993). There are compositional differences among three types of main streets:

- Large urban boulevards, wider than 30-40 metres, can feature spacious sidewalks (5 metres and more), accommodate multiple modes of transportation, and include several rows of trees. However, efforts should be made to mitigate the separation between opposing sidewalks.
- Urban avenues (20-30 metres wide) may need to compromise on multimodality and vegetation presence to ensure ample pedestrian space but are generally easier for pedestrians to cross.
- Unplanned main streets (typically less than 15-20 metres wide and irregular) often stem from the development of faubourgs or linear villages along what Caniggia and Maffei (2017) term a matrix route. These streets may consider pedestrianisation or shared spaces as options and should minimise on-street parking.

Shared spaces with clear pedestrian priority can serve as an alternative to expansive sidewalks, even on larger main streets, as demonstrated by Mariahilfer Straße in Vienna. However, in suburban contexts, car parking may be deemed necessary, necessitating compromises. To prioritise pedestrian use, a limited amount of short-term surface parking could be allocated on side streets or behind retail premises.

Specification 4.3. Main street as a hub for social interaction with soft interfaces. As discussed in Principle 3, the intensity of public life is strongly influenced by the role of the street within the broader street network. Bolin et al. (2021) demonstrated in a comprehensive European study that more central streets—those with higher levels of network centrality—in dense neighbourhoods experience greater movement and co-presence. However, the social and economic objective of main streets extends beyond facilitating pedestrian flow; it aims to encourage as much of this movement as possible to transition into social interaction and lingering.

Analysis of traditional urban forms provides invaluable insights into features that go beyond mere presence of built-up frontages. Active interfaces between buildings and streets are essential for urban vitality and natural surveillance. The vitality of street life is enriched by spatial relationships between private and public spaces (Gehl, 2010; Jacobs, 1961), facilitated by the adjacency and permeability of buildings directly accessible from the street. This relationship is elucidated in the interface maps drawn by Hillier and Hanson (1984) to explore the relationship of building entrances and public space in terms of movement and potential encounter. Co-presence and interaction are favoured in traditional streets (Shu, 2000), where the density of entrances and shallow topological depth between private and public spaces foster street vitality, safety, and social control.

Many recommendations can be gleaned from the preceding discussion:

- Facades along main streets should always be "soft" and active, engaging pedestrians with opportunities for interaction such as doors to enter, windows to look at, and recesses allowing for sitting (Gehl, 2010; Dovey and Wood, 2015; Fusco et al., 2024). Blank walls and opaque fences should be avoided.
- Urban furniture, both public and private, should encourage lingering and interaction, while pockets of activity should be developed in recesses of the urban frontage (such as setbacks within private lots or extensions of public space), away from pedestrian movement and car parking (Alexander et al., 1977).
- Layered spaces at building edges add depth to public/private interfaces (Shu, 2000; Gehl, 2010; Mehaffy et al., 2020): setbacks used for public activities and open verandas of bars, shops, and restaurants provide additional opportunities for social interaction and leisure.
- "Eyes on the street" are fostered by buildings facing the street, featuring balconies and windows above the ground floor (Jacobs, 1961), thereby enhancing the safety of public space usage.

All these features have been observed by the aforementioned authors in urban environments that are particularly successful in terms of utilisation and liveliness of public space, what Gehl (2010) defines as intensity of public life. The goal of the emc2 model is simply to ensure that these morphological elements supporting main street public life in peripheral and suburban areas, albeit combined differently to accommodate local specificities, are maximally present.

Specification 4.4. Main street as a beacon for shared urban values. Main streets serve as the embodiment of urbanity within each sector of the metropolitan area. Hosting key functions and frequented public spaces, and bordered by significant buildings, they are imbued with human meaning, anchoring community values for inhabitants and city users across a wider area. They represent the enduring presence of the community over historical time (Griffiths, 2015) and serve as an implicit agreement regarding expectations for any urban intervention in the physical layout and functioning of urban space (Gourdon, 2001).

These fundamental considerations can have far-reaching implications for design preferences and necessitate community engagement in any proposed transformation of the streetscape or public space layout of main streets. Therefore, greater attention may be warranted to use materials, proportions, and details that resonate with the local context and cultural preferences along main streets. The historical origins of main streets, whether they evolved spontaneously as faubourgs or were planned as avenues, can significantly contribute to the sense of place, complementing the design and functional considerations highlighted in Specification 3.2. Main streets will also serve as natural venues for ephemeral events, such as local markets, cultural or sporting events, and community or political gatherings. Organising these events to reclaim street space for pedestrians (Bertolini, 2020; Lyndon and Garcia, 2015) could be one of the

initial actions to implement to catalyse the transition of present-day peripheral main streets to the desired levels of urbanity outlined in the emc2 model.

Ensuring equal attention to all users of the main street, regardless of age and ability, through the provision of appropriate urban furniture and the removal of architectural barriers, not only enhances the quality of public space but also reflects important shared values. This stands in contrast to the current imbalance in the use of peripheral arterial roads, which often prioritise car drivers at the expense of neglected pedestrians.

Principle 5. The inside of the mesh is well connected to the main streets and accommodates functions outside of the movement economy.

This last principle addresses the areas within the mesh of main streets and how to establish walkable connections to incorporate them into the pedestrian shed surrounding the main streets, thereby expanding the potential clientele for their activities. In broad terms, urban functions that do not primarily serve the needs of the movement economy are situated within the mesh. These may include residential developments, urban parks, as well as industrial and agricultural areas.

Specification 5.1. Meshed Network of Local Streets. Local streets should be as meshed as possible, facilitating the efficient distribution of both pedestrian and motorised traffic while delineating blocks. Suburban and peri-urban areas in Europe often fall short in this regard, with numerous local streets branching off from main axes without effectively delineating small-sized blocks (100-150 metres maximum). Local loops can be implemented to discourage through-traffic, a strategy recently employed even in the regular urban grid of Barcelona's city centre to foster more pedestrian-friendly environments on local streets. The interconnectedness of local streets can also facilitate future development of new main streets, enhancing the density of the foreground network. This is particularly evident when a former suburban area transitions into a more central and densely populated settlement: establishing a new main street is often more feasible by catalysing densification and mixed-use development on an existing local street within a meshed network, rather than creating a new right-of-way through costly expropriation procedures. The redundancy of the meshedness of main and local streets enhances the morphological resilience of the model (refer to Specification 2.3): the foreground network of main streets can grow organically, enabling the city to function as a complex adaptive system.

Specification 5.2. Interconnected Capillary Pathways. Pathways that serve a few buildings or a housing subdivision, or traverse parks and playgrounds, are interconnected (though not necessarily meshed) for pedestrians and, whenever feasible, for cyclists. They may explicitly prohibit larger vehicles to create tranquil pedestrian sanctuaries. These pedestrian interconnections offer shortcuts across areas delimited by main streets, facilitating easier pedestrian access to the latter. However, it's important to note that the spatial configuration of the background network of alleys and pathways is the most culture-specific aspect of the street network (Habraken, 1998; Hillier, 2012), balancing privacy and publicness in residential areas. According to Hillier, the interstitial part of the background network serves a conservative function in urban space, aimed at maintaining and reinforcing existing social structures, in contrast to the generative role and serendipity of the foreground network of main streets. While its morphology generally allows for more control, its configuration is highly contingent upon the cultural context it seeks to uphold: the embedded rules governing patterns of movement and interaction are heavily influenced by existing cultural systems.

Specification 5.3. Distributed Parcs in the core of the mesh. Neighbourhood parks and community gardens, not directly involved in the movement economy, can thrive within a semi-

pedestrian environment at the core of the mesh of main streets. The concept of situating a park at the heart of a neighbourhood originated in previous urban models, namely the Garden City (Howard, 1902), and the Neighbourhood Unit (Perry, 1929), and resonates in contemporary works on pattern languages (Mehaffy et al., 2020). However, in the Garden City paradigm, we are dealing more with a large central park for a mid-sized city of 32,000 inhabitants than with distributed parks within neighbourhoods. The central parkway of Welwyn, UK, is a good example of the implementation of this Garden City guideline. Distributed local parks provide an additional amenity within a short walking distance for inhabitants and city users, complementing the 15-minute city offer. Of course, larger green spaces in the periphery remain crucial to support multi-scalar interactions between local parks inside the mesh and larger green areas and rural land. This calls for effective connections of the local parks to the green and blue networks (Specification 2.1).

Specification 5.4. Integration of Activity Areas into the Urban Fabric. When the interior of the mesh includes an activity area (industry, logistics, or intensive urban farming zone), it should be treated as an integral part of the urban space, with interconnected local streets facilitating pedestrian and bicycle access to the main streets. Specific access routes may be designated for heavy truck traffic, linking directly to nearby motorways without traversing the main streets. Examining the case of the Greater Manchester Area, Froy (2023) illustrates how logistical and industrial activities can leverage direct access to regional and national infrastructure, albeit at the expense of the multi-scale balance of the urban street network configuration. Therefore, it's crucial to ensure comfortable pedestrian and bicycle access to encourage employees to walk or cycle to local main streets and partake in the activities offered there, be it after work or during breaks. In contrast, large retailers should maintain a direct, pedestrian-friendly interface on the main street and contribute to its allure, even if their premises extend further into the mesh. While this specification draws less directly from empirical observations of best practices, it logically follows from the guiding principles of the emc2 model.

To wrap up this section, let's refine the concept of the main street within the emc2 model: it stands as a pivotal element of the street network, primarily catering to pedestrian movement while accommodating various modes of transportation to varying degrees. It serves as a catalyst for a diverse array of retail and service offerings, fostering vibrant public life within its vicinity. Moreover, it functions as an attractive focal point for a broader area, presenting opportunities for further urban densification given its inherently higher density compared to its immediate surroundings. By integrating its five guiding principles, the emc2 model proposes a meshed network of main streets as the foundational organising principle of the 15mC. This approach ensures pervasive centrality, even in peripheral and suburban areas, while capitalising on potential synergies with ecological and transportation networks.

3. An empirical research design to assess the potential of the emc2 model

Planning normally intervenes in the existing city, and contemporary urban peripheries in Europe are more or less prone to the requirements of the emc2 model. We will thus present a framework to assess the potential of contemporary urban peripheries to develop the emc2 model. Indeed, many European urban outskirts already possess incipient networks of main streets, which could serve as the backbone of the peripheral 15mC, as foreseen by the emc2 model. Beyond the model specification presented in the previous section, our research design consists of the following five steps.

The first step aims at assessing the potential of the emc2 model at the scale of whole metropolitan areas. The usual way of assessing 15mC potential in metropolitan areas is

relatively functional (Moreno et al. 2021, EIT Urban Mobility 2022): analysts look for possible local centres based on concentrations of urban functions (possibly divided in several categories to assess the presence of all of them) and define 15mC potential based on pedestrian sheds calculated around these centres. Within the emc2 model, functional concentrations are not a guarantee of the proximity-based 15mC, but rather a result of other requirements. What we want to assess is the potential for a given street to be a main street and of the resulting network of main streets to be as meshed as possible. Activities integrated along pedestrian-friendly main streets seem much more apt to induce pedestrian-based movement and public life than those randomly agglomerated within a given spatial extent. Researchers will thus first assess the pedestrian foreground street network, using the multi-scale configurational approach by Berghauser Pont et al. (2019): we calculate street centrality at different scales and identify both city streets (making up the pedestrian foreground network within and beyond the 15m radius) and main neighbourhood streets (complementing the foreground network within the 15 radius). We further assess the built-up streetscape of these main streets to ensure the presence of an urban frontage, of a sufficient built-up density and of setbacks and street cross-sections compatible with a pedestrian-friendly environment. After having checked these morphological pre-conditions, we assess the functional requirements: concentration of proximity-based activities (retail and services) and enough population in pedestrian sheds around the main streets. Clearly, part of the foreground network in peripheral and suburban areas lack many of the other morphological and functional features of the main streets, suggesting possible planning strategies to further connect the existing network of main streets by taking advantage of the already present configurational potential. In other instances, the foreground network could not be meshed enough, suggesting the presence of weak ties and possible strategies to reinforce them. These metropolitan-wide assessments will be carried out on six European metropolitan areas: the French Riviera, Lille-Roubaix-Tourcoing, Vienna, the Versilia conurbation, Florence and Gothenburg.

A second step of the analysis aims at understanding the historical genesis of the observable networks of main streets, inherited from planning or from spontaneous growth, including pre-existing rural settlements and faubourgs. The identification of the persistence of peripheral and suburban main streets over more than a century of urban history will be a main goal of the analysis. Within selected test areas, the historical formation of the observable forms and functions will be assessed through the study of old cadastral documents, above all in Vienna, where old cadastral documents include usage data. From the understanding of the underlying long-term and short-term dynamics, and considering the present situation of the test areas, possible implications for the implementation of the emc2 model can be identified, as well as the evolutive potential of the model over time. These analyses will also reveal insights into different spatial qualities in existing linear settlements, which will inform further phases of the research.

The third step of the research design studies the relations of the network of main streets of the emc2 model with other fundamental networks, mainly the multi-modal mobility network and the green/blue ecological network. The goal is to understand synergies and conflicts related to the different networks. The interaction of pedestrian movement and use of public space with car flows, as well as with bicycle and transit options will be assessed through the development of an agent-based model on a test area of the French Riviera. The synergies with the green and blue ecological networks and the implications on the ecosystem services effectively produced for inhabitants and city-users will be particularly assessed in Gothenburg, Sweden. These applications should also identify the implications for the functioning of the 15mC in the metropolitan peripheries and produce more detailed specifications for the emc2 model.

The fourth research step will zoom on peripheral test areas, which will have been previously selected because they are already organised around more or less well functioning main streets. Their fine-grained assessment will include their present form and human usage, and their possible transformations, through fieldwork, morpho-functional analysis, 3D-models and interaction with local authorities. Researchers will assess details of public space layout, organisation and usage, building façades, use of building ground-floors and of their pertaining open areas, etc. At this scale, the concentration of activities can be assessed through their capacity to create a pedestrian-based web characterised by small distances, intervisibility and ease of pedestrian reach. As the test areas are particularly favourable to emc2 solutions, this phase of the research aims at understanding the observable advantages and drawbacks of these almost-emc2 examples, quantifying their contribution to the objectives of the 15-minute city, and identifying possible improvement for a full emc2 implementation.

In a last research step, researchers will look for generalisation, to pass from what is learned on a given case study to what could be applied to all case studies and, beyond, to all European cities wishing to implement the emc2 model. The assessment of the theoretical model in the light of the obtained results is an essential aspect of generalisation of findings. A second objective of this final phase is to produce assessment and intervention guidelines for the use of urban practitioners. To include all the scales of the analysis (metropolitan, sector-wide and local) and to respect the coherence of the overall model, guidelines could be produced in the form of a pattern language (Alexander et al. 1977, Mehaffy et al. 2020).

4. Discussion: the emc2 and other models to organise the 15-mitute city

The emc2 model distinguishes itself from other seemingly related models designed to structure proximity-based cities or offer alternatives to car-dependent urban sprawl.

Transit-oriented development (TOD, as exposed by Cervero et al. 2004) is an urban planning and design approach that revolves around creating mixed-use, pedestrian-friendly communities centred on public transportation hubs, such as train stations, subway stops, or bus terminals. TOD emphasises the strategic placement of residential, commercial, and recreational spaces within walking distance of public transportation facilities, aiming to incentivize residents to use transit instead of relying on private vehicles. A foundational principle of TOD is densification and the mix of uses around transit nodes. This mix of uses not only facilitates residents in meeting their daily needs without long-distance travel but also aligns with the ethos of the pedestrian-based 15mC.

Densification is pivotal for the very viability of TOD. Increased residential and commercial densities around transit nodes justify (and pay for) the significant capital costs of new high-performance transit infrastructure and provide an alternative to urban sprawl. This density is intended to foster vibrant street life and economic vitality. Design of public space is identified as an important aspect among the different Ds of the TOD model (Cervero and Cockelman 1997, Ogra and Ndebele 2014). However, design quality alone overlooks the configurational aspects that contribute to the success of pedestrian environments, particularly concerning natural movement flows within the street network topology. The extra-flows produced by the transit hub, regardless of pedestrian configurational potential, are deemed sufficient to ensure the viability of retail and service within the TOD scheme.

Despite its well-intentioned elements, the TOD model appears to clash with the networked fabric of the pedestrian-centred 15mC. Human scale considerations are primarily concentrated around the relatively distant hubs, relying on high-capacity transit to bridge the gaps between them. This approach disrupts the continuity of pedestrian flow and restricts opportunities for

the development of retail and services to specific nodal points. In comparison to the emc2 model, TOD seems more suited to structuring metropolitan growth when demographic demand justifies it and financial resources are available to establish new high-performance transit lines. In Europe, the ambitious Grand Paris Express project and the concurrent development of dense urban hubs around its stations stand out as exemplary instances of coherent TOD (Bove and Cornut, 2024).

TOD presents itself as a capital-intensive alternative to suburban sprawl, while emc2 is more akin to a low-cost retrofitting strategy for suburbs. Its aim is to provide suburbanites with a 15mC environment through limited densification around requalified main streets. However, there is potential for profitable hybridization between the TOD and emc2 models. Both envision the presence of a network of rapid transit, but for emc2, the distinction between streetcar and railway lines is crucial. Streetcars can seamlessly integrate with the pedestrian multimodality of main streets, whereas railways are more efficient in connecting a large metropolitan area. However, they must be integrated within a pervasive network of pedestrian-based main streets and cannot be solely relied upon to create a pedestrian-friendly environment.

The Neighbourhood Unit (NU), introduced by C. Perry (1929), holds a significant position in urban planning history and can be viewed as an initial response of pedestrian-based cities to the disruptive influence of automobile systems. This model underscores the establishment of self-contained residential neighbourhoods equipped with various amenities and services within walking distance. Consequently, it remains a relevant option for addressing the challenges posed by the contemporary 15mC. The classical Neighbourhood Unit is designed to be compact and pedestrian-friendly, with a distinct boundary that delineates it from surrounding areas. This setup aims to promote pedestrian mobility within the neighbourhood while reducing the necessity for long-distance travel. Unlike the emc2 model, the NU model relinquishes the traditional centrality role of main streets, allowing them to serve as arterial roads encircling the neighbourhood. Organised around a hierarchical street network, the NU model features major arterial roads on the periphery and interconnected smaller streets within. This design aligns with the principles of traffic engineering, which were emerging in the 1920s, facilitating regulated traffic flow and fostering a sense of enclosure and safety within the neighbourhood.

Each neighbourhood unit encompasses a centrally located public space, such as a park, square, or playground, serving as a focal point for community activities and gatherings. Surrounding this space are vital civic services for the community, including schools, libraries, churches, and healthcare facilities. Interestingly, Perry's original model recognized that retail and commercial services required the through-flows facilitated by cars and thus situated them along the surrounding arterial roads, complete with necessary parking facilities. However, post-war European implementations of the NU model, often seen in social housing projects, deviated from Perry's approach by placing retail and commercial services within the core of the neighbourhood and its civic centre. Consequently, these market-based activities, heavily reliant on the movement economy, encountered challenges due to the low configurational potential of their locations within the mesh, away from the main axes. Additionally, they suffered from the gradual impoverishment of the housing projects.

What appears most problematic with the NU model is its pursuit of a self-contained settlement within a broader metropolitan context. This vision, later revived by the urban village ideal, contradicts the networked nature of cities and overlooks the intricate overlap and intertwining of catchment areas for various urban services, as noted early on by Alexander (1965) and later elucidated by network-based theories (Hillier 1996, Salingaros 2005, Mehaffy et al. 2010). NU implementations in European outskirts have consequently experienced a continual erosion of

their proximity-based offerings and have become increasingly reliant on car-based mobility, which could better integrate the networked nature of cities.

Finally, the emc2 model shares intriguing similarities with Alexander's pattern language (Alexander et al. 1977), particularly concerning the detailed specifications of Principle 4. However, when examining the urban model that emerges from this pattern language at larger scales, it appears to align more closely with the NU model. Alexander designates local transport areas approximately one-mile wide as zones for pedestrian and bicycle movement (pattern #11). Like the NU model, these areas are delineated by ring roads for car traffic (pattern #17), while maintaining one side open to connect with the surrounding countryside forming a broad ecological network.

At the heart of these local transport areas lies a pedestrian promenade (pattern #31), which, interestingly, is not the primary commercial axis but rather a pedestrian-friendly public space linking short shopping streets (pattern #32). These streets, in turn, create a dispersed network of shopping nodes (pattern #19). Two main distinctions emerge when comparing this approach to the emc2 model. Firstly, akin to the NU model, Alexander's model envisions pedestrian-friendly zones for short distances as distinct modules, relying on automobiles (and transit, as in pattern #16) to connect them within a broader urban framework. Secondly, it overlooks the observable pattern of ribbon development seen in retail and service sectors, which is heavily influenced by the movement economy and was already well-documented by contemporary urban geographers (Berry 1967). Instead, it proposes a more dispersed form of retail, lacking support from the configurational properties of the network.

In response to these general shortcomings of the NU and of Alexander's model, the emc2 model seeks to reconnect with more traditional patterns of street centrality. It aligns with a broader movement evident in European cities (and beyond) aimed at reclaiming existing streets for the public realm, following decades of prioritising motorised traffic management (Bertolini, 2020; Norton, 2015). However, this doesn't imply that the emc2 model is always the optimal solution for European metropolitan areas. Unique historical heritage and topographical constraints have given rise to distinct patterns of agglomerated villages, often situated on hilltops, ridges, or along hill-flanks. Even on flat terrain, agglomerated villages that once punctuated rural spaces have subsequently been integrated into wider peri-urban contexts, creating local pedestrian-friendly areas, alongside more linear settlements and faubourgs. In all these scenarios, there's potential for hybridization between the emc2 model and urban village concepts. This could involve revitalising main roads that connect villages, fostering a more pervasive centrality across the region.

We emphasise that the geographic scope of the proposed emc2 model primarily encompasses the suburban and peri-urban peripheries within European metropolitan areas. While the guiding principles and some detailed specifications are broadly applicable, others may be more context-specific to European urbanisation. This reflects the primary domain of expertise of the authors.

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Spaces of automobility: diverging trajectories within the Liège-Aachen diffuse city

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Abstract
The Liège-Aachen metropolitan axis sets itself apart from neighbouring cases of diffuse city by lying both at the centre of the continent and at the edge of two countries, languages, and planning cultures. The socio-technical system of automobility constitutes a defining catalyst not only for accentuating already present dispersed settlement structures, but also for producing, within a very short time span, characteristic urban forms linked to the car. This contribution aims to interrogate this very type of transborder diffuse city through the lens of automobility and a future post-car discourse. Specifically, it proposes, in the light of both Belgian and German past planning practices, to compare the spatial impact of current policy objectives and government plans in both regions to reduce future car use.

Keywords: diffuse city, urban morphology, automobility, post-car policies, transborder

Context: automobility and the European diffuse city

Emissions from the transportation sector have been recognized not only as a significant contributing factor to global climate change, but also one of the sectors on which the most ambitious CO_2 emissions reduction targets are set by the members of the European Union (2021). Indeed, one can assume that the goal of reducing emissions by around 35% by 2030 and achieving net zero emissions by 2050 (ibid.) might not be met without a significant shift in how today's mobility practices which today contribute to shaping contemporary urban settlements.

To understand this relationship between mobility practices and production of space, the term 'automobility' has been used to describe the socio-technical system in which the generalised dependency towards the use of a single mode of transportation – the car – enables (Dupuy 1995), conditions (Urry 2004), or even dictates (Böhm et al. 2006) social practices. This 'system of automobility' has subsequently been used to describe various topics related to the challenges facing the contemporary urban condition, such as social marginalisation (Walks 2015), healthcare issues (Solnit 2001), spatial fragmentation (Graham & Marvin 2001), waste of spatial resources (Berger 2006), loss of economic productivity (Rigal 2020), etc.

The rapid expansion of the system of automobility, especially in the three decades following the Second World War (Ross 1998), has also served as a catalyst for a shift in how urban settlements are spatially distributed. Indeed, automobility has allowed to funnel the rapid economic and demographic growth away from the traditional pattern of concentric expansion of the historic urban core towards the one of the 'diffuse city'. This condition has been defined by featuring extensive land use, absence of an overarching spatial hierarchy, dispersion of the built fabric, as well as high degree infrastructural connectivity (Grosjean 2010). The term 'diffuse city' originally was applied to northern Italy (Indovina 1990) but has since been related to many other geographic contexts around the world (Barcelloni Corte & Viganò 2022), each sporting their own regional characteristics. For the purpose of this article, one can name the

German *Zwischenstadt* (Sieverts 2001), the Dutch *tapijtmetropool* (Neutelings 1991), the French *rurbanisation* (Bauer & Roux 1976), and the Belgian *banlieue radieuse* (Smets 1968). For most of these cases studies, patterns of urban diffusion predate the advent of the system of automobility. Yet, the latter, especially through the building of new road infrastructure (e.g., Van Acker 2014) constitutes a defining catalyst not only for accentuating already present dispersed settlement structures, but also for producing characteristic new urban forms (e.g., Buchanan 1963, Pope 2015), within a very short time span.

Recognizing the tight relationship between mobility practices and urban morphology which plays out within the system of automobility, a growing number of research is being conducted on exploring the spatial consequences of a radical shift towards a world "beyond mobility" (Cervero et al. 2017), "after the car" (Dennis & Urry 2010), or "post-car" (Cogato Lanza et al. 2021), in which a potential diminishing of the automobile can lead to new territorial configurations. Indeed, considering what is already there as a potentially formidable resource of grey energy, it would not only reallocate the way road space is shared, but the car's ancillary spaces would also find a new purpose within a post-carbon diffuse city.

Hypothesis: automobility fuelling diverging trajectories

The goal of this paper is to show how the lens of automobility can offer explanations on how diffuse cities can acquire a variety of formal urban characteristics, and how, in turn, a post-car discourse could produce original urban forms. First, it proposes, in the light of the scientific work describing urban planning practices during the 20th century, to compare a hybrid diffuse city context through the means of cartographic visualisation. Secondly, it will feature an overview of government plans being having been drafted in the last decade to dramatically reduce the modal share of the car. This overview will finally be followed by opening a discussion about the potential spatial impact of these policy objectives.

As mentioned above, despite western Europe having undergone as a whole a comparable process of intense urban production, relying on the car as a formidable emancipating power – car adoption rates being similar between countries (Mees 2010) – the multitude of iterations of diffuse city which are still being described around the continent attest to the many ways this process has in effect taken form. Indeed, despite sharing common technical systems, unique characteristics arise through specific geographic and socio-political factors.

Similarly, European countries, bound by common agreements, have been drafting documents aimed at describing how to honour the quantitative targets the transition away from fossil fuels entails. This paper hypothesises that, as different planning cultures produced different spaces of automobility despite sharing comparable metrics, similar targets in CO_2 reduction can possibly result in distinct spatial answers. While the project of the Transition is far from clearly formulated, this paper will use as evidence the transition which is already under way, in the form of official planning documents.

Common ground: automobility in the Liège–Aachen diffuse city

To address this hypothesis, the case study of the Liège-Aachen diffuse city can be of particular interest. This territory, which lies on the border between Belgium and Germany, on the northern Ardennes foothills, features a high degree of almost continuous urban sprawl (EEA 2016), hosts a great variety of interlocking land uses (residential, agricultural, industrial, natural), as well as is irrigated by major transcontinental road and rail infrastructure. It also features a long and shared history of urban diffusion: First, soil composition led to a dispersed agrarian settlement

pattern from the Middle Ages onward (Lefèvre 1926). Later, the position of coal deposits has also served as the prime rationality for directing urban expansion in both countries (Kranz 1998, Wiesenmann 1998). Finally, with the advent of the Industrial Revolution, both nations have sought to disperse the rapidly rising population throughout their territory to curb rural exodus (Prince & Rowntree 1910, Blotevogel 2018).

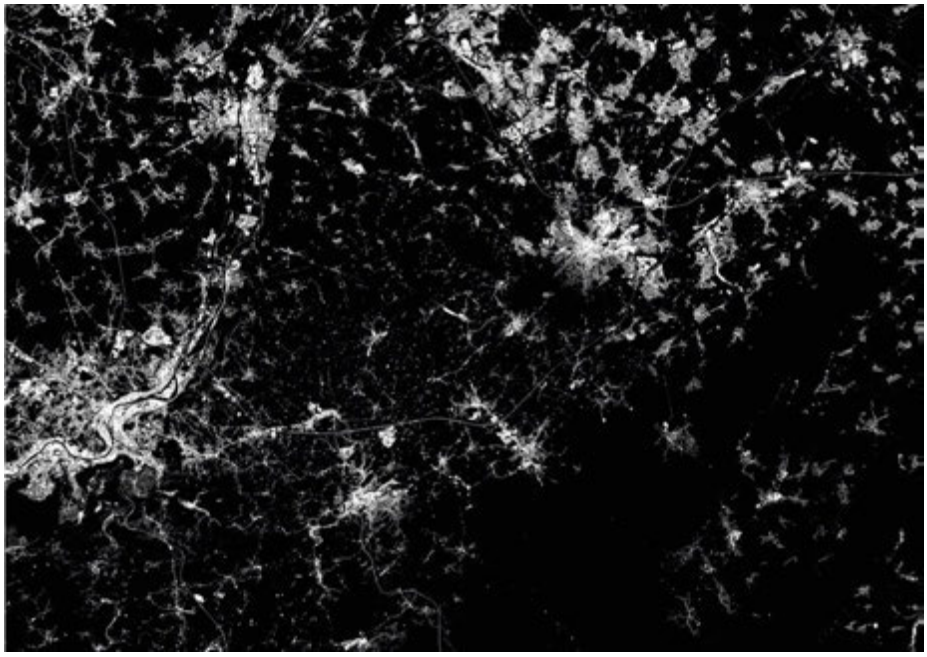

Figure 1. Impermeable areas of the transborder Liège-Aachen diffuse city. Source: elaborated by the author, data from Copernicus 2018.

As detailed above, the Liège-Aachen metropolitan axis fits on many aspects within the definition of the diffuse city (Grosjean 2010) but sets itself apart from neighbouring western European examples in several ways. Firstly, it lies both at the centre of Europe and at the edge of two countries, languages, and planning cultures. Secondly, it crucially lacks a hegemonic urban centre of which this case study can be seen as the hinterland. Lastly, despite being part of the oldest recognized European cross-border collaboration – the Euregio Meuse-Rhine (Geelen 2007) – it lacks a common territorial project.

Drifting borders: the rise of automobility in the Liège–Aachen diffuse city

Being located at the border of two countries, not to mention two major linguistic areas, the large waves of urbanisation hitting the Liège–Aachen diffuse city were throughout history approached in a different way. The period between the end of the Second World War to the mid 1970s offers a particularly clear glimpse into how the opportunities for building a territory adapted to the car were seized with different planning methodologies in mind, and thus morphologically diverging results. Indeed, these three decades see responses to the rapid spread of car use in western Europe, coupled with an increase in centralised planning by the state (Ryckewaert 2011), which lay the groundwork for subsequent zoning and building laws.

The table below aim to compare how, in Belgium and in Germany, a variety of tools of urban planning were harnessed to arrive to the spatial zoning plan, the cartographic document which would cement the urban morphology of the automobile diffuse city. These documents (the Belgian *Plan de secteur* and the German *Flächennutzungsplan*, respectively) indeed lie within a wider cultural genealogy. This genealogy starts at the beginning of the 20th century and is divided into general urban planning principles (territorial equilibrium, de-urbanisation, decentralised concentration, *auflockerung*/loosening up), archetypical spatial models which can incarnate the above principles (garden city, linear city, central place system), spatial plans drafted at different scales, as well as legislative tools aimed at steering urban growth.

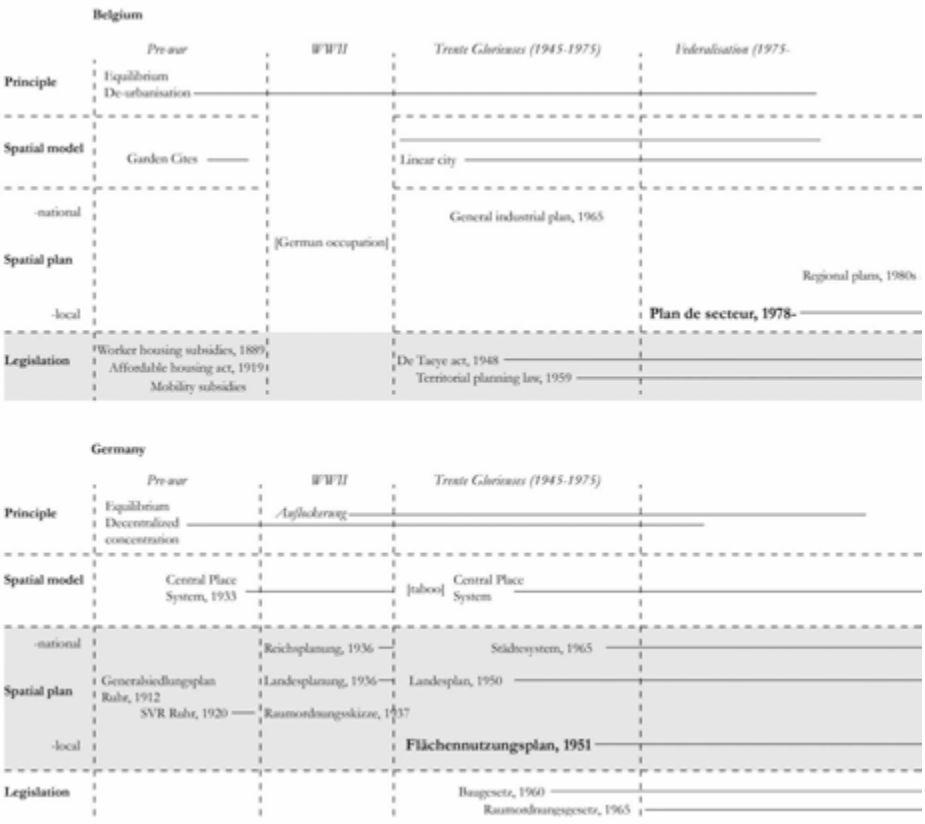

Figure 2. Comparative genealogy of Belgian and German planning instruments during the early to middle of the 20th century. Source: elaborated by the author.

Theses chronologic tables above highlight two urban planning typologies, the German one relying on an integrated spatial approach, while the Belgian chose a primarily legislative one (Nadin & Stead 2008, Dühr 2011). The Aachen region, located close to the heavily planned Ruhr basin, became a laboratory for Christaller's (1933) central space theory. The necessity to organise a vast industrial apparatus, and later the war effort, led to Christaller's theory to enjoy a wide influence (Kegler 2015). After the war, following a brief fall from grace, the central place theory was enshrined as an official planning instrument to hierarchically classify

settlements. The Land Nordrhein-Westfalen arrived at a drawn zoning plan as soon as 1951, the rest of the country following suit in the next decade and-a-half (Blotevogel 2004, 2018). In Belgium, however, the more fragmented land ownership structure (Healey 2006) was first developed using mostly legislative tools, facilitating housing production and commuting along a fine mesh of mobility infrastructure (De Block 2014). This accentuated what was later called the *banlieue radieuse* ideal (Smets 1968, De Meulder et al. 1999), in which access to private property outside city centres was encouraged. One thus refrained for drawing corseted buildable areas before the mid 1970s (Coppens et al. 2020), while more integrated spatial planning – in the form of linear bands following freeways, rivers, and railways (Ryckewaert 2011) – remained the prerogative of the industrial sector[1].

Comparing urban morphologies

In order to accommodate the automobile, new spatial typologies had to be devised by which to transform the territory. Such projects, such as the *autogerechte Stadt* in Germany (Reichow 1959), or imported models from the Anglo-American world, notably Hilberseimer's *New City* (1944), principles from Buchanan's *Traffic in Towns* (1963) or Gibberd's *Town Design* (1959), each propose new typologies of infrastructural space, as well as – to a certain degree – guidelines to transform the existing. Among those, one can mention the 'bypassing network', which allows for fast travel without interacting with the previous urban fabric, as well as the cul-de-sac, arranged in a 'ladder' (Pope 2015) structure, designed to strongly steer vehicular flow, thereby redefining the articulation between the private and the public space (Grosjean 2010).

Despite planners having access to a common canon of references, the divergence in planning methods between Belgium and Germany at this critical period resulted in very different settlement patterns between two regions, despite them sharing similar metrics of population growth, economic fortunes, and car adoption rates. The following couple of maps intends to illustrate this effect within the case study area. In the figure below, showing the sealed surfaces on a fragment of the Belgian-German border, one can appreciate the striking difference in urban morphology, despite the two areas displaying comparable built density and functional typologies.

[1] One should not interpret the here highlighted dichotomy as too rigid. For example, Christaller's influence has been evident on several official urban plans for the Liège region (L'équerre 1963, Nols & Parent 1972, Grulois 2011). However, the recommendations stemming from these documents failed to be implemented in a coherent way across the whole territory (Wahle 1977).

Figure 3. Impermeable surfaces in the Liège–Aachen diffuse city (fragment). Source: elaborated by the author, data from Copernicus, 2018.

Figure 4. Road network typology in the Liège–Aachen diffuse city (fragment). Source: elaborated by the author.

In figure 4, the red lines, representing roads built since 1945 in the same fragment, highlight how this morphological divergence between the constitutive parts of the Liège-Aachen metropolitan axis has been exacerbated with the rise of automobility. One can observe that the new urbanisation in Belgium occurred mostly along a dense network of pre-existing roads (in black), with the notable exception of the transcontinental – and industrially essential – E40 freeway. Indeed, by looking solely at the map of roads, the urban transformation which has occurred since the middle of the 20th century is almost imperceptible. In Germany, however, the increased population sprawl across the territory was harnessed to shape existing settlements as a system of interconnected discrete small centres. This was achieved through the implementation of a ladder-like new road network serving residential and selected industrial areas, as well as a carefully articulated (partially implemented) fast network bypassing the settled clusters.

Futures of automobility in the Liège–Aachen diffuse city

One has been able in the previous paragraph to observe how adapting a territory to a new socio-technical system can lead to significantly varied spatial results. The following section is dedicated to comparing current plans issued by the government to reduce future car use and honour European climate targets. The table below offers an overview of the two countries' planning system destined to address the first 2030 deadline.

	Belgium	**Germany**
Federal level	Vision de la Mobilité en Belgique, 2017	Leitbilder der Raumentwicklung, 2016
Regional level	*Schéma de développement du territoire, in preparation* Vision FAST 2030, 2019 ↳ Schéma régional de mobilité, 2019	Landesentwicklungsplan, 2022
Agglomeration level	Plan urbain de mobilité (Liège agglomeration), 2019	Regionalplan Bezirk Köln, 2022
Communal level	*Schéma de développement territorial (Liège), in preparation* Plan communal de mobilité (Liège), 2021	Aachen*2030 Masterplan, 2018 ↳ Mobilitätsstrategie 2030, 2020

Figure 5. Comparison of contemporary Belgian and German planning instruments. Source: elaborated by the author.

Both countries being today federal systems, mobility planning is the most articulate at the regional level (Wallonia and Nordrhein-Westfalen, respectively). These main regional strategies are the *vision FAST 2030* (2019) and its operational *Schéma regional de mobilité* (2019) in Wallonia, as well as the chapter on mobility of the integrated *Landesentwicklungsplan* Nordrhein-Westfalen (2022)[2]. Both plans are informed by national guidelines, such as the *Vision de la mobilité en Belgique de l'Autorité fédérale* (2017) and the *Leitbilder der Raumentwicklung* (2016). At the Belgian local level, one can mention the *Plan urbain de mobilité* on the Liège agglomeration (2019), as well numerous communal plans. Here again, these plans have been formulated while the corresponding integrated urban planning document had not been published. Finally, at the German communal level, the Aachener

2 In Wallonia, the equivalent document, the *Schéma de développement du territoire* (2023), is still at the drafting stage at the time of writing, the previous iteration, the *Schéma de développement de l'espace regional*, having been approved already in 1999.

Mobilitätsstrategie 2030 (2020) serves as a companion piece of the overarching *Aachen*2030 Masterplan* (2018).

In the light of the historic planning cultures displayed by each country, such a systemic difference in architecture can be partly explained by a reliance on integrated spatial and mobility planning in Germany, under the umbrella of urban planning at a regional level. Indeed, in the *Landesentwicklungsplan* (2022), "integration of urban- and mobility planning" serves as an overarching title to the chapter (Ibid.:119). Planning for mobility can improve accessibility, yet also bring nuisances and consume precious land resources. Businesses should be able to implement themselves more flexibly than before (ibid., 9), with the appropriate infrastructure to be supplied if necessary. In the equivalent Wallonian *Schéma directeur de territoire* (2023), however, if many of the proposed measures overlap, the wording is opposite: the space occupied by mobility is considered as an entity in itself, as one should "structure the territory in order to support flexible, durable and carbon-free mobility" (ibid.:74), nudging citizens towards a more sustainable use of the existing infrastructure.

Conclusion and further discussion

This paper has proposed to consider the specific influence of the system of automobility on the morphology of the European diffuse city. In particular, looking at the case study of the transborder Liège–Aachen metropolitan axis has highlighted how regions with comparable economic and social metrics (Geelen 2007) as well as geographic similitudes have, during an intensely directive period of urban planning, developed following divergent paths. Shifting gaze on contemporary practices, a survey of the official documents discussing plans for a rapid modal shift – a way to perhaps signal an end to the hegemonic rule of automobility – has again shown varied approaches to the problem. While the spatial effect of such policies is still to be determined, accentuating these planning culture discrepancies could not only reveal and bolster territorial specificities, but might as well weaken potential leavers for activating synergies between neighbours dealing with common socio-ecological threats.

In 2021, violent floods in both Germany and Belgium (European State of the Climate 2021) highlighted how geographically inherent territorial solidarities are ever more a crucial factor for understanding our territories in a way that is meaningful to tackle the challenges of the transition. However, as there is not only one single way towards success, different approaches to spatialise the same metrics linked to automobility and its possible decline can be found. For new solidarities between territories sharing common ecological threats to emerge, the implication of such diverging paths cannot be ignored.

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Accessibility of local amenities to reduce car dependency: Obsolete concept or change yet to come? The Prague case.

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Abstract
This paper aims to present a novel interdisciplinary framework investigating the phenomenon of urban transport based on behavioural aspects of mobility interaction with the built environment in the Czech-specific context. The central research question lies in testing the influence of the accessibility of local amenities on car dependency within the suburbs of Prague. The work utilises an activity-based modelling technique, quantifying individual travel behaviour using geolocated travel diaries. The method is based on two regression models, measuring (i) PKT (person kilometres travelled) and (ii) the number of regular car / PT users. Local amenities accessibility constitutes independent variables, whereas personal socio-economic background plus built environment characteristics control variables. The sample comprises suburban residents who are parents of at least one child aged 0-15 and state their home geolocation.

Keywords
Built Environment, Travel Behaviour, Suburbs, Amenities, Education

Introduction

The sudden transition from central planning to a free market in Eastern Bloc countries caused uncoordinated and deregulated growth followed by sheer car ownership. Extensive suburban areas heavily dependent on cars exploded around larger cities (Stanilov and Sýkora 2014). Nowadays, ongoing climate changes, technological revolution, and planned energetic transition bring entirely new challenges to urban transport planning (Shakibamanesh et al. 2020). Such challenges also draw attention to the question of car dependency in the Czech planning practice. In response, Czech local plans started working with various planning practices to reduce car dependency in suburban areas. One of the most widespread practices constitutes retrofitting local amenities in suburban residential areas. Since such practice is part of various well-established global urban concepts (New Urbanism, low-traffic neighbourhoods, TOD, 15-minute city, etc.), the relationship between amenities and transport has been well-researched for decades in the USA and Western Europe (Ewing and Cervero 2010; Næss 2022). Whereas solid evidence from various backgrounds supports Western urban transport planning, Czech planning remains hovering "in the dark" without empirical findings concerning specific central European contexts. This paper brings the first insights into measuring amenities' influence on travel behaviour.

Most of the contemporary planning concepts mentioned above work with amenities accessibility; however, there are plenty of lapses and issues in applying such an attitude to real practice. As stated by (Næss, 2006), "the dog is buried" in the matter of personal choice. People do not go to the nearest cinema because of its proximity. Nor do university students go to the nearest university. On the other hand, things may work differently on a more local level. Parents may choose the closest kindergarten or primary school due to walking time. The same could work for recreational facilities (going to the closest gym) or primary health care (visiting the closest GP), etc. However, also local amenity selection by proximity works with vague assumptions which are not always met. Such assumptions are that there are no competing facilities (e.g. two schools within a similar distance), facilities do not vary in quality (one school is significantly better) or other hidden motivations (school proximity to parent's workplace).

Nevertheless, the distinction between higher and local facilities in the previous paragraph merely captures the real-world complexity – often influenced by various personal socioeconomic backgrounds (Ortúzar et al., 2011). On top of that, people have different motivations and preferences, often socially bound, limited by institutions, etc. (Neutens et al., 2007). This makes travel behaviour a complex discipline in its gritty attempts to predict individual choices. To take at least some of this complexity into account, three decisions were made when designing this research: (i) only local amenities accessibility is considered, (ii) facilities must not significantly vary in their quality, and (iii) socio-economical aspects must be included in the model. Considering the first and second points, local educational facilities were found to fit the criteria best. Firstly, Czech lower educational facilities are considered even, mostly run by local municipalities. Secondly, in the suburbs, primary educational facilities are often distributed individually (one school per municipality). Thirdly, lower education is governed by municipal governments, including planning and spatial distribution of new ones. On top of that, accessible educational amenities are considered to spread wider benefits (e.g. in matters of social cohesion) (Hickman et al., 2017), so their positive influence on residential travel behaviour may join to "the club" of benefits.

Method and Data

Travel behaviour modelling is a sub-group of activity-based modelling (ABM) (Hensher, 2008; Ortúzar et al., 2011). To gain a disaggregated form of person-trip data, travel survey diaries are

mostly employed. The surveys include the socio-economic characteristics of every respondent and his/her travel behaviour, including the number of vehicles owned, frequency of car/PT usage, etc. Based on respondent address (self-geolocated), built environment characteristics such as residential density, urban centres and facility accessibility are derived by GIS analysis. In the case of this research, suburban zones and their centre's definition were adopted by the work of (Ouředníček, 2018).

In the case of this paper, questionaries were collected by the Prague Technical Road Administration Authority (TSK) by November 2021 and focused on residents of Prague's inner city (N = 1000) and the wider metropolitan area (N = 1000). The final population sample was filtered from the TSK data by the following parameters: adults (age 15+), suburban residents (zone 1-4) (Ouředníček, 2018), having at least one child in their household (age 0-14), and not being a student. The final sample size (N = 151) is spatially spread across the region (see Figure 1 below).

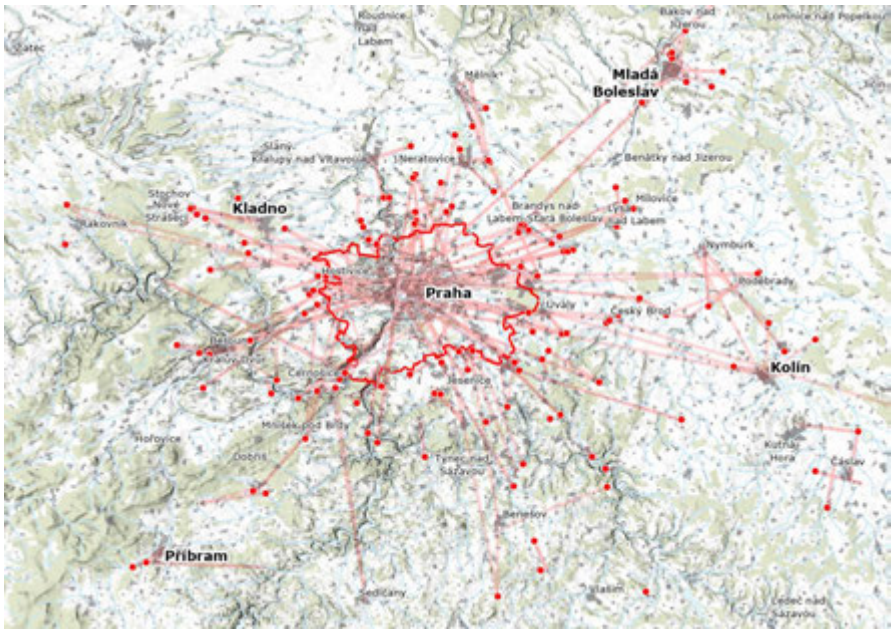

Figure 1 Respondent's home and their trips within one day

Socio-economic characteristics

The sample comprises parents mostly around in their 30s, roughly balanced between women and men (F 77, M74). The most frequent households contain three or four members. Both variables (age and household occupation) meet similar group characteristics to the Czech National Census 2021 (Ryšavý and Fiedor, 2023).

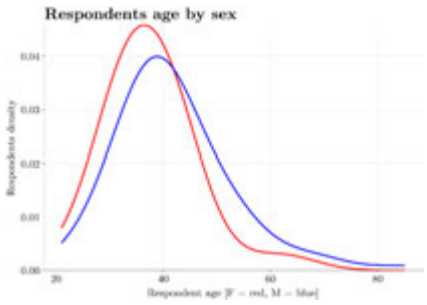

Figure 2 Respondents age by sex

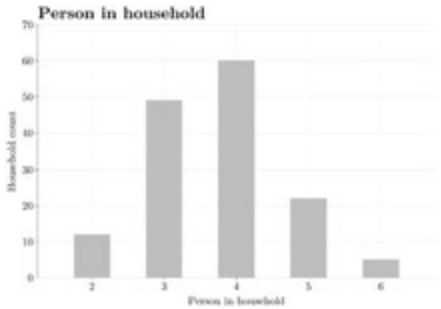

Figure 3 Persons in houshold

The primary survey data contains two children sub-categories: pre-school (age 0-5) and school (age 6-14). As shown in the charts below, the most common are households with one or two children and two adults. Comparing children sub-categories, one preschool and one school child is the most common, however, other combinations are also evenly spread across.

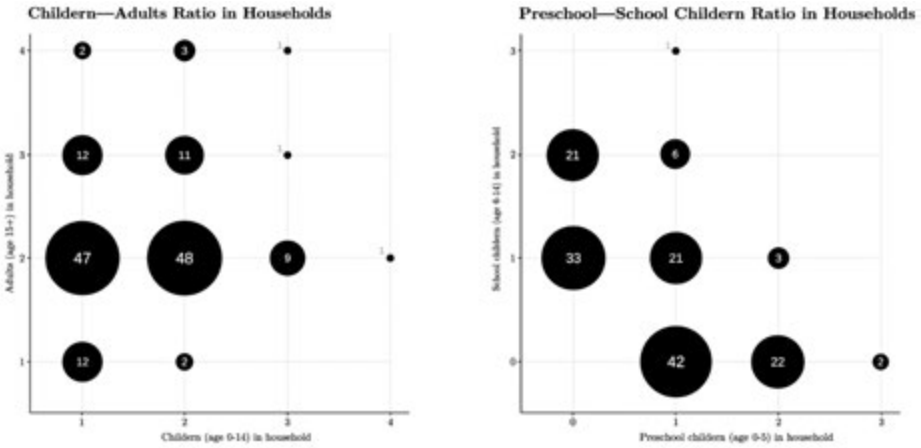

Figure 4 Adults-children and children sub-groups proportion

Other followed socio-economical characterstics are household income (normalised per adult person) and respondent education. The respondent's household income seems to be quite low (survey median CZK 22k compared to nationwide median CZK 34k (ČSÚ, 2022). However, distortion is assumed by the fact that most households with children (age 0-5) have one member on maternity/parental leave. On top of that, some other adults (age 15+) in the household may not be economically active (students). Unlike income discussed above, education distribution seems to follow common suburban patterns of an educated population, mostly diploma (secondary) and masters.

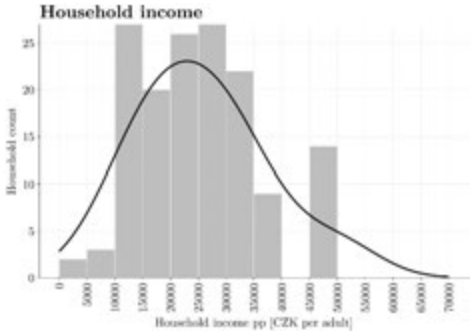

Figure 6 Household income pp

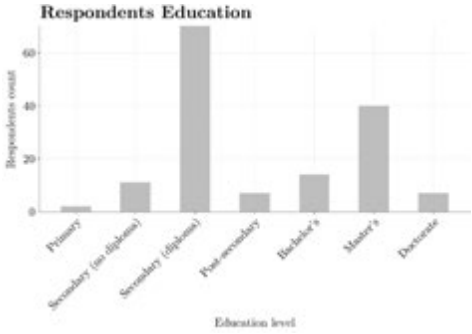

Figure 5 Respondents education

Travel Behaviour

The second group of data collected in the survey covers the travel behaviour of each respondent. The travel behaviour survey may be divided into two sections: general knowledge and trip-specific knowledge.

The first section, general knowledge, describes personal travel characteristics and habits, such as the number of vehicles in the household, PT ticket subscription or travel mode use frequency for an "ordinary weekday". Travel mode use frequency is depicted below (see Figure 7), comparing car and PT use within uneven time periods. The most obvious pattern is that respondents, unsurprisingly, tend to use cars much more frequently than PT. Over one hundred respondents use the car more than three times per week, whereas the most common frequency of PT use is less than once per month. Putting frequencies of both categories together, the car use frequency dominates across all PT use frequency categories. Thus, the sample meets the assumption of car-dependent suburban residents.

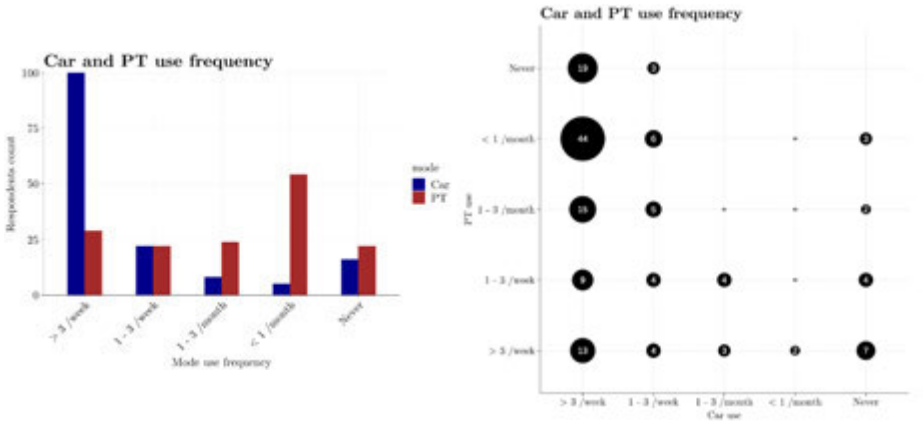

Figure 7 Car and PT frequency

The second section, trip-specific knowledge, utilises data from the personal trip inventory. Mostly, home and work locations are gained, and VTM distances are summed up. The researched sample shows sharply skewed distributions to the first interval (especially in the case of distance travelled by other transport means than a car). This may show the proportion of respondents working from home (the survey was collected between Corona epidemic waves,

however, well apart from previous lockdowns). Secondly, the distribution may show a trend in combining more transport modes, especially car and PT or walking. The specific data distribution is reflected in generalised linear regression models (GLM) in the following chapter, where negative quasi-Poisson distribution is utilised.

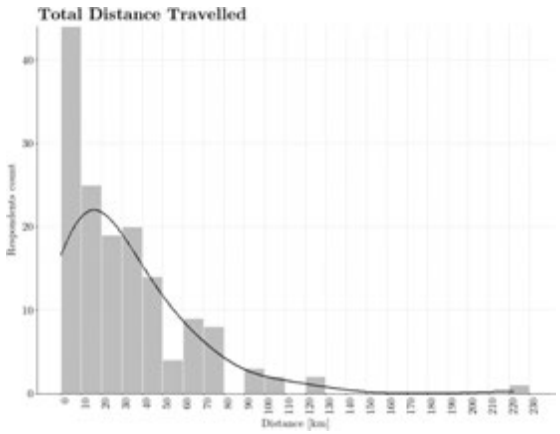

Figure 8 Distance travelled distribution

Built environment

Unlike the first and second groups, data in this third group are entirely created by secondary GIS analysis, mostly focused on home location and municipality. There is a "standard protocol" of which variables to use in order to control built environment influence – 5Ds (Ewing and Cervero, 2010). The bold lines below indicate the variable used in regression models presented later.

Density	**Household/population density**
	Job density
Diversity	Land use mix
	Job-housing balance
Design	**Intersection/street density**
	% 4-way intersection
Destination accessibility	Job accessibility by car
	Job accessibility by PT
	Distance to downtown
Distance to transit	**Distance to the nearest transit stop**

Table 1 Built environment controls – 5Ds (Ewing and Cervero, 2010)

The residential density constitutes a "traditional" challenge in terms of its definition; which places are considered to be residential and which are not? How to find out where these places are inhabited? And what to do with mixed-use? (Mees, 2010) Considering the poor quality of Czech geospatial data, built-up areas in all researched municipalities (over 100) were created by manual editing of digital zoning plans. Industrial and other obvious non-residential functions were filtered out (see Figure 9 – left). In the case of extensive recreational neighbourhoods,

where some houses are residential and some are not, only locations with a majority of objects with postal addresses were included (see Figure 9 – right: the east bank of the river is considered a residential area, whereas the west bank remains recreational, thus blank).

Figure 9 Built-up residential area – definition

The output residential density shows a shallow distribution between 10 and 30 inhabitants per ha, with a spike between 12.5 and 15. These numbers correspond to the general residential density of the Czech suburbs. Job-residents balance gained from The Czech Ministry of Treasury (MF, 2020) unsurprisingly, it indicates that most suburbs offer 0.1 to 0.3 jobs per inhabitant. This finding also meets prior assumptions.

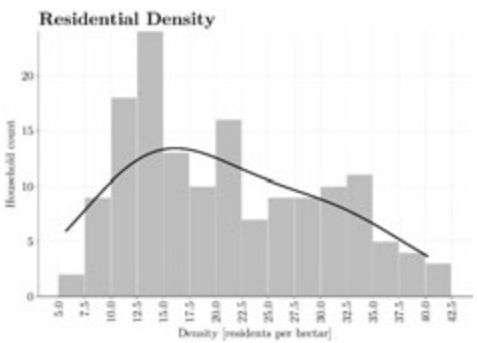

Figure 10 Residential density

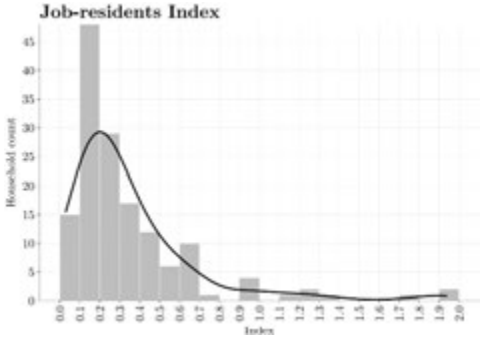

Figure 11 Job-residents index

Destination accessibility also shows unsurprising results for suburban locations – good, stable accessibility of urban centres by car and largely differing accessibility by PT across municipalities (see Figure 12 – left). Whereas car accessibility median time is 21 minutes with 8.9 minutes SD, PT accessibility offers a median of 57 minutes with 24.6 minutes SD! The ratio between car and PT accessibility is later used to determine municipality accessibility by PT compared to a car (see Figure 12 – right). On average, sample suburbs are 2.5 times better accessible by car than PT.

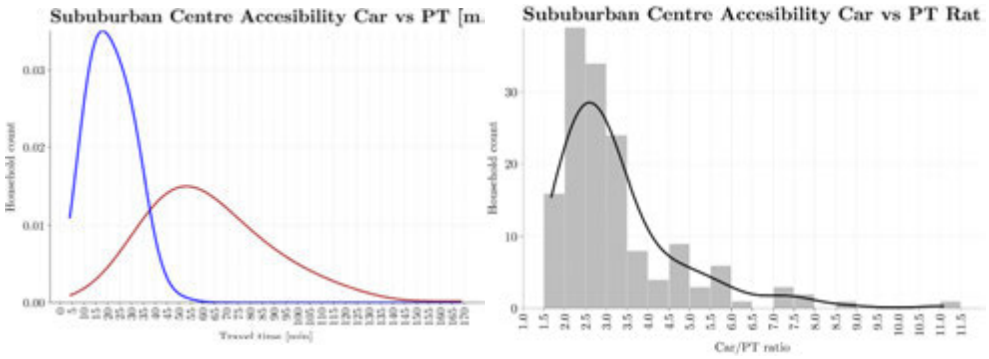

Figure 12 Urban centre accessibility car vs PT (blue: car, red: PT)

Last but the most important variable from the built environment group is accessibility to the educational facilities. Since the survey distinguishes between preschool and school children, accessibility to both kindergarten and primary school was measured (red and blue lines in Figure 13 – left). However, for parents of preschool children, only kindergarten accessibility is relevant and vice versa. Thus, a new variable, "Accessibility to the relevant ed. facility", was created, taking into account only relevant facilities (see Figure 13 – right). In the case of parents of both children groups (pre- and school), the average school and kindergarten accessibility was counted.

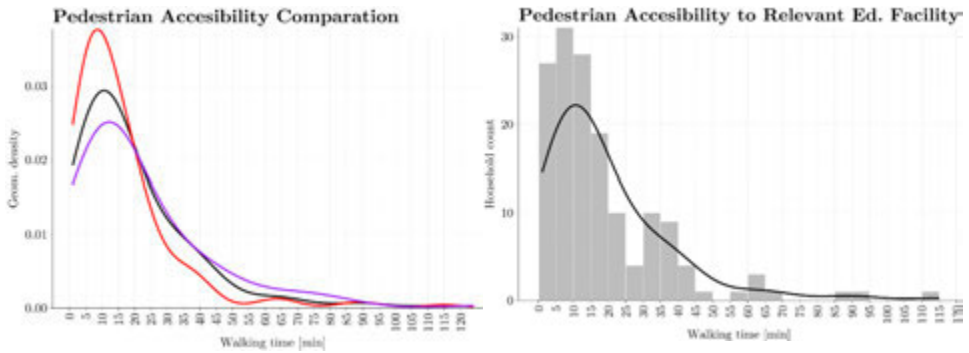

Figure 13 Pedestrian accessibility to educational amenities (red: kindergarten, violet: school, black: relevant education facility)

In summary, most input data individually behave as expected. Most distributions show Gaussian patterns, although in many cases skewed. In the case of the mentioned specifics and anomalies, findings were reflected in regression models presented in the next chapter.

Results

Data presented in the previous chapter includes: (i) personal kilometres travelled (PKT) and (ii) frequency of car and PT use. Those two variables are used as dependent (predicted) in two presented regression model sets to denote individual travel behaviour. In both sets, the researched independent variable is pedestrian accessibility to relevant educational facilities. Other variables, such as socioeconomic and built environment, are considered as controls.
Before commencing the description of the results, it is necessary to declare that certain built environment variables exhibit a strong correlation. Typically, residential density, municipal size, street density, household size and household type. The listed variables, mostly representing the built environment, also correlate to the researched independent variable – pedestrian accessibility to the relevant education facility. On the one hand, this indicates that more populous and dense suburbs are already fitted with educational amenities. On top of that, the correlation may signal a stronger connection between education and other amenities, typically concentrated together.

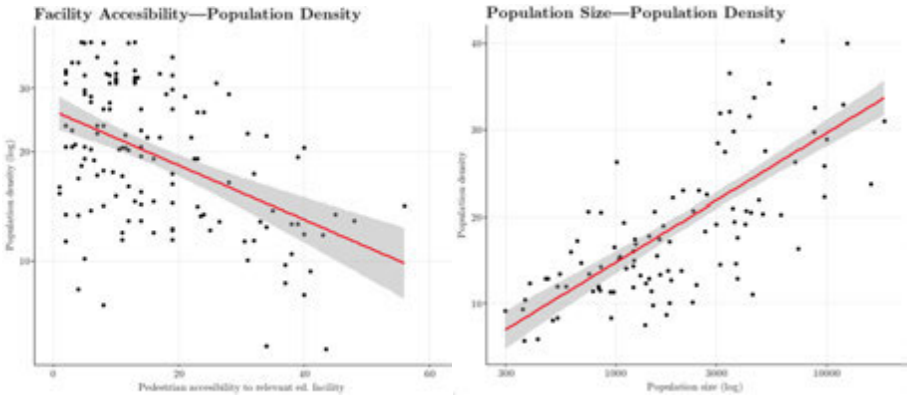

Figure 14 Variables correlation

Set one: personal kilometres travelled (PKT)
The first set of models consists of three GMLs predicting (i) total PKT travelled by the respondent, (ii) car-only PKT travelled by respondent, and (iii) PKT by other means than a car (PT, biking, walking, etc.) – see table 2.

variable	estimate			std.error			statistic			p.value		
PKT (N = 150)	total	car-only	no-car	total	car-only	no-car	total	car-only	no-car	total	car-only	no-car
(Intercept)	2.556	*insig.*	*insig.*	0.334	*insig.*	*insig.*	7.517	*insig.*	*insig.*	<0.001***	*insig.*	*insig.*
Living in detached house	0.464	*insig.*	*insig.*	0.225	*insig.*	*insig.*	2.066	*insig.*	*insig.*	<0.05*	*insig.*	*insig.*
Respondent economically active	0.543	*insig.*	1.320	0.216	*insig.*	0.580	2.515	*insig.*	2.269	<0.05*	*insig.*	<0.05*
Ed Facility < 20 min walking	0.437	*insig.*	0.871	0.190	*insig.*	0.443	2.300	*insig.*	1.963	<0.05*	*insig.*	<0.1 .

Table 2 Set one: GLM quasi-Poisson: PKT estimates – only PKT total significant variables selected

variable	odds ratios		CI		p.value	
N = 150	model 1	model 2	model 1	model 2	model 1	model 2
(Intercept)	*insig.*	0.08	*insig.*	0.00 – 1.11	insig.	<0.1 .
Respondent economically active	3.82	3.64	1.56 – 9.97	1.49 – 9.50	<0.01 **	<0.01 **
Cars in household	2.01	2.23	1.30 – 3.31	1.42 – 3.73	<0.01 **	<0.01 **
Respondent sex	0.28	0.29	0.13 – 0.60	0.13 – 0.63	<0.01 **	<0.01 **
Car/PT urban centre accessibility ratio	1.91	1.96	1.37 – 2.84	1.42 – 2.86	<0.001***	<0.001***
Residential density	0.96	–	0.92 – 1.00	–	<0.05 *	–
Ed Facility Accessible < 20 min walking	–	0.37	–	0.16 – 0.83	–	<0.05 *

Table 3 Set two: GLM binomial: Probability of regular car use (more than 3 times a week)

The initial finding shows that the car-only PKT vastly varies. Thus, none of the predictors of car-only PKT did not show significance. On the other hand, total PKT and no-car PKT work better. Perhaps the most surprising result lies in the increment of total PKT when the educational facility is accessible by walking (< 20 min). This may be caused by the fact that total PKT comprises car-only and no-car PKT, including activities like walking with children to school. To support this claim, unlike total PTK and no car PKT, car PKT indignancy may overall indicate that car use is far more complex and influenced by various hidden factors. Due to the high correlation with other built environment variables, especially residential density, only accessibility to education facilities was used (the accessibility variable also indicated the best statistical performance).
Due to the small sample (N = 150), the estimated magnitude of variables may not be accurate. However, their significance clearly declares trends. To improve overall model reliability, the sample shall be extended, and more continuous variables like dwelling size, household income, and persons in the household should be included.

Set two: car and PT use frequency
Regarding the focus of this research and the limited size of the sample (N = 150), categorical variables of car and PT use frequency were combined into dummy variables. To create the dummy variable, original survey intervals (see Figure 7) were binomially split by thresholds: using a car more than three times a week is considered regular usage, and vice versa; less than three times a week is irregular. In the case of PT, the threshold was set to at least once a week due to the broader distribution of counts in categories (see Figure 7). Created groups of "regular" and "irregular" users of car and PT are visualised below in the context of residential density. The distribution between regular PT users / irregular car users and irregular PT users / regular car users share very similar patterns. This may show that most commuters using a car regularly do not go by PT, and conversely, regular PT users don't drive. The spike in regular PT users / irregular car users, around 30 inhabitants/ha, shows better PT accessibility in more populated and, thus, bigger municipalities (see Figure 14). On the other hand, regular car users are spread across residential densities, starting at 12 (1st quantile) along to 22 (3rd quantile). Overall, all groups of users significantly differ in the context of residential density (ANOVA test).

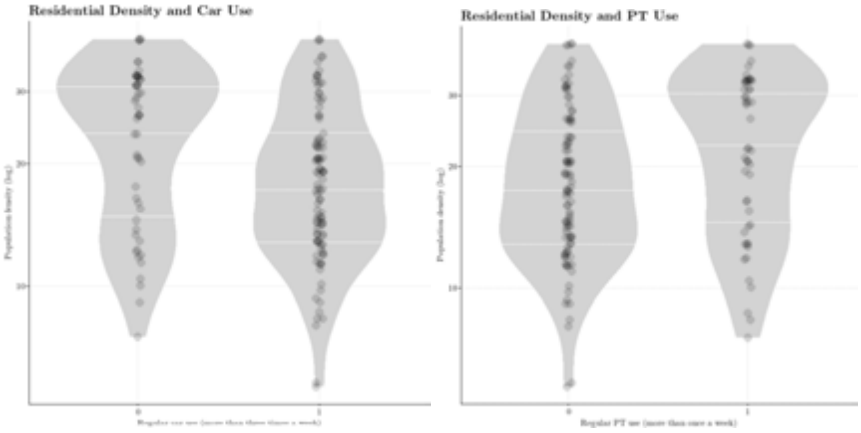

Figure 15: car and PT regular users distribution according to residential density

The GLM binomial regression is made on two models – the first using residential density (model 1) and the second replacing the density with educational facility accessibility (model 2). The reason for the isolation of these two variables is to avoid strong multicollinearity due to high mutual correlation. Due to unbalanced group sizes (regular cars are approximately two times bigger), irregular car users were weighted by two.
The model results (see Table 3) show that being economically active increases the probability of frequent car use. The same works for the number of cars owned. The other variable increasing car use probability is the ratio of car/PT urban centre accessibility – weaker PT accessibility, higher probability of regular car use. All three findings listed above are unsurprising and may confirm assumed trends. A bit surprising is the fact that being a woman strongly decreases the chance of regular car use (by 72%). This may show that women use PT instead of cars or stay home. Now, to the model's merit: residential density and educational facilities accessibility. Both variables in the corresponding model show expected trends – the increment of each person per hectare reduces the chance of regular car use by 4% in model one, and the educational facility accessible within 20 minutes reduces the chance of regular car use by 63%. Although educational facility accessibility may be connected with other close amenities, such as shops, sports centres, etc., the trend indicates a general connection between amenities accessibility and respondents' regular modal choices.
To conclude, both binomial regression models showed robust and significant results of educational facility accessibility (or residential density) influence on regular car use. Although the influence in the case of educational facilities may be indirect (correlation, not causation), the trend shows a positive tendency to be further scrutinised by employing a bigger sample and collecting geolocations of other facilities.

Discussion and Conclusion

To address the conference mobility track theme, this paper tried to shed the first rays of light onto the issue of car dependency – an issue resonating especially in the age of ecological and energetic transitions. Although the global academic discourse recognises suburban car dependency as a serious problem with ecological, social, or health consequences, Czech (and other Eastern European) research focuses only on transport supply – mostly transport systems effectivity. This paper provided a pioneering insight into the travel behaviour of Prague suburban residents and its connection to the built environment. The final focus was set on local educational facilities and their influence on residential travel behaviour. Compared to similar global research papers, this paper worked with a rather small sample of 150 respondents, sometimes methodically hitting limits – especially in the case of predicting distance travelled by respondents (PKT). The models in the first section predict PKT only by a few dummy variables that turned out to be significant. In this case, expectations were initially higher. On the other hand, the second set of models – probability prediction of regular car use – turned out to be fruitful, indicating strong results, including respondents' socio-economic characteristics. Although there is no way to prove causality between educational facilities accessibility and travel behaviour by a single set of travel dairies, the ultimate goal of this paper – to prove a connection between – was achieved. To move such research forward, further modelling is required, especially with a bigger sample and including a wider spectrum of amenities such as sport and recreation, culture, social care, healthcare, or public transport. Overall, the presented results show clear trends, thus worthy to continue working on.

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Layout Patterns and Crowd Flows of Commercial Space in High-Speed-Rail Station Complexes

-- Take three Chinese high-speed-rail station complexes as examples

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Abstract

The commercial space in the high-speed railway station area is a key factor in stimulating the vitality of the crowd in the station area, and the station complex can maximally convert the transport value of the station area into comprehensive functional value. In the era of ordinary railways, the high-speed railway station was only regarded as a passenger transport hub. The commercial space was only used as a supporting facility to serve the transport interchange activities, which failed to attract the crowd to stay for long. Still, with the gradual increase in the proportion of short-distance and commuter passengers, however, as the proportion of short-distance and commuter passengers grows gradually, the commercial space in station complexes that have appeared in recent years has also failed to take into account the needs of both passengers and citizens. In this paper, based on the block layout relationship between commercial space, station access space, and urban transport space, we construct a "node-path" network of commercial space entrances and exits with high-speed rail station entrances and exits as well as urban traffic entrances and exits, analyse the correspondence between the commercial space layout pattern of the station complexes and the flow of crowds, and explore how different commercial space layout patterns influence the flow of crowds. It also discusses how different commercial space layout patterns affect the behavioural activities of the crowd. Finally, it concludes that: 1. Appropriately narrowing the distance between the commercial space and the station space of small and medium-sized passenger stations, especially placing underground space between the two, can stimulate the consumption potential of transport-oriented passengers who transfer to the underground. 2. The entrance and exit settings of the commercial space and the distribution of the flow of people are affected by the layout of the commercial space. 3. The commercial space entrances and exits related to the movement lines of underground passengers are also affected by the layout of commercial space blocks. 4. The entrances and exits of commercial spaces related to the moving lines usually have higher pedestrian flow. This study can provide new perspectives and methods for analysing the layout patterns of commercial space in station areas and offer design suggestions for improving the use of commercial space in station complexes.

Keywords

Station-city Integration; Station Complex; Commercial Space; Crowd Flow; Layout Design

1. Introduction

The high-speed railway station is an important transport intersection in the overall layout of the region, gathering a large amount of internal and external traffic in the city. However, the urban station hub area is not only a mobility node in the transport network but also an aggregation place in the city, and it is a waste of the value embedded in the circulation to use it only as a transport hub for the collection and distribution of human flow. Relying on the traffic advantage of the high-speed railway station to create urban functions such as commerce, business, exhibition, leisure, and so on in the surrounding area and organically integrating the traffic function (switching to articulation) with the urban function (commerce, office, leisure,

etc.) (Peng Qiyuan *et al.,* 2017), in addition, it can make full use of the transport value of high-speed rail stations, explore the urban place attributes of high-speed rail stations, and promote the linked development of high-speed rail stations and cities.

The commercial function is one of the main functions of utilising the overflow effect of station traffic effectively, and commercial space has rich spatial forms and types of business, that can meet the consumption needs of different groups of users. In China's high-density cities, where urbanisation is accelerating and land resources are relatively scarce, the joint development of station hubs and commercial facilities can realise the spatial connection between the two sides of the station and the city and promote the integrated development of the station and the city in the traffic hub area. For example, New York's Grand Central Station, London Bridge Station, and Tokyo's Shibuya Station have become important urban business and commercial centres.

As a comprehensive transport hub, the high-speed railway station in the high-density city centre has strong transport value and a functional development basis. It can closely connect with and interact with the neighbouring urban space, so it can rely on the transport advantage to enhance the comprehensive urban functional value of the station area, especially the commercial function that drives the area's economic growth. It is necessary to introduce commercial functions reasonably and appropriately, taking into account the needs of consumption activities of station passengers and neighbouring citizens, and to establish a close connection with other spatial elements in the station area to create a synergistic effect between the station and the city.

However, in the current practice of construction of commercial space in the high-speed railway station area, it is obvious that there is insufficient consideration of the user groups and their needs, especially since the resources of people flowing from both the station and the city are not fully utilised at the same time. In the era of ordinary railways, the commercial space of high-speed railway station complexes in China was mainly a supporting facility serving fast-passing passengers. With the gradual growth of the proportion of short-distance and commuter passengers, the user groups in the station area not only demand the station's internal and external traffic functions but also pursue higher-quality consumption and leisure functions. However, the commercial space of station complexes that have appeared in recent years, despite emphasising the integration of commercial space with the station and the city in terms of spatial form, still presents the result of mainly serving the use of part of the group, producing a large number of unused and inefficient commercial spaces. The practical exploration of creating station-city integrated commercial space is still in its infancy and lacks effective supporting theories and assessment methods.

The station complex mentioned in this study refers to a complex system that contains station space, urban transport space, and commercial space and has great potential to develop into a regional public centre. Compared with the single passenger transport function of a traditional station, a station complex contains more comprehensive urban functions that are closely linked to the station space, and the urban transport space is placed between the station space and the urban functional space, playing a transitional role in linking the station and the city, while the urban functional space crosses the red line of the station site and is laid out close to the station space (Fig. 1). Due to the high degree of integration of various functional spaces,

clear and convenient spatial organisation and flow guidance are required to ensure basic passenger distribution and transfer functions while avoiding mutual interference and influence between functional spaces.

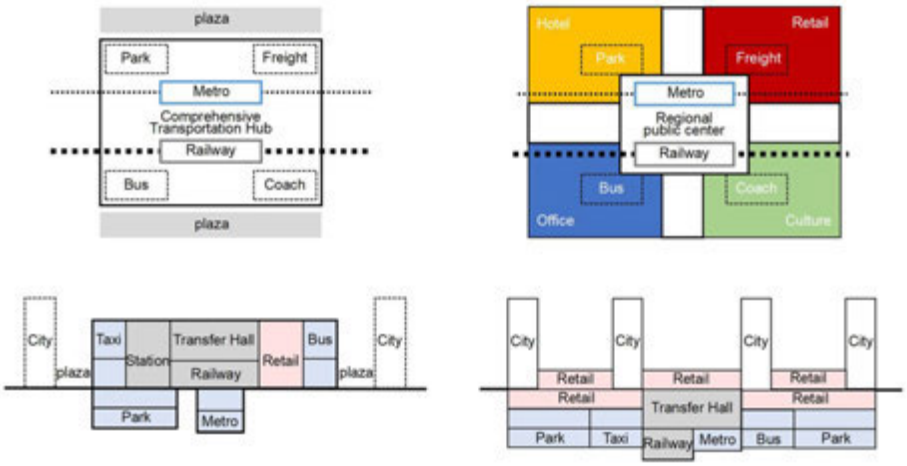


Fig. 1: Spatial pattern diagram of traditional stations and station complexes

Established studies have focused on the general organisation of station areas (Qi Guangping and LU Guanyu, 2019; Dai Yizheng *et al.*, 2018). Some studies have analysed the coupling relationship between commercial space and other spatial elements of traffic interchange activities (Gui Wangyang *et al.*, 2023; Yu Baofei and Ren Jun, 2021; Chen Binbin *et al.*, 2021). Few studies have focused on the fine-grained design of commercial space in high-speed rail station complexes from the perspective of passenger-citizen behavioural activity characteristics. On the one hand, existing studies have paid insufficient attention to the specific morphological design of commercial space in station complexes, lacked effective morphological analysis methods for commercial space layout, and have not yet answered the question of how the commercial space in station complexes should be linked to the station and the city, respectively. How should the commercial space of the station complex link the station and the city, respectively, and what role will other urban transport elements play? On the other hand, the existing studies have not deeply explored the influence of the layout of commercial space in station complexes on the flow of people, such as what kind of spatial use results will be brought about by different layout patterns.

This study selected Guangzhou East Railway Station, Chongqing Shapingba Railway Station, and Shenzhen North Railway Station, located in the centre of high-density cities in China, as the research samples. The commercial spaces of the three sample stations are similar in terms of industry composition but completely different in layout pattern. Among them, the layout pattern of the commercial space of the high-speed railway station complexes is broken down into two levels: block layout and node layout, and the crowd flow characteristics are mainly based on the data of pedestrian flow at the entrances and exits of the commercial space.

This study focuses on the layout of commercial space in high-speed railway station complexes. It builds a "node-path" network of commercial space entrances and exits with high-speed railway station entrances and exits and urban traffic entrances and exits based on the block layout. In addition, this study will classify the passengers and citizens in the commercial space of the station complex according to the purpose of travel and different types of urban transport, graphically present the behavioural activity chains of different groups, and explore the correlation between the behavioural activity characteristics of different groups in the station complex and the layout pattern of the commercial space.

The subsequent chapters are arranged as follows: Section 4 demonstrates the correspondence between the layout patterns of the commercial space of the sample station complexes and their crowd flow characteristics, Section 4.1 summarises the relationship between the commercial space of the sample stations and the block layout of the station space and urban transport spaces, corresponds the block layout characteristics of the commercial space of the sample station complexes to the total flow of people at all entrances and exits and analyses the impacts of different commercial space on the proportion of commercial space use. The impact of different commercial space layout patterns on the percentage of commercial space use is analysed. Section 4.2 abstracts the three types of functional blocks into multiple functional nodes, draws the behavioural activity chain of passengers and citizens going to the commercial space, respectively, constructs the relationship between commercial space entrances and exits with station entrances and exits as well as other urban traffic entrances and exits, corresponds the characteristics of the node layout of the commercial space of the sample station complexes with the flow of people at all entrances and exits, and analyses the effect of different node layouts of commercial space on the convergence of pedestrian flow at all entrances and exits. The influence of different commercial space node layout patterns on the gathering effect of pedestrian flow at each entrance and exit is analysed. Section 5 summarises the layout patterns of the commercial space of the sample station complexes, puts forward optimisation suggestions for different patterns, and proposes the commercial space layout suggestions of the high-speed rail station complex based on the characteristics of passenger-citizen behaviours and activities.

2. Literature Review

2.1 Study on the layout of commercial space in station areas

Theories related to functional space layout in station areas. TOD theory focuses on developing and constructing functional spaces that are closely linked to transport nodes. (Calthorpe Peter, 1993) Based on the study of high-speed railway station areas in Germany, France, Japan, and other countries, Schutz et al. were the first to put forward the circle structure model of the station area, i.e., with the increase of the distance from the station, the correlation between each functional space and the station gradually decreases and eventually forms a functional circle centred on the station. station-centred functional circles (Schütz Elmar, 1998). This theory initially explores the layout pattern of functional spaces in station areas. The commercial space of the station complex concerned in this study is located in the first circle,

which can take advantage of the traffic spillover effect of the railway station. The node-place model proposed by Bertolini is an analytical model for evaluating transport nodes from the perspective of public transport and land use based on the theory of the transport-land use feedback loop (Bertolini Luca, 1999; Bertolini Luca, 1996). The node-place model is an analytical model based on the theory of traffic-land use a feedback loop to evaluate transport nodes from the perspectives of public transport and land use (Bertolini Luca, 1996, 1999), in which the value of place is reflected in the development progress and development of the area around the high-speed railway station, and the use of commercial space is one of the indicators to measure the value of place in the station area, and the model can partly reflect the characteristics of the layout of the functional space and the effect of the use of station area.

Research and methodological tools for commercial space layout in station areas. Scholars have already classified commercial space in station areas into three categories: station commercial, station peripheral commercial, and peripheral area commercial, of which station commercial is commercial space developed integrally with station stations and transport facilities (Li Chuancheng *et al.*, 2016), which is consistent with the scope of commercial space that this study focuses on. Some scholars have also categorised commercial space as profitable building space and have analysed the coupling relationship between commercial space and elements of transport space and public space, proposing the layout patterns of tandem, adjacent, interspersed, composite, and cascading (Qi Guangping and LU Guanyu, 2019). In addition to conventional graphical analyses and qualitative descriptive methods, studies have been conducted to quantify the spatial organisation of station areas using urban spatial analysis tools such as Depth Map, such as exploring the correlation between the spatial integration degree of station peripheral areas and the functional layout of land (Du Qianyu and Zhang Fan, 2019). For example, to analyse the integration, connectivity, and comprehensibility of the underground interchange space of high-speed rail stations (Gui Wangyang et al., 2023), some studies abstract the complex urban spatial structure into graphical relationships based on urban morphology and building typology (Wang Zhendong & Wang Yindong, 2011). (Wang Zhendong and Wang Yinpu, 2015). The spatial structure of the station area is more complex, and it is difficult to determine a unified spatial reference point, but the connecting relationship between spaces can be expressed in diagrammatic form.

The distribution of crowd flow in the station area directly affects the use of commercial space. Still, few studies have analysed the connection between commercial space and other spatial elements in the station area from the perspective of crowd flow. Based on the above relevant theories, existing studies, and methods, this study will analyse the layout pattern of commercial space in station complexes from the two spatial floors of blocks and nodes by mapping the crowd flow in commercial space and summarising the layout pattern and expected usage effect of commercial space in station complexes.

2.2 Study on the crowd activity in station areas

Types of people who use the functional space in the station area. Studies have classified station users into two categories, namely "traffic transfer users" and "destination users" (Zhuo Weide *et al.*, 2022). For example, the destination segment is divided into four categories:

business, commuting, visiting relatives, and shopping (Wang Shaojian *et al.,* 2021). Other studies have analysed the functional space needs of different groups, such as short- and medium-distance passengers who are highly time-sensitive and have higher requirements for the accessibility of commercial space, long-distance passengers who are more likely to be price-sensitive and concerned about the type of commercial space, and citizens from the urban end of the city, who are more likely to have higher requirements for the quality and accessibility of commercial spaces (Wang Li, 2015).

Research and methodological tools for crowd activities in commercial space in station areas. Studies have used pedestrian simulation software to obtain complete data on crowd activities in station areas that cannot be collected in short-term studies, such as using AnyLogic software to simulate peak passenger flows in the distant future (Chen Binbin et al., 2021). For example, AnyLogic software is used to simulate the transfer situation of passengers leaving the station and to analyse the problems of the transfer space in the station based on the two indicators of transfer time and regional passenger density (Yu Baofei and Ren Jun, 2021). The problems of station transfer space are analysed based on two indicators: transfer time and regional passenger density. A large number of studies have also focused on the use of commercial office space in railway station areas, using field research, observation point counting, and other methods to obtain data such as the average number of people entering the shop per hour and the path flow of people to comprehensively evaluate the performance of the use of commercial space in the area of the railway station (Zhang Lingzhu *et al.,* 2019; Zhuang Yu and Yao Yiqian, 2016). This study mainly analyses the impact of the layout pattern of commercial space in station areas on crowd use, i.e., treating multi-floor commercial space blocks as a whole and ignoring the differences in the number of people entering the shop within the commercial space so that the use of the commercial space can be simplified to the flow of people converging to the entrances and exits of the commercial space.

Existing studies have mainly focused on transport interchange activities in station areas. Still, few studies have analysed the distribution among activities of different groups, or separately transport interchange activities and destination leisure activities, and the interweaving and transformation phenomenon of the dynamic lines of the two types of activities. In this study, according to the basis of traffic transfer and destination leisure groups and taking into account the different starting points of activities of tourists and citizens, the population using commercial space is classified into three categories: leisure citizens, traffic tourists, and leisure tourists, and the commercial space of the station complex is taken as the core to analyse the origin, flow, and process of the three categories of people converging to the entrances and exits of the commercial space in the station area.

3. Methods

3.1 Sample Selection

Since the urban location of the station affects the use of commercial space, this study selects high-speed rail stations located in the centre of high-density cities in China (Fig. 2) as samples among the station complexes that have been built and operated for many years and

have well-functioning commercial space: Guangzhou East Railway Station, Chongqing Shapingba Railway Station, and Shenzhen North Railway Station, which are located no more than 10km away from the city centre and represent different commercial space layout patterns of the station complexes. The scope of the study is the station access space, the multi-floor commercial space, and the urban transport space between them. Among them, urban traffic space which is far away from commercial space and does not have a spatial connection is not considered. The entrances and exits of the commercial space are set as the junction between the space of each floor and the external space. The vertical connection within the commercial space is not taken into account, i.e., multiple entrances and exits located at the same position in the commercial space of each floor are all connected with the external space of the ground floor through the vertical connection. Only the entrances and exits on the ground floor of the position are taken into account.

Fig. 2: Urban location of the sample stations

3.2 Layout analysis of commercial space in station complexes

First, the overall layout of the commercial space of the station complex is analysed. Through field research on the layout relationship between commercial space, station access space, and urban transport space, the "space-block" relationship of the three types of functional space is extracted. The second is to analyse the layout of the entrances and exits of the commercial space. Abstract the three types of functional spaces into corresponding functional nodes, take the entrances and exits of commercial space as the core, draw the footpaths of passengers and citizens who may pass by commercial space and whose destinations are commercial space, and construct a "node-path" network. In terms of the spatial object of the research, only the floors of commercial space that have a close spatial connection with the station entry and exit spaces are selected.

3.3 Pedestrian flow analysis of commercial space in station complex

The first is to compare the pedestrian flow in the station space and commercial space, and the proportion of the pedestrian flow in the commercial space to the total pedestrian flow in the station core area. The footfall in the station space is the total footfall entering and exiting the station; the footfall in the commercial space includes all the footfall passing through the

commercial space and the footfall destined for the commercial space; and the total footfall in the station core area is the footfall entering all the functional spaces. The second is to compare the pedestrian flow of each entrance and exit of the commercial space of the station complex. The research time is selected on weekdays, and taking into account that shops basically start the business at 10:00 a.m., the two time periods of lunch peak and evening peak are selected, and each time the people flow statistics lasts for 5 minutes.

4. Results

4.1 Layout and use of blocks of commercial space in station complexes

In the planning and design stage of a station complex, the number of passengers in the station influences the layout patterns of the functional space (Suo Chao and Zhang Hao, 2015). Considering the impact of the rapid in-and-out passenger flow of the station on the commercial space, the commercial space of the high-speed railway station complex will be appropriately far away from the in-and-out space of the station, and after the station complex is put into use, the location of the body layout of the commercial space usually significantly affects the overall use of the commercial space (Li Chuancheng et al., 2016).

4.1.1 "Space-block" layout of commercial space in station complexes

The commercial space of the station complex is usually chosen to face the external urban space, taking into account the accessibility of the public to the commercial space and the potential for passengers to pass through the commercial space on their way, including the urban transport space of the metro and motor vehicle loading and unloading points, which is usually laid out between the commercial space and the entrance and exit space of the railway station, i.e., forming a horizontal layout structure of external urban space, commercial space, urban traffic space, and station entrance and exit space. The passenger scale of Shenzhen North Station, Guangzhou East Station, and Chongqing Shapingba Railway Station decreases in turn, so the potential for integrating the commercial space of the station complex with the station space increases in turn. The average daily arrivals and departures of Shenzhen North Station are more than 0.2 million; the average daily arrivals and departures of Guangzhou East Station are about 0.05 million; and the average daily arrivals and departures of Chongqing Shapingba Railway Station are less than 0.01 million. The "space-block" layout characteristics of the commercial space of the three sampled station complexes are: far away from each other, overlapping, and overlapping, respectively (Fig. 3).

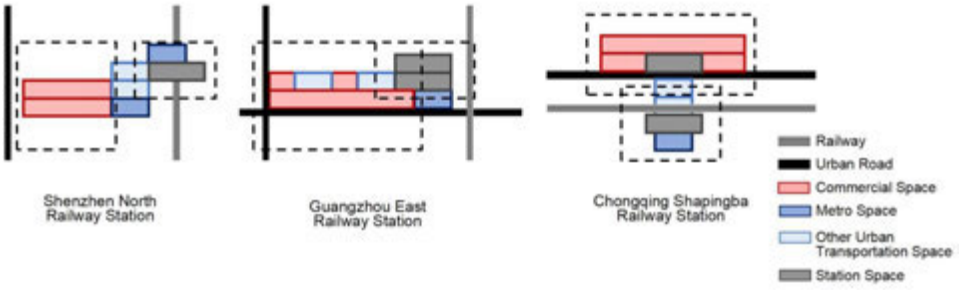


Fig. 3: Schematic layout of commercial space with station space and urban transport space

The commercial space of Shenzhen North Railway Station is completely separated from the station entrance and exit space, and between the two is an urban transport space integrating metro, buses, and taxis. The commercial space of this station complex consists of two floors with no vertical dislocation; the plan form is a U-shape facing south; and the concave space on the south side is a continuous outdoor promenade. The commercial space on the ground floor is connected to the metro station hall, and the commercial space on the second floor is connected to the transfer hall for buses and taxis. The city-facing area of the commercial space is adjacent to only one city road, with city roads farther away in the other two directions (Fig. 4). The shop formats are mainly catering, retail, and lifestyle services.

The commercial space of Guangzhou East Railway Station is intertwined with the station access space, and the urban transport space is embedded between the two. The commercial space of this station complex has four floors, and this study only considers the ground floor and the first underground floor, which are closely connected with the station space and the urban transport space. These two layers of commercial space are in the shape of a ladder; the ground-floor commercial space is located on the south side of the station space; between the two is the motor vehicle lane and drop-off area; the ground-floor commercial space is deep below the station space; and the underground station hall is below the station space. The city-facing area of the commercial space is adjacent to three city streets with plenty of pavements and overpasses (Fig. 4). The shop formats are mainly catering, retail, and life service, with the ground floor mainly for fast food, the first basement floor mainly for retail business, supplemented by a small number of catering businesses, and life service businesses and hypermarkets located in the second and third basement spaces.

The commercial space of Chongqing Shapingba Railway Station is completely superimposed with the station access space and urban transport space, and all kinds of urban transport space are spaced out from the station access space, and the commercial space is located above the two, adjacent to the station access space. The main part of the commercial space of this sample station complex is five floors, and the local part is seven floors, only the ground floor and the first floor, which are closely connected with the station space and urban transport space, are considered in this study. These two floors of commercial space are located entirely on the ground, and the plan form is a dumbbell shape distributed on both sides of the

station building, and the east and west sides are connected through the aerial connecting corridor that spans above the station space with the commercial space on the ground floor. The commercial space is close to several urban roads and overpasses (Fig. 4). The shop formats are equally dominated by catering, retail, and lifestyle services.

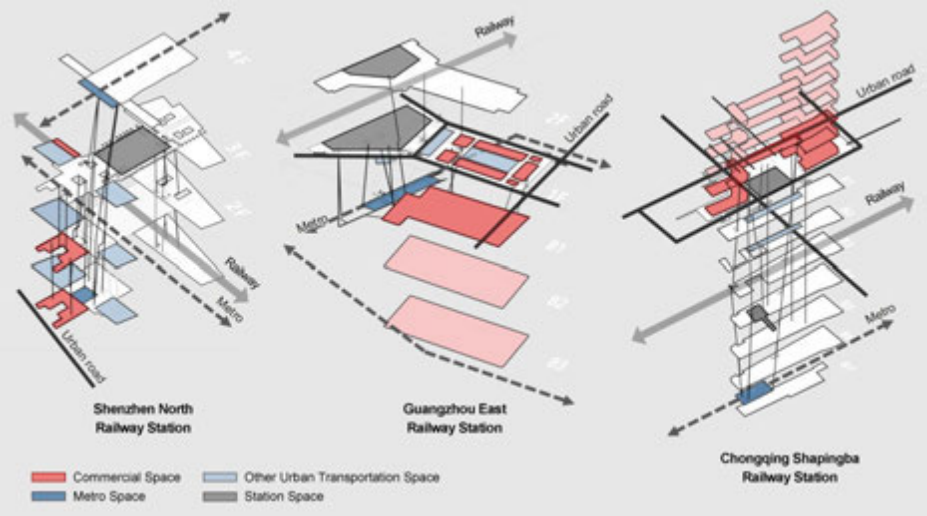


Fig. 4: General layout of commercial space in the sample station complexes

4.1.2 Total footfall of commercial space in station complexes

The pedestrian flow in the station space is usually proportional to the size of the station passenger flow, while the pedestrian flow in the commercial space is jointly influenced by the size of the passengers and the layout location of the commercial space. Based on the passenger scale of the station, the influence of the layout location of the commercial space of the station complex on the flow of people is analysed by comparing the relative size of the commercial space flow of the sample station to the station space flow of people and the proportion of the commercial space flow of people to the total flow of people.

As shown in Fig. 5, the percentage of commercial space use in Guangzhou East Station, Chongqing Shapingba Railway Station, and Shenzhen North Railway Station decreases in turn. Guangzhou East Station has a higher commercial space footfall than its station space; Chongqing Shapingba Railway Station and Shenzhen North Railway Station both have a lower commercial space footfall than station space footfall; and Chongqing Shapingba Railway Station has a relatively small gap between commercial space footfall and station space footfall. Among them, Guangzhou East Station, which has a medium passenger size, has the highest pedestrian flow of commercial space in its staggered layout, while Chongqing Shapingba Railway Station, which has a smaller passenger size, does not have a pedestrian flow of commercial space in its overlapping layout that exceeds that of Guangzhou East Station. In addition, although the pedestrian flow in the commercial space of Chongqing Shapingba Railway Station is lower than that of Shenzhen North Railway Station, the total pedestrian flow

of the former is much smaller than that of the latter, and thus the commercial space usage ratio of Chongqing Shapingba Railway Station is still higher than that of Shenzhen North Railway Station, which also shows that the calculation of the respective commercial space usage ratios of the sample stations can be used to make effective comparisons between the stations.

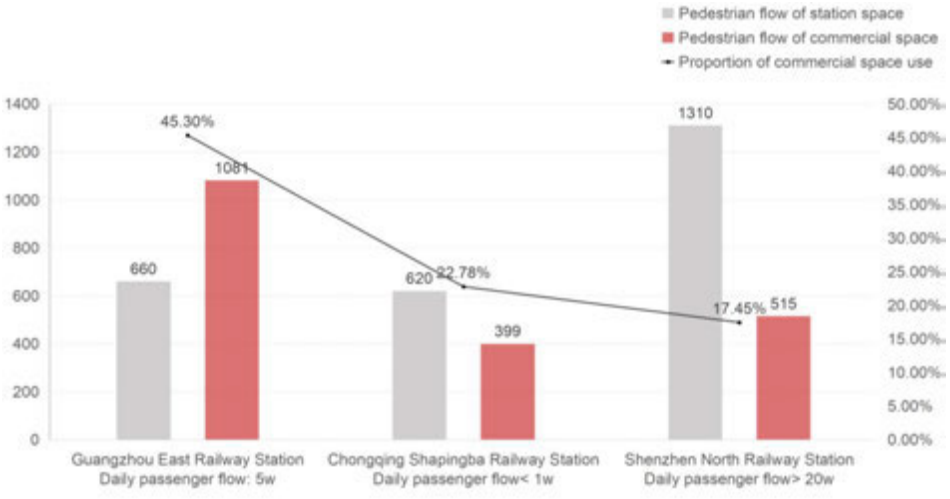


Fig. 5: Total footfall in commercial space of the sample station complexes

4.2 Nodal layout and use of commercial space in station complexes

In addition to the above commercial space block layout, the actual use of commercial space in station complexes is also affected by the more microscopic layout of entrances and exits. The node layout relationship between the commercial space of the station complex and the station entrance and exit space and urban transport space affects the origin, flow, and convergence of people travelling to and passing through the commercial space, and the "node-path" layout is reflected in the flow of people through the various entrance and exit nodes of the commercial space.

4.2.1 "Node-path" layout of commercial space in station complexes

The main users of commercial space in the station complex are leisure citizens (citizens who specially go to and use commercial space within the radius of the station), traffic passengers (passengers who pass through the commercial space in the process of entering and exiting the station by railway), and leisure passengers (passengers arriving by railway and especially go to and use commercial space), and the urban transport means to be chosen are underground, taxi, bus, and so on. The starting point of the passenger's movement is the station entrance and exit node, while the starting point of the citizen's movement is the various urban transport nodes, which are usually located between the commercial space entrance and exit

node and the station entrance and exit node. The movement of the two groups will cross and overlap, and there are commercial space entrances and exits shared by both the passengers and the citizens.

As shown in Table 1-3, the entrances and exits of the commercial space of Guangzhou East Station are mainly distributed at the end near the station, and only two ground-floor entrances and exits are set up in the city-facing area; the 16 entrances and exits of the commercial space of Chongqing Shapingba Railway Station are located at the ground floor and above; the entrances and exits of the commercial space of Shenzhen North Railway Station are set up both at the near-station end and the near-city end, of which eight entrances and exits are set up in the near-city area, and six entrances and exits are set up in the near-station area. The "node-path" layout of the commercial space of the three sample station complexes takes into account both passengers and citizens and has the potential to attract transport and leisure passengers in addition to serving as leisure shopping destinations for citizens in the vicinity.

The commercial space at Guangzhou East Railway Station can attract transport-oriented passengers transferring to the metro, and most of the entrances and exits of the commercial space are exclusively for passengers or citizens. Passengers who choose to transfer to the metro and citizens who take the metro to the commercial space are distributed in the same area, but the two movements do not interfere with each other. Passengers transferring to the metro will pass through Entrance 6/7/9 in the process, while citizens arriving by metro will enter the commercial space through Entrance 5 or Entrance 7, and Entrance 7 will be shared. People choosing buses, taxis, and walking will enter the commercial space through Entrance 2, Entrance 1/8, and Entrance 1/2/3/4/8, respectively. Leisure passengers travelling exclusively to the commercial space will mainly enter through Entrance 1/6/9. Entrance 1 will be shared by taxi-only citizens and leisure passengers, so Entrance 2/3/4/8 will be the exclusive entrance for citizens entering the commercial space, and Entrance 6 and Entrance 9 will be the exclusive entrance for passengers entering the commercial space.

The commercial space at Chongqing Shapingba Railway Station is not able to attract transport-oriented passengers entering and leaving the station, and its commercial space entrances and exits are only partially shared. People who choose the metro to go to the commercial space enter through Entrance 1/2/6/7, those who choose buses and taxis enter through Entrance 1/2, those who choose private cars enter through Entrance 4/5/12, those who choose to walk can enter through Entrance 1/2/3/6/7/8/9/10/11/12, and leisure passengers who go to the commercial space exclusively enter through Entrance 1/2/4/5, i.e. Entrance 6/7, which is directly accessible from the metro station hall on the seventh floor of the underground, and Entrance 6/7, which is directly accessible from the metro station hall on the seventh floor of the underground, as well as Entrance 6/7, which is directly accessible from the metro station hall on the seventh floor of the underground. Entrance 6/7, which is directly accessible from the MTR station hall on the seventh basement floor, and Entrance 3/6/7/8/9/10/11/12, which is accessible on foot from the city road, are the entrances and exits of the commercial space for public use.

The commercial space of Shenzhen North Railway Station attracts transport passengers entering and leaving the station on foot and the public walking to the commercial space, and their entrances and exits to the commercial space are shared by both passengers and the public.

Traffic passengers who choose to enter the station on foot and citizens who walk to the commercial space enter through Entrance 1/2/8/9/10/11/12/13/14 facing the city, while traffic passengers who choose to leave the station on foot, leisure passengers who go to the commercial space exclusively, and citizens who choose the metro, buses, and taxis enter through Entrance 3/4/5/6/7/12/13/14 adjacent to the station. There are no entrances or exits to commercial space exclusively for the public.

Table 1: Node-Path Layout of Commercial Space in Guangzhou East Railway Station

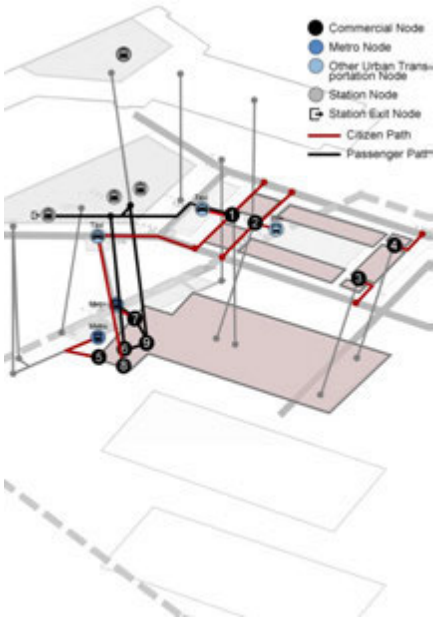
	Traffic Passengers (through commercial space)	Entering the station by metro	Metro --- E7 --- E9 --- E6 --- Entrances
			Metro --- E7 --- E9 --- Station
		Exiting the station by metro	Station --- E6 --- E9 --- E7 --- Metro
			Station --- E9 --- E7 --- Metro
	Leisure Passengers (to commercial space)	Station --- E1 / E6 / E9	
	Leisure Citizens (to commercial space)	By metro	E5 / E7
		By bus	E2
		By taxi	E1 / E8
		On foot	E1 / E2 / E3 / E4 / E8

Table 2: Node-Path Layout of Commercial Space in Chongqing Shapingba Railway Station

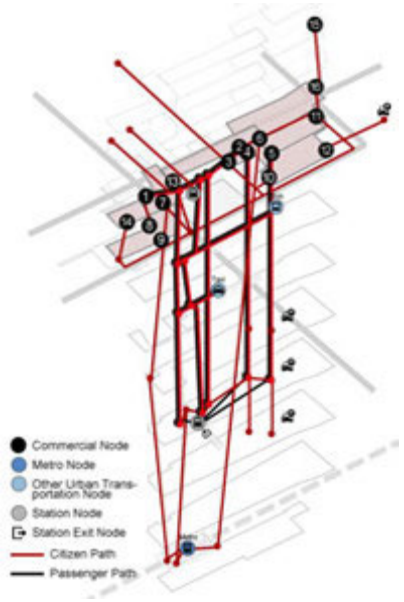
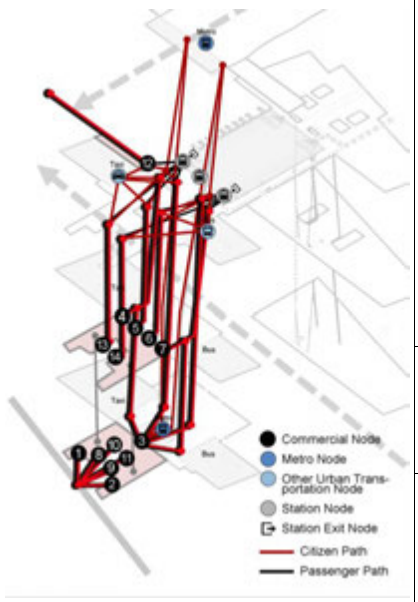
	Leisure Passengers (to commercial space)	Station --- E1 / E2 / E4 / E5	
	Leisure Citizens (to commercial space)	By metro	E1 / E2 / E6 / E7
		By bus	E1 / E2
		By taxi	E1 / E2
		By private car	E4 / E5 / E12
		On foot	E1 / E2 / E3 / E6 / E7 / E8 / E9 / E10 / E11 / E12 / E13 / E14 / E15 / E16

Table 3: Node-Path Layout of Commercial Space in Shenzhen North Railway Station

	Traffic Passengers (through commercial space)	Entering the station on foot	Urban road --- E1 / E2 / E8 / E9 / E10 / E11 / E12 / E13 / E14 --- E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14 --- Station
		Exiting the station on foot	Station --- E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14 --- E1 / E2 / E8 / E9 / E10 / E11 / E12 / E13 / E14 --- Urban road
	Leisure Passengers (to commercial space)	Station --- E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14	
	Leisure Citizens (to commercial space)	By metro	E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14
		By bus	E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14

		By taxi	E3 / E4 / E5 / E6 / E7 / E12 / E13 / E14
		On foot	E1 / E2 / E8 / E9 / E10 / E11 / E12 / E13 / E14

4.2.2 Pedestrian flow at entrances and exits of commercial space in station complexes

The pedestrian flow at the entrances and exits of commercial space in station complexes reflects the convergence effect of the "node-path" chain with different attributes. By comparing the average flow of people at the entrances and exits of the commercial space in the sample station and the flow of people at each entrance and exit, we analyse the influence of the node layout of the commercial space in the station complex on the flow of people.

As shown in Fig. 6-8, the number of entrances and exits in the commercial space of Guangzhou East Railway Station is the lowest, but the flow of people at each entrance and exit is more than 50, and there are two entrances and exits with higher than average flow of people, and the difference between the highest flow of people and the lowest flow of people reaches 164 people. Chongqing Shapingba Railway Station has six entrances and exits with higher-than-average passenger flow, and the difference in passenger flow between them is relatively small. Shenzhen North Railway Station has four entrances and exits with higher than average passenger flow, and the difference in passenger flow between the entrances and exits is in the middle.

Among the entrances and exits in the commercial space of Guangzhou East Railway Station, the ones with higher than average flow rates are Entrance 7 and Entrance 9 on the basement floor. Entrance 7 is common, and the flow rate is much higher than the other entrances and exits. It is directly opposite to the main axis of the commercial space on the basement floor, and it is the necessary entrance and exit for the traffic passengers who are transferring to the metro and for the leisure passengers who are taking the metro (Fig. 9). Entrance 9 is a special entrance for the passengers and is connected to the ground floor through the staircase facility. Entrance 9 is one of the entrances for passengers, connected to the ground floor through the staircase facility, and is close to the station access space on the ground floor, which can be used by leisure passengers and transport passengers transferring to the metro.

Among the entrances and exits of the commercial space of Chongqing Shapingba Railway Station, the ones with higher than average pedestrian flow are Entrance 1, Entrance 2, Entrance 4, Entrance 6, Entrance 7, and Entrance 11 on the ground floor. Entrance 1, Entrance 2, and Entrance 4 are shared entrances and exits, which are accessed by leisure citizens who choose to take the underground, bus, taxi, and walk, as well as by leisure passengers who travel to the commercial space exclusively (Fig. 10), and Entrance 4 is connected by a straight staircase to the station exit space and private car garage at the fourth basement floor, which is shared by leisure passengers and those who choose to travel by private car. Entrance 4 connects the station exit space on the fourth basement floor and the private car garage on the ground floor via a

straight staircase, which is shared by leisure passengers and leisure citizens who choose to travel by private car. Entrance 6, Entrance 7, and Entrance 11 are dedicated entrances for citizens, with Entrance 7 mainly carrying leisure citizens travelling on the underground, and Entrance 11 being one of the entrances for citizens to walk into the commercial space.

Among the entrances and exits of the commercial space of Shenzhen North Railway Station, the ones with higher than average pedestrian flow are Entrance 1, Entrance 3, Entrances 4+7, and Entrance 12, which are across the three floors of the commercial space. Both passengers and citizens share these five entrances and exits. Entrance 12 is close to the station space and leads to the commercial street adjacent to the station's entrance and exit space, which has the highest flow of people and is one of the shared entrances and exits for all passengers and citizens (Fig. 11). Entrance 1 is close to the city road and mainly accommodates transport passengers entering the station on foot and citizens walking to the commercial space. On the other hand, Entrance 3 and Entrances 4+7 are located in the area close to the station space and are used by transport-oriented passengers who choose to walk out of the station, leisure-oriented passengers who travel exclusively to the commercial space, as well as citizens choosing the metro, buses, and taxis.

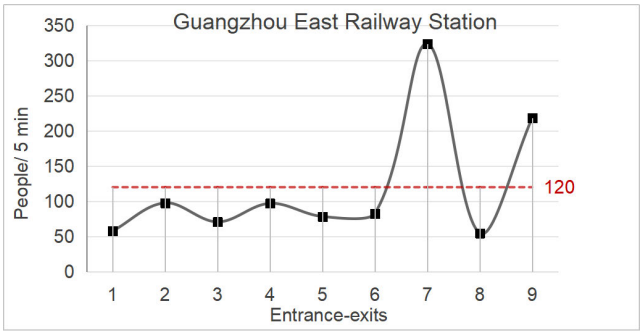


Fig. 6: Nodal pedestrian flow in commercial space of Guangzhou East Railway Station

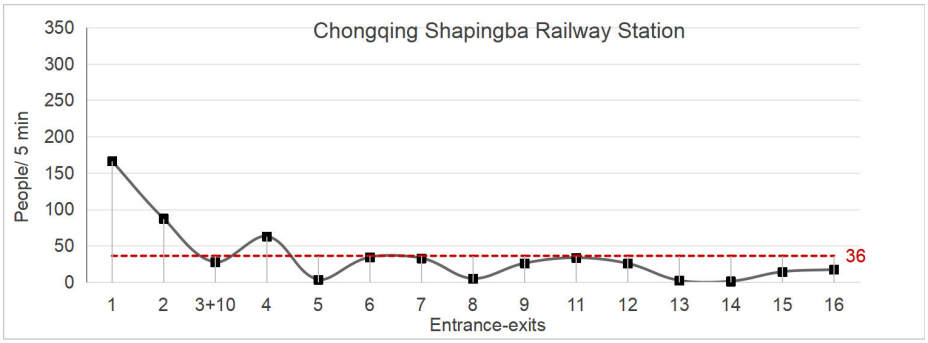


Fig. 7: Nodal pedestrian flow in commercial space of Chongqing Shapingba Railway Station

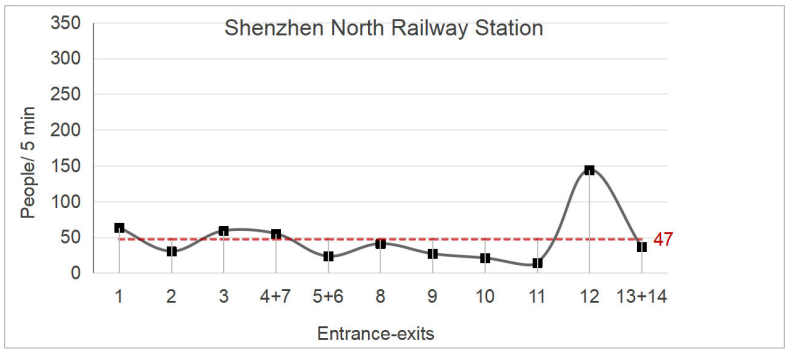


Fig. 8: Nodal pedestrian flow in commercial space of Shenzhen North Railway Station

Fig. 9: Pedestrian flow at E7 of Guangzhou East Railway Station

Fig. 10: Pedestrian flow at E1 of Chongqing Shapingba Railway Station

Fig. 11: Pedestrian flow at E12 of Shenzhen North Railway Station

5. Conclusions

The circle structure of centre agglomeration is usually regarded as an ideal model for the high-density development of high-speed railway station areas, while this study is based on the walking line of two types of groups, tourists and citizens, to refine the deduction of the design of the layout form of the commercial space of the high-speed railway station complex, which includes two aspects, namely, the layout of the body of the commercial space and the layout of the nodes at the entrances and exits.

Firstly, the correlation law between the block layout of the commercial space of the station complex and the total pedestrian flow. There is no positive correlation between the distance of commercial space from the station space and the use of commercial space, and the commercial space with the closest and the farthest distance from the station space shows a lower percentage of commercial space traffic, while the commercial space with the station space in a staggered layout and with the distance between the two in the middle of the commercial space, on the contrary, has a higher percentage of commercial space traffic. The reason is that the interlocking commercial space and station spaces have strong spatial connections, and the metro space is embedded between them, which attracts a large number of transport-oriented passengers to pass through the commercial space.

The proportion of long-distance passengers in the core area of China's high-speed railway stations is very large, and passengers' demand for rapid transportation is much larger than their demand for leisure consumption; therefore, the people who use the commercial space of station complexes are mainly leisure-oriented citizens in the surrounding area, and the number of leisure-oriented citizens > the number of transport-oriented passengers > the number of leisure-oriented passengers. Therefore, in the process of planning and laying out the commercial space of station complexes, attention can be paid to stations with small and medium-sized passenger scales, appropriately shorten the distance between their commercial space and station entrance and exit space, and create a staggered space for guiding traffic passengers, especially by placing

underground space between the two and stimulating the recreational potential of traffic passengers who transfer to the underground, whereas, in stations with large-scale passengers, the distance between their commercial space and station entrance and exit space needs to be maintained to provide a more comfortable and comfortable environment for the passengers. For stations with a large passenger scale, the commercial space and the station access space need to be kept at a distance for the use of the neighbouring citizens and a small number of passengers.

Second, the node layout of the commercial space of the station complex and the correlation law of the entrance and exit pedestrian flow. Firstly, the setting of entrances and exits of commercial space and the distribution of people flow are influenced by the layout of commercial space blocks. Located in the commercial space on the side of the station space, its entrances and exits are distributed in the area close to the station and facing the city, and there is a big gap between the flow of each entrance and exit. Located in the commercial space directly above the station space, its entrances and exits are distributed on the ground floor where the two are intersected, and because these entrances and exits are facing the surrounding city, the gap between the flow of each entrance and exit is relatively small. Secondly, the entrances and exits of the commercial space that are connected to the metro line usually have high pedestrian flow. Among them, the passenger-citizen shared entrances and exclusively for public use entrances and exits with a direct spatial connection with the underground line have a higher flow of people, while the entrances and exits exclusively for leisure passengers have a higher flow of people close to the station entrances and exits. Therefore, in the process of planning and laying out the commercial space nodes of the station complex, it is necessary to enhance the spatial connection between the entrances and exits of the commercial space, the metro space, and the station entry/exit space based on the block layout form of the commercial space.

Then, the layout pattern and optimisation suggestions for commercial space in the sample station complexes are:

Guangzhou East Station and Shapingba Railway Station are stations with small and medium-sized passenger scales. The commercial space of Guangzhou East Station is interlaced with the station space, with metro space embedded between the two, and the entrances and exits of the commercial space are separated for the exclusive use of passengers or citizens, especially the special entrances and exits set up for the transport-oriented passengers who change to the metro, so that the commercial space of this station complex can attract a large number of transport-oriented passengers changing to the metro while accepting citizens from the surrounding areas. The passenger scale of Shapingba Railway Station is relatively small, and its commercial space is completely superimposed with the station space, between the two there are urban transport spaces such as buses, rentals, and private garages, while the underground is located below the station exit space, and most of the entrances and exits of the commercial space are shared by citizens and passengers, and only a small number of entrances and exits are for the exclusive use of the citizens who take the underground and go to the commercial space on foot, and the commercial space of this station complex mainly serves the peripheral citizens, and only accepts a small number of leisure-type passengers. citizens, and only takes on a small number of leisure-type passengers. However, Shapingba Railway Station does not attract traffic passengers who must pass through the commercial space, and the passenger flow of the station is mainly concentrated in the ground floor entrances and exits, and the flow of people inside the

commercial space lacks traffic power, so it is possible to increase the commercial space and adjust the position of the entrances and exits of the commercial space between the station exit space and the underground to accept the traffic passengers who transfer to the underground.

Shenzhen North Railway Station is a station with a large passenger capacity. Its commercial space is completely separated from the station space, and between the two, urban transport spaces such as metro, bus, taxi, and private garage are integrated in a three-dimensional way, with entrances and exits to the commercial space shared by passengers and citizens, and a separate commercial street is set up in the area adjacent to the entrance and exit of the station, which is supplemented by the use of leisure-type passengers. Citizens choosing either mode of transport share all entrances and exits to the commercial space with leisure passengers who visit the commercial space exclusively and transport passengers who enter and exit the station on foot. Due to the large area of interchange space and station square between the station space and the surrounding urban roads, the number of transport passengers walking in and out of the station is minimal. The commercial space is far away from the station space. Even if it is close to the entrances and exits of the station space, the accessibility is low, so leisure passengers will choose to go to the commercial street, which is close to the entrance and exit of the station. The citizens who go on foot will also go to the commercial street, so the area gathers a large number of passengers and citizens. Therefore, the area gathers a large number of passengers and citizens. However, the distance between this commercial street and the two-floor commercial blocks is relatively far, so the vertical connection between the two commercial spaces can be increased appropriately so that the pedestrian flow of the commercial street can be directed to the entrances and exits of the commercial blocks below.

Finally, additional research is needed on the factors and indicators that influence the use of commercial space in station complexes. For example, the use of commercial space in station complexes is also affected by the organisational structure of various types of urban transport spaces and the urban transport sharing rate of different stations. In addition, this study focuses on analysing the layout of commercial space in station complexes from the perspective of "node-path", and abstractly expresses the use of commercial space as the total flow of people at all entrances and exits and the flow of people at all entrances and exits, which is only one aspect of measuring the effect of the use of commercial space, and can be measured by choosing more detailed indicators such as the flow of people entering stores. metrics such as inbound foot traffic to measure, and can also be supplemented with weekend foot traffic data for comparative studies with weekday usage. In addition, if the number of traffic-type passengers is increased excessively, it may affect the efficiency of passengers entering and leaving the station, and in the actual planning and design process, it is necessary to consider the balance and conversion of both traffic dispersion and commercial agglomeration.

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Being a Child on a Car Free Island: Exploring Independent Mobility and Children's Perception in Büyükada-Istanbul

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Abstract

This study aims to discover the mobility of children in a car-free area to understand the effects of freedom of mobility on perception of space. Büyükada Island in Istanbul defines a unique alternative due to its car-free living environment and offers a significant potential in terms of creating a child-friendly environment and freedom of movement. Within this scope, "mind mapping" methodology used for exploring children's spatial perceptions and freedom of mobility through drawings and written expressions of 20 students of 10-years old, living and studying at Büyükada. This paper discusses the findings of a field study regarding active and independent mobility patterns and explores children's perception of space in a car-free settlement which can be promising for developing policies for a child-friendly urban future.

Keywords: child friendly cities, child perception, independent mobility, mind mapping.

Introduction

In today's cities, transportation is developing with the motor vehicle-oriented approach, and traffic problems and their effects are addressed as an important field of study by different disciplines. The problem of the pressure that fossil fuel-using motor vehicle traffic puts on the environment and citizens becomes even more important when it comes to children, preventing their safe and free movement and weakening their relationship with the city. Cities where motor vehicles and highways are dense and dominant are increasing, and the areas where children can walk safely, play, and experience the city freely are decreasing day by day. However, it is noteworthy that within the scope of urban transportation policies and plans, there are few studies on children's access and rights to sustainable transportation, which gives priority to sustainable transportation modes such as pedestrian, bicycle and public transportation (Gilbert et al., 2018). Whereas settlements that children can move safely and freely are important for the healthy development of children who will be adult urban residents of the future.

Studies in the literature show that increased motor vehicle traffic reduces children's physical activities and games (Mindell & Karlsen, 2012), reduces their access to parks and playgrounds (Veitch, Salmon and Ball, 2007), and restricts their free mobility (Collins and Kearns, 2001; Haikkola et al., 2007; Tranter and Doyle, 1996) and weakens the perception of space (Appleyard, 2022; Mitchell, Kearns and Collins, 2007; Rissotto and Tonucci, 2002). As children's opportunities for active movement such as walking and cycling decrease, their free mobility also decreases, and this negatively affects both their physical, mental, and social development (Villanueva et al., 2014). Studies show that parents also restrict their children's independent mobility due to concerns about traffic safety (Björklid and Nordström, 2007; Chandwania and Natu, 2022; Tranter and Doyle, 1996; Villanueva et al., 2014; Wales, Martensson and Jansson, 2021), prefer motor vehicular instead of active transportation for home-school journeys (Appleyard, 2022; Collins and Kearns, 2001; Mitchell, Kearns and Collins, 2007), or cause children to be accompanied by an adult (Collins and Kearns, 2001; Kyttä, 2004).

The Child Friendly Cities (UNICEF, 2024a) approach, based on the Convention on the Rights of the Child (UNICEF, 2024b) declared by UNICEF in 1989, is defined as 'cities and communities where children feel safe, have their voices heard and can benefit from social services'. Based on this definition, one of the main goals is to create urban environments where children feel safe, where there is no traffic safety or pressure, and where children can move safely and alone on the streets (Riggio, 2002). At this point, supporting the active and independent mobility of children in their daily lives, making cities car-free, reducing and slowing down traffic in cities, and expanding sustainable and active transportation types are considered to be one of the important steps in creating child-friendly environments (Gilbert et al., 2018; Jansson et al., 2022; Karsten and van Vliet, 2006; Tranter and Doyle, 1996). As Chawla stated, walking and cycling, which are sustainable and active modes of transportation, are also child-friendly modes of transportation (Chawla, 2002). Walking and cycling are also the most basic and independent forms of mobility that children can do on their own. On the other hand, while car-dominated transportation systems contradict the Convention on the Rights of the Child because they restrict the mobility of children, active transportation types such as pedestrian transportation and bicycle transportation support the child rights-based transportation system (Gilbert et al., 2018).

Children's independent mobility, or freedom of mobility, is one of the most important components of child-friendly cities. (Freeman and Tranter, 2011; Global Designing Cities Initiative, 2022; Haider, 2007; Kyttä, 2004). This concept is defined as the ability of children to move and play freely and on their own in the environment they live in, without being accompanied or observed by any adult (Hillman, Adams and Whitelegg, 1990; Tranter and Whitelegg, 1994; Wales, Martensson and Jansson, 2021). In their independent mobility, the activities that children perform with their peers or friends are also considered in the independent category (Mikkelsen and Christensen, 2009). Children's independent mobility and therefore their physical-social health are closely related to the environment in which they grow up (Björklid and Nordström, 2007), and are shaped by the existence of environmental opportunities and their ability to access these opportunities independently (Broberg, Kyttä and Fagerholm, 2013; Kyttä, 2003, 2004). Research shows that the independent mobility of children is decreasing all over the world (Johansson et al., 2020; Wales, Martensson and Jansson, 2021), in this context, it is accepted that vehicle-dense cities are one of the important problems in terms of the independent mobility of children.

There are physical and social benefits of increasing children's active mobility in cities (Carver et al., 2013; Fagerholm and Broberg, 2011; Kyttä, 2004; Maiss and Handy, 2011; Villanueva et al., 2014; Wales, Martensson and Jansson, 2021). Active and independent mobility of children can be supported by reducing traffic and increasing walkability (Bourke, 2017; Carroll et al., 2015; Kaplan, Nielsen and Prato, 2016; Prezza, 2007; Villanueva et al., 2014). Independent mobility can contribute to children's development (Mikkelsen and Christensen, 2009), may decrease health problems such as obesity (Mackett et al., 2007), and improve environmental perceptions (Appleyard, 2022; Björklid and Nordström, 2007; Carroll et al., 2015; Mitchell, Kearns and Collins, 2007). There are also studies showing that the sense of social belonging and social bonds may increase (Bourke, 2017; Carver et al., 2013) and social relations may improve (Pacilli et al., 2013). In addition, by reducing vehicle traffic, speed and density, it becomes possible for children to travel with active modes of transportation (Kaplan, Nielsen and Prato, 2016) and thus a child-friendly environment can be created (Gilbert et al., 2018; Tranter and Doyle, 1996), free mobility may increase (Carroll et al., 2015; Whitzman, Worthington and Mizrachi, 2009), and the opportunity to play games in car-free areas may increase (Njeru, 2022). These studies reveal the benefits of car-free settlements in terms of both the physical and mental development and health of children. Considering all these benefits, it is very important to investigate the opportunities that enable/restrict children to freely explore the environments and neighbourhoods in which they live and to act independently (Veitch, Salmon and Ball, 2007) and to produce policies and plans that give priority to children (Carroll et al., 2015).

Considering that urbanized areas are increasing in the world and motor vehicles dominate urban transportation, it is important to explore the opportunities car-free settlements. Studying the mobility and space perception of children living in a non-motorized environment, which the studies in the literature are idealizing, would provide important clues. Within this scope, the purpose of the study is to discover the mobility of children in a car-free area and to understand the effects of freedom of mobility on perception of space. For this purpose, a car-free island from Istanbul, Büyükada Island, has been chosen for the case study. It is aimed to reveal through which spaces children living in Büyükada perceive and give meaning to their living spaces by producing mind maps through a workshop to be held with children. Thus, by identifying children's routes in Büyükada and the areas they use, it will enable questioning the relationships between space

perception and mobility. As part of the case study, spatial components of children's perception about the place they live in and the relation with their mobility types were determined by mind maps with 20 students of 9–10-years old residents of Büyükada Island.

Methodology

As the methodology, "mind mapping" used for exploring children's free mobility experience through drawings and written expressions. Field work was carried out with 20 students of 9–10-years-, living on the Island and studying at Büyükada Primary School. According to Piaget, a child in this period can think logically and process information in his/her mind schematically depending on his/her senses, movements, and intuitions. During this period, children can draw what they perceive about the environment in an abstract way and transfer the routes they know (Appleyard, 2017). Since children's physical and mental development reaches the level where they can perceive the city and act independently at this age, working with children of this age group will ensure that their contributions are at the highest level.

On the other hand, in the curriculum determined by the Ministry of National Education of Türkiye, environmental literacy, perception of change and continuity, map literacy, location analysis and spatial perception, which are among the basic skills that the Social Studies course aims to provide, are included in the 4th grade curriculum. In the 4th grade curriculum, the Learning Area "People, Places and Environments" aims to give students an awareness of human-environment interaction, to establish the cause-and-effect relationships of interaction and to gain an individual or social perspective for the future. It is aimed to provide students with the skills of research, environmental literacy, perception of change and continuity, observation, map literacy and spatial perception with an approach that opens from simple to complex, from near to far and from the location to the environment.

As a beginning of the study, observations were made on the school street while students leave the building after class hours to better understand the mobility behaviours of the children. The individual and group behaviours of the children were noted by observing the streets and routes that the students mostly used after school. Observations supported by shadowing method (Gehl and Svarre, 2013) for identifying the behaviour patterns during their journeys.

For the first phase of the in-class study, individual mind maps were prepared by children to explore the individual perception of space. Children were asked individually to draw and write the island they experienced on a blank sheet of paper. Then in the second phase, collective maps were produced in groups of 2-3 people to determine the general perception about the Büyükada. Children were asked to make markings on a ready-made map, and their verbal transmissions were recorded at the same time. University students studying in the City and Regional Planning Department of Mimar Sinan Fine Arts University accompanied the groups to avoid problems in map reading and prevent this from being an obstacle for the study.

The maps prepared with the children reveal the spaces through children's experience and perception about the Büyükada. The details of the drawings and verbal expressions with the identification of the activity areas related to mobility patterns helped to determine the level of

children's perception about the environment they live in. The prevalence of spaces used by children on the island reveals children's emotional, spatial, or functional related motivations for using and limiting space in a settlement without motorized vehicles pressure.

Büyükada: A car-free district of Istanbul

With its 16 million residents, Istanbul is the most crowded city of Turkiye (TÜİK, 2023). The metropolitan area is shaped by a variety of urban typologies from different historical periods, diverse lifestyles, and heavy traffic load of transportation. Experiencing the Istanbul metropolitan area as a child has difficulties, such as lack of accessibility to amenities, dependency on vehicle urban mobility, large scale physical environment challenging for cognitive mapping. On the contrary, the Büyükada Island in the Sea of Marmara defines a unique alternative due to its low-density urbanization, accessible services, strong urban identity, and car-free transportation. As the largest island district of Istanbul Metropolitan area, the Büyükada, which have managed to preserve the culture of car-free living, and offers a great potential for children and adults, in terms of creating a child-friendly environment and freedom of movement. Since the 19th century, transportation has been provided by horse-drawn carriages and phaetons. Motorized vehicles are only used for public services such as fire brigades, ambulances, and garbage collection. The increase in the number of individual electric vehicles over the last 10 years has brought a different dynamism to on-island mobility. In 2022 the municipality banned horse-drawn carriages, since public transportation was provided by electric shuttles and electric cards. As a result of this heritage residents and even visitors of the islands have this non-motorized and pedestrian dominant awareness as mind setting.

In contrast to the increasing motorized vehicle-oriented development of the Istanbul metropolis since the 1980s, the Princes' Islands are only car-free areas in Turkiye. Büyükada, the largest of the islands, is a settlement where private motor vehicle ownership doesn't exist, transportation is provided by pedestrians, bicycles, electric bicycles, and electric shuttles. The winter population is higher than on the other 3 islands, and offers functional diversity at different levels in terms of education, health, culture, etc. Therefore, Büyükada has significant advantages over Istanbul in terms of creating a child and youth friendly environment and freedom of movement. The Büyükada is a small settlement with a population of 8586 according to 2022 statistics (Adalar Municipality, 2023). According to the 2020 household survey results, 19% of the population living in the Büyükada have battery-powered vehicles or electric bicycles, 17% have bicycles and 52% do not own any vehicle (IBB IPA Statistics Office, 2020). According to the same study, the majority of trips to the islands are made by active transportation modes such as walking and cycling. Children make their school journeys in the Büyükada without a vehicle, and for home-school journeys within the island or to the mainland, pedestrian and ferry options are the highest with 35.7% each, while private vehicles account for 0.9% (IBB İPA Statistics Office, 2020). Therefore, the Büyükada, where there are no private cars, active transportation modes are common, and children go to school on foot, was selected as the study area.

Exploring Children's Island Perceptions, Mobility Behaviours and Activity Spaces

To explore children's perception of the Island and mobility patterns, a field study was conducted with 20 children. The study group consisted of 10 female and 10 male students residing in the Büyükada. While 12 of the children live in the centre of the Island where commercial facilities and services concentrated among dense urban patterns, 8 of them live on the periphery with lower building density and a more dominant natural environment. The primary school is located in the centre of the settlement and within walking distance of the pier, the market area and most of the residential areas.

Figure 1: Mind Mapping study and drawings of children

Figure 2: Walking routes and activity spaces of children from mind maps and collective maps.

The in-class activity conducted with the students within the research's scope is a two-stage mapping exercise. In the first phase, mind mapping, children were asked to draw and describe the Büyükada on a blank paper. As a hint, they were told to describe their favourite places, streets, home, or school surroundings of the Büyükada to someone who did not know the island. At this stage, it was aimed to determine children's perceptions of location, spatial relations, scale, and spatial details. In the second phase students worked on collective maps, and asked to mark their favourite, least favourite and most frequently visited places on a map showing the current state of the settlement, and to draw the routes of the places they visited. Finding from the mapping exercises with children provided insights about **the general set up and perception of space, mobility patterns and spaces, functions and activities, spaces for play and relationships with the natural environment.**

In terms of **general set up and perception of the space,** the areas where children live, play and use are spread over various parts of the island, and therefore their perception of space covers a wide area. 15 out of 20 children referred to their own home and its close surroundings when defining their living environment on individual mind maps. They defined other spaces by associating them with their location in relation to the house and axes of connection. 3 students chose to draw a single favourite spot (the restaurant in Dilburnu (Dil cape) and its flowery entrance; an old mansion and its garden, which she found peaceful) or a situation (a family picture among their favourite buildings). In each case, the drawings contain spatial references and details.

17 children who preferred to describe their living environment by drawing a map used their own house (89%), the school (65%), the hospital adjacent to the school (53%), and other houses (70%) as main references while describing their physical environment. While the rate of drawing the houses of classmates, neighbours or relatives was 53% in individual mind maps, in all collective island maps, the houses of relatives and friends were marked in addition to their own houses.

In the collective mapping study, students marked the locations by reading on the existing map. Since they were novices in map reading, 90% of the students used the ferry pier as the starting point for finding directions and marked the school by following the road from there. Ferries are the main vehicles to connect the islands to Istanbul mainland. Therefore, pier is also a real starting point when stepping onto the island. The fact that children start from the pier, which is the entry point to the island, by simulating real life while searching for a place on the map and find the house and school by following the path they walk shows the high level of children's spatial cognitive perceptions.

In terms of **mobility,** walking emerges as the primary mode of transportation. Children's school journeys are mostly made by walking as individuals or accompanied by their siblings / friends, rather than by their families. Children living in the periphery mostly use vehicles for commuting. Electric motorcycles are the most common ones, another way is the public shuttles. In mind maps 2 students draw the route of the shuttles, and 4 picture the electric vehicles.

> *Zeynep Ö.: "When my mom takes care of my brother, she can't pick me up from school, so I go down to the market and take the bus."*
>
> *Pamir: "my parents bring me to school on an electric motorcycle, but I like walking more because I can observe"*
>
> *Zeynep B.: "My sister brings me to school by electric car, our house is close to the museum"*
>
> *Hazal: "we live close to school, so I walk with my brother, and sometimes my mom brings us with the electric motorcycle"*

Depending on the weather conditions, students walk to school or are given a ride by their parents via electric bicycles. It has been observed that children walk in groups after school as well as accompanied by an adult. In some cases, adults provide access to neighbourhood children with their electric vehicles, in the sense of a division of labour. Most of the children participating in the study own a bicycle. However, they reported that they used bicycles for recreational purposes around the home and usually walked to school or were chauffeured by their parents with electric bicycles.

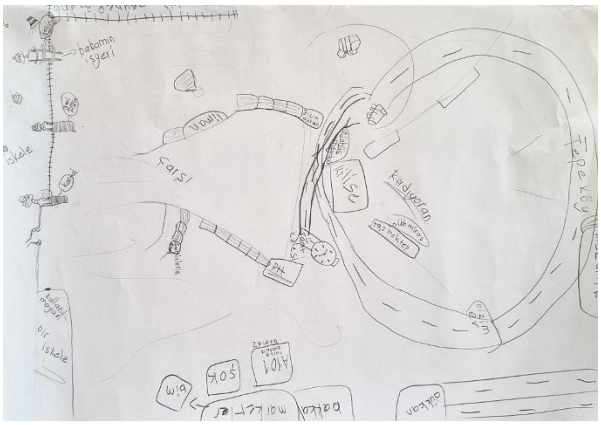

Figure 3: Mind map drawing of a child that shows transportation hubs and routes.

Regarding urban mobility, the main elements reflected in children's mind maps about transportation are the ferry pier and the electrical public shuttles' station. Ferries provide the main connection with Istanbul and other islands. Therefore, the pier is the entrance gate to the island; it constitutes the centre of the settlement functionally and semantically. The shuttle station takes places in part of a square surrounded by shops and cafes in the market area. The square is not only a transportation hub, but an important node / junction for the centre. Children mark these two areas as landmarks, gathering points for daily activities as well as the centres for transportation.

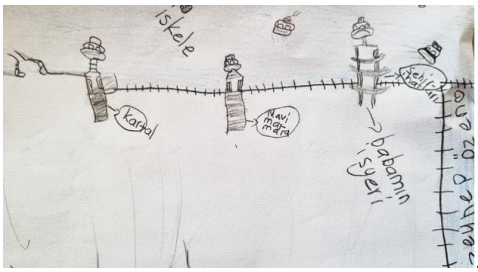

Figure 4: Detailed landmarks of the Island such as ferry pier

Another prominent element on the maps is the market area where urban **functions and activities** concentrate. Shops and commercial areas included in 59% of the individual maps, were marked in all the collective maps in detail, with the names of the chain markets, local shopkeepers, cafes, and the workplaces of acquaintances. Children mention that they can meet on their own in the market area in their free time, while those living in the centre play on the street. The market area is one of the activity areas of the Büyükada children with its commercial vividness.

Asya: "I like to spend time at the coast because we can sit there with our friends. There are cafes and parks."

When it comes to **the natural environment,** it has been observed that children establish a close relationship with nature and draw in detail the elements that shape the environment they live in. Children know the types of trees, write their names in drawings and visualize them in different ways. All the children said they liked the forest areas at the back of the island. Dil cape, beaches, the big tour route, forests and Aya Yorgi hill are mentioned equally with the uses in the centre. However, this area is more secluded due to the sparseness of the settlement pattern, families do not allow children to go alone for safety reasons. Instead, these areas are visited for family activities such as visiting relatives, nature walks, cycling or swimming in summer. Therefore, the limited use of forested areas by children is not due to accessibility, but to parental concerns about safety and strangers' danger.

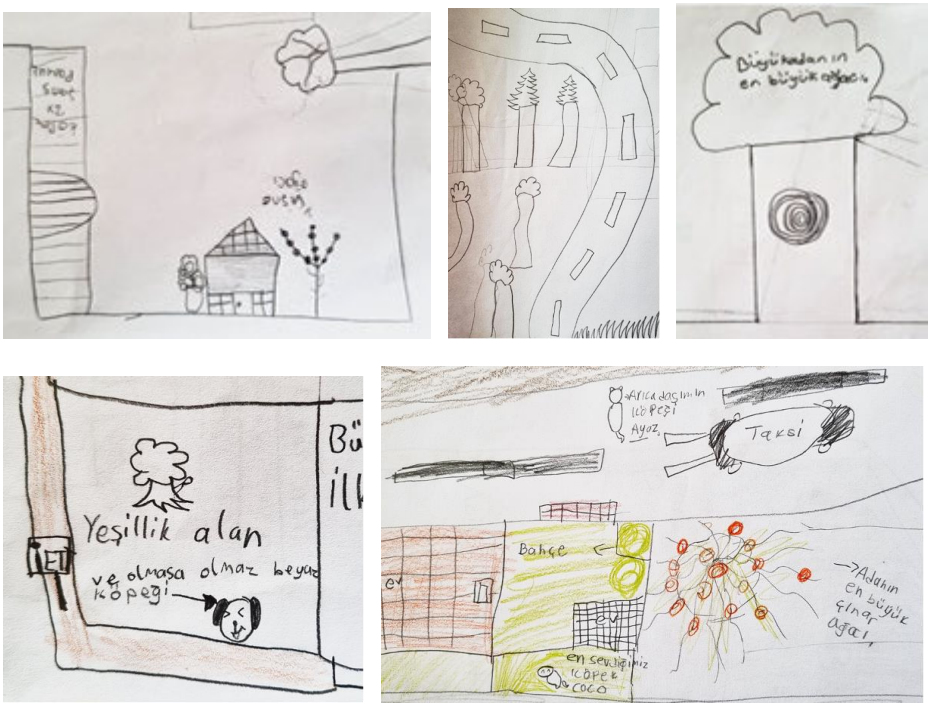

Figure 5: Details of natural element such as trees, gardens, animals in children's mind maps drawings

In terms of play, children drew several places where they played, such as the school garden, the streets where they lived, the island's square and the football field. In their out-of-school activities, most of the children can perform independent activities such as playing on the street / in the park, going to sports, or wandering around the city centre, alone or with groups of friends. The school

garden is one of the most important gatherings and after school play areas since it also offers children out-of-school alternatives with courses and activities. While all boys marked the football field as an important gathering place on the collective map, girls predominantly marked Atatürk Square. Çınar square, located at the intersection of the market and the residential area in the centre, is also expressed by both boys and girls as a play street. Another important finding is that walking backwards on a slope, running and pacing, the movement itself can turn into a game. These findings suggest that active mobility in car-free settings can support play function and turn independent mobility into fun.

Regarding the **interactions between children's independent mobility and their perception** of space, it has been seen that there is a close and strong relationship between active and independent mobility and strong spatial perception. The most important finding of the mapping research is that children who are taken to school by their caregivers cannot identify the routes they use on a map, cannot define spatial references or identical structures. Although they can draw their immediate surroundings around home and micro-scale spatial relations in individual mind maps, their perception of the whole is poor compared to children who commute on foot.

Walking speed makes it possible to notice details and develop a strong perception of space. On the other hand, walking together after school, even if it is for the purpose of going home, provides shared free time on the street. In this way, individual awareness of the environment can be shared, that enables peer education. Naming the animals on the route together, talking about tree and plant species, eating and shopping together in the market reinforces the experience of both life and space. Since children walk with their siblings or friends, they know each other's homes and even their parents' workplaces which enhances the sense of security in the neighbourhood. 75% of children were aware of the names of neighbourhoods, streets or special functions and mentioned them when describing the settlement.

Conclusion

This paper discusses the findings of the field study that shows children living on a car-free island have developed perception of space which allows them to describe the details of space and the ability to find their way independently. In addition, their spatial perceptions vary in terms of their mobility patterns and durations, location of their homes, distances to the centre, and differentiate according to the variety of urban elements they encounter every day.

In the mind maps produced as part of the study, children describe the environment they walk and perceive through four basic components (Zhu and Lee, 2008) as pedestrian facilities, housing density, land use mix and street connectivity. *Residential density* is expressed in terms of rows of houses defining streets or a description of specific houses. Among the activity patterns, children's favourite places to go alone or with their caregivers were the market area, pier, and the coast where the commercial and services take place with the highest level of *land use mix*. Büyükada offers a variety of functions such as Adalar Museum, libraries, football fields, tennis courts, woodlands,

seashores, and beaches. All these uses are marked in the mind maps and collective maps in addition to the mix use zones. *Pedestrian facilities* are at a high level as the entire island is a pedestrian priority area. This issue is reflected on the mind maps through open public spaces and the promenade on the coastline of the centre. The promenade starts from the small port, continues with cafes, restaurants, municipality building, ferry piers and supermarket, ends at the Atatürk Square. Atatürk Square is an important gathering point of the island's public pedestrian system. In collective maps children defined the square as a most important meeting and playing point by also mentioning the monument on the square as climbing wall or slide statue. Modern style monument on the square became a playing point for Büyükada children with its form that enables them to climb, slide and sit on top of it. In the means of *street connectivity*, the permeable car-free street pattern ensures a high level of connectivity in the centre. In children's mind maps, the streets of Büyükada appear as the main area of activity and the connectors of urban uses and movement areas.

The study showed, in addition to functional diversity, richness and elements that lead to sensory diversity strengthen the relationship between children and space. The variety of natural elements provides significant potential in this regard. Children referred to noisy and crowded areas, silent and peaceful spots, different materials and textures that create surfaces in the urban environment. The elements that attract different senses are recognized in their cognitive mappings.

Findings of the mutual analyses on mind maps and the voice recordings showed that the children's perception of the built environment in Büyükada, is parallel to the natural environment. Büyükada has a very strong natural identity as well as its identical architectural environment. As a result of the study, it was determined that children perceive the built environment together with natural environment references. The sea shore, hills, sloping streets and stairs, which are the result of the rugged topography, play an important role in the perception of space. The viewpoints defined by the hills, combined with the presence of monumental buildings such as the Greek Orphanage and the church of Aya Yorgi, strengthen the emphasis on landmarks. Clock tower, Splendid Palace Hotel, Taşmektep (renovated museum), Anadolu Club, Church and Hamidiye Mosque are landmarks in the centre.

Figure 6: Details of landmarks of Büyükada such as Greek Orphanage, Clock Tower, Hamidiye Mosque and Dilburnu (Dil cape) in children's mind maps.

In most of the studies that use mind mapping method on children's neighbourhood walkability, children marked traffic points, zebra crossings, parking cars as well as the sidewalks and traffic

lanes as a part of their spatial perception. Whereas in Büyükada, children draw streets and roads as connections of spaces and functions, without mentioning any traffic information. It is concluded that when traffic pressure is removed, children can see roads in their most basic urban function. They may not be perceived as traffic or problem areas that limit movement. Roads connect and unite different parts of the city, forming the whole and providing circulation.

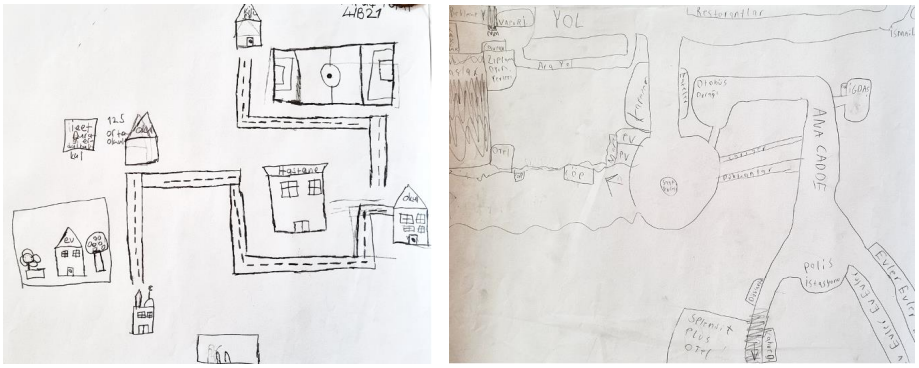

Figure 7: Details of street connectivity and connected activity spaces in children's mind maps.

Another finding of the study was about parental concerns and its' relationship with children's independent movements. It has been determined despite living in an environment without motorized vehicle traffic, the parental concerns persist, and parents continue to chauffeur their children the presence of electric vehicles, the inability to get up early in the morning, or weather conditions. This situation shows that even in car-free environments, parental concerns do not completely disappear and can be limiting on children's independent movements as in other studies in the literature (Collins & Kearns, 2001; Kyttä, 2004).

As a result, children's independent mobility allowed them to establish more connections with nature, to perceive landmarks in the urban space they live in, and to spend time and play in diverse urban areas such as the market centre on the island or in natural areas such as the seaside and forests. It is concluded that what is attractive for children in the Büyükada settlement is not attractive playgrounds, well-designed facilities, or smart schoolyards, but a realistic and coherent diversity of the whole environment at a perceptible and walkable scale. This is a real-life experience for children, and in Büyükada, removal of the vehicle pressure makes this experience possible for children. These findings from a car-free settlement can be promising for strengthening the policies for building a child-friendly urban future.

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Stakeholders of participatory planning: a comparison between Megacities and Cities in Europe

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Abstract

Participatory planning is regarded as an accelerator of sustainable development. However, it comes with its own set of challenges. In this paper, we study the challenges that are explicit in the case of Megacities. As they are more prominent in our current years, megacities form a large portion of their countries' population, not to mention they constitute an issue when combatting climate change. In the context of megacities, the analysis of the participation process requires a breakdown of the one factor which constitutes the biggest difference between its application in cities and megacities: the stakeholders and their extrapolation. Following this method, a solution for its implementation in megacities is proposed highlighting the use of digital tools and following the learnings from the city of "Vinnytsia" and applying them to the case of the megacity of "London".

Keywords: *Participatory Planning – Megacities – City Development – Planning Stakeholders*

Introduction:

As urban areas are rapidly growing, with more than 4 billion people, representing more than 50% of the world's population currently living in urban areas (Ritchie et al., 2018), handling each type of urban space individually is necessary for sustainable planning. This is to allow the shaping of processes tailor-made to fit the type of communities living in it and most importantly to keep up with its rate of expansion. An extraordinary phenomenon of urbanization is the formation of Megacities. Megacities are defined by their population size, which crosses the threshold of 10 million inhabitants (World Urbanization Prospects The 2018 Revision, 2018). Other than their defining aspect, the unique characteristics of megacities include their expansive size, intricate infrastructure, rapid growth, and socio-economic diversity ((Wenzel et al., 2007) and (Buehler, 2003.)). These necessitate a re-evaluation of traditional planning methods including participatory planning approaches. As megacities form a complex eco-system, their development elements are usually differentiated between one another during the planning process. This is already true in other types of cities and leads to the shift of power structures between the different stakeholders depending on the objective of the development. This division of elements shows, nevertheless, a higher level of disconnect in megacities due to their high level of complexity, which results in most cases in a top-down approach in decision making. Megacities are furthermore characterised by two attributes: their high population density and the speed in which they expand. Currently, there are 33 megacities worldwide, a number expected to rise to 44 in the next 10 years, as projected by the United Nations Department of Economics and Social Affairs (United Nations, 2018). A megacity forms a complex organism where the race between sustainability and growth is fierce. With high speed expansion, pollution becomes just as fast on the rise. This is then worsened by the difficulty of controlling

and maintaining sustainable development with the high number of stakeholders involved. A common trend to overcome this obstacle in recent years, has been to regard megacities as agglomeration of neighbourhoods. Planners breakdown the megacity into neighbourhood islands, where development could be controlled and to an extent monitored. This method has proven however ineffective in recent studies, as the case in the research conducted in a selection of Eastern megacities such as Hong Kong (Edermann et al., 2023). Such methods tackle the centres of neighbourhoods and fail at their border. In their attempts to remedy such failures, the authorities create new masterplans with overarching policies. These in turn suffer under the magnitude of the challenge and resolve into one of two faults: failing to account for the individuality of established communities in each neighbourhood or expanding the city more to cater for the residents' needs, an endless loop as the megacity becomes even more difficult to contain and manage. On the other side of the spectrum, small cities have mastered the art of maintaining an identity whilst creating their overarching masterplans. As planning methods were created with cities of medium and small scale in mind, their application proves more effective. Adaptations are in any case needed to match with socio-economic and administrative contexts, nevertheless, the tools themselves do not need to be altered. A good witness is reflected in the use of participatory planning as a sustainable development method.

In this research, we discuss the use of small cities as a blueprint for the translation of urban planning processes into megacities. The focus point in this method is to tackle the division and boiling-down of stakeholders in small cities and allocating their counterparts in a megacity as a whole. As part of the SURPRISE project[1] we will investigate the research question at hand by dissecting the processes taking place in the Ukrainian city of Vinnytsia and translating the learnings into the European Megacity of London.

To tackle this challenge, we will start by understanding participatory planning and the stakeholders that are involved. We will then move on to studying the two cities in question, mapping out their stakeholders and comparing them to one another. At the end, we will be deriving conclusions, highlighting what solutions megacities could adopt and what could be enhanced in small cities' planning.

2. Participatory Planning:

2.1 – Its definition and principles

Participatory planning signifies the involvement of all stakeholders and end-users of an area in its development plan. This method has been commonly used since the 1960s and has been referred to as a tool for sustainable development. In itself, participatory planning was the result of the shift from urban planning to strategic planning development. The main pillar of this method is the inclusion of different stakeholders in the decision-making process while urban planners play the role of mediators between the different stakeholders (Steinberg, 2005).

Researchers such as Jane Jacobs (Jacobs, 1961) and Sillak et al (Sillak et al., 2021) have studied how the involvement of citizens is related to the durability of the development. Jacobs has discussed this topic from the perspective of ownership. She explains in her book how citizens who are involved in the planning phase tend to protect said developments, e.g. against vandalizers in the case of small developments, and maintain the developments as a community. Sillak et al, amongst other researchers, have perceived the question of sustainability from a knowledge perspective. They have investigated participatory planning in topics such as energy

[1] The Sustainable Urban Planning and Resilient Reconstruction In Ukraine with Spatial Data Science (SURPRISE) project is conducted by HafenCity University in Hamburg, Germany. It focuses on creating a pathway for sustainable planning in Ukrainian cities.

planning and perceived the citizens as holders of first-hand experience on the place, and therefore, having communicated to them any missing knowledge and through working with the experts, they are guaranteed to communicate a development masterplan that will correspond to the needs of the place. This helps prevent the repetition of work through the modification and readaptation of development plans during the operational phase.

2.2. - Obstacles in participatory planning:

Whether in megacities or small towns, participatory planning forms consistently a challenge for modern-day planners. From the start of the process, the challenge rises in managing and engaging stakeholders into the conversation (Cohen et al., 2015). The risk is this challenge resulting in only having a small sample of the society joining the decision-making process. More often than not, if this issue is not resolved, the sample in itself is then over-dominated by city officials and authoritative figures (Innes and Booher, 2004).
The second challenge is apparent when discussing more technical sectors related to planning, such as energy topics, governance, and economic issues among others. In this scenario, it is the case that there is a gap between the knowledge required for an effective debate, and that which the general public possesses. In energy topics for example, this problem is caused due to the discrete nature of the field. From complicated energy bills, lack of available open-data on the topic, to the complex theories behind its planning process, many energy topics present a black box for the normal citizen (Crippa et al., 2021). This is to say that such lack of knowledge is not the citizen's fault. Therefore, the role of the mediator (i.e. urban planner) in the participatory process is to ensure a levelling of all involved stakeholders in terms of knowledge. This solution adds in turn to the timespan of the planning process as a whole. The latter issue of time, with its different scales is one of the challenges in every planning process as they are viewed by experts as lengthy add-ons to the development process. To tackle this issue, developers resolve to the inclusion of citizens in the last phase which is the reviewing of the resulting plan, leading to frustration from the citizens and lack of enthusiasm in joining the conversation for future projects. The cycle continues leading to disinterested citizens and an inactive citizenry. The last common challenge of participatory planning is the translation of plans made by citizens into effective plans that could be used on site. This issue related and adds to two of the previously mentioned challenges: the lengthening of the process due to reformation of the plans, and the overruling of some of the citizens additions resulting once again in their frustration.

2.3- Breakdown of participatory planning stakeholders in megacities vs cities:

Finding the solution to the first obstacle of the subsection above, starts with understanding the stakeholders necessary for participatory planning. In its essence and as presented by Jacobs in her book (Jacobs, 1961), participatory planning is only effective if all samples of the community take part, arguing that minorities are often overlooked although they bring a unique perspective to issues at hand. Other researchers, such as Siliak et al (Sillak et al., 2021) and Voorberg (Voorberg et al., 2015) have expanded on the need for experts to join the conversation in the technical development areas such as energy and traffic. Since our research is discussing the overarching concept of city developments, we have also taken into the work of researchers tackling large-scale issues of development, such as the work of Arlati et al in discussing the CLEVER Corridor project in Hamburg, Germany (Arlati et al., 2021). From merging the literature, we can divide the stakeholders into 4 different categories: Experts, planners, stakeholders with economic interest, Authorities.

- Experts:

Needed especially in complex technical issues, such as sustainability, water management, energy, traffic, among others. This category of holds deeper knowledge on the topic in question. Their presence helps with asking and answering case-specific questions which then bridges the gap between the resulting masterplan and what can be realized on site.

- Planners:
  Planners are first and foremost mediators of the conversation. Equipped with the right tools, they guide the different stakeholders to reach the wanted results. They are sometimes hired by the city directly or are part of development consultancy and planning offices that are responsible for the project.
- Authorities:
  Comprised of government representatives and city offices, the level of authoritative figures involved on a project depends to its scale and its implication on local politics
- Economic-Interest Stakeholders:
  This last category is for private entities including, among others, funding agencies, energy companies and real estate developers. Despite them not being present in all types of projects, their involvement provides a challenge as the ideals they are reflecting has economic interest in their centres instead of general-interest questions such as sustainable development. Their contribution, however, provides a good inside on the feasibility of suggested plans.

The citizens, despite being at the centre of the process, constitute several intersections with each of the 4 mentioned categories, as they are workers, experts, city officers as well as citizens. They are therefore encompassing all the categories, as shown in Figure 1 below.

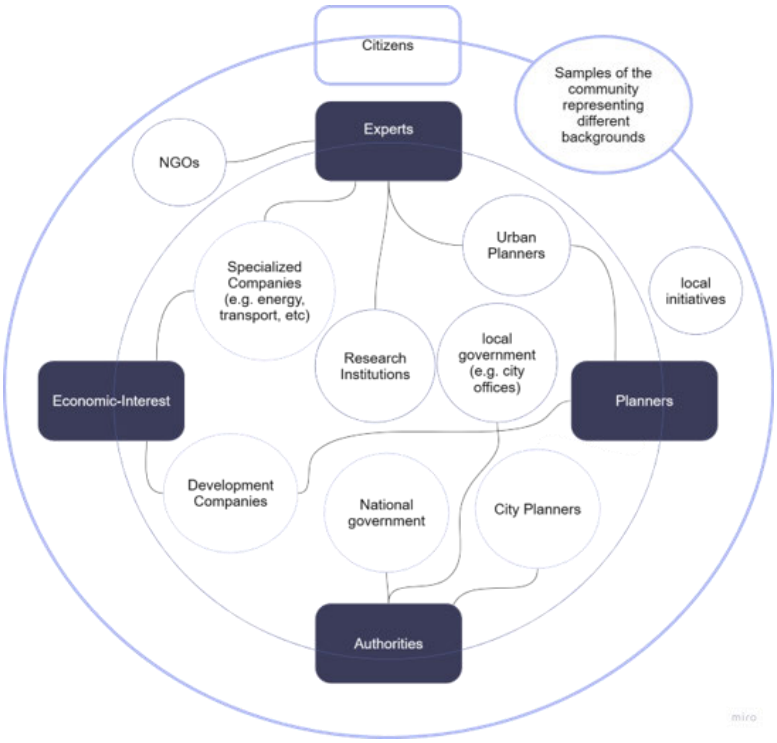

Figure 1: Categories of stakeholders in participatory planning

3 – Stakeholders distinction between cities and megacities

This stakeholder's breakdown, has been made in studying participatory planning in cities. The question rising here, is whether this categorization could be applicable to megacities in their large-scale development processes. In this section, we will study the 2 examples of Vinnytsia, Ukraine, and London, England to view what the above-mentioned categories translate into in the small city and how such learnings can be applied into the megacity.

3.1- Vinnytsia, Ukraine as a city example:

The first city of our study, is the city of Vinnytsia located in west-centre Ukraine. As Ukrainian administrative boundaries follow the hierarchy adopted from the traditional Soviet planning, the name Vinnytsia is given to both the Oblast and the Hromada as shown in Figure 2. With a population of over 350000 in the Hromada and 1.5M in the Oblast, the general population density of Vinnytsia amounts to 56.98/km² (City Population, 2022). As is the case in most post-Soviet cities, Vinnytsia currently faces a shift in identity where the current population is inclined to a more European image and development trends. A change is also obvious in its economy, where traditional industries are fading and their sources of income are shifting. Previously known as "Small Kyiv", the actors in Vinnytsia are conducting big movements to

reassign the city's urban identity. It is currently regarded as a power-player in its local region and in Ukraine (Melnychuk and Gnatiuk, 2019)

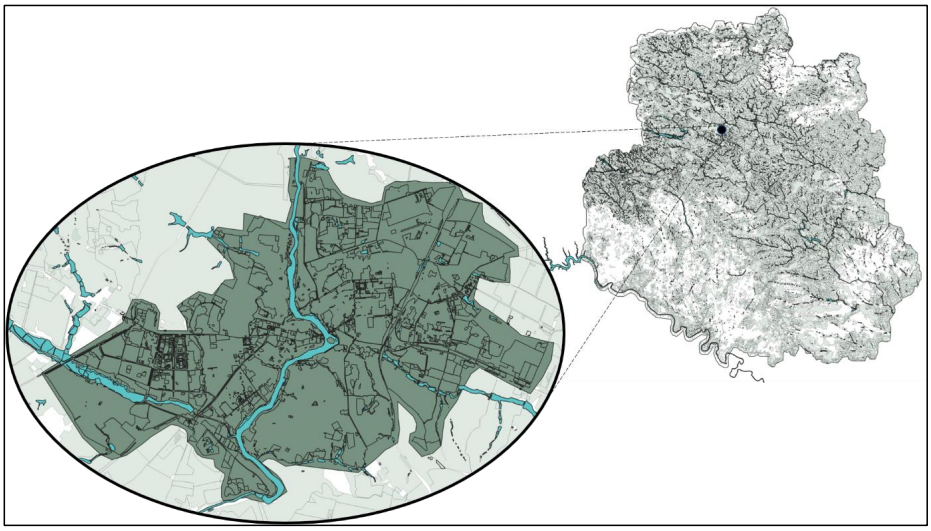

Figure 2 Map showing the position of the Hromada Vinnytsia in the Oblast of Vinnytsia using OpenStreetMap data

3.2 – Stakeholders in Vinnytsia, Ukraine

Currently in a wake of development, the Ukrainian city is following a plan to derive a more sustainable development path for its citizens. One of the pillars of which is the planned increased involvement of citizens in decision-making. To carry this task, and in the frame of work of the SURPRISE project, the degree of involvement of different stakeholders has been identified through conversations held with the local representatives. As explained in Figure 3 below, some stakeholders in Ukraine contribute only at the Oblast level. Translated into Western European planning definition, an Oblast could signify a municipality while the Hromada is the city. In the context of Vinnytsia, it could be regarded as an Oblast encompassing a town, prompting two different layers of intervention depending on the project. One main learning from this division, is the stakeholders' categories themselves do not differ based on the development scale, but rather stakeholders themselves are distributed throughout the different scales. For example, authorities are needed at both scales, however the level of jurisdiction needed is the variable.

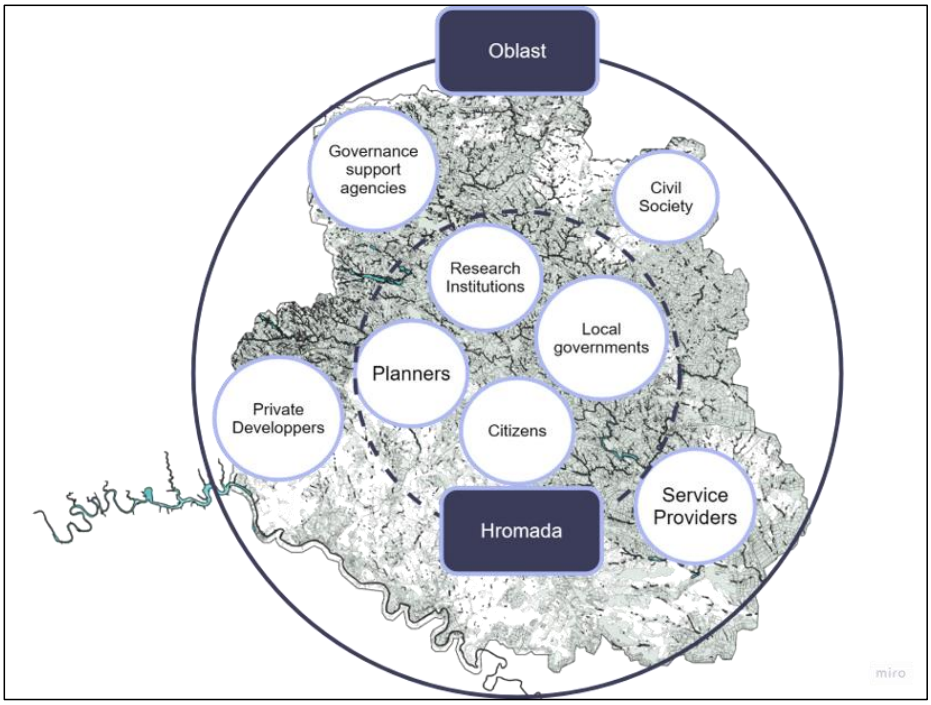

Figure 3 Distribution of participatory planning stakeholders between the Oblast and the Hromadas based on conversations with local actors in the frame of the SURPRISE Project

3.3- The Greater London area as an example of Megacity:

England's London is one of the two megacities of Western Europe, the other one being Paris, France. In 2024, London is house to a population of 9.7 million. The megacity encompasses the greater London area which has the city of London at its centre, forming only 2.9 sq.KM out of the 1569 sq.Km of the Greater London Area. London (referring to the greater London area in this research) has a population density of 5596 residents per sq.Km. (World Population Review, 2024). It encompasses an exceedingly diverse population, with 41% of its population formed by immigrants. With a very rich history, London is currently a global economic hub. As a megacity, London faces challenges such as traffic congestion, housing affordability, air pollution, and income inequality (Wenzel et al., 2007). Urban planning and sustainability initiatives are being implemented to address these issues. Although London is technically not a coastal city, it is often studied as a coastal megacity thanks to the Thames river crossing the city, connecting it to the North Sea, and its very close proximity to the coast.

3.4 – Comparison between stakeholders of Vinnytsia and London:

To understand the development of megacities, researchers have distinguished between the megacities in the western and eastern parts of the world. The development of the megacity of London has been studied as shown in Figure 4 (Li et al., 2019). A trend that has been spotted amongst them, is the tackling of problems through construction of satellite cities to fulfil the needs of the residents. The question we are investigating however is focused on a process encompassing the megacity as a whole.
Following the blueprint of the city of Vinnytsia, the inclusion of all stakeholders' categories remains a defying aspect to achieving effective participatory planning. To understand the difference between the two different city types, we resolve to extracting the stakeholder examples from Vinnytsia and assigning their counterparts in London as seen in Table 1.

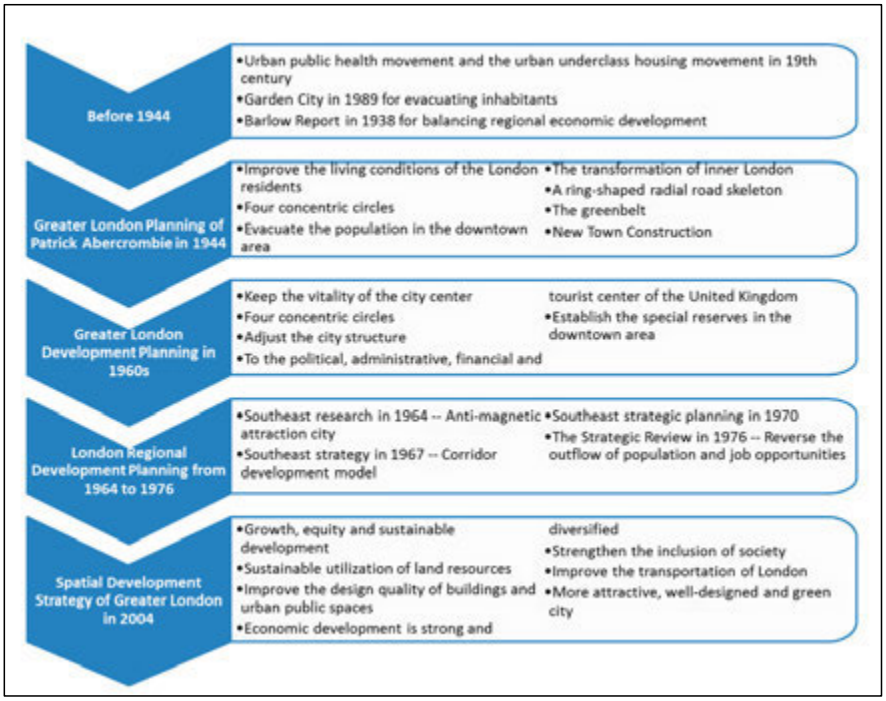

Figure 4 Development history of the Greater London area - Extract from Li et al (2019)

One stakeholder category that stands out as differing greatly between the megacity London and the city of Vinnytsia, is the "Authorities" category. In the example of Vinnytsia, Ukraine, the authorities are divided into local authorities and central government (Vinnytsia City Council, 2024). Their bodies are divided such as:

- Local authorities:
  - Mayor's office
  - City Council: includes several deputy mayors responsible for the different sectors, such as the deputy mayor of urban mobility and transport.
  - Executive bodies of the city council: working under control of the city council

- Central government:

The central government in Ukraine is divided into several ministries that are involved to different degrees in urban planning development. Some ministries such as Ministry of Restoration and the Ministry of Infrastructure, are conducting more fast-paced work in the domain of sustainable development. The involvement of ministries in participatory planning can only happen at the oblast level.

In the city of London, and as the case in metropoles and large cities, the city is divided into several boroughs, signifying the different neighbourhoods with their different uses. The division of authorities and their inclusion in planning processes in London are as follow (London Councils, 2022):

- The boroughs: they manage the neighbourhoods, and are in charge of planning applications, maintain the roads and deliver environmental and leisure services. They can be regarded as a union of the different neighbourhoods.
- The city of London: works on a smaller scale than the boroughs but is responsible for the communication of the image of London to the outside world.
- Greater London Authority: includes the mayor and is the authority responsible for the overall development vision of the megacity. We can understand from there their indispensability in the participatory planning process.
- Local government association: representing the council on the national level. As it deals with issues concerning England as a whole, its presence in the development process can be referred to at the later phases.

3.5 – Process differences between cities and megacities:

Taking the case of Vinnytsia as an example, we can see how the Hromada involved less stakeholders in its process than the Oblast. This is however justified by the character of these two different spatial contexts, where each Hromada comprises one centre, specific communal characteristics, and specific challenges. This scenario is different when breaking a megacity like London into boroughs. Despite the different boroughs facing different sets of challenges, their impacts on one another are inevitable. The points elaborated upon provide examples of the aspects that result in the difference of the processes between the cities and megacities.

(a) Financial centres:

A city centre is easily allocated on the map of a small city. In the case of Vinnytsia, tackling issues regarding the centre of the city can be done individually by each Hromada, meaning the participatory process can be divided by Hromada, with a bigger set of contributions to tackle the Oblast as a whole. The city of London, however, not estranged to other megacities around the world, comprises of several financial centres (Roberts, 2008). Such centres are visited daily by inter-city commuters. These are residents of the city of London, who live in a residential borough but work in one of the many financial centres. The further development of London's industrial district for example cannot be carried without the inclusion of neighbouring citizens that are not part of this specific district but are influenced by its impact on pollution and on the traffic condition among others.

(b) Environmental issues:

Environmental sustainability is a subject controlled first and foremost by local developments. In the megacity, the degree of contributions of different neighbourhoods to the issue at hand

varies. As explained in previous sections, such issues are mostly tackled by further development of the megacity with minimum contributions to existing constructions.

Stakeholder	**Vinnytsia (Hromada)**	**London**
Governments	- City offices - Local governments for Oblast - Central government ministries	- Wards - The boroughs - The city of London - Greater London Authority - Local government association - Transport for London
Private Entities	- Private businesses	- Private businesses
Research Institutes	- Research Institutes in the Hromada - Research Institutes in the Oblast - International Partners - Institute of development studies as a main player	- Research Institutes and university all over the Megacity act independent of their location - International experts
City Planners	- Government assigned planners (Oblast) - Private planning offices	- The mayor's planning consultants (London.gov.uk) - Private planning offices
NGOs	- Working together with research institutes on development topics - Shift in focus into post-war and post-soviet developments - International NGOs with presence Vinnytsia	- A big focus of NGOs is the raising of the voice of minorities - A focus on human rights issues on the local and international level

(c) Energy issues:

In Europe, and with the provided legislations for energy communities, small cities residents have proven to have more ownership over the energy discourse in their cities. Energy communities, defined as stakeholders of energy in the urban setting, are more prominent in cities where ownerships of houses are more common than apartment buildings. This provides cities with the characteristic of having residents with more knowledge and involvement in such a technical topic than a megacity. This solves, to a certain degree, the knowledge issue prominent in participatory planning.

(d) Community engagement:

The sense of community in the megacity is far from non-existent. It is however more obvious on small scales, such as a sense of community in the neighbourhoods themselves. Small city communities possess feelings of ownership over the city as a whole. This makes the inclusion of citizens an easier task.

Table 1: assigning the stakeholders to the contexts of Vinnytsia and London

4 - Proposed Stakeholders involvement strategy in megacities

The challenge at hand is understanding how megacities can conduct an effective participation process on its large scale. Studying the two examples at hand, it can be seen how the involvement of all stakeholders' categories is easier to be achieved in smaller cities than in megacities. To achieve the up-scaling of the process without losing its integrity, a proposed solution can be the division of the process through the timeline rather than spatially as shown in the figure 5 below. This solution is proposed to tackled the obstacles elaborated upon in section 3.

As opposed to the usual spatial division of stakeholders, the timeline division attempts the inclusion of all categories of stakeholders concerned with the megacity. It solves the issue of the enlarged scale by dividing the process into 2 phases. In the first phase, directly-impacted stakeholders are included to have a first-hand discussion of the needs and problems of the development location. The first phase would include the definition of the problem at hand, the co-creation of a solution through collaborative work with the stakeholders, and the reduction of the knowledge gap on the topic which is easier to achieve with the smaller group.

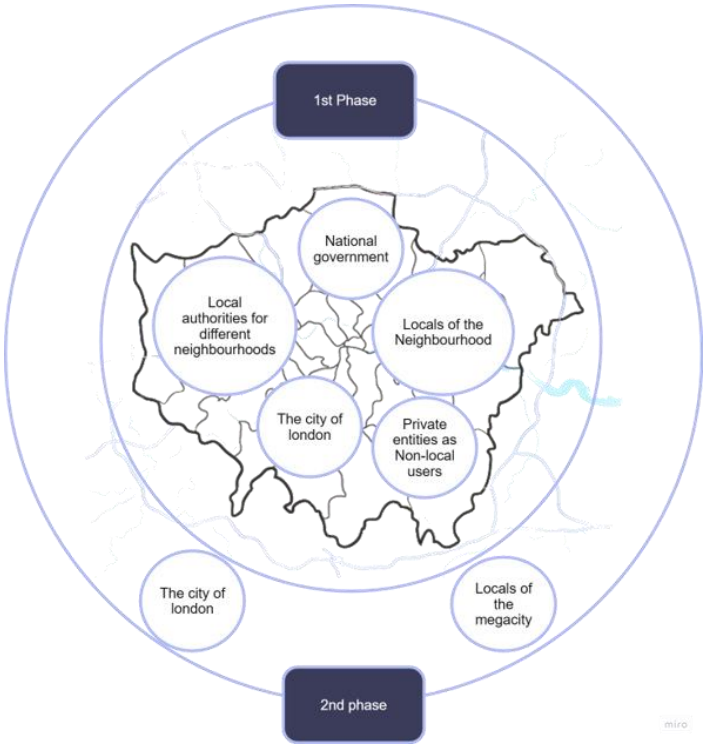

Figure 5 Proposed division of stakeholders through the development timeline of the megacity of London

Whereas the second phase involves larger contributors to the decision-making. It assures the acknowledgement of the impact of the development on a larger scale, be it a larger radius of neighbourhoods or the megacity as a whole. The involvement of larger-scale authorities in the second phase ensures the feasibility assessment of the development and prevents the overshadowing of the voices of local communities that are more involved during the first phase.

5 - Digital tools as a future solution

Smart cities have been an expanding concept in cities regardless of their scale. They are regarded as a solution to a big part of the sustainability question. One of the areas in which this is achieved is the introduction of digital tools for sustainable planning, including digital tools for participatory planning. Democracies around the world are facing increasing demands from citizens to be included in decision-making processes, thus, many political systems have responded by opening up to the public by incorporation more participatory elements. In the context of the deliberative democracy becoming a focal point in political science, a communicative turn in planning has emerged that emphasises more intensive and widespread citizen participation (Friedman 1987; Healey 1992; Healey 1997; Peric´ and Miljuš 2017 in Timotijevic, et al. 2024). The application of technical tools has to be analysed in the context of the different participatory procedures and the respective institutional contexts (Silva, Carlos Nunes, Herbert Kubicek, 2010).

5.1 – Implications of digital participation technologies in urban planning

Digital participation technologies have the potential to reshape urban planning and development practice, especially in enabling constructive participation in early pre-design phases thus allowing for changes on a feasible basis (Münster et al., 2017). Some implications of introducing digital participation technologies in urban planning include the possibility to utilise a wider knowledge base through crowdsourcing knowledge compared to conventional design practices and to tap into the creativity and experience of citizen expertise. In addition, design sentiment analysis, interactive and communication-oriented planning process allowing direct exchange between stakeholders and agile processes are all advantages of integration of digital participation technologies (Münster et al., 2017).

5.2 – Challenges of digital participation technologies in urban planning

Some key challenges were identified by Münster et al., 2017 for the introduction of digital participation technologies in urban planning. These challenges, as illustrated in Fig. 6, consist of:

- Few users – It is often a challenge to find a sufficient number of users due to lack of information on the process, barriers in culture or accessibility of issues.
- Wrong users – Due to self-selection biases, participants choosing to take part in an urban planning process may rarely represent a majority of inhabitants

- Communication issues – Prior thoughts, beliefs and feelings may influence participants, including framing effects such as presentation formats, techniques or media channels and the level of presented problem and objectives
- Process deficits – The lack of transparency, inclusion and fairness could result in disagreement as a result of the process leading to poor decisions

Initiatives have been carried out in both of our study cities to accelerate their development into smart cities and their use of digital tools to ensure better inclusion of the public in participatory planning. In this regard, the movement towards such tools depends greatly on the political and economic contexts and needs to consider the challenges of integrating digital participatory tools in planning processes. Nevertheless, the methods to conduct this shift can be learned from set examples.

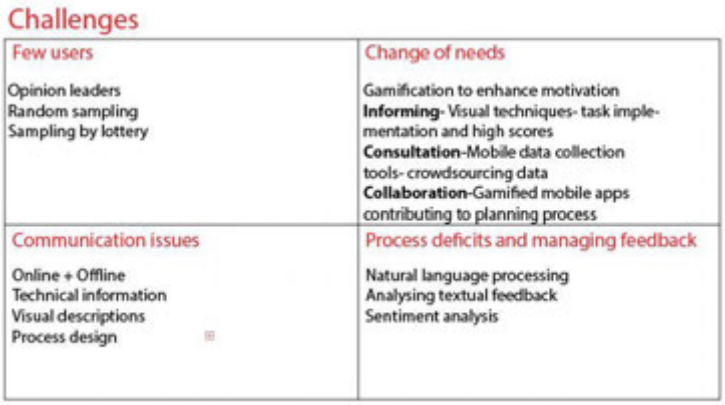

Figure 6 Key challenges and promising approaches adapted from Münster et al.

5 - Conclusion:

This paper has revisited the planning method that is participatory planning from the perspective of megacities, by studying the European city of Vinnytsia and the megacity of London. Through the analysis, differences were extracted between the two cities in respect first and foremost to stakeholders, but also with regard to the general challenges faced by the two cases when it comes to sustainable development. It is important to note that some factors were not considered in this analysis, as is the case that, despite the inclusion of the city governance structures in both scenarios, some political constraints still do exist that could limit the participation of some of the mentioned stakeholders. A number of political and socio-economic differences also exist between the two cities, that affect highly the public perception of such exercises. The goal of the study remains to showcase the possibility to derive learnings from cities and to adapt them into the cases of megacities instead of regarding megacities as islands in urban planning learnings.

In the case of Vinnytsia, it was concluded that the inclusion of stakeholders, namely authoritative figures, is dependent on the scale of the development. This was then explained as a symptom of the scale of the city (mentioned as a Hromada) and its individuality in the municipality (or the Oblast). This individuality is shared by all small cities, and result in the lack of justification for the inclusion of residents and stakeholders from outside the city itself if the development is of small scale. Different actors are then called upon for Oblast development projects. These can share similar categories as those included for Hromada development but are of different specialities and interests.

While studying the city of London, it was noted how the development of satellite cities followed the trend set by western megacities. It also corresponds to the pattern of megacities to fulfil their residents needs through further development. We addressed therefore the challenge of attempting to regard the megacity as a unified entity during the participatory planning process. The blueprint derived from Ukraine was therefore altered to a different concept which is the distribution of stakeholders through the phases of the project, to allow for a more inclusive process. Such alterations allow the carrying of successful processes and their exchange between different cities.

This to say, that although cities cannot copy each other’s processes, there is some learning available despite differences in the scale. Understanding the history of city developments and the reasoning behind the methods used in conducting urban planning are a mandatory step to their re-adaptation. This could however only be achieved when transparency exists in the planning process, which allows for a more in-depth look on the conditions in which planning decisions were made.

Lastly, more research needs to be carried out to study the tools used for conducting participatory processes. The introduction of digital tools for participatory planning, which provide a remarkable solution for large-scale citizens inclusion as is the case for megacities. It provided a way to conduct the process in a time-efficient manner and while despite the different circumstances. Digital citizen involvement however should be studied more to overcome its shortcomings, and especially to assure the process being conducted fairly and democratically.

Acknowledgment:

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The role of urban planning in perceived accessibility to public transport

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Abstract
The integration of urban and transport planning is strongly supported in the literature, and the transit stop is an element common to both fields. Stops provide accessibility, which can be measured objectively (section 1) or evaluated from the user's perspective (section 2). This paper reads the topic by exploring the factors that influence perceived accessibility in the literature (section 3), with particular attention to the elements included in the domain of urban planning, like places of residence and urban design (section 4). Results (section 5) show some inconsistencies about the role of spatial factors in shaping accessibility perceptions, as well as a lack of relevance of the issue of transit stops. Therefore, some new approaches are suggested to fill the gaps in future research.

Keywords: Urban planning, transport planning, perceived accessibility, public transport, transit stop

1. Accessibility as a common theme for urban and transport planning
The integration of urban and transport planning is a concept that has been well-documented in academic literature (Bertolini, le Clercq and Kapoen, 2005). This integration lays the foundations for sustainable city planning (Barbarossa and La Greca, 2014) by providing viable alternatives to car transport (Nigro, Bertolini and Moccia, 2019). Such an approach can take different forms, from micro-scale actions such as community involvement in traffic calming measures (Boglietti and Tiboni, 2022) to transit-oriented development (TOD) (for a review see Taki *et al.*, 2017). The term TOD was first coined by Peter Calthorpe (1993) to describe a "mixed-use community that encourages people to live near transit services and to decrease their dependence on driving." However, citizens can use these services only in presence of an element of interchange between the place of activities and the service itself. This element is the transit stop, which varies according to the mode of transport (e.g. bus stop, metro station, train station). In the context of a transport network that resemble a mesh of arcs and nodes, stations serve as nodes. The transit stop plays a crucial role both in urban and transport planning realms. Its positioning and design considerations encompass transport aspects (e.g., supply and demand) and urban planning elements (e.g., land use) (Tira, 2011). Consequently, the stop serves as a critical interface between these two domains, facilitating access not only to public transport (PT) systems but also to nearby activities. Accessibility emerges as a key conceptual

focus for this integration, bridging transport attributes (e.g., speed and travel costs) with the land use system (e.g., density and functional mix) (Straatemeier and Bertolini, 2020).

1.1 Accessibility: definitions

The term “accessibility” may encompass various interpretations. A wide variety of definitions of accessibility can be found in the literature, but there are also many commonalities. One widely cited definition defines accessibility as “the extent to which land use and transportation systems allow activities or destinations to be reached through combination of transportation modes” (Geurs and Ritsema Van Eck, 2001). This sentence recalls the interaction models between land use and mobility (Wegener and Fuerst, 1999) and between accessibility and land use (Hansen, 1959). According to the latter, accessibility is the ease with which places (or activities) can be reached in relation to one or more starting points in a given space. A definition that focuses on mobility sees accessibility as “the extent to which the land-use and transport systems enable individuals to reach activities by a (combination of) transport mode(s)” (Geurs and Van Wee, 2004 p. 2). However, Handy (2002) emphasised that accessibility is the measure of interaction potential, distinguishing that term from “mobility”, which is instead the ability to move or to be moved. In summary, accessibility can be defined as the ease of reaching a destination (Litman, 2011). Some common points emerge from this overview, which were established by Geurs and Van Wee (2004) as the four theoretical components of accessibility: transport network (supply), land use (supply, demand), temporal factors (demand), and individual characteristics (demand). Given the importance played by transport and mobility networks, PT can thus have a fundamental role in ensuring sustainable accessibility. Referring to accessibility and PT, can be interpreted as access to the PT system itself, or as access to the destination reached by the systems, or both (Olsson, Friman and Lättman, 2021). Accessibility to PT is becoming increasingly important in the design and evaluation of transport systems (Saif, Zefreh and Torok, 2018).

1.2 Accessibility: measures

Given the importance of accessibility, it is clear that the measurement of this concept is a fundamental issue. The traditional assessment methods are based on mathematical models and tools known as accessibility instruments (a collection of which can be found in Hull, Silva and Bertolini (2012)), which, however, encounter some limitations in the literature. Firstly, despite their usefulness, low use is detected, due to several barriers, namely political (focus on mobility instead of accessibility), organisational (lack of integration between transport and mobility planning), and institutional (lack of institutional framework) (Silva *et al.*, 2017). Secondly, these tools make aggregate measurements, seeing people as homogeneous, without considering individual capabilities (Pereira *et al.*, 2017). In fact, they evaluate objective measures such as (average) travel time and distance, not capturing the perceived accessibility of certain individuals or groups of people (Lättman, Friman and Olsson, 2016). Indeed, if travel time does not accurately reflect lived reality, spatial accessibility measures can hide access inequalities (Curl, 2018). Notably, such limit can also be considered as a limit to the concept of the "city of x minutes", as the actual travel times to reach a specific service can vary depending on the individual. These considerations have led to a growing interest in the user's point of view, and in the concept of "perceived accessibility". Given the importance that PT stops play in providing accessibility, both in urban and transport planning, the current paper reviews how the issue has been treated in research about perceived accessibility, with particular attention to the elements that can be included in the domain of urban planning.

2. Perceived accessibility: accessibility by the citizen's perspective

Citizen's perspective is not a brand-new subject. A paradigm shift has been called for by Handy and Niemeier (1997), who emphasised how accessibility must be based on how individuals perceive their surroundings and evaluate the aspects that are most important to them. Although various definitions of accessibility centre on transportation (see section 1), people-focused definitions do not lack. For instance, Kwan (1998) defined accessibility as "a property of people revealing how easily an individual can reach activity locations" (p. 192), while Bertolini (1999), describing "accessible areas", referred to places in which many people arrive and can perform different activities. Burgio and Maritano (2012) defined accessibility as "the capacity to access goods and services by a person" (p. 2), while Curl, Nelson and Anable (2015) referred to "the ability for people to reach destinations" (p. 87). These definitions, together, focus on people's ability to satisfy their needs (Huisman, 2005). Such concept has been expressed in various way in literature. Jehle *et al.*, (2022) identified four: "Experienced Accessibility" (Chorus and De Jong, 2011); "Self-Reported Accessibility" (Curl, Nelson and Anable, 2015; Ryan and Pereira, 2021); "Subjective Accessibility" (Damurski, Pluta and Zipser, 2020), "Perceived Accessibility". As the latter is the most used term (i.e. Lättman, Friman and Olsson, 2016; Ryan et al, 2016; Pot, Van Wee and Tillema, 2021), it will be used in this paper via the abbreviation PA. If centred on PT, PA can be referred as "how easy it is to live a satisfactory life using the transport system" (Lättman, Friman and Olsson, 2016, p. 36); while a broader definition can be "how individuals or groups of individuals understand or experience their own accessibility" (Jamei *et al.*, 2022, p. 4).

2.1 Perceived accessibility: implicit references

Although, as seen, the topic has been considered relevant for at least fifteen years, 85% of the research was carried out only in the last 10 years (ibidem). Research investigating PA can address the topic implicitly or explicitly. For instance, Delbosc and Currie (2011), investigated "transport disadvantage (…) measured using subjective, self-reported measurements" (p. 557). That is, how people report (and therefore perceive) the transport supply (and thus, the accessibility provided by it) of their area of residence in comparison with other regions. Additional implicit mentions are in research about the propensity to use specific transport modes (Roy and Basu, 2020; Raghuram Kadali, 2021), given that the intention of use PT is in fact directly linked to the accessibility of the system itself (Guglielmetti Mugion *et al.*, 2018). A greater propensity to use PT may imply a greater propensity to walk to the PT stop, thus further implicit references to PA may be found in research which compare the standard catchment areas of PT stops versus the ones perceived by the users (El-Geneidy, Grimsud and Wasfi, 2014). Broadening the concept of PA to the act of walking, implicit mentions of PA can be also traced back in the topic of perceived walkability (for a review, see De Vos *et al.*, 2023).

2.2 Perceived accessibility: explicit references

Given that PA research aims to address how accessibility is perceived by the users, explicit research on PA often focused on specific categories of citizens, namely weak users, including the elderly (i.e. Hess, 2012; Vitman-Schorr, Ryan and Pereira, 2021); women (Al-Rashid et al., 2021), disabled people (Sze and Christensen, 2017), reduced mobility people (Andrade et al., 2024) and minority (Chen, Wang and Wu, 2022). Another line of research aims to recognize the gaps between measured accessibility and perceived accessibility, having found the existence of such a gap (i.e. Curl, Nelson and Anable, 2015;). However, even research focused on PA

attempts in some way to describe the phenomenon by measuring it, loyal to Peter Drucke's the statement that "only what gets measured, gets managed" (Klaus, 2015, p.81). For such purpose, the most used measurement units are perceived travel time (i.e. Börjesson, 2012; Tiznado-Aitken *et al.*, 2020; Ryan and Pereira, 2021) and abstract indexes of PA such as the PAC (Perceived Accessibility Scale) developed by Lättman, Olsson and Friman (2016). However, it is possible to find additional methods in literature. For instance, some research describe PA through proxies like perceived distance (Hess, 2012) perceived utility (Coppola and Silvestri, 2018); probability to face a certain barrier (Sundling *et al.*, 2013); perceived Level of Service (LOS) (Campisi *et al.*, 2022). Such approaches to study PA are quantitative, but some exceptions emerge. In Andrade et al. (2024), the material collected from the interviews was analysed obtaining first-level categories and then organized by making a narrative description. Tiznado-Aitken *et al.*, (2020) applied a convergent mixed approach: a quantitative analysis, which resulted in accessibility maps based on origin/destination matrices, was accompanied by focus groups, the results of which were analysed with word clouds. Curl (2013) chose a qualitative approach, with extensive use of interviews and cognitive maps drawn by the interviewees.

2.3 Perceived accessibility and public transport

Since the strong relationship between accessibility and transportation (see section 1), unsurprisingly PT play a significant role in research about PA, both in PA *through* the PT or *towards* the PT. For instance, Lättman, Friman and Olsson (2016) asked to their surveyee their satisfaction degreed in reaching daily activities with PT, while Jehle *et al.* (2022) asked information about how train users reach train stations. Otherwise, if the PT is not the focus of the study, transportation in broader term play a role in research. Friman, Lättman and Olsson (2020) looked over PA to carpooling, while in Lättman, Friman and Olsson (2020), car use restriction effects on PA has been investigated. Vreeswijk *et al (*2014) explored route selections linked to the role of environment demonstrating that people choose their routes based on subjective considerations, like preferring linear or already known routes, even if longer.

3. Elements that influence perceived accessibility to public transport

Factors which influence PA can be clustered into four typologies: sociodemographic, transport related, personal, spatial. Research conducted so far demonstrate a clear correlation between PA and perceived safety and security of PT (i.e. Jones and Lucas, 2012; Lättman, Olsson and Friman, 2018; M. Friman, Lättman and Olsson, 2020), as well as between PA and perceived quality of PT (i.e. Lättman, Friman and Olsson, 2016; M. Friman, Lättman and Olsson, 2020; Lukina *et al.*, 2023). A positive correlation has also been demonstrated with personal aspects such as: attitude towards PT (van der Vlugt, Curl and Wittowsky, 2019; Pot, Van Wee and Tillema, 2021; van der Vlugt, Curl and Scheiner, 2022); the social narrative towards the different PT systems (Tiznado-Aitken *et al.*, 2020); emotions and memories (Curl, 2013); environmental consciousness (Cheng and Chen, 2015).

3.1 Sociodemographic factors

Some sociodemographic conditions have shown a certain correlation to PA, like the existence of disability conditions (i.e. Curl, 2018; Márquez, Poveda and Vega, 2019; Campisi *et al.*, 2022). Other factors, instead, show contrasting results. For example, some studies demonstrate that an advanced age is associated with a worsening of PA (i.e. Ryan *et al.*, 2016; Lättman *et al.*, 2019; Liu *et al.*, 2021). This result is not surprising, especially in studies where PA is

measured in perceived time and perceived distance (like in Curl, 2018 and Tiznado-Aitken *et al.*, 2020), as older people walk slower than youth. Yet, in some studies (i.e. Cheng and Chen, 2015; Lättman, Friman and Olsson, 2016; Campisi *et al.*, 2022) even young people perceive worse PA, while other studies do not see a correlation between PA and age (i.e. Ryan *et al.*, 2016; Lättman, Olsson and Friman, 2018; van der Vlugt, Curl and Wittowsky, 2019).

3.2 Spatial factors

People are guided by their perceptions, and perceptions of the environment shape mobility decisions representing the "lived reality" of accessibility (Van der Gluct ey al., 2022, p.1). Therefore, it could be expected that spatial context plays a fundamental role on PA. When referring to PA to PT, some research investigate the context through the concept of "barriers" (i.e. Sundling *et al.*, 2013). By "barriers to PT" are generally meant all those elements that impact accessibility to PT (Olsson, Friman and Lättman, 2021). They can be material (geographical location, location of stops, weather conditions) and immaterial (insecurity) (Tiznado-Aitken *et al.*, 2020). Van der Gluct et al., (2019) also stated that perceptions are influenced by aspects such as safety, atmosphere, a barrier-free environment. Since this review focuses on the spatial variables, a more comprehensive explanation is provided in the next section.

4. Spatial factors and their influence on perceived accessibility

Effects of spatial variables on PA can been clustered into three categories: perceived distance as a proxy of PA; place of residence; urban design. The first group include all the studies that focused on the concept of perceived distance, which in section 2 was described as one of the proxies for measuring PA. In fact, if perceived distances are shorter than actual ones, travellers can be encouraged to take trips towards destination, meaning that the destination is perceived as more accessible. In addition, even if studies often do not explicitly focus on PA, the approaches they use provide key findings regarding the influence of spatial variables on PA. The second group includes studies that have focused on differences between geographical areas (parts of cities, different cities, different types of settlements) while the third group contains research on the role of urban design elements such as sidewalks, furniture and lighting.

4.1 Perceived distance as proxy of perceived accessibility

Some research does not explicitly mention PA but investigates the gap between real distances and perceived distances. This approach can be particularly useful for determining the effective catchment area of PT stops. The conventional used radii (e.g. 400 m. for bus, 800 m. for metro) may in fact not correctly reflect the distances that people are willing to travel to reach a station. Therefore, a perceived catchment area larger than a traditional one may in fact indicate greater perceived accessibility to PT stops itself. Such approach has been carried out by El-Geneidy, Grimsud and Wasfi (2014), developing a methodology taking into account transportation, socio-demographic and neighbourhood variables. About the last category, they found that network density (e.g. number of nodes in the road graph) increased the service area, while density and vicinity to downtown decreased it. Other studies have been carried out by O'Sullivan and Morrall (1996) and by Sarker, Mailer and Sikder (2019), both demonstrating that stops in urban areas have a shorter range of action than those in extra-urban areas. Hess (2012) also investigated walking distance to PT stop, demonstrating that characteristics of built environment like density and network intersections have a strong impact in encouraging people

to walk further to reach the transit stop. Krizek, Horning and El-Geneidy, (2012) linked perceived distance to place of residence, showing that urban residents underestimate distances, while suburban residents underestimate them.

4.2 Place of residence

Interactions between spatial factors and PA has been, indeed, investigated through the urban/extraurban dichotomy. Such approach has been used by Curl, Nelson and Anable (2015): aiming at comparing objective and subjective measures of accessibility in the UK, they performed a GIS-based research using national census areas as study areas. The result showed that in urban areas, PA is higher than measured accessibility, while in rural areas the opposite situation occurs. Such result is consistent with Olsson, Friman and Lättman (2021) findings, who demonstrate that who live in urban areas perceive double accessibility than those who live outside. However, Vitman-Schorr, Ayalon and Khalaila (2019) obtained opposite results. They explored the direct and indirect effects of settlement type on PA, comparing urban and rural (kibbutzim) locations in Israel. They found a higher PA in rural areas due to higher security perception and more social participation, in turn due to a greater "sense of place" among the inhabitants. This suggests that the sense of belonging of particular communities such as Israeli kibbutzim may be a powerful determinant of perceptions of accessibility. Centre/periphery is another dichotomy that has been explored, for instance, by Lukina *et al.* (2021), who conducted a survey aimed to investigate possible links between PA and place of residence in Moscow, Russia. As reference study area, they used the 12 districts into which the Russian capital is divided. The results show that, contrary to what was expected, PA was not higher in the city centre district. Similar results were found by Chen, Wang and Wu (2022), who investigated role of built environment in perception among three disadvantage population (minority, poverty, elderly) in South Carolina, USA. Their analysis indicated that high and low values of PA can be found in both central and rural areas. However, the results change if the mode of transport is differentiated. Ceccato *et al*. (2020) compared perceived and measured accessibility in Turin, Italy, comparing cars and PT and visualizing data on a map. They pointed out that PA by car is greater in the periphery, while public transport PA is greater in the centre and along the metro corridors. The result confirms the strong role of the PT supply. Studies specifically focused on studying differences between neighbourhoods have not highlighted significant findings, as stated by Lättman, Olsson and Friman (2018): they compared PA between different residential areas of Malmö, Sweden, without finding significant differences between areas. Liu *et al.* (2021) conducted a survey in Kumning, China, investigating the relationship between the ease of using smartphone-based services, perceived accessibility, and perceived transport equity during COVID-19. Sociodemographic variables like age and car ownership showed a significant correlation, while place of residence no. These outcomes may be the result of a residential sorting mechanism, in which people tend to choose, as a place of residence, environments in which they can meet their preferences, as proposed by Pot, Koster and Tillema (2023). In fact, in their research focused on Dutch rural areas, they found that, across different regions, PA is five times less variable than measured accessibility. On the other hand, significant effects with place of residence were found by Tiznado-Aitken, Muñoz and Hurtubia (2021). The results of their survey in Santiago de Chile showed that distribution of opportunities is positively correlated to PA to PT. In fact, residents of areas with fewer opportunities experience lower levels of accessibility, having to make longer and less comfortable journeys. Other significant results can be found in Tiznado-Aitken *et al.* (2020). Their survey, always in Santiago de Chile demonstrates the a big impact of isolation: those who live in isolated areas

prefer to use the car or a combination of car and metro, rather than walking. Areas with few services or little traffic are in fact perceived as dangerous to cross. They also argue that a safe, friendly and attractive environment can therefore encourage PA. This argument leads to the next topic covered in the paper, that of urban design.

4.3 Urban design

Numerous studies highlight how urban design elements influence perceived accessibility. Security of built space has been investigated by Börjesson (2012) who, in order to assess the elements that contribute to security, focused on how secure people felt in urban environments when walking. Findings show that security is a significant component to PA to PT, particularly for women. This result is consistent with Lotfi and Koohsari (2009), who analysed PA to neighbourhood activities in two different districts of Teheran, finding that fear and crime have strong impacts to PA. Another element that has a positive impact on PA is directness, i.e. how direct a path from A to B is. Vreeswijk *et al.* (2014) demonstrated that the perception of travel time depends on road hierarchy and route directivity, as the most direct routes and those higher in the hierarchy were perceived as relatively fast. Curl (2013) identified some factors which links environment and the sphere of emotions and sensations, such as pleasantness and beautifulness, finding positive correlation with PA. On the other hand, complexity of urban space has a negative influence, as due to a more complex landscape, travellers remember more elements of their route, leading them to perceive longer distances (Krizek, Horning and El-Geneidy, 2012). Notably, according to Jehle *et al.* (2022), a "stimulating" surroundings has no effect in encouraging people to walk. However, an important role is played by the quality of pavements and pedestrian paths,

Reference	**Spatial factor**	**Correlation with PA**
El-Geneidy, Grimsud and Wasfi, 2014; Hess, 2012 O'Sullivan and Morrall, 1996; Sarker, Mailer and Sikder 2019	Perceived distance from PT stops (urban areas)	Negative
Curl, Nelson and Anable, 2015; Olsson, Friman and Lättman, 2021	Place of residence (urban areas)	Positive
Vitman-Schorr, Ayalon and Khalaila, 2019	Place of residence (non-urban areas)	Negative
Chen, Wang and Wu, 2022; Lättman, Olsson and Friman, 2018; Liu et al., 2021 Lukina et al., 2021;	Place of residence	None
Tiznado-Aitken et al., 2020;	Place of residence	Positive
Tiznado-Aitken, Muñoz and Hurtubia, 2021	Place of residence	Positive

Börjesson, 2012; Lotfi and Koohsari, 2009	Urban design (Public space security)	Positive
Jehle et al., 2022 Vreeswijk et al., 2014;	Urban design (Path directness)	Positive
Curl, 2013	Urban design (Emotions and sensation)	Positive
Jehle et al., 2022; Krizek, Horning and El-Geneidy, 2012	Urban design (complexity)	Negative
Andrade et al., 2024 Campisi et al., 2022; Cheng and Chen, 2015; Jehle et al., 2022;	Urban design (Quality of pedestrian environment)	Positive

Table 1. Spatial factors affecting PA to PT

(i.e. Cheng and Chen 2015; Andrade et al. 2024), thus linking the theme of PA to that of walkability. Campisi et al. (2022) focused on factors that affect perceived level of service (LOS) of sidewalks in Thessaloniki, Greece, finding that a smooth walking environment has a positive correlation with PA. Curl and Mason (2019) examined the role of walking as a mediator between older people's mental wellbeing and their perceptions of their built and social environment in deprived urban areas. They found a relationship between neighbourhood perception and wellbeing. De Vos et al. (2023) conducted a systematic literature review on perceived walkability, finding that characteristics related to the built environment, such as neighbourhood aesthetics and paving's quality, have effects on perceived walkability. Jehle et al. (2022) explored the topic of pedestrian accessibility, which can be defined as "the ease with which certain destinations can be reached by walking" (p. 1). They conducted a survey with the specific aim to investigate PA by walk to six train stations in six German cities. Results shows that aspects related to the built environment such as the directness of the path to the station, walking comfort (e.g. wide and continuous footpaths), traffic safety and street security have strong impacts. In addition, they observed significant differences between cities according to their size: in smaller cities people are more likely to walk to reach the train station.

5. Final reflections: findings and gaps

The studies presented in this review have focused on correlations between PA and different variables, mostly through quantitative methods. In this way, significant links were identified between PA and the quality of PT, as well as between PA and perceived safety. However, correlations with spatial factors are less clear: this result is quite unexpected, given the emphasis that accessibility models give to land use (see section 1). Starting specifically from these models, some authors deduct a very strong role of land use and environment of PA: for instance, conceptualising PA as a "function of perceptions on the distribution and characteristics of

activities, transport and temporal feasibility of seizing these opportunities through the transport system" (Pot, Koster and Tillema, 2023, p. 3).

5.1 Contradictions about distance from city centre

Contradictions emerge by comparing the results of research that focus on perceived distance and studies that investigate the role of residence through the urban/extraurban dichotomy. The first group of studies highlights how, in areas further away from the city centre, the real service area of PT stops increases, while the second group highlights how, in urban areas, the PA is greater than in extra-urban areas. If perceived distance is considered as a proxy for PA, then the first group of studies seems to associate a negative correlation between urbanity and PA, while the second group of studies identifies a positive correlation. However, two aspects need to be considered. Firstly, in central areas, the PT coverage is typically more extensive, thereby reducing the necessity for individuals to walk in order to reach the stops. Secondly, the perceived distances are a function of the time it takes to travel them. Consequently, in less dense (and less congested) areas, it is possible to travel a greater distance in the same amount of time, which leads to an underestimation of perceived distances and an increase in the actual catchment areas. Consequently, the use of perceived distance as a measure of perceived accessibility may not be the most accurate approach.

5.2 Inconclusive results about place of residence

Research that focuses on differences between places of residence does not highlight significant associations with PA. However, the study areas considered in such research are very large, and therefore presumably very heterogeneous within them, like the districts of Moscow (Lukina *et al.*, 2021), the Dutch municipalities (Pot, Koster and Tillema, 2023), the counties of South Carolina (Cheng and Chen, 2015). Consequentially, it is suggested that future research on this topic should be conducted in smaller study areas, selected through qualitative criteria and not using administrative subdivisions. Furthermore, future research could consider not only the place of residence (origin), but also the place of destination, focusing the surveys among subjects such as workers of specific firms, as well as school students, shop customers, and other frequenters of activities located in a defined area. Similar approach can be found in Damurski, Pluta and Zipser (2020), where the study areas were selected through an inventory process and where the survey concerned not only residents but also users of public spaces.

Figure 1. Location of the reviewed case studies

Figure 2. Location of the reviewed case studies, focus on Northern Europe

5.3 Emerging spatial factors

It has been observed that the role of spatial factors emerges under two conditions. The first condition is that PA is measured through perceived time as in Börjesson (2012), Vreeswijk *et al.* (2014), Ceccato *et al.* (2020), Tiznado-Aitken, Muñoz and Hurtubia (2021), Jehle *et al.* (2022), rather than through indexes that contain a high level of abstraction within. The second condition is the use of mixed - qualitative and quantitative - approaches, as exemplified by Curl (2013) and Tiznado-Aitken *et al.* (2020), in order to more effectively capture users' perceptions of the built environment. Indeed, the representation of the environment carried out through quantitative and numerical terms (such as density), or through dichotomies does not always demonstrate to be sufficient. It is also important to consider that the majority of the studies were conducted in Northern European cities, which are characterised by a high presence of transit-oriented development (TOD) such as Stockholm and Copenhagen (Papa and Bertolini, 2015). It is noteworthy that the role of the place of residence clearly emerges in the research conducted in Santiago de Chile, a city characterised by pronounced spatial inequalities. Future research conducted outside Northern Europe could lead to consolidate these findings. A comparison of PA between TOD and not TOD neighbourhood could lead to significant results, Additionally, a comparison between case studies in different areas of the world, perhaps including cultural characteristics of residents (as also highlighted by Lukina *et al* 2021), could be beneficial.

5.4 Lack of emphasis on public transport stop

Finally, a significant gap in the literature is the relative lack of relevance, outside of studies focused on catchment areas, of PT stop. Although numerous studies have focused on PT, or consider PT as a key element, the stop is often considered a mere element of the transport network, and not the object of the investigation (notable exceptions are Ryan *et al.*, 2016; Jehle *et al.*, 2022). This discrepancy is in contrast with the fundamental role that the stop play in the context of accessibility (see section 1), and future research could consider the PT stop as an element of urban space (and thus as a spatial element) rather than a mere transportation node (as suggested by Vitale Brovarone, 2021).

5.5 Final conclusions

The research conducted to date has highlighted a gap between measured accessibility and perceived accessibility (PA). Moreover, there is substantial evidence indicating a strong

correlation between PA and the perception of PT and perceived safety, as well as with certain sociodemographic factors (e.g., disability) and attitudinal conditions. However, the role of the spatial factors remains less clear, with some research suggesting an influence and others finding no significant correlations. It is therefore proposed that, future research should focus on the following aspects, in order to address the aforementioned gap:

- describing PA through time perceived by people rather than through perceived distance or abstract PA indexes;
- analysing study areas described with qualitative rather than quantitative terms;
- collecting data and information with mixed quantitative-qualitative methods;
- focusing not only on the place of residence but also on the destination;
- isolating the PT stop as an element in its own right, also considering its role as spatial element;
- extending the research beyond the geographical areas explored so far.

Such research could assist in elucidating the manner in which urban planning decisions can guide the perceived accessibility of PT, thereby identifying potential new ways of dialogue between urban and transport planning disciplines.

Author contributions:

The authors confirm contribution to the paper as follows: study conception and design: Michelangelo Fusi; data collection: Michelangelo Fusi; analysis and interpretation of results: Michelangelo Fusi; draft manuscript preparation: Michelangelo Fusi; manuscript supervision: Michela Tiboni.

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Exploring Transformations in Sustainable Urban Mobility: Insights from CityWalk 2.0 project and beyond

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Abstract (up to 125 words)
In response to societal shifts towards green and digital transitions, urban mobility emerges as a pivotal arena for change, influencing behaviour, transportation modes, as well as urban planning policies. This paper investigates the role of CityWalk 2.0 project in promoting energy-efficient urban mobility and shifting urban transport systems from car-centric to active mobility modes. Firstly, a literature review is conducted to define a framework for categorising different practices that promote active mobility. Secondly, a comparative analysis was conducted between three CityWalk 2.0 pilot cities. Despite the distinct local contexts, the results showcase the evident impact of 'soft' and 'hard' actions across various dimensions. Common walkability issues related to regulation and street design, as well as the elevation of pedestrians and cyclists to the apex of the "traffic pyramid" are highlighted in the cities' approaches to sustainable urban mobility. In conclusion, the paper provides essential guidelines for reshaping the discourse on urban mobility transformations in the 21st century.

Keywords: urban transportation, street redesign, travel behaviour, urban mobility policies

1. Introduction

In the context of the twin green and digital transition, urban mobility emerges as a driving domain for transformation (Schipper et al, 2020). A new paradigm raises around the concept of sustainable urban mobility, leveraging technological advancements and societal changes. This shift significantly impacts not only behavioural patterns and transportation modes but also shapes urban planning policies (Van Acker et al, 2016).

Urban mobility plays a pivotal role in shaping the sustainability and liveability of cities worldwide. In accordance with the European transport legislation, concerted efforts are directed towards achieving a competitive and resource-efficient transport infrastructure to align with the ambitious objectives outlined in the 2030 climate and energy framework, namely the reduction of greenhouse gas emissions by at least 40% compared to 1990 levels, the increase of energy efficiency by at least 32.5% and the increase of energy from renewables by at least 32% (EC, 2011; EC, 2013). Considering the significant proportion of European citizens residing in urban areas and the projected exponential growth of the urban population globally, estimated to surpass two-thirds of the world's population by 2050, urbanisation challenges need to be urgently addressed (UN, 2019). The exponential rise in urban population necessitates a heightened emphasis on sustainable urban mobility, as current transportation systems heavily dependent on cars causes harmful environmental effects, health risks, and a deficiency of quality public spaces in the urban context (Schipper, 2002).

Firstly, the dominance of conventional modes of urban transport, notably car-centric mobility, exacerbates these challenges, posing significant obstacles to environmental, social and economic sustainability. European cities are progressively adopting Sustainable Urban Mobility Plans (SUMP), which advocate for walking, cycling, public transportation and shared mobility services as substitutes for private car usage (Maltese et al, 2021). Generally, SUMPs tackle issues stemming from excessive car traffic, including congestion, air pollution, noise, CO2 emissions, compromised road safety and decreased physical activity levels among residents (Hudoklin et al, 2021).

Secondly, the well-being of residents is highly impacted by car traffic dominance, leading to congestion and safety hazards. Moreover, current transportation systems, heavily reliant on automobiles, contribute to adverse environmental effects, health concerns and a lack of high-quality public spaces, greenery and public amenities within urban areas (Schipper, 2002). In this context, active urban mobility emerges as a compelling solution to mitigate the adverse impacts of car-dependent transportation systems. Active forms of mobility, such as walking, cycling, and micro-mobility offer a promising pathway towards achieving sustainable urban transportation. These modes of travel not only reduce reliance on fossil fuels, but also promote public health, enhance urban liveability and foster community cohesion. Through empirical research and data-driven analysis, cities can unlock the full potential of street experiments as powerful tools for fostering sustainable urban mobility (Bertolini, 2020).

Upon this background, the CItyWalk 2.0 project emerges as a beacon of innovation and collaboration, building upon the legacy of its predecessor, CityWalk (2016-2019), to pioneer new pathways towards energy-efficient urban transport. At its core, CityWalk 2.0 seeks to catalyse a paradigm shift in urban mobility, steering cities away from the entrenched reliance on energy-intensive automobile-centric systems towards a more sustainable and resilient future. The project aims to become a catalyst for transformative change in urban mobility in 10 pilot cities located in the Danube Region, particularly in the Central and Eastern part of Europe. By advocating for specific policy changes at both local and transnational levels, CityWalk 2.0 aims not only to reduce the energy footprint of urban transport, but also to foster a global network of decision-makers committed to sustainable mobility.

Literature shows that addressing the root causes of car dependency requires a multifaceted approach that extends beyond the realm of physical infrastructure and encompasses not only technological innovations, but also behavioural change interventions (García-Garcés et al, 2016). Therefore, key elements of CityWalk 2.0 include redesigning streets to encourage active mobility and discourage car use, changing the travel behaviour of citizens and strengthening the political will and commitment to implement the transformation.

Central to fostering sustainable urban mobility is the imperative to prioritise pedestrians' needs and create inclusive environments. Achieving this demands a delicate balance, ensuring equitable distribution of urban space, while enhancing conditions for walking and active transportation. By adopting a holistic approach and leveraging universal design principles, cities can cultivate socially inclusive, pedestrian-friendly spaces. Simultaneously, evaluating city street experiments and integrating ‘soft’ and ‘hard’ measures unlocks synergistic effects, propelling sustainable mobility initiatives forward and shaping resilient urban ecosystems capable of meeting diverse community needs (Anciaes and Jones, 2020; Bertolini, 2020; García-Garcés et al, 2016).

2. Methodology

The present research is conducted within the framework of the CITYWALK 2.0 project, funded under the Interreg Danube program. The project entitled "Together for Energy-efficient Urban Mobility: Decreasing Carbon Intensity of Urban Transport by supporting Shift to Active Urban Mobility through rethinking street design and changing travel behaviour" started in January 2024, building upon the foundation laid by its predecessor, CITYWALK project.

The main objective of this paper is to investigate the impact of CITYWALK 2.0 project in promoting energy-efficient urban mobility and shifting urban transport systems from car-centric to active mobility modes. Specifically, the paper highlights measures to effectively reduce carbon emissions, based on the interventions tested by three pilot cities: Nyiregyhaza (Hungary), Ptuj (Slovenia), and Valjevo (Republic of Serbia). Given the diverse geographical and cultural landscape of Central and Eastern Europe, it is crucial to acknowledge the prevailing mentality and rigidity towards change. Moreover, cultural factors also play a significant role in shaping attitudes towards change in Eastern European cities. Deep-seated cultural values, such as a preference for private car ownership as a symbol of status and independence, can pose challenges in promoting alternative and more sustainable transportation systems.

Data collection and analysis for this research were conducted through a multifaceted approach. Firstly, an extensive literature review was undertaken to synthesise existing knowledge and identify gaps in understanding the existing body of knowledge related to sustainable urban mobility practices. Based on the findings, this paper proposes a categorisation framework of different practices that fall under two main categories: street redesign (‘hard’ interventions) and travel behaviour change (‘soft’ intervention). Additionally, qualitative methods such as case studies were conducted to gather insights into the methods and pilot actions employed to stimulate a transition towards active mobility in the three Central and Eastern European cities (Nyiregyhaza, Ptuj and Valjevo). Finally, the paper suggests a list of policy recommendations for cities which pursue the objective of decreasing carbon intensity of urban transportation systems. Overall, this methodological approach enabled a robust exploration of the role of street experiments as potential triggers of systemic change in urban mobility, with a focus on moving away from motorised traffic dominance towards non-motorized travel.

3. Literature review

Based on the existing literature, this paper provides a conceptual framework for categorising transformations in sustainable urban mobility, based on current theories, concepts and practices. Urban mobility is not merely a transportation issue, it is also intricately linked to broader societal and environmental challenges. Planning for sustainable mobility typically involves fostering efficient transportation options that enhance competitiveness while simultaneously mitigating air and noise pollution, including the reduction of greenhouse gas emissions.

Existing literature highlights a notable increase in research dedicated to active mobility, coupled with the development of conceptual frameworks aimed at guiding interventions (Koszowski et al, 2019). The concept of active mobility, also known as active transportation, encompasses modes of transportation reliant on human power, notably including walking and cycling, utilised for various travel purposes (Kong et al, 2024). They advocate for the integration of active mobility into daily routines, insisting that cities should prioritise the development of infrastructure conducive to walking and

cycling. This approach embodies an urban planning ethos centred on prioritising the needs of people over specific modes of transportation. The most efficient and cheapest way is to shift from extremely energy-intensive (and inefficient) car-based mobility to active forms of mobility (walking, cycling), with micro-mobility and public transport as the primary means of transportation. Generally, strategies for facilitating a modal shift towards active transport focus on reallocating road space and creating pedestrian and cyclist-friendly environments, such as safe and extensive networks of bike lanes, pedestrian paths and accessible public spaces (Ferretto et al, 2021; Kong et al, 2024).

The literature also emphasises the positive impacts of active mobility on various aspects including health, safety, life quality, economy, environment and air quality (Koszowski et al, 2019; Ferretto et al, 2021; Pisoni et al, 2022; Kong et al, 2024). However, there are several factors which determine the adoption of active mobility, such as the built environment, infrastructure development, user perceptions and individual health (Rojas López and Wong, 2017; Ferretto et al, 2021). Psychological and neighbourhood variables play a significant role in influencing individuals' mobility behaviour, highlighting the need for comprehensive urban design tools to create healthier urban environments (Götschi et al, 2017; Said et al, 2021).

Various transportation policy measures have proven beneficial in encouraging a shift from car use to public transportation or environmentally friendly modes such as walking or cycling (García-Garcés et al, 2016). Concretely, these measures vary from reallocating road space to accommodate pedestrian and cyclist-friendly urban settings (Ferretto et al, 2021) to Travel Behaviour Change Programmes. These initiatives are designed to incentivize individuals to reduce their reliance on cars, particularly for single-occupancy trips. Numerous societal and individual benefits have been demonstrated when walking or cycling replaces car use. Such programs encompass personal travel planning, travel awareness, campaigns, workplace or educational institution travel plans and strategies like car-sharing.

There is a wide range of concepts and theories that address the issue of active mobility, always placed into two basic categories, commonly referred to as ‘hard’ and ‘soft’ interventions (Anciaes and Jones, 2022; Bertolini, 2020; García-Garcés et al, 2016). The first category of ‘hard’ interventions refers to street redesign, involving tangible alterations to the physical infrastructure. The second category of ‘soft’ interventions refers to travel behaviour change, which targets individual habits and choices. These interventions offer distinct yet synergistic avenues towards achieving safer, more efficient and equitable urban transportation systems.

3.1 ‘Hard’ interventions - Street redesign

Street redesign refers to a process of altering the physical layout, infrastructure and amenities of roads and streets within urban or suburban areas. This approach aims to improve various aspects of street function, such as safety, accessibility and efficiency. Street redesign projects often involve modifications to road geometry, traffic flow patterns, signage and markings, pedestrian infrastructure, cycling facilities, landscaping and street furniture (Lahart et al, 2013; Anciaes and Jones, 2022).

In numerous urban centres, a sustained trend is emerging towards allocating increased space for pedestrians, reflecting a novel paradigm in transportation and urban governance centred on promoting health, well-being and urban liveability (Anciaes and Jones, 2020). The reconfiguration of streets to prioritise pedestrian access yields

various advantages, encompassing enhancements in local economic communities and environmental sustainability (Bertolini, 2020).

Street redesign has the potential to achieve greater cost-efficiency by addressing driver behaviour, thereby effectively managing traffic speeds. Enhanced public spaces not only instil a sense of civic pride, but also attract private investment, thus stimulating employment opportunities and enhancing commercial and retail activity. Promoting pedestrian and cyclist-friendly environments, accessible to individuals of diverse ages and physical abilities, fosters street vitality and social interaction (Tmou and Rodi, 2023). Moreover, prioritising improved street redesign contributes to enhanced value for investment towards social inclusivity (Lahart et al, 2013).

Several subcategories of possible interventions fall under the street redesign measures, each serving distinct purposes within the urban planning and transportation policies (Figure 1).

(1) *Pedestrian-only streets*, designated exclusively for pedestrian traffic, not only encourage walking and active transportation, but also contribute to community cohesion and economic vitality when used as public spaces which accommodate certain activities (Lahart et al, 2013; Bertolini, 2020). (2) *Shared space streets* eliminate barriers hindering movement between transportation modes, cultivating vibrant urban environments with outdoor activities for children and pleasant spaces for walking and cycling (Lahart et al, 2013; Peters, 2017). Another requirement for streets to become shared spaces in residential areas is to host less than 100 vehicles per hour during the afternoon peak (Hamilton-Baillie, 2008). (3) The transformation of boulevards from main roads focuses on revitalising *avenues* to prioritise aesthetics, pedestrian-friendly infrastructure and versatile utility, serving their initial scope (Jacobs et al, 2002). (4) *Promenades* serve as expansive avenues, blending leisure walking with recreational activities, offering lively environments for public activities (Miaux and Garneau, 2016). (5) *Low-speed streets and slow zones* aim to reduce injuries and enhance safety and comfort for non-motorized users by reducing vehicle speed limit up to 30 km/h and prioritising pedestrians and cyclists (Neki et al, 2021). Moreover, traffic calming interventions include adjustments to road geometry, such as horizontal and vertical modifications, as well as lane narrowing and insertion of slow zones near sensitive land uses like schools or parks. (6) *Parklets* repurpose on-street parking spaces into (semi-)public areas for alternative uses, promoting walking, cycling, social interaction and economic activity (Speck, 2018; Bertolini, 2020). Parking-space installations gather basic structures that provide amenities such as seating, bike racks, public art or exercise equipment. (7) *Cycling infrastructure* optimises the use of limited public space, mitigates climate change, and improves accessibility, emphasising systemic interventions to cultivate sustainable transportation environments (Hofmeister and Stibe, 2017; Tosics et al, 2022). (8) *Urban signage* embodies various codes and elements such as architectural, compositional, graphical, colour, to guide movement and facilitate a user-friendly navigation within cities (Sokolova, 2018). (9) *Urban furniture/ amenities* encompass aesthetic and comfort-oriented elements that contribute to city liveability, comfortable and secure environment, urban identity and guide movement through elements such as public art, lighting, seating and bicycle parking amenities (Lahart et al, 2013; Bolkaner et al, 2019).

Street redesign		
Sub-category	**Definition**	**Source**
Pedestrian-only streets	Pedestrian-only streets, designated exclusively for pedestrian traffic, not only encourage walking and active transportation, but also contribute to community cohesion and economic vitality when used as public spaces which accommodate certain activities.	Lahart et al, 2013; Bertolini, 2020
Shared space	Shared space streets eliminate barriers hindering movement between transportation modes, cultivating vibrant urban environments with outdoor activities for children and pleasant spaces for walking and cycling.	Lahart et al, 2013; Peters, 2017; Hamilton-Baillie, 2008
Boulevards from main street	Boulevards are broad streets that divide large urban areas into connected zones, acting as a barrier between the edges of commercial or residential streets and fast-moving traffic lanes. They achieve this by incorporating multiple lanes and frontage roads.	Jacobs et al, 2002
Promenades	Promenades serve as expansive avenues, blending leisure walking with recreational activities, offering lively environments for public activities	Miaux and Garneau, 2016
Low speed-limit street	Low-speed streets and slow zones aim to reduce injuries and enhance safety and comfort for non-motorized users by reducing vehicle speed limit up to 30 km/h and prioritising pedestrians and cyclists.	Neki et al, 2021
Parklets	Parklets can be defined as the temporary transformation of on-street parking spaces into semi-public areas by installing simple structures like seating, bike racks, public art, or exercise equipment.	Bertolini, 2020; Speck, 2018
Cycling infrastructure	It contributes to maximizing the use of limited public space, addressing climate change, reducing air and noise pollution, promoting public health, and enhancing overall accessibility.	Tosics et al, 2022; Hofmeister and Stibe, 2017
Urban signage	An urban sign integrates various elements like verbal, architectural, graphic, and pictorial aspects, reflecting a pressing concern in modern urban planning, requiring an interdisciplinary approach.	Sokolova, 2018
Urban furniture	Urban furniture encompasses aesthetic and comfort elements that reflect a city's identity and enhance urban livability by improving comfort and meeting resident needs.	Bolkaner et al, 2019; Lahart et al, 2013

Figure 1. Categorisation framework for interventions that encourage active mobility: 'hard' interventions (source: authors)

3.2 'Soft' interventions - Travel behaviour change

Without any doubt, robust infrastructure is pivotal in urban planning to reduce individual car dependency. Despite vital elements like public transport networks, pedestrian-friendly infrastructure and cycling facilities, addressing transportation behaviour complexity is crucial. Human behaviour significantly shapes travel patterns, often maintaining car reliance despite alternative options. Changing this behaviour requires diverse interventions such as awareness campaigns, modal shift incentives, education and policies encouraging alternative travel modes. While infrastructure forms the backbone, a comprehensive approach addressing social, cultural and psychological factors is key to achieving meaningful behaviour change.

In addition to altering the travel environment, behavioural strategies like mobility management have been implemented to raise awareness and influence psychological factors, encouraging voluntary shifts from car dependency to non-auto travel modes. These strategies often involve providing tailored information on public transportation, launching travel campaigns and offering travel education programs (Fujii and Taniguchi, 2014).

Several subcategories of possible interventions fall under the travel behaviour change measures, each targeting distinct aspects of individual and collective transportation choices (Figure 2).

(1) *Educational campaigns* represent an encouragement strategy for active mobility, aimed at raising awareness of multimodal and sustainable travel practices (Haufe et al, 2016). (2) *Zoning regulations* delineate permissible land use and operational activities to shape transportation patterns within comprehensive master or zonal plans (Chriqui et al, 2016). (3) *Parking policies* aim to optimise parking utilisation and turnover, often through strategies such as time restrictions, paid parking zones and

workplace parking fees to discourage car commuting (Tosics et al, 2022). (4) *Congestion pricing* aims to align driving costs with demand dynamics. This mechanism typically involves elevating the cost of driving on congested routes or within densely populated downtown areas to better reflect demand patterns, thereby incentivizing the use of alternative modes of transportation (Speck, 2018). (5) *Incentives and rewards* engage stakeholders in tracking and rewarding sustainable mobility habits, encouraging sustainable travel behaviour through a system of rewards facilitated by merchants and mobility service providers, often employing ICT technologies to monitor citizens' mobility habits - i.e. GPS tracking systems (Ricci et al, 2020). (6) *Behavioural nudges* represent subtle interventions designed to influence individuals' transportation choices and encourage more sustainable travel behaviours by providing information and manipulating specific factors to encourage desired outcomes (Barr et al, 2021). (7) *Technology solutions* promote alternatives to single-occupancy vehicle trips. These solutions encompass various techniques, including sensor-driven lighting, enforcement and security measures, as well as real-time data collection, all aimed at enhancing street efficiency and encouraging sustainable travel practices (Duncan et al, 2016). Together, these interventions form a comprehensive toolkit for fostering behavioural change and promoting more sustainable urban mobility patterns.

Travel behaviour change		
Sub-category	**Definition**	**Source**
Educational campaigns	) Educational campaigns represent an encouragement strategy for active mobility, aimed at raising awareness of multimodal and sustainable travel practices.	Haufe et al, 2016
Zoning regulations	Zoning regulations delineate permissible land use and operational activities to shape transportation patterns within comprehensive master or zonal plans.	Chriqui et al, 2016
Parking policies	The parking policy, within an organization, is the set of regulations governing parking lot management. Its aim is to improve parking management through the implementation of diverse strategies and functions, tailored to address specific challenges as they arise.	Tosics et al, 2022
Congestion pricing	Congestion pricing is a strategy aimed at aligning the cost of driving with its inherent value by increasing fees for driving on congested roads or within densely populated downtown areas, thus reflecting demand dynamics more accurately.	Speck, 2018
Incentives and rewards	An incentive-based solution in the mobility sector entails a specialized business model centered on a tracking and reward system involving four primary stakeholders: citizens, municipalities, merchants, and mobility service providers.	Ricci et al, 2020
Behavioural nudges	Behavioural nudges in Travel Behaviour Change encompass subtle interventions strategically crafted to sway individuals' transportation decisions and foster the adoption of more sustainable travel behaviours.	Thaler and Sunstein, 2008; Barr et al, 2021
Technology solutions	These solutions utilize advancements in information technology, data analytics, and communication to shape travel behavior and advocate for alternatives to single-occupancy vehicle trips.	Duncan et al, 2016

Figure 2. Categorisation framework for interventions that encourage active mobility: 'soft' interventions (source: authors)

Integrating 'soft' and 'hard' measures maximises effectiveness in driving cities towards sustainable mobility patterns, mitigating the adverse effects of car reliance and promoting a culture of sustainable mobility (García-Garcés et al, 2016). Therefore, the combination of street redesign actions, targeted incentives, educational campaigns and zoning regulations offers a powerful tool for encouraging active mobility and discouraging car use, changing the travel behaviour of citizens, as well as strengthening the political will and commitment to implement the transformation. As such, CityWalk 2.0 project relies upon these elements in its approach to promote energy-efficient urban mobility, encompassing interventions at both the city and citizen levels. Moreover, the project aims to stimulate political will and commitment to drive

systemic change, recognizing that effective urban mobility transformations require a collective effort from policymakers, stakeholders and the broader community.

4. Case studies of Active Mobility interventions in CityWalk 2.0 Pilot Cities (Nyiregyhaza/ HU, Ptuj/ SL, Valjevo/ RS)

The CityWalk 2.0 project has brought together a consortium of pilot cities to explore innovative approaches aimed at promoting sustainable urban mobility and enhancing the pedestrian experience. Across diverse urban landscapes, these pilot cities have embarked on a collective journey to reimagine streets as vibrant public spaces, prioritising the needs of pedestrians and fostering active transportation modes. Through collaborative efforts, each pilot city has implemented in CityWalk project a unique set of strategies and interventions tailored to its specific context and mobility challenges, continuing these efforts in CityWalk 2.0. The three selected case studies namely Nyiregyhaza (Hungary), Ptuj (Slovenia) and Valjevo (Republic of Serbia) (Figure 3) implemented actions in CityWalk and proposed a set of actions for CityWalk 2.0 which cover the two main intervention categories, respectively street redesign and travel behaviour change.

4.1 Active mobility in Nyiregyhaza, Hungary

Nyíregyháza, located in northeastern Hungary, holds the status of a city with county rights and serves as the capital of Szabolcs-Szatmár-Bereg. With a population of around 118.000 residents, it holds the seventh position among Hungary's largest cities and it is the second largest in the Northern Great Plain region. Its historical evolution positions it as a significant economic and cultural centre in the area. Nyíregyháza developed the Sustainable Urban Mobility Plan in 2018, which sets the proper context for the CityWalk objectives. Its main actions include the completion of walking and cycling infrastructure and the induction of zoning regulations.

Firstly, the 'Downtown Pedestrian Streets' project in Nyíregyháza addressed the challenge of excessive car use in the city centre, leading to air pollution and traffic accidents. The solution involved a comprehensive pedestrianisation effort spanning from 1987 to 2012. The downtown area was transformed into a car-free pedestrian corridor adorned with green spaces, restaurants, cafes, fountains and sculptures. This created a peaceful urban oasis suitable for outdoor events and featuring Hungary's largest bridge between buildings. Emergency and cargo vehicles are the only authorised vehicles, ensuring barrier-free traffic for pedestrians and cyclists. The investment resulted in decreased car traffic, greener and safer surroundings, attracting more pedestrians and cyclists who contribute to the local economy by frequenting restaurants and outdoor cafes.

Secondly, the purchase of technological equipment for passenger counting (sensors) and user feedback (tablet with suitable software) is vital for the pilot activity in Nyíregyháza. It aims to assess public transport utilization and user experiences, with the goal of improving public transport service quality. The pilot seeks to provide the city with current data on public transport usage and gather feedback on satisfaction, problems and needs. Ultimately, it aims to boost public transport usage indirectly. The device will be deployed on local government-owned buses operated by Volánbusz Zrt, promoting a change in the citizens' travel behaviour.

4.2 Active mobility in Ptuj, Slovenia

The city of Ptuj, situated in northeastern Slovenia, serves as the administrative center. As Slovenia's oldest documented city, Ptuj traces its roots back to the late Stone Age and evolved from a Roman military stronghold. Positioned strategically at the intersection of the Drava River and a historic trade route linking the Baltic Sea with the Adriatic, Ptuj holds significance in the traditional region of Styria and was historically part of the Austria-Hungarian Empire. The Municipality of Ptuj adopted in 2017 the Sustainable Urban Mobility Plan for the Maribor Functional Urban Area, of which it is a part. The main objectives of SUMP are: (i) to have a better traffic planning and management (ii) to promote walking as one of the most important ways of travelling, (iii) to further promote cycling and creation of additional cycling infrastructure in the city, (iv) to improve public transport to be more appealing and (v) to enforce rational use of motorized vehicles (Letnik et al, 2019).

In the first CityWalk project, Ptuj focused on a single action, combining both street redesign actions such as completion of pedestrian streets (walking infrastructure) and low speed-limit streets with zoning regulations that encourage travel behaviour change. The renovation of Ptuj's city marketplace, completed in 2020, addressed limited pedestrian accessibility due to interior and exterior poor conditions. The comprehensive solution included renovation, new facility establishment and traffic regulation adjustments. The outcomes of this actions were increased attractiveness, equitable access, as well as cultural and economic stimulation.

For CityWalk 2.0, Ptuj City pilot investment will introduce an innovative strategy to tackle travel behaviour challenges and gather insights beneficial to the program area. With a focus on enhancing pedestrian infrastructure, encouraging walking, minimising car dependency and fostering behaviour change, this small-scale initiative aims to advance urban mobility development. The proposed intervention will promise a fresh visual identity for the city while enhancing safety and mobility for residents and tourists alike through the implementation of parklets, urban furniture/ amenities and behavioural nudges. By addressing traffic concerns, it aims to cut CO2 emissions caused by congestion. This initiative will highlight the power of urban design and small interventions to enrich an area and address various issues resulting from neglectful urban development.

4.3 Active mobility in Valjevo, Republic of Serbia

Valjevo serves as both a city and the administrative hub of the Kolubara District in western Serbia. As of the 2022 census, the administrative region of Valjevo boasted a population of 82.169 residents, with 56.145 residing in urban areas. The Sustainable Urban Mobility Plan for Valjevo was designed under the first CityWalk project and it aims to enhance walking conditions to reduce emissions, noise and enhance safety, fostering sustainable urban transport, particularly walking and cycling (Danilović and Đorić, 2020).

Within the first CityWalk project, the City of Valjevo focused on traffic calming measures, urban signage and furniture, as well as zoning regulations. Therefore, a pilot action for active mobility was undertaken to enhance the city's walkability and promote healthier lifestyles. This initiative encompassed the design and implementation of thematic walking routes, accompanied by clear signage and signalization for pedestrians, cyclists, and tourists. Furthermore, recognizing the need to educate citizens on traffic safety and the benefits of walking and cycling, a series of educational workshops and promotional events were organized.

The pilot action envisaged by the City of Valjevo in CityWalk 2.0 project refers to tactical urbanism and street design interventions, aimed to regulate pedestrian, bicycle and vehicles traffic and parking, enhance mobility, increase safety and improve the appeal of the Valjevo's central area. By implementing innovative solutions, the city centre will benefit from reduced emissions, green areas and infrastructure dedicated to walking and cycling. The main challenge addressed by the Čika Ljubina Street refers to the lack of organisation and usage regulations for pedestrian, bicycle and car traffic intersections. The proposed action will renovate the physical infrastructure and green areas, differentiating between car and pedestrian routes and includes horizontal markings for pedestrian pathways. Additionally, the city will acquire equipment like solar decorative lighting, vertical signalling, traffic calming devices and bicycle parking facilities. Upon completion, the area will be more walkable, attractively designed, safer and friendlier for pedestrians and cyclists.

4.4 Comparative analysis

Despite the distinct local contexts of these cities, positive outcomes have been demonstrated through actions such as improvements in traffic safety, adoption of active mobility means and diversified transport modes. The three pilot's concepts, methodologies and tools can be replicated or adapted in other EU cities facing similar challenges, accelerating efforts to improve urban mobility. Therefore, documenting results, challenges and successes can serve as a valuable resource for other cities, aiding knowledge sharing and understanding of potential benefits.

In this context, a brief comparative analysis has been conducted between the approaches of the CityWalk 2.0 pilot cities. The results showcase the evident impact of 'soft' and 'hard' actions across various dimensions. Common walkability issues, as well as the elevation of pedestrians and cyclists to the apex of the "traffic pyramid" are highlighted in the cities' approaches to achieve sustainable urban mobility. The comparative analysis reviews the pilot actions in the three cities according to five main criteria: (1) effectiveness of implementation, (2) impact on urban mobility patterns, (3) socio-economic benefits, (4) accessibility/ inclusivity measures and (5) sustainability and resilience of the initiative (Tabel 1).

Tabel 1. Comparative analysis results

Criteria	Nyiregyhaza (Hungary)	Ptuj (Slovenia)	Valjevo (Serbia)
Effectiveness of implementation	Successful pedestrianization efforts	Renovation of city marketplace	Enhanced city's walkability
	Proactive measures to improve public transport services	Low speed-limit streets with zoning regulations that encourage travel behaviour change	Promotion of healthier lifestyles
Impact on urban mobility patterns	Likely shift towards reduced car traffic and increased walking/ cycling	Potential positive changes in urban mobility patterns	Improvement in pedestrian routes and signage for different traffic categories
Socio-economic benefits	Improved air quality, increased foot traffic for local businesses	Stimulated economic activity and cultural events, increased attractiveness	Urban design improvements
	Enhanced public space utilization	Benefited local businesses and residents	Citizens' education and awareness-raising campaigns

Accessibility and inclusivity	Improved accessibility for pedestrians and cyclists	Planned enhancements for barrier-free environments	Improved accessibility for pedestrians and cyclists
	Promotion of inclusivity and community engagement	Creation of inclusive environments for diverse user groups	Prioritization of pedestrian safety and accessibility
Sustainability and resilience	Alignment with sustainability goals and long-term resilience	Contribution to sustainability and resilience in urban mobility	Promotion of active transportation modes
	Investment in sustainable mobility solutions	Preparation for future environmental and social challenges	Enhancement of the city's resilience to future challenges

Source: authors.

In what concerns the effectiveness of implementation, Nyiregyhaza's pedestrianization efforts have been successfully implemented over several years, transforming the downtown area into a car-free pedestrian corridor. Additionally, the city's proactive measures to improve public transport services through the acquisition of equipment for passenger counting and user feedback demonstrate effective implementation strategies. Ptuj's intervention of city marketplace renovation and the planned initiatives for CityWalk 2.0, indicate a commitment to enhancing pedestrian infrastructure and addressing traffic concerns. Valjevo's interventions have been effectively implemented to improve pedestrian accessibility and safety.

Regarding the impact on urban mobility patterns, Nyiregyhaza's pedestrianization project has likely led to a noticeable shift in urban mobility patterns, with reduced car traffic and increased walking and cycling. While the full impact may require longitudinal studies, initial observations suggest positive changes in travel behaviour. The proposed interventions for Ptuj aim to encourage walking, minimize car dependency, and enhance safety, potentially leading to positive changes in urban mobility patterns. However, the true impact will depend on the effectiveness of CityWalk 2.0 initiatives in promoting active transportation modes. Valjevo's interventions have likely influenced urban mobility patterns by improving pedestrian accessibility and promoting healthier lifestyles. The city's focus on sustainable mobility solutions indicates a commitment to creating a more walkable and bike-friendly environment.

As far as socio-economic benefits are concerned, Nyiregyhaza's transformation of the downtown area has likely generated socio-economic benefits, such as improved air quality, increased foot traffic for local businesses, and enhanced public space utilization. These benefits contribute to economic vitality and social cohesion within the city. Ptuj's interventions, including the renovation of the city marketplace, are expected to stimulate economic activity and cultural events, benefiting local businesses and residents. By creating vibrant public spaces, Ptuj enhances the city's appeal and promotes community engagement. Valjevo's interventions have likely resulted in increased attractiveness of the urban space and an increased awareness of citizens in what concerns the importance of active mobility.

In terms of accessibility and inclusivity, Nyiregyhaza's pedestrian-friendly environment improves accessibility for pedestrians and cyclists, ensuring equitable access to transportation services. By prioritising active transportation modes, Nyiregyhaza promotes inclusivity and fosters a sense of community within the city. Ptuj's planned interventions for CityWalk 2.0 aim to enhance pedestrian infrastructure, making the city

more accessible and inclusive for all residents and visitors. These efforts contribute to creating barrier-free environments and promoting social inclusion. Valjevo's interventions have likely improved accessibility for non-motorized traffic participants, creating urban environments that accommodate diverse user groups.

Sustainability and resilience are present in all three pilot cities. Nyiregyhaza's focus on reducing car dependency and promoting active transportation aligns with sustainability goals, contributing to long-term environmental resilience and resource efficiency. By investing in sustainable mobility solutions, Nyiregyhaza enhances the city's ability to withstand future challenges. Ptuj's interventions, particularly those aimed at reducing CO2 emissions and enhancing safety through pedestrian infrastructure improvements, contribute to sustainability and resilience in urban mobility. By prioritizing sustainable transportation options, Ptuj prepares for future environmental and social challenges. Valjevo's pilot actions contribute to sustainability by improving environmental quality and promoting active transportation modes. These efforts enhance the city's resilience to future challenges and support long-term environmental goals.

To sum up, the comparative analysis of interventions in the three cities sheds light on the effectiveness of various strategies in promoting sustainable urban mobility. Each city's approach, tailored to its specific context and mobility challenges has demonstrated notable successes in improving pedestrian infrastructure, reducing car dependency and enhancing the overall quality of urban mobility. From successful pedestrianization efforts in Nyiregyhaza to the revitalization of public spaces in Ptuj and Valjevo's interventions of urban streets' signage, these interventions have generated socio-economic benefits, improved accessibility and contributed to long-term sustainability and resilience. While challenges remain, such as the need for longitudinal studies to assess the full impact of interventions and ongoing efforts to address cultural attitudes towards transportation, the comparative analysis underscores the importance of proactive measures and collaborative approaches in creating more liveable, walkable, and inclusive urban environments.

Lessons learned from the CityWalk pilot cities' interventions can inform future initiatives aimed at advancing sustainable urban mobility and fostering resilient cities for all. To achieve this goal, a set of five key policy recommendations are proposed for other cities based on the results of the CityWalk 2.0 pilot actions, tools and methodologies:

1. Encourage active transportation through investments in dedicated bike lanes, pedestrian-friendly streets and safety measures.
2. Expand public transportation accessibility, reliability and affordability to incentivize its use over private car ownership.
3. Implement congestion pricing schemes to discourage single-occupancy vehicle trips and alleviate urban traffic congestion.
4. Create standard street design models for various urban street categories, prioritizing walking, cycling and public transport over personal vehicle usage.
5. Implement behavioural strategies like mobility management to influence psychological factors, encouraging voluntary shifts from car dependency to non-auto travel modes.

By adopting these policies, cities can effectively reduce carbon emissions, enhance urban liveability by prioritizing pedestrian-friendly infrastructure, cycling networks and create more resilient urban environments for their citizens.

5. Conclusions

In conclusion, the literature review underscores the multifaceted nature of sustainable urban mobility, highlighting its significance in contemporary urban planning and transportation discourse. Current mobility policies aim to reduce car usage and promote changes in travel behaviour among car users, driven by the recognition of the social costs associated with car dependency, such as traffic congestion, accidents, air pollution and global warming. Furthermore, the synthesis of existing literature reveals a growing emphasis on active mobility as a pivotal component in promoting sustainable transportation systems. Active mobility interventions, encompassing both 'hard' interventions like street redesign and 'soft' interventions like travel behaviour change programs offer promising avenues for fostering more equitable, energy-efficient and environmental-friendly urban mobility. Strategies such as pedestrianization, cycling infrastructure development, educational campaigns, zoning regulations and congestion pricing demonstrate the diverse approaches cities can adopt to promote sustainable urban mobility. Furthermore, the integration of 'soft' and 'hard' measures emerges as a key strategy for maximizing the effectiveness of urban mobility interventions. By combining infrastructure improvements with initiatives aimed at influencing individual travel behaviours, cities can create more walkable pathways.

In summary, the comparative analysis of the CityWalk 2.0 pilot cities located in Central and Eastern Europe (Nyiregyhaza, Ptuj, and Valjevo) reveals a diverse array of interventions aimed at promoting sustainable urban mobility. Each city has implemented unique strategies tailored to its specific context and mobility challenges, encompassing both 'hard' interventions such as street redesign and 'soft' interventions like travel behaviour change programs. Despite their differences, all three cities share a common commitment to promote active mobility as a core strategy. The findings highlight the importance of adopting a holistic approach that addresses infrastructure improvements, behavioural change and political commitment. Through collaborative efforts, the CityWalk 2.0 pilot cities are pioneering new pathways towards energy-efficient urban mobility, serving as beacons of innovation and inspiration for other cities dealing with similar challenges as decreasing the carbon intensity of urban transportation systems.

The outcomes of CityWalk pilot cities' interventions can inform future initiatives aimed at advancing sustainable urban mobility through the following policy recommendations: promote active transportation infrastructure, enhance public transport accessibility and reliability, introduce congestion pricing, develop standardized street designs prioritizing walking, cycling, and public transport, as well as implement behavioural strategies to reduce car dependency.

In future research, it is essential to delve into the longitudinal effects of sustainable urban mobility initiatives on various aspects of community well-being, including health outcomes, economic growth and environmental resilience. Understanding the interplay between these factors over time can provide invaluable insights into the effectiveness and sustainability of different mobility interventions. Additionally, initiatives should prioritize the integration of emerging technologies, such as smart transportation systems, flow counting sensor and electric mobility solutions to optimize the efficiency, accessibility and environmental impact of the urban transportation.

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Appendix 1. Map of analysed pilot cities from CityWalk 2.0 project

Figure 3. Geographical distribution of case studies (source: authors)

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Track 06: Governance

GOVERNANCE - Planning and democracy: contradictions, failures, and agonistic alternatives in shaping urban spaces and in urban planning practices

Chairs:

- Enrico Gualini, TU Berlin
- Joel Idt, Université Paris-Est
- Donato Casavola, Politecnico di Torino

Keywords: *agonistic democracy; conflict; co-production; experimental governance; local democracy; Planning practices and instruments; public-civic cooperation*

Can conflicts and contradictions be at the heart of urban policy-making and planning practices? After decades during which viewing the production of space from a 'governance' perspective (for instance, focusing on the dialogues, partnerships, negotiations, etc.) appeared to be commonsense, times are ripe now, more than ever, either for critical assessments and for experimental alternatives to this narrative. Conflicts are no longer systematically seen as problems. Through local experiments and networked exchange, urban political communities have started addressing tensions,contradictions, and failures of established governance practices. In doing so, they are turning critique and agonistic engagement into opportunities for cooperation and materials for innovation in urban planning and policies. At the core of these new emerging practices is the struggle for recovery and – as it were – for the reinvention of the role of the public in producing urban policies. New local democracy experiments thus dwell on a problematisation of governance that highlights such contradictions as well as the quest for alternatives.

This track aims at exploring the current state of local planning and governance as practices developing in a dialectic environment of de- and re-politicisation in agonistic arenas where the struggle for change is at the same time a struggle for new formats and principles of co-production that is at least partly based on conflicts, tensions and contradictions between stakeholders. The track welcomes contributions that aim at promoting scholarly analysis of current practices dealing with issues such as:

- emerging contentious issues of urban development, for which planning and governance struggle to find effective balances of divergent positions and interests;
- experimental governance initiatives by introducing new patterns of interaction and leaving some room for conflict;
- the role of conflicts and contradictions in urban planning techniques and in public policy instruments, which bring technical debates to a political level.

- new forms of public-civic cooperation potentially capable of introducing policy change and institutional innovation, despite (or rather thanks to) the tensions that can exist in this type of situation;
- directions towards overcoming formal-institutional ‘invited’ citizen participation and towards ‘inventing’ new forms of participatory governance;
- critical reflections on achievements of the ‘new municipalism’ in reinventing urban governance as well as on the mid-to-long-term challenges facing it.

Conflictual Natures: the role of architectural imagination in building paths for ecological transition in the city of Goias – Brasil

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Abstract (up to 125 words)

This article addresses the intertwined history of Goias City and Vermelho River to show how social perceptions about nature evolve alongside social dynamics. Different nature perspectives were interpreted as tools shaping the socio-natural phenomenon. The study analysed nature's social construction across history by treating it as a design object and by aligning a new right to nature akin to Lefebvre's right to produce the city as a work of art. Design workshop was used to analyse societal perceptions of the river and it uncovered conflicting views. It explored micro-utopian approaches to foster counter-hegemonic ecological transitions by merging utopian ideals with practicality and challenging conventional nature narratives. This perspective can help establish benchmarks for alternative practices and build a socially active approach to ecological transition strategies.

Keywords: environmental conflicts; micro-utopias; design-thinking.

1. Introduction

The city of Goiás, Brazil, has evolved closely attached to its main river, called Vermelho River. However, this relationship was quite conflicting and changed overtime as nature gained different social meanings. Thus, the aim of the current study is to investigate nature as a social product by revealing its different social performances at different times in Goiás City's history. In order to do so, a design workshop was held in the investigated city, with support of professor Wagner Rezende from UFG, to develop and explore a regressive-progressive analysis of the role played by nature in it. First, a photographic analysis aimed at identifying conflicting trends towards nature and different aspects of social perception about Vermelho River was carried out. This procedure enabled exploring virtualities and blind fields to imagine ecological transition paths in the city. Arguably, this grounds a 'right to nature', in the same terms that for Lefebvre (2000) the right to the city meant the right to produce the city as work of art. Likewise, the 'right to nature' in the city means the possibility of citizens to produce nature as work of art.

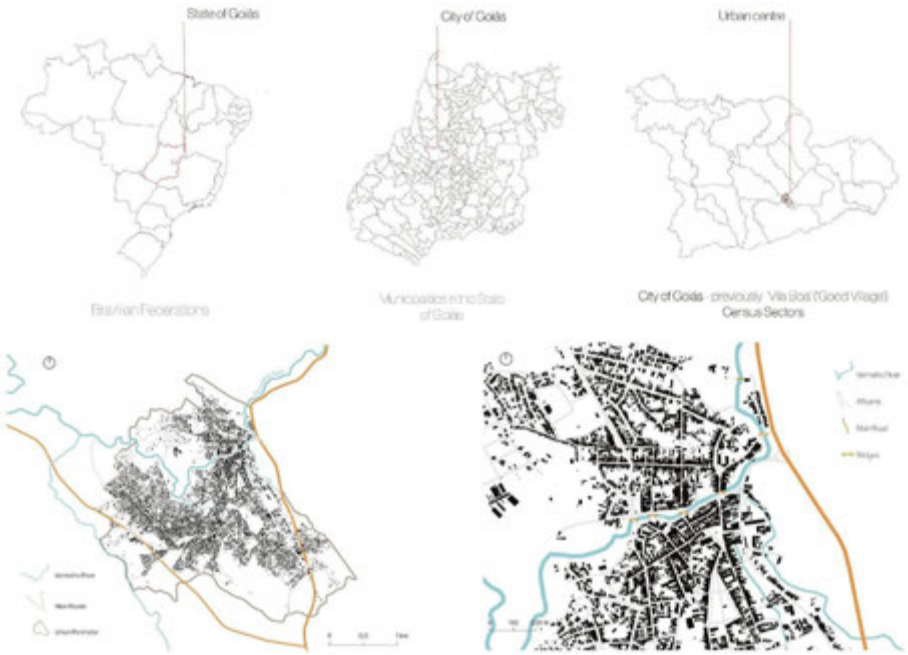

Figure 01: The city of Goias and the Vermelho River

A workshop/seminar event developed by UFG and POLITO was held to discuss the social implications of dynamics between rivers and Goiás City. It focused on addressing conflicts, social impacts, changes in social perception, and how people actually live these dynamics in their daily lives.

The workshop explored critical theories of nature and environmental planning, approaches to Urban Political Ecology, the production of subjectivities, and critical postcolonial approaches to nature. It aimed at investigating the role played by design and architecture in developing immanent possibilities for social-environmental alternatives. In order to do so, it explored design-thinking to visualise hidden aspects of urban nature through cartography, critical representation, diagrammatic interpretation and photographic *dérives*; and to envision new possible futures through utopian imagination and by seeding immanent micro-utopias.

Short lectures and discussions aimed at building a critical view and at developing tools to interpret nature as an object of design were held. Round tables were performed with, and short presentations were introduced to, the local community. Field trips produced photographic *dérives* and interviews, whereas workshops based on the flipped classroom methodology developed utopias and micro-utopias.

Visitors arriving in Goiás City will find a city immersed in nature. Yet, its history is full of complex nature-artificiality interactions ranging from negation to valorisation. Nature has always been there in the city, although it had different roles and values. The current study took some steps towards deconstructing values attributed to nature in the city, mainly by focusing on Vermelho River to find new potentials for nature's different historical blind fields. It was

done to develop an approach focused on critically dealing with history in order to set new paths for ecological transition visions.

Associations between social and natural ideas were herein explored to approach Goiás City's environment, but not with the aim to investigate nature as abstract ideal, but to analyse how it concretely performs social interactions. This approach was adopted to highlight how radical ideas about nature could point out some blind fields of, and new possibilities for, society's socio-environmental structure and its contradictions.

The herein adopted approach was based on Henri Lefebvre's (2003: 111-120) regressive-progressive method, which, in its turn, is based on two steps that were herein used to , later on, formulate micro-utopias. The first (horizontal) step focused on identifying current contradictions, according to which, a given historical moment can be read as antagonistic social phenomena. This step enabled understanding that reality is a complex field full of 'virtualities' and 'blind-fields'. The second (vertical) step comprised the process to search for the root of such contradictions and complexity back in history by analysing the paradoxical juxtaposition of archaic and modern formations. Finally, the aforementioned blind fields and virtual elements were explored using design-thinking tools to imagine ecological transition paths for both the city and its river.

2. Natural Contradictions

The current section explores living contradictions observed in the relationship between Vermelho River and Goiás City. For that, initially, a series of lectures were held to introduce the main contradictions inherent to the neoliberal context, namely: its instrumental logic, the parasitic exploitation of nature, the commodification and objectification of both nature and subjects, as well as the financialisation, individualism and spectacle observed in current times. The lectures also introduced alternative topics, such as postcolonial approaches, coexistence, ethics of care, mobility of frontiers and co-poiesis of nature.

Later on, a lecture held by the*Paesaggi Sensibile* group (conducted by Viviana Rubbo and Alessandro Guida) introduced a photographic approach to the landscape to help developing territorial narratives. Their office uses photography as a method to explore the way landscapes are perceived and have deep roots to be sought back in time. They aim at "listening" to the territory in order to find the values governing and emerging from landscapes by developing it as an interdisciplinary narrative tool to merge different participants and imaginaries. They aim at decoding, understanding and communicating key aspects to foster territorial policies. This approach was used to develop a photographic *dérive* to identify the 10 main trends towards, and views on, nature in Vermelho River context.

2.1. Concrete contradictions

The 10 conceptual perspectives about the main contradictions observed during the photographic *dérive* carried out in Vermelho River, at Goias City, are presented below.

Conflicting exchanges

The interchange between city and river unfolds amid conflicts that highlight a dynamic relationship full of tension. Although mediation mechanisms ostensibly aim at regulating the flow between these two entities, they often operate recklessly by exacerbating instead of mitigating issues. Unwanted waste streams into the river, whereas sediments encroach upon the cityscape. The river receives polluted water and retaliates through violent floods that cover the urban landscape. Consequently, it is imperative to promote a paradigm shift towards a more conscientious exchange and care based on innovative approaches to harmonise the relationship between the investigated city and its aquatic counterpart.

The problem arises from not acknowledging the city-river interdependence. , These entities are treated as separate and opposing forces, rather than as interconnected entities relying on each other for sustenance purposes. This failure to acknowledge their mutual dependence and the reckless operation of mediation mechanisms further exacerbates conflicts and tensions. It is essential promoting a shift towards a more conscientiousness about the inherent interdependence between city and river to address this issue.

Figure 2: Conflicting exchanges

Care and abandonment

There is evidence of people actively engaged in planting activities everywhere along the river banks, and it depicts people's deep connection to the environment. Ornamental plants adorning backyards, windows and verandas indicate locals' willingness to nurture and to take care of their surroundings. Ornamental plants add aesthetic appeal, as well as emphasise community members' collective willingness to take care and improve the appearance of their shared spaces. Despite these positive initiatives, several riverbank sections are left abandoned and neglected, and it emphasises their stark contrast to areas flourishing with greenery.

However, it represents a significant opportunity for transformation, rather than being seen as a setback. Communities can unlock their potential to provide a more inclusive and sustainable future by acknowledging and addressing these neglected areas.This is a unique opportunity to ground care in a local existing ethics. These abandoned spaces can be revitalised and repurposed for the benefit of all by harnessing the collective efforts of individuals and investing it in their communities' well-being. This approach not only fosters the sense of belonging and connection among residents, but it also promotes environmental stewardship and resilience. Ultimately, embracing this *ethos* of care and solidarity has the potential to turn riverbanks into vibrant community-life hubs, where everyone plays an essential role in shaping a brighter future.

Figure 3: Care and abandonment

Fruit Surplus

In addition to their connection with ornamental plants along riverbanks, people also maintain traditional relationships with rural practices. Beyond the mere presence of ornamental greenery, backyards produce a surplus of several fruits, and it is a testament to the community's agricultural heritage. Traditionally, locals freely share excess production by placing fruit boxes in front windows and by fostering a 'sharing of abundance' culture. However, despite these generous gestures, the sight of fruits rotting on the ground is all too common, and often locals insist with visitors to bring some of the fruits with them. These behaviours highlight the paradox between surplus production and waste, desire of sharing and lack of consumption.

Nevertheless, a great opportunity to promote an economy rooted in both solidarity and sharing lies amidst this apparent challenge. Communities can harness resources' abundance to create a more equitable and sustainable economy by acknowledging and addressing inefficiencies observed in the current system. This process encompasses implementing strategies to effectively use production surplus through community-wide sharing initiatives or food security programs and networks. Moreover, integrating agroforestry practices along riverbanks is a sustainable way to revitalise the landscape, enhance biodiversity and improve soil health. Communities can unlock the full potential of their resources to foster resilience and cohesion in this process by embracing the *ethos* of solidarity and mutual support.

Figure 4: Fruit Surplus

Bonding Frontiers

Symbolic lines divide anthropic and natural spaces. They simultaneously establish domains and connection points. Thus, the lines separating the river from the urban fabric are more than mere geographic contours. They are permeable borders between the natural and the built environment, between waters' fluidity and human structures' solidity.

These delimitations, which are intertwined like the lines of a poem, reveal the duality inherent to coexistence, where the winding river water meets the rigidity of urban lines. This dichotomy is not just geographic, it is a metaphor for the constant clash between nature and human creation. However, instead of rigid divisions, these lines subtly intertwine and remind us that, even in the sharpest borders, there is an eternal dance between the wild and the domesticated, between the free flowing of waters and the ordering of urban constructions.

Figure 5: Bonding Frontiers

River gateways

The quiet backyards in the neighbourhoods along the riverbanks flourish with an array of gates leading directly to the edges of water. These passages are foundational gateways that work both as guardians and mediators by controlling the dialogue between city and river. Each door is a symbolic element embodying both residents' desire for security and the desire for connection between urban life and the river's natural flow. They are mainly symbolic, and in some only the portal remains, in others there is the gate but the fence is missing. Nonetheless its symbolic protection and demarcation remains.

There lies an inherent tension between access control and yearning for connection. Thus, although these gateways frame and structure exchanges, they also embrace nature by echoing the eternal dance between the need of security and the desire for freedom. Moreover, these gateways are also frames selecting views of the calm river water current to revive the city's dynamic pulse. Although these gateways work as barriers, they are also a symbolic longing for the river's fluidity and serenity. A mosaic of gates and windows unfolds as passersby cross these spaces. Thus, these gates have the potential to recreate a harmonious experience between homes and the river.

Figure 6: River Gateways

Fluid Backyard

Houses near Vermelho River reveal an intricate dance between the need of proximity to water and caution towards nature's unpredictable pace. The carefully tended backyards at the back of the lots play a crucial role in spatial dynamics, since they outline the border between the private sphere of homes and the tortuous paths leading to the river. Solid walls emerge as guardians against natural dangers by separating everyday life from likely agitated waters. However, although these defensive barriers provide security, they often imply loss of direct contact with the riverside environment. The delicate balance between desire for protection and preserving the intimate contact with nature is revealed in this complex spatial arrangement, where architecture acts as mediator between human comfort and the unpredictability of natural settings.

Although backyards present fluid boundaries encroaching one another and extending towards the river, they lack structure. They are non-integrated landscape units. Some spaces are abandoned, whereas others are carefully tended. They form another urban ambience that is neither entirely nature-based nor completely structured. Furthermore, the boundaries between public and private properties are not clear. Locals blame the municipal administration for neglecting the river, and they see themselves as lacking agency to take care of these spaces. In this limbo, the riverbanks work as a non-activated field of potentialities.

Figure 7: Fluid Backyards

Connecting Devices

Locals have scattered DIY benches on the riverbank and created places for contemplation purposes. These seats are not only resting spaces and work as small devices capable of creating places for people to take a break, while they feel the murmurs of the river and the city's pulsating energy. Thus, the water and the streets converge to provide meeting arenas where people punctually explore the potential of calm spaces and viewpoints towards nature. This factor shows both lack of structured initiatives to explore the landscape potential of the area and the local population's willingness to adopt a hands-on approach to improve their surroundings.

Figure 8: Connecting Devices

Ordinary Invaders

Brachiaria is an exotic grass genus used to feed cattle. Species belonging to this genus provide tall and large bushes, as well as feature a common state landscape element. They outcompete native species, reduce biodiversity and create a monotonous landscape. These *brachiaria* spaces indicate places people do not approach and do not interact with. Thus, most spaces in riverbanks do not have native plants or orchards. Both natural and community ecosystems disappear in these places. Thus, *brachiaria* grass grows like a green desert in places lacking care, accessibility and backyards, in places people do not take ownership of, do not plant anything, do not take care of nor cultivate in. Nevertheless, the living river still lies there, in the middle of that place, behind that sharp, stinging curtain.

Figure 9: Ordinary Invaders

River Words

Words stand like silent sentinels arranged on plaques that trace a peculiar narrative along the tortuous paths leading to the river. Each plaque is a link in a series of discourses as an attempt to tame the fluidity of ideas that continuously seek a broader meaning. These words, like 'tributaries', intertwine to form a fabric that reflects the diversity of calls to experience, protect and take care of the river. However, these texts reflect the continuous flow of thoughts unfolding before us. As we follow the signs, we are encouraged to contemplate not only the destination, but the journey itself, and it enables shaping the course of our reflections and sculpting different lenses to look at the environment. This journey of language invites us to delve into the waters of meaning, where words reveal the constant process to keep on looking to common places.

Bruno Latour's (2004) call for scientists to be democratic representatives of non-human entities finds echo in these local practices. The community crafted these signs to communicate both human and non-human concerns by acknowledging the river's agency and intrinsic values. Scientific knowledge is translated into small slogans and the river gets a voice through the action of external subjects. Although these signs aim at education, they also promote the deeper aesthetics of interdependence and coexistence, as well as other ways to approach the local environment.

Figure 10: River Words

River Voices

“The river is used for swimming purposes, but it is not like it used to be. Nowadays, it is very dirty and disasters happen when the floods come."

“The river is used for bathing purposes, as well as for catching and eating fish. It is also used to supply tap water to the city.”

“The river is everything. It is used for bathing and refreshing purposes. The river is nature.”

“A few years ago, there was an artistic demonstration that was considered inappropriate by the natives; after that, the river lost the incentives that encouraged more people to use it.”

"We only use the river for bathing purposes. But it also plays an important role in supplying and maintaining the city."

“It is used for everything, such as giving water to and bathing animals. A few minutes ago, my daughter was asking to get in the water.”

Figure 11: Local Inhabitants giving voice for the river

2.2. Abstracting contradictions

On the one hand, the main current social contradiction lies on the almost hegemonic common sense about the need of developing sustainable alternatives, in contrast to a social performance that is leading us to a catastrophic Anthropocene. This contradiction is deeply rooted in our modern epistemology, which performs through the domination and instrumental use of nature, humans and non-humans, while having a hard time dialoguing with what is outside its own logic.

On the other hand, ecosystems are supposed to be synonyms of nature. However, the two parts of that word are already full of social and cultural assumptions. According to Juan Martinez Alier (1988), the Greek root "Oikos" means space of life, and it encompasses both the community and its territory. It is also shared by the economy, which accounts for managing this space of life. Therefore, the concept of ecology is intricate with political economy.

Moreover, systems are theoretical instruments. Adam Curtis' documentary 'All Watched Over by Machines of Loving Grace' charmingly captures how systems' theory prevail in contemporary culture, mainly through a specific branch of ecological thinking. According to Kasper (2000), the General Theory of Systems became a scientific movement in the 20th century in order to approach complex problems not as a sum of small problems, but in an integral approach focused on acknowledging the complex interactions of a set of elements (organised complexity). Nonetheless, according to Lefebvre, social reality is not 'a pre-existing system':

> …it follows that the 'real' cannot be enclosed. It is not a situation where there is no possible outcome, nor is the only outcome global collapse; for the contradiction themselves develop though unevenly. And finally, theoretical concepts may escape the system, even though they are born in it and have emerged from (…) space dominated by the strategy of homogenization and of the programmed everyday. But they still have to free themselves from that system (Lefebvre, 1976, pp. 90-91).

Furthermore, Alberto Toscano (2006, pp. 136-156) introduced dynamic system theories to discuss concepts of subjectivity. According to him, systems can be conceived without a previous hierarchical order, in a complex interaction between the internal and the external, and with no stable and distinct objects. Jameson (2002, pp. 75-78), in his turn, has stated that these positions within a 'total system' can trace their roots to Weber's 'iron cage', which rules out the possibility of dissent, and reintegrates any form of struggle as a functional part of the system.

In addition, Lefebvre (1967, 375-377) advocates that poiesis creates a new reality by operating in residual fields left untouched by current epistemologies. According to him, every epistemology has 'virtualities' and 'blind-fields' (Lefebvre, 2003b, pp. 23-44), and it means that every epistemology has specific potentials that are explored and specific fractions that remain hidden. These fractions are unarticulated into potential deeds; therefore, they are the limits of any form of reasoning. Based on his approach, poiesis creates reality by disclosing the obscure, blind and hidden part of reality. Therefore, the limits seen by a given epistemology are the source to create (possible) new realities.

Lefebvre (1967) called the possibility of having ideas creating reality poiesis. According to him, poiesis is the production of concrete experiences through ideal representations, in opposition to praxis, which focuses on real practical experiences, and to mimesis, which focuses on ideal representations in the mind. Thus, the concept of poiesis refers to how ideas can change reality; it aims at understanding the foundations, the groundwork and the decisions made within the process of creating truth/reality (Lefebvre, 1967, p. 64-65). The aforementioned author states that the creation of new possibilities is the factor driving changes in reality. This process operates just like that of a seed, which cannot simply be explained by its current reality, namely: being a seed, but by the prominent nature of its virtual reality, in other words: the possibility of becoming a tree.

3. Present past future

The current section explores the roots of the observed contradictions. Diving into the history of the relationship between the city and the river enables identifying different moments and approaches to nature. Arguably, this regressive movement focused on understanding the roots of these contradictions may be a source of 'blind fields' to be explored as 'virtualities' for future transition strategies to be implemented in the city. Present, past, future; contradictions observed between river and city were "excavated" in 5 paradigmatic periods (see Figure 12) to meet the scope of the exploration process developed during the workshop.

Figure 12: Evolution of the River and City relations

(1) Goiás City was founded as an 'arraial' (village), back in 1727, for gold mining in the margins of Vermelho River, but the State had little presence. During the first two decades, the river was a dangerous place, since the gold mining process was based on slaves' toiling and degrading the environment, increasing the spread of several diseases. In this context, the city developed with its back to the river, and its main urban spaces (also known as 'largos') were away from it, on high and dry plans.

(2) The city became the capital of 'Capitania de Goiás' in 1748, as gold mining developed. A Jail and Chamber House was built in the city in 1766, and a baroque plan was developed after 1778. On the one hand, nature in this colonial context was seen as wild and as a threat. On the other hand, it was welcome in backyards as heavenly gardens replicating gifts from God in a very catholic society.

(3) The gold production declined after the 1780's and, in 1822, Brazil became an independent state with the ambition to become a modern empire under the British empire's influence. The 19th century experienced changes in the subjective approach to nature. A series of governmental measures and laws aimed at changing citizens' relationship with nature, functioning as a means for the modernization of society . For instance, hunting was prohibited to implement modern labour practices, whereas green areas in the city were introduced to forge romantic delightful experiences.

(4) After the city lost its gold mining economic source, it turned into a rural economy based on livestock farming. The city froze and became stagnant, without almost any changes, for one century. Nonetheless, an important transformation changed the city's relationship with the river. In 1869, a new road was built to provide access to the new Central Market (finally built in 1926); it created a new entrance to the city and cut the old backyards facing the river. Although inverting the face of the river to the city, the road remained mostly empty, only holding backyard doors and few new modern institutions.

(5) An Environmental Film Festival was launched in the city, in 1999. Since 2001, the city and the local mountain range became Unesco Heritage; the river became the ecological symbol connecting them. Furthermore, the current environmental crisis has changed urban nature values and subjectivities. Local communities often engage in practices and new attitudes towards nature. These new forms of valuing and conservation practices have turned the river into the central point in the city, and it encouraged the construction of new stores and restaurants.

Different perspectives have emerged from this brief excavation of the city's relationship with nature, and it highlighted unique ways through which this relationship was perceived and connected the natural to the human world. This process led to perspectives, according to which, nature can be seen as a social innovation technique, as well as emphasised the dynamic interplay between society and the environment. Therefore, nature transcends its traditional portrayal as a separate entity and displays its phenomenon shaped by socio-natural interactions. This perspective invites us to re-imagine our approach to nature by not merely seeing it as a passive backdrop, but as an active participant in our socio-cultural fabric. By embracing this paradigm shift, we unlock the potential to conceive nature as an object of design and to foster innovative solutions that include human needs and the metamorphic rhythms of the natural world.

4. Micro-utopian perspectives and the Right to Nature

In 'Spaces of Hope', David Harvey (2001) advocates for the concept of dialectical utopias to avoid the simple 'imagination' of alternative worlds. These utopias should be conceived as counter-utopias, as devices negatively related to reality. This is fundamental to enable imagining future alternatives rooted in the concrete world. Similarly, Henri Lefebvre (2000), in his book "The Right to the City", proposed an experimental utopia developed in an intellectual

operation he called ‘transduction’: the production of a possible theoretical object as reference, as strategy designed to change society.

In a similar, but distinct, line, Sande (2013) defends the creation of ‘micro-utopias’ or ‘acting as if one is already free’ (Sande 2013). Ringel (2012) adopted the ‘anthropological-anarchist approach’ to state that micro-utopias should be dedicated to creatively produce free spatialities. It is done to avoid the neoliberal evacuation of the future by developing a ‘creative presentism’, which, in its turn, creates new grounds for hope. Webb and Lynch (2010) analysed how the post-punk scene built new experiences of reality that were momentarily actualised in ‘pirate spaces’ of globalisation and, then, into ‘lifeworld’.

According to Bourriaud (2002a, p. 31), the traditional critical theory can no longer substantiate artistic strategies, since the total negation and society transformation strategy is no longer available. He defends everyday tactics that work within and against the system, promoting new forms of conviviality and encounters. According to him, contemporary art already works through the invention of idiosyncratic ‘vanishing lines’. What ‘artists are trying to do now is to create micro-utopias, neighbourhood utopias, like talking to your neighbour’ (Bourriaud, 2002b). These micro-utopias are a new form of ‘possible’ micro-politics. Similarly, John Wood (2007) proposes designing micro-utopias in a less rational, critical and negative way by dismissing the ideas of monolithic utopia and Western mechanistic individualism to benefit the multifaceted proliferation of imaginative ‘miracles’ and ‘dreams’ in the ethics of flow.

Micro-utopias can be used as a strategy to articulate counter-hegemonic approaches in order to envision political green transitions. This methodology requires exploring utopia through a dialectical lens by engaging in discourse that acknowledges both concrete and creative elements. Thus, a concept of Right to Nature can emerge from this framework and advocate for citizens' entitlement to shape nature as their own work of art. This assertion underscores the transformative power inherent to human interventions within natural systems and frames such actions as acts of design. Thus, those who intervene in the nature of nature are not merely passive observers, but active participants in the ongoing process to design nature.

The designing nature endeavour operates at multiple levels and each level contributes to a given approach towards reshaping our relationship with the environment. At a visual level, it involves visualising the often-overlooked facets of urban nature. Techniques, such as cartography, critical representation, diagrammatic interpretation and photographic *dérives*, reveal the hidden layers of the natural world, which is embedded in urban landscapes. Concurrently, designing nature involves imaginative exercises through which one can envision alternative and sustainable futures. Utopian imagination enables exploring possibilities beyond the constraints of present times, as well as envisioning harmonious coexistence between humanity and the environment.

Finally, the seeding process involves cultivating immanent micro-utopias — small-scale initiatives that embody principles, such as sustainability and ecological transition, within urban contexts. The work to design nature becomes a multifaceted endeavour aimed at fostering meaningful transformations to both society and the environment by integrating visualisation, imagination and seeding. Three different conceptual perspectives were used as lenses through which one can engage in these latent possibilities to confront the immanent potentials, or virtual elements inherent to the place: commons, dark ecologies and postcolonial perspectives.

The lens of commons emphasises the collective ownership and stewardship of resources by challenging traditional concepts of private property and by promoting communal responsibility. Dark ecologies, on the other hand, delve into the complex entanglements between human and non-human actors within ecosystems, as well as acknowledge the often obscured or overlooked ecological interaction aspects, such as disturbances and disruptions. Finally, postcolonial perspectives provide critical insights to the legacies of colonialism and to the ongoing dynamics of power and oppression within different spaces and communities. Micro-utopian proposals emerged from this framework to transcend utopia as a mere apolitical and abstract ideal.

This process resulted in the overall acknowledgement that the urban stretch of the investigated river is structured as a rosary, with rooms and lines. Instead of having this configuration challenged, it was explored to enrich and nurture the existing potentials. The main proposal comprised a series of rooms, each one of them with different features and solutions that were intertwined by connection lines: streets, pathways, among others. Thus, the master plan strived to engage in the tangible realities of both the place and the context by addressing social, environmental and political concerns. It was done through practical and interactive procedures grounded in local specificity and communal agency.

Figure 13: General Concept

4.1 Micro-utopia 01: Backyard Commons

Figure 14: Map locating micro-utopia 01.

The process of restructuring backyards along Vermelho River banks transcends barriers by simply rearranging barbed wire and small pathways, by embodying a poetic transformation from the intimate to the common. The once-dominant exotic undergrowth in public spaces disappears and is replaced by areas taken care of with affection, where vegetation intertwines with both houses and the river. These open backyards are not mere physical extensions of dwellings; they are spaces capable of fostering sensory and emotional connections by inviting us to engage in silent contemplation and in interactions with neighbours.

The backyards of houses lining up along Vermelho River are teeming with orchards presenting abundant fruits on the ground. Dwellers insist that visitors should take the surplus fruits in a practice known as "pegue e leve" ("pick-up and go"), according to which, generosity works as a form of assistance and prevents fruits from just rotting on the ground. It has become a local tradition to leave surplus fruits in boxes for anyone to take. This proposal aims at enhancing this practice. The proposed fruit-sharing boxes symbolise a gift from nature to be shared among people, and it strengthens community bonds and enables the collective construction of a harmonious environment.

Common Edges (Figure 15) emerge as spaces behind houses along the river, as well as promote a deep redefinition in residents' relationships with their backyards, the river and their neighbours. As "common goods" managed by local groups and communities, these edges work as coexistence and exchange settings. Living by the river becomes a collective celebration of harmony between people and the environment. Common Edges are the backyards' transition from simple private extensions to sites of encounter by fostering shared experiences.

The pathway amalgamated with the existing ecosystem, the built environment, the river and the trees seamlessly connects these elements for users and the community. Households have designated spaces to share their traditions with visitors through simple provisions that, in their turn, can be referred to as 'commoning' the spaces. They have tables set to place boxes filled with fruits to be taken by visitors. This new connection device brings visitors together with the local community and the river. Moreover, seating areas are provided for visitors so they can observe the affection of sharing local traditions with them.

Figure 15: Shaping Common Edges with the local tradition spirit of 'pegue e leve'.

4.2. Micro-utopia 02: Interweaving River and City

Figure 16: Map locating micro-utopia 02.

This micro-utopia aligns with the concept of weaving by interweaving the urban landscape along the river. Its core goal is to draw people closer to the river by providing opportunities for contemplation and unique experiences to help establish a direct link between the urban area and river. The sinuous pathways aim at both connecting and creating microenvironments suitable for several activities. This vision goes beyond mere urban development; it strives for a symbiotic relationship by intertwining lines of life between the built environment and nature to foster a transformative journey for local residents. This proposal not only enhances connectivity but also paints a picture, wherein weaving becomes an urban life narrative by stitching together physical structures, as well as experiences and narratives along the riverbank. This process gives users the opportunity to observe and analyse different aspects, be it the urban transformation of Goiás City, the river, biodiversity or introspective exploration.

Proposals (Figure 17) include small pedestrian networks resembling bridges to enrich the urban fabric along Vermelho River. In addition to these bridges, one finds contemplation squares, as well as the provision of spaces for people to connect and enjoy the river flow. Both the bridges and the squares are linked to adjacent sidewalks through permeable pathways, and they provide perfect connectivity for users to access both sides of the river and its surroundings. Moreover, circles of Goiás' native species were created to reintroduce local species to the riverbank, to connect users to the region's biodiversity. The existing trees are preserved, and the positioning of bridges, squares and circles merge with the urban context.

Figure 17: Act of Weaving: panorama of an urban narrative

4.3. Micro-utopia 03: Connecting Strategies

Figure 18: Map locating micro-utopia 03.

Contemplation stands as a crucial aspect of human existence inviting deep reflections. The proposal aims at making a subtle shift of attention by moving away from the usual focus on human constructions towards the river. This reversal aims at inverting what is seen as backward to help improve individuals' perception about riverbank textures. Fragmenting a given wall and reorienting street food trailers to face the river helps breaking barriers to vision, encourages close observation and sparks visitors' curiosity to approach the river and its surroundings. This process fosters an immersive experience. Both solutions enable users' visual connection to the river, which is now blocked either by the wall or by kiosks' arrangement. Thus, replacing the gap in the urban fabric and the relation with the river established by current ordination.

The existing heightened wall (Figure 19), which once acted as a visual barrier, is cut to establish a connection with the river by inviting users to flow towards and engage in it. This visual link is tangibly reinforced by permeable pathways leading to the river zone and bringing users closer to nature. Sitting and contemplation spaces are proposed along the riverbank after crossing the wall.

Kiosks (Figure 20), which once obstructed users' view of the river, are now systematically arranged to allow an immersive experience with natural sounds and sights of the river, and with its surroundings. The open spaces between these kiosks invite users to engage in the river, whereas pathways guide them towards the riverbank for contemplation purposes.

Imaging 19: Towards contemplation: Fragmenting Walls to Connect with the River

Figure 20: Towards contemplation: Re-orientation of spaces

4.4. Micro-utopia 04: Green Streets

Figure 21: Map locating micro utopia 04.

It is essential re-imagining the streets in Goiás City's urban landscape to reinforce the sense of belonging among its citizens. This re-imagination process aims at cultivating connections between individuals, as well as between humans and the environment, through the seamless integration with the river's edge. This merger is essential to help instil in users' confidence in the accessibility to Vermelho River. It aims at encouraging pedestrians to navigate these spaces, as well as to feel connected to the river and to its surrounding environment.

The existing streets are re-imagined as green streets to give users the sense of ownership over the city and its natural surroundings through their design (Figure 22). Wide sidewalks, along with greenery, bioswales and a two-way bicycle track flanked by proposed avenues of trees take one step forward in the re-naturalisation of what were green backyards, until 100 years ago. The street seamlessly merged with the river edge, and contemplative spaces were defined. Consideration was given to the flow and potential rise of the river's level, and stepped seats were implemented.

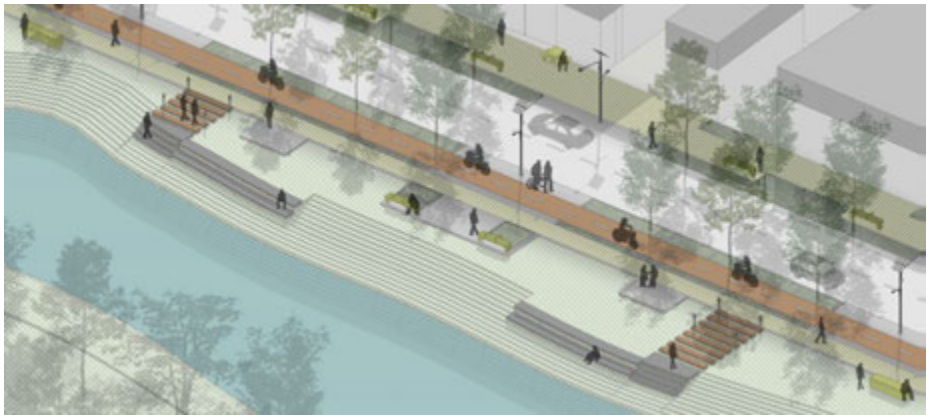

Figure 22: Re-imagining green streets

4.5. Micro-utopia 05: From Grey to Green Infrastructures

Figure 23: Map locating micro-utopia 05.

The proposal aims at transforming what previously were grey infrastructures (car parking areas) into a new green infrastructure focused on regulating the exchange of waters between the city and the river. The prototype proposal for different parking areas incorporates two key elements, namely: deployment of solar panels and implementation of bioswales. The solar panels can harness energy, whereas the bioswales help manage stormwater and create a sustainable and resilient urban ecosystem by filtering the city waters through bioswales before discharging them into the river.

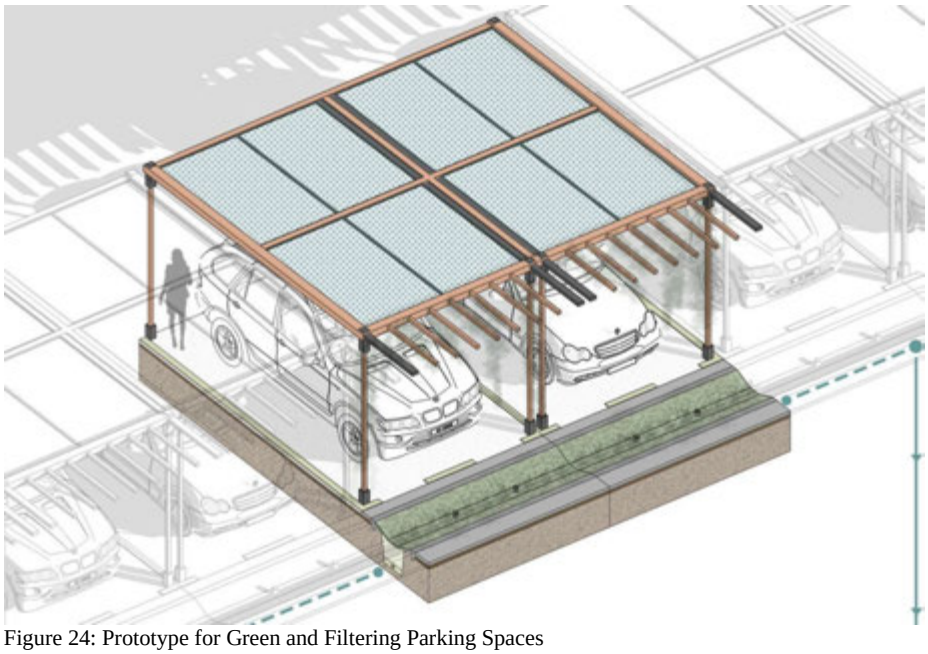

Figure 24: Prototype for Green and Filtering Parking Spaces

5. Final considerations

Subjects can be empowered to shape their environments as active participants in the ongoing social process by dialectically exploring micro-utopias to redesign nature itself, by acknowledging both concrete realities and creative potentials, and by advocating for the Right to Nature. Micro-utopias operate at multiple levels, such as integrating visualisation, imagination and seeding, to re-imagine our relationship with both nature and society. Drawing from perspectives, such as the commons, dark ecologies, and postcolonial insights, micro-utopian proposals seek to address pressing social, environmental and political challenges through practical and transformative actions grounded in local specificity and communal agency. By confronting the immanent potentials of the place, micro-utopian approaches provide a dynamic framework to envision alternative futures and to foster meaningful changes in both urban landscapes and societal structures.

By contemplating the transformative potential of micro-utopian practices, one may wonder: how can these approaches challenge the reproduction of relationships by the social performance of our ideas about nature? The goal is not to discover a swift and universal solution to manage the river and the natural landscape in Goiás City. Rather, it is about shedding light on inherent conflicts arising from the diverse desires and perspectives of several stakeholders. Contrasting visions emerge from this context: some see the river as a mere economic asset to be relentlessly exploited, whereas others see it as something sacred and untouchable.

Similarly, Goiás City's natural environment is susceptible to conflicting desires and visions that range from those advocating for its pristine preservation to those pushing for tourism development. These tensions underscore the intricate relationship between humans and their environment, as well as highlight the need of adopting a balanced approach that respects the manifold perspectives and the needs of communities living in it. The answer mostly lies on stakeholders' capacity to deconstruct prevailing notions of nature that objectify complex social relations within it. By actively engaging with and reshaping our conceptualizations of nature, micro-utopian initiatives have the power to disrupt entrenched power dynamics and to foster more equitable and sustainable relationships between society and the environment. Ultimately, this perspective contributes to establishing benchmarks for alternative modes of practice, as well as building a socially active approach to ecological transition strategies.

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Study on governance model of multi-subject participation in rural industry development -- A case study of Shanghai rural revitalization model village

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Abstract: In the process of rapid industrialization and urbanization, the problem of rural decline has become a global trend. Shanghai is the most economically developed city in China, but its rural areas also have rural decline problems. Therefore, since 2018, the Shanghai municipal government has created 112 model villages for rural revitalization as the pilot projects, introducing the city's capital, talent, management, technology and other elements to them, with the core goal of exploring the demonstration model of rural industrial prosperity. This study selected 18 rural revitalization model villages of Shanghai. Through on-site investigation and interviews with relevant subjects, it concluded that: The essential process logic of multi-subject joint participation in rural industrial development is to increase the value of rural land, buildings, facilities and equipment, intangible assets and other assets by introducing elements, achieve industrial introduction, upgrading or scale expansion, and carry out operations, thus generating cash flow and reasonable distribution. There are three typical governance models: The single-subject dominant mode, multi-subject cooperation mode. intervention mode. We analyzed the characteristics, effectiveness, and issues of each approach and provided suggestions for future development.

Key words: Shanghai, Rural revitalization model villages, Rural industry development, Governance model, Strategic suggestions

1. Introduction

In the process of rapid industrialization and urbanization, the problem of rural

decline has become a global trend. In response to this trend, China's central government put forward the rural revitalization strategy in 2017. Industrial prosperity is the core of the rural revitalization strategy.

Shanghai is the most economically developed city in China, but its rural areas also have problems such as aging, hollowing out and widening economic gap between urban and rural areas. Since 2018, the Shanghai municipal government has created 112 model villages for rural revitalization as the pilot projects, introducing the city's capital, talent, management, technology and other elements to them, with the core goal of exploring the demonstration model of rural industrial prosperity. This process has formed a governance pattern in which multiple subjects such as governments, enterprises, village collectives, villagers, and social organizations jointly participate in the development of rural industries. Clarifying the essential process logic of the common participation of these subjects, integrating the resources and advantages of them and realizing the coordination of their respective rights, obligations and interests, have become the most critical issues to realize the revitalization of rural industries.

This study aims to explore the typical diversified governance models formed by these entities participating in rural industrial revitalization, analyze the characteristics industrial development effectiveness, and existing problems of each model, and provide suggestions for future development.

2. Research methods and data

This study selected 18 rural revitalization model villages of Shanghai. Through on-site investigation and interviews with relevant subjects, we have obtained information on the development status and governance models of the research subjects.

3. Three typical governance models

We found that the essential process logic of multi-subject joint participation in rural industrial development is to increase the value of rural land, buildings, facilities and equipment, intangible assets and other assets by introducing elements, achieve industrial introduction, upgrading or scale expansion, and carry out operations, thus generating cash flow and reasonable distribution. There are three typical governance models: The single-subject dominant mode: The single-subject dominant mode, multi-subject cooperation mode. intervention mode.

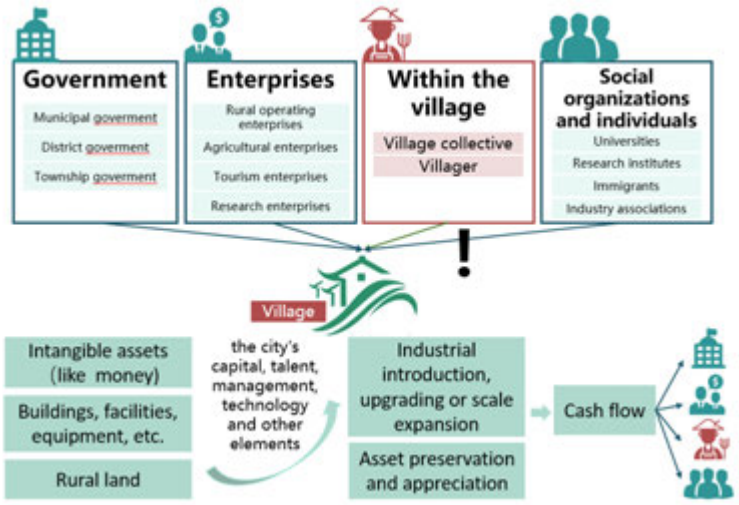

Figure 1. the essential process logic of multi-subject joint participation in rural industrial development

3.1. The single-subject dominant mode

This model generally has a leading body to carry out investment and financing, rural asset management, investment operations and other work. For example, Fengxian District of Shanghai has set up a rural collective assets operation platform "Hundred villages Group" at the district level, which invests through the integration of village collective funds, increases village operational assets, and feeds back the village collective economy with income dividends. At the township and village level, the linkage of collective economic organizations in towns and villages is encouraged, such as the development and establishment of four township platforms in Nanqiao Town, which are responsible for the construction, investment and operation of demonstration villages, the circulation, decoration, leasing, and the investment and operation of village collective and villagers' idle funds. In general, through the "three changes" reform of "resources to assets, funds to shares, farmers to shareholders", the model has formed an effective "state-owned assets to drive collective assets, collective assets to drive farmers to increase income".

3.2. The multi-subject cooperation mode

This mode generally means that all types of entities give full play to their resource advantages, jointly carry out project development, construction and

operation, and share benefits. For example, in Maogang Town, Songjiang District, Shanghai, 12 villages collectively raised more than 60 million yuan, which was held by the town asset company, and jointly established a joint venture company with a foreign enterprise. In one of the villages, the collective construction land was invested in the market pilot, the science and technology park was established, and high-quality enterprises in light industry, high-tech research and development, commercial office and other fields were introduced. Many villages share the benefits of housing rental.

3.3. The intervention mode

This mode generally refers to the involvement of foreign subjects in some links of rural industrial development. If foreign new villagers intervene in the rural development mode, it means that people with lofty ideals from all walks of life settle in the countryside for production and life, bring new ideas and impetus to the countryside, and help the rural revitalization and development. For example, Cenbu Village, Jinze Town, Qingpu District, Shanghai, is the first village in Shanghai to form a group of new villagers. The ecological environment in the village is beautiful, and the water sports are rich. At present, there are 62 new villagers, mainly engaged in scientific research, operating kayak clubs, homestays, cafes, aquaculture and so on. The new villagers have brought the drainage effect of new life, bringing diversified industrial development and emerging vitality to the countryside. Some new villagers have built houses with different styles through house rental transformation, adding differentiated characteristics to the rural style.

4. Problems with three governance models

In essence, the single-subject dominant mode is governance under the strong government's dominance. As district-level governments tend to achieve the concentration and visibility of rural revitalization in the shortest possible time, they focus more on accelerating the implementation of the national strategy of rural revitalization at the grassroots level. Therefore, they tend to let local state-owned enterprises with strong profitability participate in the construction of rural collective economy, which is easy to fall into the low efficiency of mandatory distribution by the government, and the participation of village collectives, villagers and small and micro market entities is not high.

The multi-subject cooperation mode: On the one hand, there are relatively high contractual requirements for the various subjects involved in the cooperation, such as how to reasonably distribute the benefits if it succeeds, how to bear the consequences

if it fails, and how to reasonably withdraw if some subjects want to withdraw. On the other hand, it is also difficult to find profitable assets and achieve sustainable operations, because since each entity invests in a common asset, it needs larger assets with higher returns, but such assets are less common in rural areas.

The biggest problem of the intervention mode is the lack of sustainability, because foreign subjects have their own original living places, and rural areas are likely to be only a place for them to stay for a short time, and how to sustainably use the resources they bring to the countryside is a problem. In addition, the contradictions caused by the different living habits of new villagers and local villagers also need to be paid attention to.

5. Conclusion and suggestions

Conclusion: Different subjects are different in their dominance, power and responsibility distribution, interest needs and income distribution in participating in the revitalization of rural industries. Different combinations lead to different characteristics such as industrial development speed, scale and sustainability. The dominant mode should focus on stimulating the enthusiasm of other participants, the diversified cooperation mode should focus on the establishment of cooperation systems and mechanisms, and the intervention mode needs to consider more sustainability and habit-running. Specific development proposals are as follows:

(1) The establishment of multi-subject joint governance system, whole process supervision mechanism and normal communication mechanism is an effective way to achieve the coordination of co-governance.

(2) In order to realize the revitalization of rural industry, it is necessary to combine the location, resource conditions of the village and the characteristic of each subject to choose, integrate and continue to innovate the governance model.

(3) In particular, for most villages, village collectives and villagers are in a relatively weak position in the co-governance pattern. In the open co-governance pattern, great attention should be paid to the protection of the interests of village collectives and villagers. The village collective governance ability, villagers' self-organization ability, endogenous development motivation and ability should be continuously enhanced.

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A Study on the Integrated Governance Model of Development Zone and Town: Take South Jiangsu Region of China as an Example

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Abstract: Promoting the integrated development of development zones and towns has become a crucial focal point for achieving high-quality urban and rural development in South Jiangsu, China. This paper commences with an examination of the historical evolution of the relationship between development zones and towns, followed by an exploration of the imperative for their integration. Using the South Jiangsu region as a case study, the paper establishes a framework for analysis based on the theory of scale reconstruction, termed as 'power-space' re-scaling analysis, and delves into the various types and distinguishing features of governance practices concerning the integration of development zones and towns. The research highlights the following key points:(1) The integration of development zones and towns represents an inevitable and progressive stage in the evolution of their relationship, and urbanization in Southern Jiangsu has transitioned into a new phase characterized by the integration of development zones and towns, facilitated by institutional innovations.(2) The reformation of integrated governance mechanisms for development zones and towns manifests in four distinct types: linkage platforms, cooperative agreements, administrative consolidation, and embedded proxies.(3) Examining the subject relationship, spatial domain, and governance structure across various integration practices reveals a discernible pattern of business alienation indicative of re-scaling dynamics."

Key words: Development zone, Town, Integration of development zone and town, Re-scaling

1 Introduction

"Development zone and town integration" refers to the local governance practice of the development zone and its surrounding towns to promote the overall development of the development zone and town through functional space integration, collaborative mechanism innovation, administrative relationship adjustment and other ways. Since the reform and opening up, there is no doubt that development zones and towns are the two core carriers to promote economic development, spatial growth and population agglomeration in southern Jiangsu. However, in the process of rapid urbanization, due to differences in property status and management system, development zones and towns have conflicts of governance in the aspects of functional division, right boundary and social management responsibility. Under the background of new urbanization, in the face of the social needs of high-quality overall development of urban and rural areas, in order to solve the overall imbalance caused by the division of development zones and towns, since 2006, Kunshan Huaqiao Economic Development District and Huaqiao Town implemented the "integration of development zone and town" management system reform, promoting the integration of development zone and town has become an important way to promote new urbanization and overall urban and rural development in southern Jiangsu.

Most of the existing studies on the integration of development zones and towns are carried out under the theme of "linkage between development zones and towns" and "integration of development zones and towns", focusing on the analysis of the development imbalance of development zones and towns[1-2,5], discussion on the purpose and significance of the integration of development zones and towns[3-6], introduction of individual policies and measures[5-8], operation difficulties and countermeasures[9-10],etc. However, the relevant research still has the following shortcomings: First, it focuses on the introduction of the specific type of " development zone and town integration", and lacks the systematic summary of the types and characteristics of the diversified practice of development zone and town integration; Second, the research mostly stays in the macro description of individual policies and measures, and lacks the theoretical traceability and internal logic analysis of the integration practice of districts and towns.

As the dividends of spatial restructuring released by the adjustment of administrative divisions gradually decline, in the later stage of urbanization, the urbanization transformation under the guidance of high-quality economic development

prompts local governments to rely on optimizing traditional administrative management methods to achieve spatial governance in the new era [11]. After the 1970s, influenced by Lefebvre's spatial production theory and neo-Marxist trend of thought, "Scale" and its reconstruction theory gradually became an important object and theoretical tool of political and economic analysis, and was widely used in the study of governance issues at the national and urban regional levels. In the practice of spatial governance of local administrative districts in China, two sets of rescaling system logics, namely "rigid rescaling" and "flexible rescaling ", have been formed for the consideration of differentiated governance objectives such as the construction of government structure network or the restructuring and optimization of economic and social factor relations [11]. The integration of development zones and towns is essentially a flexible rescaling practice of spatial governance of local government districts based on administrative system innovation.

This paper takes 26 development zones and 42 townships in southern Jiangsu Province that have implemented the practice of development zones and town integration as research objects, obtains case oral history materials and policy documents and other data through field investigation and interview, and systematically summarizes the diversified practice types of development zone and town integration governance in southern Jiangsu Province and analyzes its characteristics of rescaling with the help of rescaling theory tools. In order to provide decision-making reference for China's local district spatial governance.

2 The Evolution of "Development Zone-Town Relationship" and the Necessity of "Development Zone-Town Integration" in Southern Jiangsu

2.1 The Evolution Course of Development Zone-Town Relationship: From Separation to Integration

The evolution of the relationship between development zones and towns has always accompanied the development and transformation of urbanization in southern Jiangsu. Since the reform and opening up, the urbanization process in southern Jiangsu has roughly experienced the following four stages: Namely, rural industrialization

driven by town enterprises (1978-1991), centralized development of parks driven by development zone system (1992-2000), new industrialization stimulated by policy orientation (2001-2010), and integrated governance of development zones and towns driven by institutional innovation (2011-present)[13].Due to the institutional arrangement of urbanization in different historical periods in southern Jiangsu, the relationship between development zone and town has gradually changed from the independent development of towns and townships to the development zone, and then to a new stage of interactive integration. The relationship between districts and towns has gradually changed from township independent development, to development zone as the leading, and then to a new stage of interactive integration development.

Since 2006, adhering to the principle that economic construction should be based on districts and social construction should be based on towns, Kunshan has taken the lead in promoting the reform practice of integrating development zones and towns. By endow development zones and towns with county-level economic management authority, unified planning and construction, economic development, organizational personnel and public management measures, and promote the overall development of urban and rural areas and development zones and towns. By the end of 2023, 26 development zones(Figure 1) and 42 towns(Figure 2) in southern Jiangsu have implemented the reform practice of development zone and town integration according to local conditions through different re-scaling strategies.

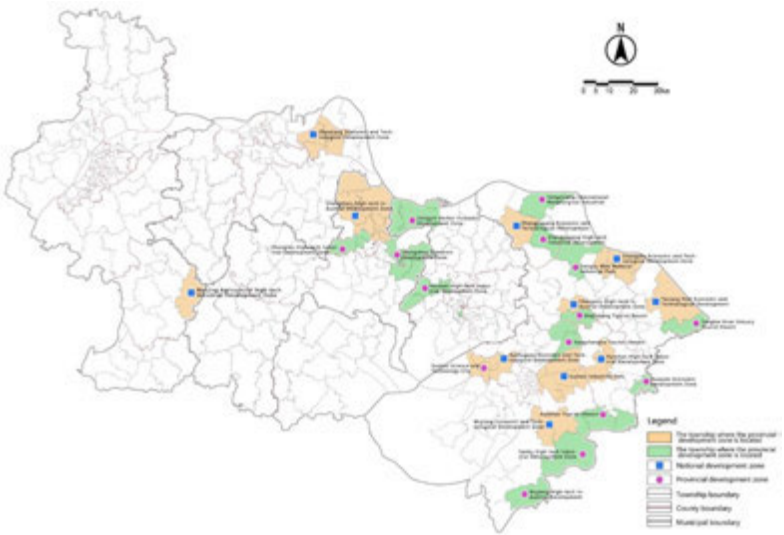

Figure 1 The distribution map of 26 development zones

Source: Author's own drawing

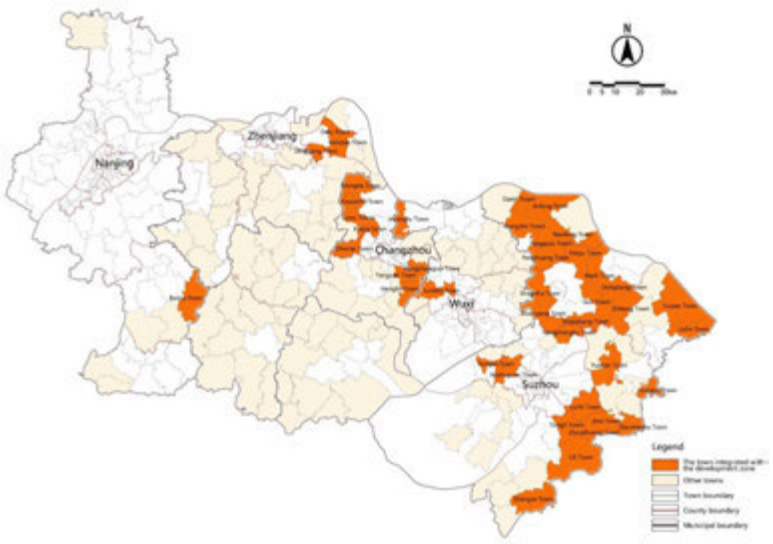

Figure 2 The distribution map of 42 towns

Source: Author's own drawing

2.2 The Necessity of Integrated Governance of Development Zone and Town: Build a Community of Development Zone and Town

2.2.1 Coordinate Urban-Rural Areas and Promote the Overall Development of Development Zone and Town

Most of the development zones are set up in the town districts in the urban fringe, and there are many geographical states such as spatial overlap and nesting. Under the spontaneous action of market forces, the development zone with increasing comprehensive strength promotes the evolution and development of surrounding towns through the diffusion effect, but the differences in administrative levels and management systems between development zones and towns lead to conflicts of

governance in areas such as power boundaries and social management responsibilities.

Due to the inherent influence of the city-oriented concept, the development level of development zones and towns have a certain "stopgap" feature [2], which damages the overall interests of the city. Therefore, whether it is to coordinate the interests of multiple subjects such as counties, development zones, and towns, or to coordinate urban and rural development, it is necessary for urban governments to overcome administrative barriers at the macro level, establish an innovative mechanism for the integration and coordinated development of development zones and towns, and promote the overall high-quality development of urban and rural areas.

2.2.2 Learn From Each Other and Coordinate the Functional Division Between Development Zone and Town

Since its establishment, the development Zone has focused on economic development as its core goal. As an agency of the local government, although the development zone has the autonomy of economic development and fiscal and tax management, its ability to provide public services and social security is insufficient [5]. With the transformation of the development zone into an urban comprehensive functional area, taking into account the upgrading of economic functions and the innovation of social governance is an inevitable requirement for the modernization and improvement of governance capacity of the development zone in the new era [15].

As a basic-level government, the town has the right to manage all the elements in its jurisdiction, but because of the influence of the city-oriented tendency and the fiscal and tax system, the town is often in the awkward situation of power and responsibility not corresponding in the development.

Therefore, promoting the integrated governance of districts and towns, forming a "development zone and township community" from the city level, promoting the functions of development zones and townships to complement each other, and overall allocation of resources such as industry and land are not only the objective needs of the transformation of development zones to comprehensive functions, but also the key path

for towns and townships to enhance development with the help of development zones.

2.2.3 Rebuild the Relationship and Improve the Efficiency of Administrative Governance

The difference in management system is the root cause of economic and social friction between the development zone and surrounding areas, and the governance conflict between the development zone and the dependent administrative district has also become a major obstacle affecting the overall high-quality development of the region. Straightening out the administrative relationship between the development zone and the town is an inevitable requirement and the key to the success of the third venture of the development zone and the promotion and development of the town [1]. Implementing integrated governance between development zones and townships, coordinating the interests of multiple power subjects, and coordinating the allocation of resources inside and outside the region [5] is conducive to overcoming the governance dilemma of "two skins" between development zones and townships, and improving the efficiency of administrative governance through restructuring strategies such as administrative structure integration and collaborative management innovation. Promote the development zone and township to form an integrated, integrated development of governance pattern.

3 The Logical Framework For the Integration of Development and Towns: a Theoretical Analysis Based on Scale Reconstruction

3.1 Overview of Scale and Its Reconstruction Theory

Scale was originally a parameter tool in geography for measuring spatial scale. Since the 1990s, with the infiltration of geography into fields such as economics, politics, and society, the connotation of scale has evolved from expressing concepts of

spatial physical scale to a hierarchical epistemological framework, structure, or relationship for dividing, combining, and representing geographic processes of different scopes and dimensions [17]. Research in scale theory has increasingly focused on the shaping of economic space and the influence on social governance by the process of scale production and reconstruction [20]. Represented by Neil Brenner, Western academia has pioneered the study of "reterritorialization" and "scale reconstruction" phenomena of various regional organizations in the context of globalization using scale theory [18]. In recent years, domestic scholars have also utilized scale theory based on the phenomenon of scale reconstruction arising from global economic and political transitions. They have explored governance issues such as cross-domain coordination of urban regions [19], administrative management [11,15], development zone transformation[12,16], and new city construction[20] based on the transformation process of scale elements such as power hierarchy and spatial domains.

3.2 Logical Framework: "Re-scaling" of Power-Space

Scale reconstruction refers to the process of changes in spatial development and power distribution across different scales. Its purpose is for governance entities to employ strategies of rescaling power and spatial capacity to regulate and intervene in urban development in order to maximize interests [12]. As discussed in the introduction, the rescaling of spatial governance of local political regions includes two sets of institutional logics: rigid administrative boundary adjustments and flexible administrative institutional innovations. Institutional innovation in administration, as it neither alters traditional government organizational structures nor involves drastic reorganization of administrative space, is more easily accepted by all parties and smoothly implemented, with generally significant effects [19]. From a governance perspective, the integration of districts and towns is a flexible scale reconstruction of local political region spatial governance based on administrative institutional innovation. According to scale reconstruction theory, scale consists of two core elements: "power"(subject interest relations) and "space"(territorial spatial

environment). Power elements exhibit a vertical characteristic, reflecting intergovernmental interest subject structure relations, while spatial elements possess a horizontal characteristic, representing the physical environment characterization of local political region differentiation and reorganization [11]. The rescaling of local political region governance is the dynamic adjustment and rematching process of the "power-space" scale relationship (Figure 3).

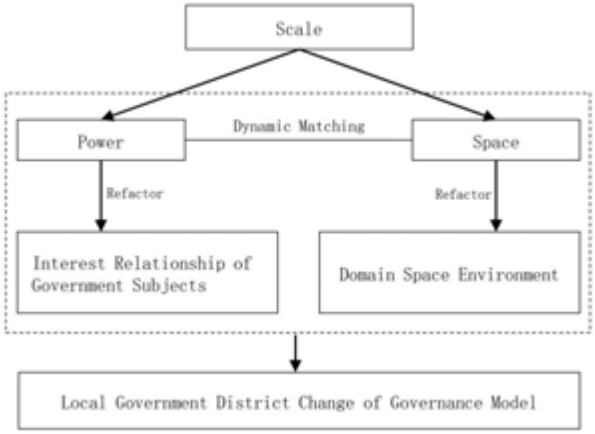

Figure 3 Logical relationship between rescaling and the change of local governance mode

Source: Author's own drawing

The article introduces the theory of scale reconstruction and constructs an analytical framework based on "power-space" rescaling (Figure 4). It uses this framework to analyze the diverse types and differentiated characteristics of scale reconstruction in the practice of district and town integration reforms in southern Jiangsu. Overall, the integration of districts and towns in southern Jiangsu is an initiative by local governments to maximize the overall development benefits of cities. It involves the top-down promotion of scale reconstruction of both the power relations between disjointed and unevenly developed districts and towns and the territorial spaces between them. This process facilitates governance structural adjustments, thereby forming an integrated "district and town community" functional unit. In other words, it is a process of institutional environment reconstruction aimed at achieving coordinated urban-rural development and overall development of districts and towns.

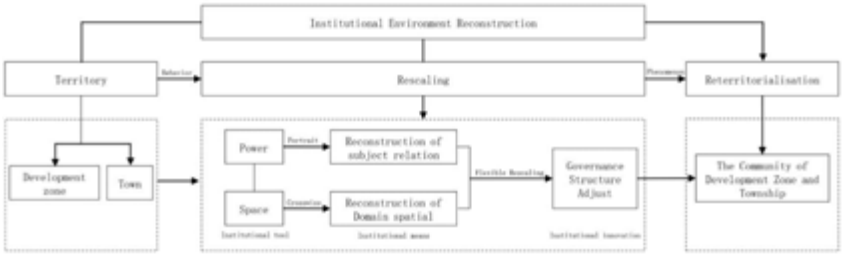

Figure4 Logical framework of rescaling of "Development zone and town integration"

Source: Author's own drawing

4. Practices Types and Re-scaling Characteristics of "Development Zone -Town Integration" in Southern Jiangsu

Based on field investigations of innovative practices in various regional administrative systems and the differential strategies of "power-space" rescaling in each district and town, a summary of the practice types involving 26 development zones and 42 townships in Southern Jiangsu's district-town integration was compiled. These practices can be categorized into four types: platform linkage, agreement cooperation, administrative co-location, and entrusted management embedding (Figure 5 and Figure 6). The diversity of practice types is related to factors such as whether the district and town cross county-level administrative regions, the administrative level of the development zone, and the number of integration subjects, reflecting the pragmatic characteristics of local spatial governance scale reconstruction. Subsequent sections will define the concepts of each type and, based on the logic framework of "power-space" rescaling, analyze the characteristics of scale reconstruction in terms of subject relationships, spatial domains, and governance structures using corresponding case studies.

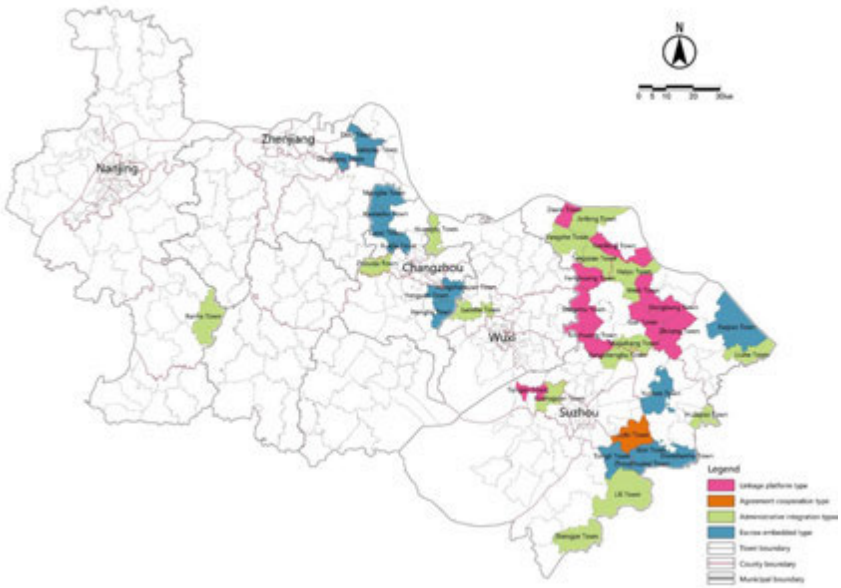

Figure 5 The type distribution map of "development zone and town integration" for towns
Source: Author's own drawing

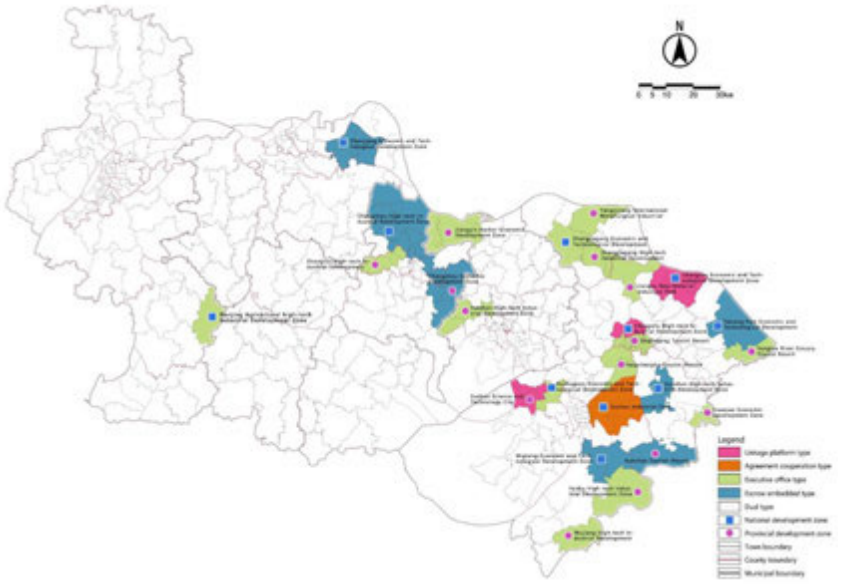

Figure 6 The type distribution map of "development zone and town integration" for development zones
Source: Author's own drawing

4.1 The type of linkage platform: Municipal-level coordination, Industrial Synergy, Enclave Integration

Platform-driven integration of districts and towns refers to the establishment of municipal-level coordination mechanisms between development zones and townships, creating a platform for the coordinated development of district and township industries. It relies on the industrial advantages and investment attraction capabilities of development zones to integrate the industrial space of districts and towns, thereby driving the transformation and upgrading of township industries. This type of integration does not involve traditional administrative restructuring but relies on flexible scale reconstruction. "Top-down coordination of industrial development and spatial layout optimization effectively avoids vicious competition between districts and towns" (Interviewee A). For example, the integration of Changshu High-tech Zone, Economic Development Zone, and surrounding townships is a practice of platform-driven scale reconstruction. Since 2012, Changshu City has established a municipal-level working leadership group to strengthen the role of development zones in attracting investment citywide, enhance the development of township industries and the level of industrial park construction, and fully realize the effective allocation of resources throughout the city. Through measures such as unifying external brand image, promoting coordinated investment attraction between districts and towns, and sharing information resources, each township has been allowed to hang the sign of "Development Zone XX Supporting Industrial Park," forming a new pattern of industrial development with districts leading towns and achieving mutually beneficial interaction in investment attraction. In the past five years, under the promotion of district-town integration practices, various linked townships have introduced nearly a hundred projects relying on development zones, facilitating the settlement of high-quality projects such as Olin Automotive and Linde Electronics in various township industrial parks, accelerating the agglomeration and development of township industries.

4.1.1 Subject Relations: Superior Coordination, Development Zone-Town Collaboration

The linkage platform type of development zone and town integration reflects the characteristic power relations of "superior coordination, development zone-town collaboration" among the three main entities of counties, development zones, and towns. In the organizational framework of the development zone-town linkage working leading group, municipal leaders and the heads of the management committee respectively serve as the leader and deputy leader, while relevant municipal functional departments and each linked town participate as member units. At the municipal level, it undertakes the functions of top-level system design and work coordination supervision, while development zones and towns serve as implementing entities. With the assistance of relevant municipal functional departments, they promote the collaborative development of development zone-town industries through the method of " development zone-leading-town, interactive sharing."

4.1.2 Spatial Domain: Core-Periphery Pattern, Enclave Integration

The linkage platform type of development zone and town integration exhibits the characteristic of spatial scale reconstruction, characterized by a "core-periphery pattern, enclave integration" in industrial spatial organization. Based on the optimization of industrial spatial resources across the entire municipality, development zones primarily focus on attracting leading enterprises in key industries, while industrial parks in each town serve as supporting industrial parks for gathering upstream and downstream manufacturers of these leading enterprises. Through the industrial spillover from development zones, the supporting parks in towns provide spatial carriers for the construction of complete industrial chains in development zones. Towns are effectively integrated into the overall industrial system and spatial pattern of the municipality through the linkage platform. Through the spatial scale reconstruction of industrial space, a pattern of interactive development in the domain space, characterized by "core-

periphery," is formed between development zones and towns (Figure 7).

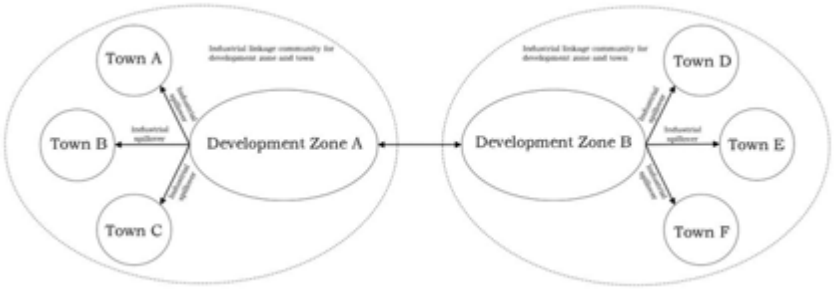

Figure 7 The diagram of domain space re-scaling for the type of linkage platform
Source: Author's own drawing

4.1.3 Governance Structure: Hierarchical Upward Movement, Empowerment Downward

From a governance structure perspective, the linkage platform-type integration of development zones and towns, beyond the traditional administrative system, is based on the governance goal of overall urban industrial development and improving the construction level of town parks. Under the unified deployment of the municipal-level linkage leading group, it coordinates the function of industrial development in development zones and towns, forming an "development zone-town community" for industrial space governance. Essentially, it is a governance action that empowers towns from development zones in a top-down manner.

In the governance process, by establishing clear incentive and constraint mechanisms through specific reward methods and goal tasks, a two-way evaluation system targeting zones and towns is established. The effectiveness of investment attraction in zones is mainly assessed, while the construction level of supporting industrial parks in towns is the main focus of assessment. This ensures the effective achievement of governance goals for the collaborative development of zone-town industries.

4.2 The Type of Agreement Cooperation: Transfer of Development

Rights, Sharing of Benefits

Agreement-based cooperation refers to the practice of scale reconstruction of development zone-town integration through cooperative agreements between development zones and towns across county-level administrative regions. An example is the collaborative development of the Dushu Lake Open Innovation Collaborative Development Demonstration Zone by Suzhou Wuzhong District (Luzhi Town) and Suzhou industrial parks.

According to the agreement, a core area of 26 km^2 was designated within the jurisdiction of Luzhi Town, including a high-end innovation industry agglomeration area of 6.5 km^2 primarily developed and operated by the industrial park. The high-end innovation industry collaborative area of 8.5 km^2 is primarily developed by Wuzhong District according to the same standard, with support from the industrial park. The ecological countryside area of 11 km^2 is jointly developed by the two districts. Within ten years, the Suzhou industrial park will invest no less than 20 billion yuan in education, healthcare, and innovation platforms in Wuzhong District. After ten years of development, the fiscal revenue will be shared and distributed with 20% to the municipal level, 40% to Wuzhong District, and 40% to the Suzhou industrial park.

Through the delineation of inter-district cooperative parks in the critical zones of county-level administrative regions, and by adopting a fusion development approach of transferring development rights and sharing benefits, effective cross-domain integration of production factors such as land and funds has been achieved. This not only provides expansion space for industrial spillover for development zones but also enhances the quality of industrial development and spatial construction in towns. Currently, the core area has attracted industrial projects with a total investment exceeding 15 billion yuan, covering fields such as electronic information, biomedicine, and fund platforms.

4.2.1 Subject Relations: Exchange of Elements, Win-Win Alliance

Outside the statutory administrative system, the rescaling of cross-domain spatial governance power structures is achieved through the establishment of the Working Coordination Council for the Demonstration Zone. According to the "Working Rules of the Working Coordination Council for the Dushu Lake Open Innovation Collaborative Development Demonstration Zone in Suzhou City," the Council serves as the decision-making body guiding and coordinating the construction of the demonstration zone, reflecting the characteristic of hierarchical upward movement in power rescaling. The Council is composed of municipal leaders, main officials from various districts, and leaders of relevant departments at the municipal and district levels. From top to bottom, it establishes positions such as chairman, vice chairman, and members, forming a hierarchical structure. This structure facilitates cooperation among multiple entities including municipal government, management committee, district government, functional departments, and towns, based on the exchange of development elements and cross-domain spatial governance, thereby forming a win-win alliance.

4.2.2 Spatial Domain: Critical Integration, Cooperative Development

The demonstration zone is adjacent to functional areas such as the Dushu Lake Science and Education Innovation Zone and the Huawei Research and Development Center on Sangtian Island. However, it is constrained by administrative boundaries, hindering the effective construction of a mutually beneficial relationship for the development of industries in cross-domain critical areas. Additionally, there are real issues of fragmented and imbalanced urban landscape images along both banks of the Wusong River.

The construction of the demonstration zone is based on the integration of cross-domain critical spaces to form inter-district cooperative parks (Figure 8). This approach, depicted in Figure 8, promotes spatial governance contracts through critical integration and cooperative development without altering the existing administrative affiliations of spatial domains. This process drives the reconstruction of spatial scales, thereby achieving high-quality integrated development of spatial domains for towns.

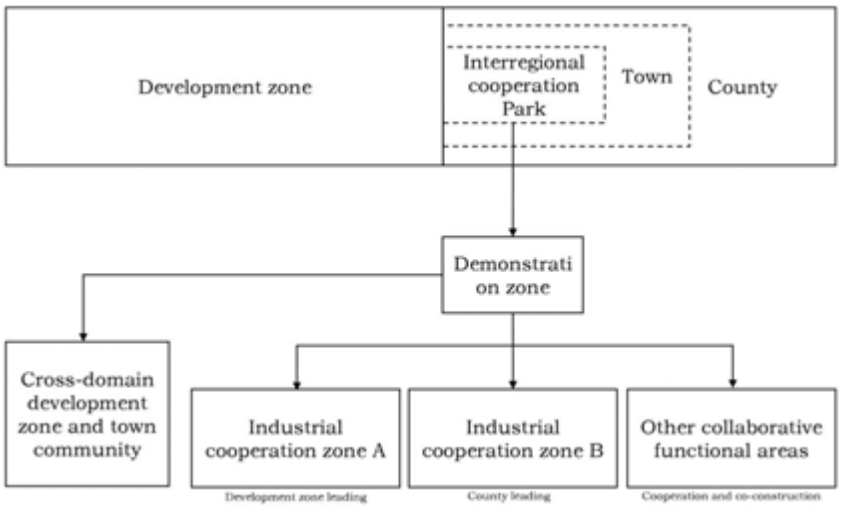

Figure 8 The diagram of domain space re-scaling for the type of agreement cooperation
Source: Author's own drawing

4.2.3 Governance Structure: Top-Level Promotion, Collaborative Construction

Constrained by administrative district economics, any unilateral action between development zones and towns cannot promote spatial governance in cross-domain areas. It is essential to establish a top-level organization beyond development zones and towns to break free from the constraints of administrative district economics. Agreement-based cooperative integration of zones and towns achieves this by establishing a Working Coordination Council mechanism, with municipal-level leadership coordinating the overall efforts. This mechanism clarifies the functions of decision-making and executive bodies within the council, thus facilitating the realization of "cross-domain critical area construction, governance, and shared governance goals" (Interviewee B). From a governance structure perspective, agreement-based cooperative integration of development zones and towns embodies the characteristics of "top-level promotion, collaborative construction" in spatial scale reconstruction.

4.3 The Type of Administrative Integration: Unified Management System, Coordinated Functional Division

The type of administrative integration refers to the integration of administrative management systems between development zones and towns, implementing a practice of "one team, two brands" co-location offices in the scale reconstruction of development zone-town integration. Following the principle of prioritizing development zone-level economic development and town-level social development, it achieves the integration of zone-town management through "six unifications" in the management system, namely unified economic development, administrative approval, planning and construction, management of social public affairs, financial management, and organization and personnel. This type is relatively common, mainly occurring between provincial-level development zones and towns, such as Huishan High-tech industrial development zone (Luoshe Town) and Wujiang High-tech industrial development zone (Shengze Town).

4.3.1 Subject Relations: Parallel Concurrent, Development zone -Town Integration

From the perspective of subject relations, the administrative co-location model of development zone-town integration adopts a strategy of complete integration, implementing a rescaling approach of "one team, two brands." This promotes the rescaling of power subject relations between development zones and towns, achieving "parallel concurrent, development zone-town integration" in the administrative system. Specifically, the Party Working Committee and Management Committee of the development zone correspond respectively to the Party Committee and Government of the town. Moreover, the Secretary of the Party Working Committee and the Director of the Management Committee of the development zone concurrently serve as the Secretary of the Town Party Committee and the Mayor of the town, respectively.

4.3.2 Spatial Domain: Boundary Elimination, Integrated Development

Initially, most of the approved areas for development zones were located within the jurisdiction of towns. As development zones expanded their areas, the geographic phenomenon of development zone and town jurisdictions intertwining became increasingly complex. The administrative co-location model of development zone-town integration relies on a rescaling strategy of "eliminating boundaries, promoting integrated development" to drive the complete overlap of spatial domains between development zones and towns (Figure 9). Within the same spatial domain, unified industrial layout, planning, construction, and land development for both the development zone and the town effectively address spatial governance conflicts between development zones and towns.

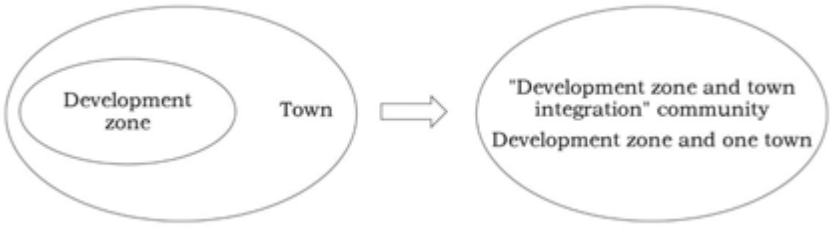

Figure 9 The diagram of domain space re-scaling for the type of administrative integration
Source: Author's own drawing

4.3.3 Governance Structure: Institutional Restoration, Quasi-Governmentalization

From a governance structure perspective, the governance of development zones, with economic development as its goal, significantly differs from urban governance and rural governance, forming a centralized third-region governance model with "integration of government and enterprises" as its core feature [21]. As development zones gradually transition to comprehensive functional areas, besides focusing on economic functions, there is a need to enhance public services and social management functions. The administrative co-location model of zone-town integration achieves mutual complementarity of functional advantages between development zones and

towns by integrating their functions. This promotes the transformation of development zones towards "institutional restoration and quasi-governmentalization."

At the administrative level, provincial-level development zones are mostly at the deputy division level, while towns are generally at the section level. The administrative co-location model promotes the "upward scaling" of town-level power levels, aiding towns in gaining greater influence in the development process. For example, the administrative functional structure of "two offices, eight bureaus, and one platform" in Wujiang High-tech industrial development zone (Shengze Town) is an administrative power structure reconstructed by the city government, granting county-level management authority to zones and towns, thereby enhancing the governance capacity of development zones and towns.

4.4 The Type of Proxy-embedded: Town Leadership by Zone, Unified Management

The proxy-embedded model refers to an innovative administrative system where the administrative functions of towns are embedded into the development zone and managed by it, without complete integration, in the scale reconstruction practice of zone-town integration. This type mainly occurs between national-level development zones and towns, such as Wujiang Economic Development Zone (Tongli Town) and Taicang Port Economic Development Zone (Fuqiao Town). For towns, "as the leaders of the development zones often hold concurrent positions as government committee members, compared to other general towns, towns integrated with zones have greater opportunities for development resource allocation" (Interviewee C). Additionally, towns are government entities at the township level, with relatively abundant administrative staff positions. "Proxy management of towns is beneficial for development zones to manage surplus staff positions in towns systematically, thus solving the problem of employment status for hired employees" (Interviewee D).

4.4.1 Subject Relations: Hierarchical Nesting, Town Affiliation to Development

zone

National-level development zones are often at the deputy department level, while towns are mostly at the section level. The significant difference in administrative levels prevents the formation of unified power subject relations between development zone and town. Therefore, in the process of integrating administrative functional structures, the rescaling strategy of hierarchical nesting of towns within development zones promotes the rescaling of power subject relations between zones and towns, forming a "hierarchical nesting, town affiliation to zone" power subject relationship. Compared to the administrative co-location model, the proxy-embedded model demonstrates that the Party Working Committee and Management Committee of the development zone hold a higher administrative level than the Party Committee and Government of the town, with the town being led by the development zone

4.4.2 Spatial Domain: Geographic Integration, Development zone Encompassing Town

In the spatial domain rescaling of proxy-embedded zone-town integration, there generally exist two scenarios: one development zone corresponds to one town or one development zone corresponds to multiple towns (Figure 10). The former scenario is similar to the spatial domain restructuring characteristics of the administrative co-location model of zone-town integration. Overall, through the rescaling strategy of "geographic integration, zone encompassing town," the previously separate development zones and towns form an integrated community of zone-town fusion and development. Under the management of the development zone, there is a comprehensive promotion of optimal allocation of spatial resources within the zone-town scope, eliminating spatial governance conflicts between zones and towns, and promoting overall high-quality development of zone-town space.

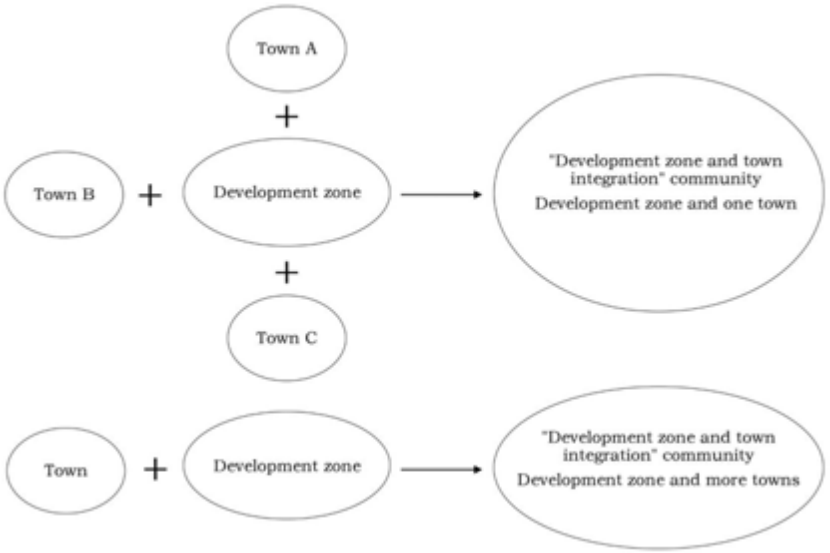

Figure 10 The diagram of domain space re-scaling for the type of proxy-embedded
Source: Author's own drawing

4.4.3 Governance Structure: Development zone-oriented, Unified Management

The proxy-embedded model of development zone-town integration reflects the governance structure restructuring characteristic of being "zone-oriented, with unified management." Taking Wujiang Economic Development Zone (Tongli Town) as an example, after embedding the administrative functions of towns into the development zone, their power hierarchy is scaled up. The administrative structure of Wujiang Economic Development Zone (Tongli Town) indicates that the development zone focuses on investment promotion and economic development functions, while the town emphasizes social governance and rural work functions. In terms of cross-functional areas, the relationship between the development zone and the town is one of leadership and being led in governance, where the "XX Bureau" of the development zone corresponds to the "XX Office" under the town. This helps to streamline the governance relationship between development zones and towns and coordinate administrative functions, promoting the centralized governance of dispersed economy and fragmented

space at the development zone-town level, thereby facilitating integrated urban-rural development.

5 Conclusions

Promoting the integrated development of development zones and towns has practical significance in promoting the complementarity of functional advantages of development zones and towns, the rationalization of administrative relations, the integration of functional space, and the coordinated layout of industries, and is also an important starting point for the redistribution of resource elements in the region and the elimination of conflicts of development zone and town governance. The integration of development zones and towns is an inevitable trend and advanced state of the evolution of the relationship between development zones and towns. In the context of the new urbanization with the overall high-quality coordinated development of urban and rural areas, the reform practice of development zone and town integration has become an important path for southern Jiangsu to seek new "institutional dividends" and improve the spatial governance ability of local political districts.

The development stage, administrative level and the relationship between the development zone and the township determine the diversification of the types of integrated governance practices of the district and town. Taking southern Jiangsu as an example, the integration reform practice of development zones and townships has evolved into four types: linkage platform, agreement cooperation, administrative offices and proxy-embedded. Moreover, the main body relationship, domain space and scale reconstruction of governance structure of each type are different, indicating that the integration development of development zones and townships is a governance reform tailored to local conditions. It also reflects the change of local governance thinking from rigid and radical "space governance" to flexible and flexible "system design".

The scale theory paradigm has a strong explanatory power for the reform practice

of integrated governance between development zones and townships. The essence of integrated governance between development zones and townships is to reconstruct the power relationship and domain space between development zones and towns through the establishment of cooperative mechanisms or innovative management systems and other flexible re-scaling strategies, so as to promote the adjustment of governance structure system. It is the process of institutional environment reconstruction and local governance change under the interest game of multi-level administrative subjects in the city. The integration reform practice of development zones and towns under their jurisdiction is closely related to the stage of urbanization development and institutional environment of the region. Due to space limitations, this paper focuses on the types and characteristics of the practice of integrated governance of development zones and towns in southern Jiangsu Province, such as the adaptability of the integration of development zones and towns, the effectiveness evaluation and the problems still existing in the implementation process are still to be studied in the next step.

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Evaluation and Spatial Governance Strategies for Old Residential Areas' Renewal and reconstruction in Urban Downtown Districts: A Case Study of 70 old residential areas in Changzhou ,China

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Abstract

As vital components of urban renewal efforts in old city districts, old residential areas play a crucial role in rejuvenating regional vitality, enhancing residents' well-being, and fostering sustainable economic and social development in cities. Taking the example of the transformation of old residential areas in the Zhonglou District of Changzhou City over the past three years, a comprehensive assessment is conducted.By integrating the theory of a full life cycle, a holistic evaluation system for the renovation of aging residential communities is established to assess the project comprehensively. This evaluation system focuses on three dimensions: space, services, and culture, in order to evaluate overall resident satisfaction across all elements.Finally, long-term governance strategies are proposed from four dimensions: government governance, social operations, engineering projects, and economic funding.

Keywords

Old residential area,Renewal evaluation, Spatial governance

Introduction

With the accelerated process of urbanization and rapid population growth, some old residential areas face the imminent threat of decline and contraction, posing a critical issue of how to rejuvenate these communities (Schenkel, 2013). Old residential areas, integral components of urban downtown districts, need to consider various influential factors including multi-stakeholder participation (Bovaird, 2007), preservation of historical heritage (Said, Aksah, and Ismail, 2013), infrastructure upgrading and redevelopment, resident satisfaction (Gu et al., 2019), and the diverse needs of marginalized groups (Clark, Kearns, and Cleland, 2016). The renewal of old residential areas holds paramount significance in revitalizing regional vitality, enhancing resident well-being, and fostering the sustainable development of urban economics and social aspects.

On the practical front, Singapore, Japan, and Western countries initiated urban renewal projects in the 20th century, tailoring innovative transformation models to address issues such as elderly care and employment for low- and middle-income groups based on their respective development contexts. Tokyo actively engages in the transformation of old residential areas, exemplified by projects like Hanada and Takashima, leveraging both governmental and private sector efforts to create multi-party agreement platforms that ensure smooth renovation processes. Regions like Sweden, Denmark, and the Netherlands prioritize community aging adaptation and eldercare service facility configurations. In the Eastern New York Neighborhood Plan in the USA, there's an emphasis on the mixed-use of community street spaces, highlighting the shaping of public areas during transformations.

Compared to international efforts, China's old residential area renovations started relatively late. Since its initiation in 2020, significant progress has been made but challenges such as long-term operation difficulties and governance shortcomings have emerged. In July 2023, China's Ministry of Housing and Urban-Rural Development issued the "Notice on Solid Progress in the Renovation of Old Urban Residential Areas in 2023," proposing qualitative and quantitative analyses to evaluate the current phase of renovations and strengthen the analysis of experiential issues.

As phases of old residential area renovation projects are complete, many Chinese cities are evaluating and providing feedback on completed work at the district level. The Ministry of Housing and Urban-Rural Development surveyed residents of old residential areas in eight pilot cities in Shandong, Zhejiang, Shanghai, and Suzhou in 2022, focusing on residents' subjective satisfaction. Cities like Tianjin's Binhai New Area, Ningbo's Fenghua District, and Nanchang's Donghu District are conducting annual performance evaluations of old residential area renovation projects. Changzhou, as one of Jiangsu Province's pioneering cities in old residential area renovations, has numerous typical samples for evaluation, aiding in systematically addressing issues and demands during renovations and improving management methods and resource allocation for future projects.

Literature review

Research on the renovation of old residential areas mainly includes aspects such as policy analysis, renovation models and strategies, and community governance. In terms of policy analysis, some scholars analyze the advantages and disadvantages of policy samples through textual analysis of renovation policies and quantitative evaluation (ZHANG et al., 2022); while others analyze the policy systems and implementation measures for the renovation of old residential areas in domestic and foreign cities (Lu , 2023). In terms of renovation models and strategies, scholars usually conduct research around a certain element involved in the renovation of old residential areas, such as spatial renovation(MA et al., 2021), sponge-city transformation (LI, GU and WANG, 2019), funding input (LI and ZHANG, 2019), etc.; or from the perspective of micro-renovation (CAI , YANG and LI , 2017), community renewal (Dai , Wang and Dong , 2019), etc., exploring the content and countermeasures of renovating old residential areas. In terms of community governance, some scholars analyze the conditions for social forces' participation and the ways of benefiting, constructing a community governance system for social forces to participate in the renovation of old residential areas (XU and XU, 2020); or from the perspective of resident participation, analyzing the paths and strategies that promote resident participation in governance in the renovation of old residential areas (LI, GU and ZHU, 2020); there are also scholars exploring informal governance models based on communities from the perspective of community administration (ZHAO , LIU and WEN , 2023).

Research on the evaluation of renovation projects for old residential areas is still in its early stages. Researchers usually evaluate the implementation effects of renovating old residential areas from a specific perspective, with significant differences in indicator selection. Some papers have evaluated the effectiveness of renovating old residential areas in a specific aspect

from perspectives such as environmental suitability (LI and WANG, 2016), aging-friendliness (HU, MA and HUANG, 2021), comprehensive environmental improvement (ZHANG, LI and GU, 2021), material space renewal (WEI, 2022), etc.; while others have started from the perspective of project performance evaluation (LI, SI and BAI, 2021), analyzing the comprehensive benefits and outputs of renovating old residential areas.

Through a review of existing theoretical research, it becomes evident that the evaluation of renovation projects in old residential areas encompasses various dimensions. Nevertheless, a comprehensive evaluation system addressing the entire project life cycle remains absent, with a limited number of studies offering comprehensive reviews and summaries of renovation efforts in old residential areas. Drawing upon existing research and practical experiences, this study examines the renovation of old residential areas in Zhonglou District, Changzhou City, employing life cycle theory to develop an evaluation system and establish an evaluation framework at the district level for such renovations. Subsequently, empirical research is conducted.

Research Demands and Objectives

Research Demands

1. The renovation of old residential areas is influenced by various factors such as the scale of construction, construction era, construction subjects, personnel composition, spatial location, and more. It is urgent to propose classified and graded renovation and optimization strategies through scientific evaluation. Effectively enhancing residents' satisfaction is one of the important goals of the renovation work.

2. The factors influencing satisfaction are diversified, including the cultural atmosphere of the community, the organization of activities, personnel composition, and the situation of residents' families. To more effectively guide future work, it is necessary to conduct scientific and systematic research to accurately identify the core contributing factors that enhance residents' satisfaction before and after the renovation, precisely match residents' needs, and effectively improve their satisfaction.

Research Objectives

Based on the two core demands mentioned above, this study aims to establish an evaluation framework with the following objectives:

Incorporating the concept of a full lifecycle, this study comprehensively considers the types of renovation and facilities involved in the renovation of old residential areas. It evaluates the entire renovation process from multiple dimensions, including the output of renovation projects, the quality of renovation works, the management of renovation operations, and the comprehensive benefits of renovation. This evaluation framework encompasses multiple stakeholders, such as residents, community (street) leaders, property management companies, and construction companies.

Furthermore, this study aims to verify the accuracy of the evaluation results by surveying residents' satisfaction after the renovation. Through questionnaire surveys comparing

satisfaction levels before and after the renovation, as well as satisfaction with individual elements and among key demographic groups, this study aims to scientifically identify the proportion of satisfaction improvement brought by the renovation of the community. This will provide sufficient data support for the implementation of future work.

Finally, based on the evaluation content and results of these two parts, this study aims to summarize the experiences and issues encountered during the renovation process and propose long-term governance strategies for community renovation from multiple dimensions.

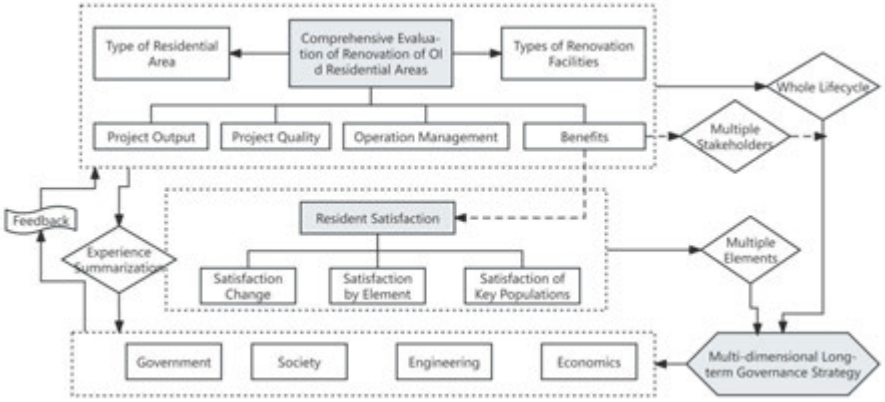


Figure 1 Research Framework

Research Design and Methodology

Construction of a Comprehensive Evaluation System for Renovation

The concept of the whole lifecycle, originating from project management science, is used to describe the various stages of a project from its inception to its completion. The application of the whole lifecycle theory to the evaluation of renovation projects in old residential areas helps align the evaluation chain with the various stages of the renovation project. This approach establishes a comprehensive evaluation process that integrates problem identification, resource allocation, implementation planning, supervision and feedback, as well as summary and improvement. It avoids issues such as incomplete element selection and biases in evaluation focus, providing a basic framework for the implementation, management, and evaluation of future renovation projects in old residential areas.

In light of the planning and construction characteristics of renovation projects in old residential areas, the whole lifecycle of these projects can be divided into four main stages: pre-decision stage, implementation and renovation stage, operation and maintenance stage, and benefit evaluation stage. By further aligning the evaluation process with each stage of the whole lifecycle, an evaluation system for renovation projects in old residential areas can be constructed (Figure 2).

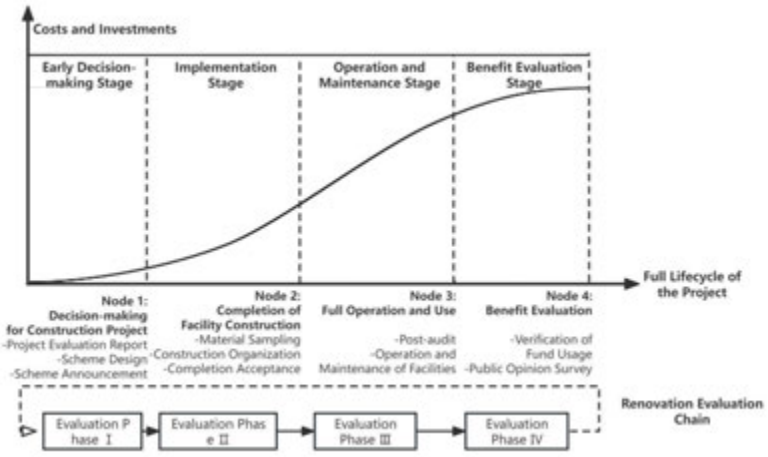


Figure 2 The lifecycle stages of renovation projects in old residential areas

(1) Early Decision-making Stage

Prior to the design of the renovation scheme, it is necessary to conduct a physical examination and assessment of the current operational status of the old residential areas to identify the main issues they face. During this stage, various methods such as field research, interviews, and big data analysis are typically employed to comprehensively evaluate the internal and external environments of the old residential areas. A comprehensive project evaluation report is then formulated. Next, based on the results of the physical examination and assessment, a list of renovation projects for the corresponding old residential areas is compiled. By considering residents' renovation preferences and funding estimations, renovation projects with urgency and feasibility are reasonably selected. This ultimately leads to the formation of a planning and design scheme with clear objectives, reasonable implementation plans, and high recognition among the residents. The indicators of this stage reflect the completeness of the physical examination and assessment results as well as the renovation project list.

(2) Implementation Stage

The implementation stage of the renovation of old residential areas involves multiple aspects such as authorization, execution, supervision, and management control of the renovation projects. During the implementation process, apart from focusing on the completion of construction objectives and the engineering benefits generated by the project, attention should also be paid to residents' satisfaction with the construction progress and the collection and feedback of public opinions. Residents should be encouraged to participate in supervising the renovation process. At the end of the implementation stage, acceptable renovation results should be achieved, with the project accounting settled and residents' feedback addressed appropriately. The indicators of this stage mainly focus on the engineering construction progress during the renovation process as well as the construction status of various facilities at key completion milestones.

(3) Operation and Maintenance Stage

The operation and maintenance stage of the renovation project for old residential areas is a crucial part of the entire lifecycle. At this stage, the spatial renovation and facility configuration for the old residential areas have been fully completed. It is necessary to establish corresponding operation and maintenance institutions or organizations and establish a long-term management mechanism for the residential areas to ensure the sustainable operation of the renovation projects. The quality of operation and maintenance is directly related to whether the project can effectively radiate and drive surrounding areas, and it also influences residents' evaluation of the project. The indicators of this stage assess the operational management status of the old residential areas based on the completeness of institutional systems and actual communication.

(4) Benefit Evaluation Stage

For the completed renovation of old residential areas, a "looking back" process should be implemented. Through the evaluation and measurement of the project's implementation benefits, a comprehensive understanding of the actual outcomes of the project's implementation should be obtained. Incorporating the evaluation and analysis of the renovation benefits of old residential areas into the lifecycle stage of the renovation project helps the government to make a deeper judgment on the social and economic benefits generated by the renovation project. The indicators of this stage demonstrate the benefits brought by the renovation project from both economic and project recognition perspectives (Table 1).

Table 1 Comprehensive Evaluation Index System for Renovation of Old Residential Areas

Primary Indicators	**Secondary Indicators**	**Explanation of Indicators**
Early Decision-making Stage	Type of Residential Area	Proportion of improvement and upgrade renovation projects among the types of community renovation projects
	Types of Renovation Facilities	Whether the types of renovation are comprehensive
	Number of Renovated Facilities Produced	Output of renovation and construction of facilities in old residential areas
Implementation Stage	Civility in the construction process	Whether the implementation process of the project construction meets relevant safety and civilization management regulations
	Qualification rate of renovation works	Operational and maintenance status of completed renovation projects
Operation and Maintenance Stage	Completeness of Management Organization	Whether the organization and business management system of the project implementation unit is sound
	Effectiveness of multi-stakeholder communication	Whether the communication channels between residents, construction parties, and the government are complete
Benefit Evaluation Stage	Project recognition	Residents' recognition of the project
	Efficiency of economic investment	Whether the improvement in residents' satisfaction is proportional to the capital

	investment per unit of renovation area in the community

Satisfaction Evaluation System and Questionnaire Design

Based on the "Technical Guidelines for Renovation of Old Residential Areas in Jiangsu Province (2021)"(jsszfhcxjst.jiangsu.gov.cn, n.d.) and the "Technical Guidelines for Renovation of Old Urban Residential Areas in Jiangsu Province (2022)" (jsszfhcxjst.jiangsu.gov.cn, n.d.), this article draws on the widely referenced evaluation systems for physical spatial environment and public service levels in existing research . By combining emotional value evaluation methods based on residents' perceptions, a comprehensive satisfaction evaluation system encompassing three dimensions of "space + service + culture" and 22 indicators is constructed. The Likert five-point scale is adopted to collect and analyze data on a per-element basis.

Among these, satisfaction with the spatial environment is the most obvious and intuitive aspect of the renovation of old residential areas, and it is also the core content of the early renovation work. Satisfaction with supporting services involves various aspects such as hygiene, parking, elderly care, property management, and safety, reflecting the comprehensive renovation level and humanistic care. Cultural satisfaction covers content such as cultural atmosphere creation, information communication, and dispute resolution efficiency, demonstrating the fine level of renovation and the changes in life brought about by the renovation. In addition, further attention is paid to changes in satisfaction before and after the renovation, as well as the impact of the renovation on surrounding areas and residents' activities (Figure 3).

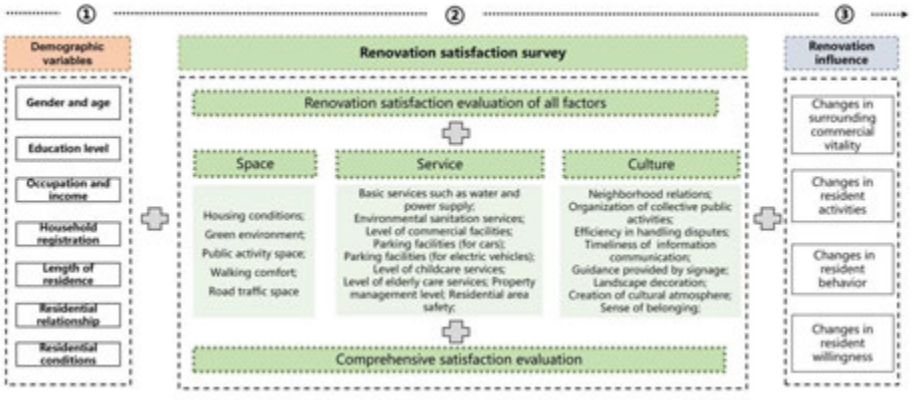


Figure 3 Questionnaire Design and Evaluation Indicators

Research Objects and Data Processing

The Zhonglou District of Changzhou City, located in the central area of Changzhou City, Jiangsu Province, is a core urban area with a long history. In recent years, some old urban residential areas in Zhonglou District have faced issues such as aging infrastructure and incomplete facilities, necessitating renovation and upgrading works. The renovation projects for old residential areas in Zhonglou District of Changzhou City are carried out on a street-by-

street basis, with the old residential areas within the area being classified into two types: improvement type and upgrading type[1].The research objects of this study are 70 old residential areas in Zhonglou District of Changzhou City that started renovation and upgrading from 2020 to 2022 (all built before 2000). More than 90% of them are located in the old city revitalization demonstration area of Zhonglou District, covering both the inner and outer parts of the old city of Changzhou. From 2020 to 2022, a total of 49,126 households were covered by the renovation, with a total building area of 4.0386 million square meters.

Through a comprehensive survey of the implementation of renovation in 70 old residential areas in Zhonglou District, Changzhou City, 1200 valid resident questionnaires and quantitative data on capital investment and engineering construction in each residential area were obtained. Among them, a judgment matrix (see formula 1) was constructed, and the 1-9 scaling method was used to compare the relative importance between renovation evaluation indicators. A questionnaire for judging the importance of indicators was designed. Experts from planning institutions, universities, and street management departments were invited to score the importance of the indicators. Decision-making expert Meta-decision software Yaaph was used to process and analyze the data, obtaining the weight values of the renovation evaluation indicators（Table 2）.

$$A = (a_{ij})_{m\times n} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix} \quad (1)$$

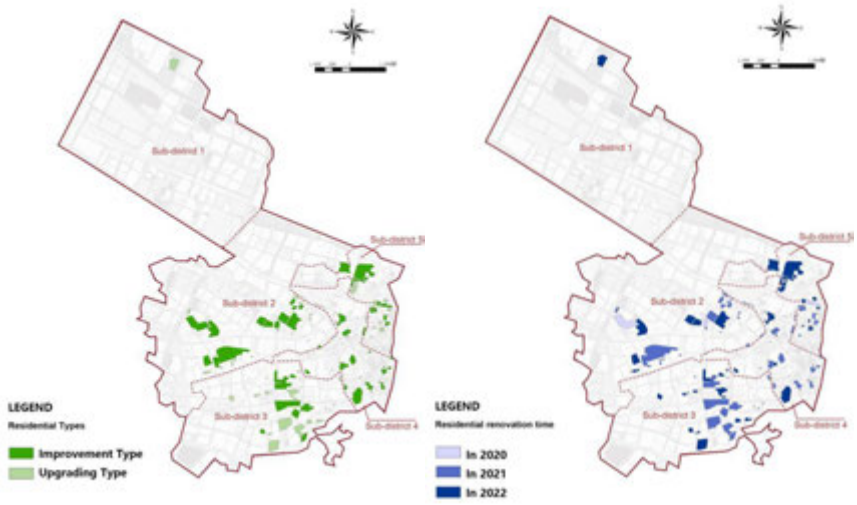
Note: a_{ij} represents the ratio of importance between row factor i and column factor j. When a_{ij} is 1, the two indicators are equally important. The larger the number, the higher the importance of row factor i compared to column factor j.

Table 2 The weight of the evaluation index system

Primary Indicators	Weight Values	Secondary Indicators	Explanation of Indicators
Early Decision-making Stage	15.48%	Type of Residential Area	7.79%
		Types of Renovation Facilities	7.69%
Implementation Stage	39.22%	Number of Renovated Facilities Produced	16.29%
		Civility in the construction process	10.86%
		Qualification rate of renovation works	12.07%
Operation and Maintenance Stage	15.55%	Completeness of Management Organization	10.53%

[1] According to the "Technical Guidelines for Renovation of Old Residential Areas (Creation of Livable Residential Zones) in Jiangsu Province," improvement-type renovations emphasize improving residents' daily lives and enhancing the environmental facilities of the community, while upgrading-type renovations focus more on improving social service provision and enhancing the quality of life.

Benefit Evaluation Stage	29.75%	Effectiveness of multi-stakeholder communication	5.02%
		Project recognition	9.92%
		Efficiency of economic investment	19.83%



(a) (b)

Figure 4 Spatial layout of the old residential areas

(a. Residential Types, b. Residential renovation time)

Results

Comprehensive Evaluation Results of Renovation

In accordance with the performance scoring and rating method outlined in the "Measures for the Administration of Performance Evaluation of Project Expenditures" issued by the Ministry of Finance , the total evaluation score is set at 100 points and divided into four tiers. Specifically, a comprehensive score of over 90 points is considered excellent, 80-90 points is considered good, 60-80 points is considered passable, and below 60 points is considered in need of improvement. For the secondary indicator level, the weights of each indicator are converted into specific scores based on a hundred-point system, and the scoring criteria remain consistent with the comprehensive scoring standards. Based on the comprehensive evaluation results of the renovation, the residential areas can be divided into four categories: demonstration communities with excellent renovation results, communities with good evaluation results, qualified communities with one or two shortcomings, and general communities whose evaluation results need to be improved. Figure 5 displays the comprehensive evaluation results of the four types of communities. It should be noted that some scattered residential buildings, due to the limited scope of renovation and the lack of representative data results, are not included in the evaluation results indicated on the map.

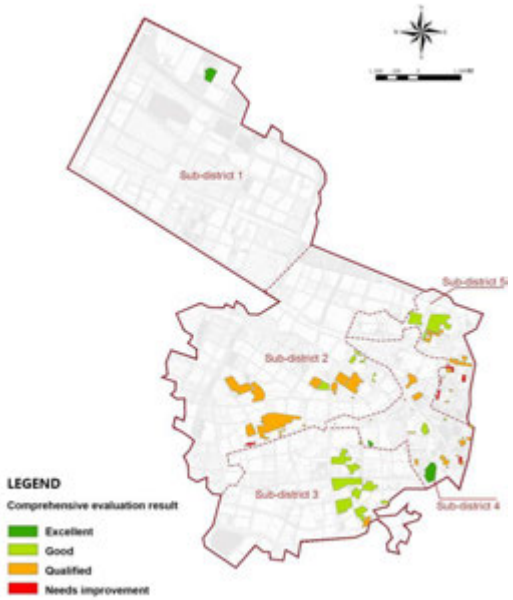
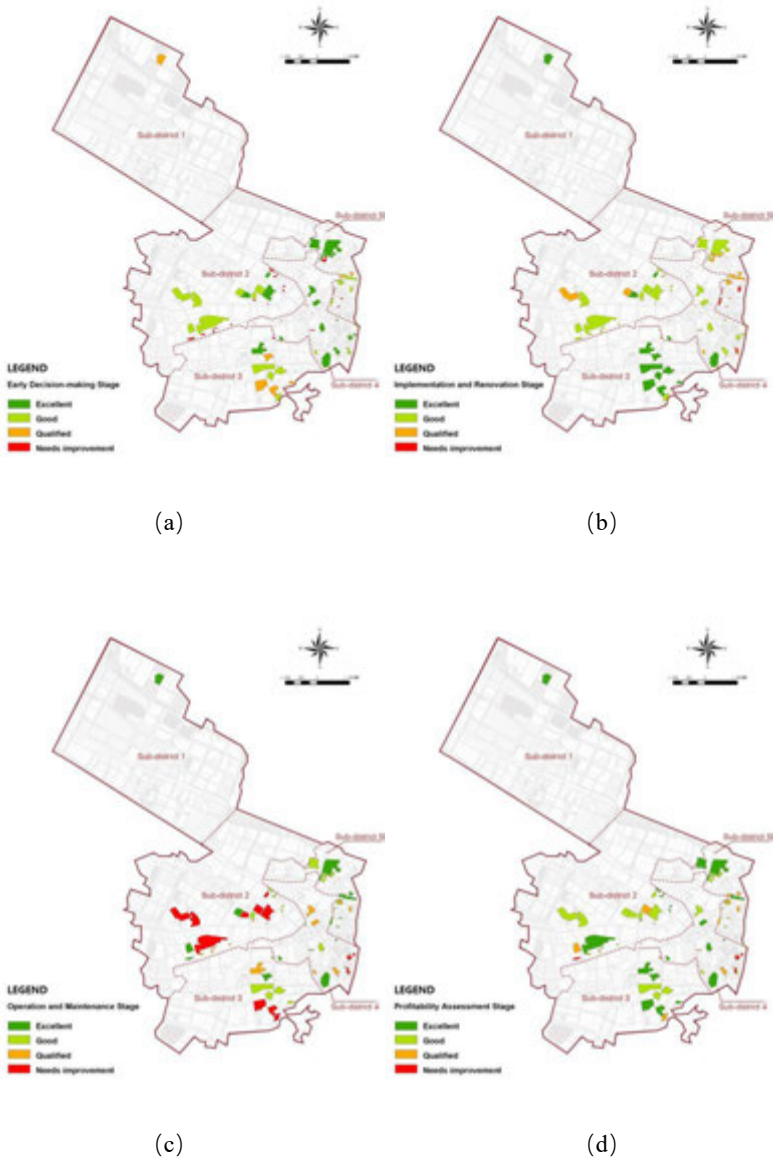


Figure 5 The comprehensive evaluation results of the renovation project

Based on the scoring results of each stage of the life cycle of each residential area, it is found through comparison that:

(1) Excellent and good demonstration residential areas in renovation have made sufficient preparations in terms of preliminary scheme design, engineering construction organization, and later operation and maintenance. Moreover, the construction units have also adopted finer manufacturing techniques, optimized construction methods, and more durable construction materials during the construction process to ensure the effectiveness of various facilities.

(2) For the old residential areas with problems, the main issue is that the effect of the renovation project is difficult to meet various requirements throughout the renovation process of the old residential areas. For example, in terms of building construction, some apartment blocks in some residential areas have issues such as peeling walls and balcony leakage, which have not been promptly addressed during the renovation; in terms of additional parking spaces, some residential areas are limited by their own site conditions and need to vacate parking spaces by reducing green activity spaces, leading to conflicts among residents of different ages; in terms of landscaping, due to the lack of professional greening management teams or property companies, the greening management and maintenance work after the renovation of old residential areas is difficult to carry out in a timely and effective manner; in terms of facility renovation, some old facilities in some residential areas have not been replaced in time, and there are also phenomena of secondary damage after replacement.



(a) (b)

(c) (d)

Figure 6 Evaluation Results for Each Lifecycle Stage

(a. Early Decision-Making Stage, b. Implementation and Renovation Stage, c. Operation and Maintenance Stage, d. Benefit Evaluation Stage)

Evaluation Results of Residents' Satisfaction

The evaluation results indicate that since the renovation of the old residential areas in Zhonglou District, the satisfaction of the residents has significantly improved, with an overall increase of 21.87%. Specifically, the satisfaction levels in the spatial dimension, service dimension, and cultural dimension have increased by 25.32%, 21.44%, and 19.78% respectively (Figure 7). Among the single factors, the improvement in walking comfort stands out the most, as the partial separation of pedestrians and vehicles, road hardening, and the improvement of public spaces have significantly enhanced the quality of daily life for residents. Additionally, through the renovation, most of the residential areas have added access control and garbage classification facilities, leading to a notable increase in satisfaction with environmental hygiene and community safety. Furthermore, the integration of cultural elements of some neighborhoods with wayfinding signage design during the renovation has been widely recognized by residents.

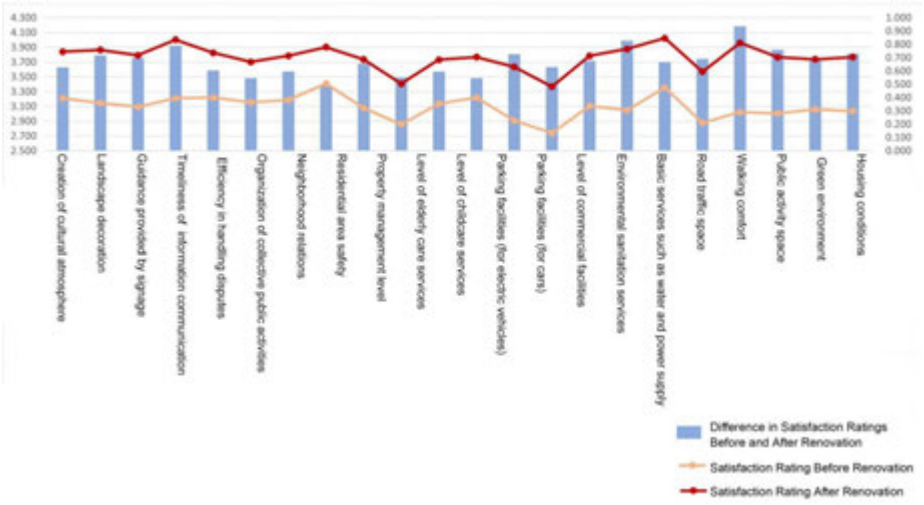


Figure 7 Changes in Satisfaction Ratings for Different Factors Before and After Renovation

However, the difficulty of parking for motor vehicles remains the most prominent issue in old residential areas. Additionally, problems such as inadequate property management, a shortage of human resources, and insufficient introduction of property management companies in old residential areas have generally affected the satisfaction ratings for property management.

The proportion of elderly individuals in the renovated old residential areas is generally high, and whether their living needs have been met during the renovation process has become an important factor influencing satisfaction. The changes in satisfaction among the elderly population towards various facilities before and after the renovation are basically consistent with the overall situation. However, satisfaction levels in areas such as elderly care, parking, and greening are relatively low (Figure 8). The focus on elderly care facilities during the renovation process was not high, and the main renovation content involved elderly canteens and meal assistance services. Although some neighborhoods provide elderly canteens and meal

assistance services on a community-basis during the survey, this service has not yet been popularized in all residential areas. Furthermore, the elderly population often has a high demand for green environments, which conflicts with the demand for parking spaces among other younger and middle-aged groups. The improper management of parking spaces by property management companies later on has led to chaotic parking, which not only encroaches on the activity spaces and green spaces of the elderly but also poses safety hazards for their travel.

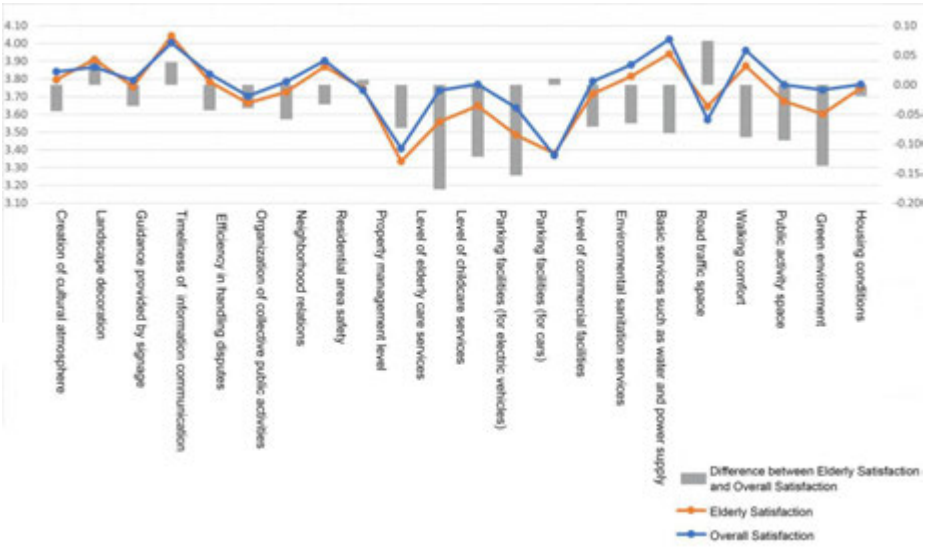


Figure 8 Comparison between Satisfaction of Elderly Groups and Overall Satisfaction

Summary

In recent years, the number of old residential areas included in the renovation scope in Zhonglou District has continued to increase, with the renovation involving a wider range of diverse content and increasingly rich connotations and levels. Through a comprehensive assessment, it can be found that the current core contradiction mainly manifests as a focus on renovation over management. Particularly, difficulties in introducing property management after renovation and the lack of flexibility in using remaining funds have led to a large number of issues arising in the later stages of the residential areas. These issues include patches of bare soil in the green spaces, unmanaged parking spaces, inadequate garbage classification, and difficulties in rapidly accessing firefighting facilities. These problems have seriously affected residents' evaluation and satisfaction with the renovation results.

Suggestions

Based on the analysis of existing issues and the interpretation of relevant policies, this paper draws on the experience of old residential area renovation from both domestic and international contexts to propose targeted long-term governance strategies for the renovation of old residential areas from four dimensions: government, society, engineering, and economy

Dimension of Government Governance: Improving Long-Term Management and Emphasizing Multi-Dimensional Linkages

Optimize the long-term management mechanism, advocate a multi-party co-governance system, and establish a governance system with the participation of grassroots party organizations, community residents' committees, owners' committees, and property management enterprises. Strengthen the leading role of grassroots party organizations in party building and coordinate the handling of various mass affairs; stimulate the supervisory role of owners' committees and actively participate in the follow-up management and effect feedback of the renovation plan; promote cooperation between property management enterprises and party organizations to jointly promote community governance activities. Provide multiple information transmission channels and combine online platforms to timely report community governance information and ensure the right to know for residents in the community. Establish long-term management evaluation standards, normalize the work of conducting "look-back" assessments on the renovation of old residential areas, and conduct graded and categorized acceptance inspections on the management effectiveness of renovated old residential areas.

Dimension of Social Governance: Encouraging Multi-Party Participation and Implementing Classified Management Models

Encourage property management enterprises to actively participate and explore diversified property management models. Research a trinity model combining government underwriting and trusteeship, residents' self-management, and property enterprise management based on the principle of "one community, one policy." For communities that do not meet the conditions for introducing market-oriented property management, an owner self-governance management model can be adopted. For communities that already have property management enterprises, it is necessary to actively promote service upgrades to meet residents' high-quality needs and stimulate enterprise enthusiasm through market-oriented means. Reduce property management costs and minimize "small, scattered, and isolated" communities through management models such as "connectivity, merger, and trusteeship."

Dimension of Engineering Governance: Addressing Facility Shortcomings and Promoting Facility Upgrades

Regularly conduct self-inspections of infrastructure renovation projects, coordinate with communities, and organize construction units to actively make rectifications to ensure smooth and level roads and unobstructed drainage systems in the community after renovation, safeguarding residents' basic daily travel environment. Enhance the quality of housing through improved technological processes, promote the adoption of technologies and materials that are innovative, mature in process, meet quality standards, and have controllable costs, maintain the unity of styles and materials for the renovation of old residential areas in different districts, and achieve organic integration with the cultural heritage and stylistic characteristics of the community. Scientifically assess and accelerate the updating of infrastructure pipelines and ducts with potential safety hazards such as water supply and heating systems, and strengthen the supporting infrastructure for fire safety.

Dimension of Economic Governance: Innovating Financing Models and Using Special Funds Flexibly

Innovate pilot fund sharing and sharing mechanisms, improve fund allocation rules, and raise renovation funds through general public budgets and government bonds. Pilot the introduction of a flexible fund use mechanism, where a smaller proportion of land transfer income from newly added residential land can be extracted as special funds for the renovation of old residential areas, with the remaining portion allocated according to regulations. Increase government financial support, attract market forces to participate, encourage qualified state-owned enterprises to participate in the renovation as scaled implementation and operation entities, and further explore various funding methods.

Conclusion

Based on the concept of a full lifecycle, this article constructs a comprehensive evaluation system for the renovation of old residential areas, aiming to provide a scientific and reasonable evaluation standard for relevant departments to accurately grasp the issues and contradictions in the renovation of old residential areas. An empirical analysis of the renovation of 70 old residential areas in Changzhou City shows that there are still core issues such as insufficient public participation, prominent contradictions in the needs of different groups, inadequate facility maintenance, and a lack of long-term management mechanisms during the renovation process of old residential areas. In the future renovation of old residential areas, it is necessary to further combine the characteristics and needs of the renovation of old residential areas in the region, identify the positioning of the management subject, straighten out various relationships, strengthen the multi-level linkage management model of district-street-community, focus on establishing corresponding operation and management organizations or platforms at various stages of the project's full lifecycle, and explore the formation of sustainable renovation and management models for old residential areas.

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How to deal with conflictual central policy incentives? Regional governance dynamics in Flanders unpacked.

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Abstract

In most European nation-states, addressing societal challenges demands collaborative approaches and broad actor coalitions. The regional level, often cited as conducive to policy integration, serves as a platform for diverse societal objectives. Despite extensive literature on policy initiatives at the regional level, the configuration and interweaving of the regional space as a result of divergent central policy incentives remain understudied. This paper addresses this research gap by focusing on Flanders, where diverse regional policy initiatives and reforms are shaping a complex ensemble. Specifically, we examine the interplay of three recent central Flemish policy initiatives. We analyze how these initiatives interact, potentially leading to conflicts or innovations, and highlight tensions and trade-offs underlying them. By studying this interplay, we aim to contribute to understanding conflict dynamics in regional governance arrangements and their implications for the academic debate on planning and governance.

Keywords: intergovernmental collaboration, rescaling, regional governance, conflict

Work in progress

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DRAFT

Introduction

In many national contexts, societal challenges are more interconnected than ever, necessitating the development of new collaborative approaches and the forging of broad actor coalitions. The regional level is often highlighted in the literature as a suitable scale to achieve various forms of policy integration (Gualini, 2006) and is framed as a platform upon which diverse societal objectives can be realized by facilitating interaction among different actors and policy levels (Fricke & Gualini, 2018).

Various policy initiatives within many EU states attempt to concretely address these societal challenges at the regional level. Policy incentives range from those situated in the relational sphere of projects and programs on one hand to more systemic reforms that are territorially oriented on the other, intervening at the basic tiers of government (Zimmerman et al., 2020). However, the actual configuration and interweaving of the regional space resulting from various, often diverging policy incentives and particularly the tensions that such a fragmented setting can cause, often remains overlooked in literature. To address this research gap, we will focus on the following research questions: how does the region take concrete shape through various and diverging policy initiatives? What roles do central government administrations play in that regard? And to what extent does this interplay of policy initiatives leads towards conflicts and contradictions at the regional level?

This contribution focuses on a specific set of policy initiatives descending from the central government to the regional level. It zooms in on the concrete interplay that can arise between these various policies, examining how they interact with each other, the potential for conflict or innovation, by exposing the tensions and trade-offs that underlie them (Christmann et al., 2020).

Evidence is presented from Flanders (northern part of Belgium), where diverse regional policy initiatives and reforms are being implemented, which gradually seem to form a complex ensemble. This contribution therefore hopes to contribute to the role of conflict in regional governance arrangements within the broad sphere of (spatial) planning.

More specifically, we delve into the interplay of three central Flemish policy initiatives which seem to develop somewhat in parallel within the current regional governance set-up:

1. The establishment of Flemish mobility regions as part of a broader reform of central mobility planning, establishing a more intense intergovernmental cooperation for addressing urban mobility & planning issues.

2. The Flemish regionalization reform (‘regiovorming’) as an overarching central policy initiative, promoting the rescaling of intermunicipal cooperation by installing a fixed ‘reference region’ scale.

3. A new policy approach being developed within the spatial planning domain, aimed towards intergovernmental contractualization via 'region deals', along which local and central stakeholders make goal-oriented and implementation-focused agreements.

We approach the interplay of these different policies towards the region as a specific policy arena where, through confrontation and mutual influence, a new space for collaboration and innovation can emerge, albeit with room for conflict, through which various trade-offs and power dynamics between heterogeneous interests and positions can find its way (Kuhn, 2021; Rangoni, 2020).

Conceptual framework

In this section, we examine how tensions and conflicting policy approaches towards the region are conceptually addressed within the literature and what frameworks are provided to contextualize our own analysis. We focus on both literature that addresses conflicting interests between public sector administrations, as well as conceptual approaches that frame the region as an intermediate coordination space more broadly.

The region as conflicting central interests

One way in which conflicting policy incentives are framed in the literature is through the theoretical concept of 'modes of governance'. Witzel (2019) demonstrates how issues encountered by practitioners within planning practices can be related to organizational and management changes within administrations, which may reflect a broader change in public sector governance, such as neoliberalism, marketization and New Public Governance (Osborne, 2010). A commonly used framework in this regard concerns the concept of ‘governance modes’. Hierarchy, market, and network are distinguished here as ideal types that refer to ways in which organization, coordination, and governance are approached within a particular sector or administration (Hedegaard Sørensen & Gudmundsson, 2010).

Hierarchy in this context refers to a model in which clear dependent relationships are formed between superiors and subordinates, with coordination occurring through an authoritative system of commands and routines. Market refers to an interaction among actors based on self-interest, wherein clearly defined property rights, competition, price signals, and forms of contract formation serve as regulatory elements. A network mode refers to the premise that each participant is mutually dependent on others to achieve desired goals, necessitating reciprocally supported actions. The coordination mechanism crucial within this mode involves mutual trust to foster a collaborative approach.

Addressing conflicting central policy incentives also involves framing them within a broader debate on decentralization and the capacity of central government to maintain a monopoly on control and political power. From this perspective, Ayres et al. (2003) demonstrates how divergent approaches from central government towards the region can be understood through a so-called 'pathology of departmentalism', which has consequences for regional working. Their findings suggest that several influences, including administrative culture, political leadership and historic legacies have therefore played a residual part in determining departmental approaches to decentralization.

Central departments are characterized by their own histories, institutional biases, priorities and leadership and have long-term policy preferences that influence how they respond to new policy initiatives (6 et al., 2002). These will determine the extent to which departments are influenced by pressures to decentralize or devolve functions and the tier of government to which responsibilities are transferred. Their analysis reveals a picture in which departments face contradictory and uneven pressures to meet national delivery targets, respond to demands for

the better co-ordination of policies with a regional dimension and refine policies to more accurately reflect regional conditions.

The region as a gap

Several authors provide insights to frame the region as an intermediate coordination space from a more generic perspective. A common approach in this regard is Hajer's concept of policy making in an institutional void (Hajer, 2003), where clear norms and rules are absent according to which politics is to be conducted and policy measures to be agreed upon.

According to this approach, territorial synchronicity is increasingly being challenged, which necessitates greater attention to the legitimacy of policy interventions. Within the loss of territorial synchrony, actors have to collaborate by transgressing institutional boundaries. As a result, trust cannot be assumed. Policy and politics are therefore not simply about finding solutions for societal problems, but also about finding formats that generate trust among mutually interdependent actors. Within this perspective, the emphasis lies on the limits of knowledge in the light of 'wicked' policy problems and the identification of unawareness as about the provision of knowledge. Policy implementation therefore requires active coordination and an awareness of mutual interdependence.

Hyotonen (2019) frames this issue within the domain of planning via the formation of so-called 'policy vacuums'. According to the author, policy vacuums are connected to the increase of short-termism and market-reactivity in spatial planning. Vacuums have therefore three intertwined dimensions: (1) horizontal, (2) vertical, (3) pervasive. The horizontal dimension arises from inter-municipal rivalry, when there is no governmental scale responsible for planning that transcends municipal boundaries. The vertical dimension refers to potential inconsistencies or mismatches between spatial planning instruments at different scale levels. The pervasive dimension refers to increasing growth-oriented dynamics, land-use practices, particularly among smaller local governments lacking sufficient planning resources.

The region as unfinished institution

Thirdly, we highlight approaches that focus on the framing of the institutional setting of the regional space. Durose (2021) frames the institutional design of governance arrangements at the urban level within a scope of 'incompleteness'. Incompleteness is conceptualized through three alternative design logics: instrumental, pragmatic, emergent.

An instrumental design logic views incompleteness as a 'description', representing a foundational or reformative moment in the institutional design process. Here, institutional design is considered 'incomplete' on its path toward becoming 'complete'. Incompleteness may arise from stalled, failed, or abandoned institutional design efforts, or from a lack of attention to enforcing institutional rules.

A pragmatic design logic approaches incompleteness as 'action', aimed at achieving 'good enough' design. It recognizes the inherently partial and incomplete access to information that designers face, their limited cognitive capacity to model and analyze all possible alternatives, and the stickiness or path dependencies of existing institutions. Finally, an emergent design logic views incompleteness as part of a deliberate and purposeful design strategy. The objective of such a strategy is for institutional arrangements to evolve over time and through usage. In

this approach, incompleteness is valued as a design principle in itself, indicating that intentional incompleteness can be a strategic choice in institutional design.

Incompleteness in institutional design can also be allied with the agonistic perspective in planning literature that values democratic opposition and seeks to realize it through an institutional design process imbued with the principles of contestation, contingency and interdependence (Kuhn, 2020). Agonistic planning theories critically oppose communicative planning theories, which fail in their view to adequately address conflict and overly focus on consensus and cooperation, leading towards a depoliticization of planning theory. Kuhn (2020) distinguishes in this regard three ideal types of dealing with conflict: (a) avoidance, (b) occasion for consensus and (c) acceptance. The agonistic planning approach is situated within the latter type and distinguishes itself from the comprehensive and communicative approach by developing a proactive relationship with conflict, which can assume a transformative function and act as a catalyst for social and institutional change (Mouffe 2013).

Our analysis builds upon the theories and approaches discussed above. Within each case, we therefore highlight the governance mode being developed, how the policy interests of central departments affect the region, and how various actors approach the institutional shaping of the regional space.

Methodology

The analysis in this study is based on a 5-year research project on regional governance arrangements in Flanders (the northern territory of Belgium), which included the three cases discussed. For this purpose, we employed an exploratory and qualitative research approach.

Considering the Belgian federal state structure and after several rounds of Belgian state reform, the Flemish Government is now responsible for most aspects of mobility and spatial planning policy and is the central state in the intergovernmental relationship with the local governments. Given the research focus on divergent central administration approaches, we focus therefore on three cases of Flemish policy initiatives towards the region, which are directed from various central administrations, being the Flemish administrations of Mobility, Environment (spatial planning), as well as Domestic Governance. The three cases can be considered as critical cases of regional reform in public administration in recent years (Yin 2018), being set up by central government during the past legislatures and involving both local and central government actors. Also, the cases concern reforms that are not limited to a few parts of the country, but cover a sufficiently wide area to also detect variation in dynamics between different regions within the same case.

Regarding data collection, interviews were conducted with a broad group of stakeholders and involved actor groups, such as regional administrative coordinators at the central level, civil servants involved in the design of the three policy reforms, officials and politicians of the municipalities involved and staff working within inter-municipal cooperative structures. All the respondents were involved in one of the three cases in some way. Following a bottom-up approach, the focus in the interviews was on both the central motivations behind the policy reforms and assessments of the desired policy objectives, as well on the practical experience of implementing the reform, the consequences this had for cooperation, and the impact on the relationships between the involved actors.

In addition to the interviews, a document analysis was conducted. The selected documents analyzed provided additional insight into the development of legislative framework and included various policy documents, supporting policy research and regional guidelines created by central administrations. Also the data collection builds from a involvement as action researchers in the reform process. The researchers took part as experts both at local level and the Flemish level of the central departments involved in the reforms via the Flemish Policy Research Centre on Governmental Innovation (Steunpunt Bestuurlijke Vernieuwing) and also as members of expert teams brought together to reflect and advise the Flemish government regarding regional reform trends and developments in general.

Analysis

We use the following structure for our analysis. Firstly, the basic characteristics of each of the three discussed cases is outlined below. Subsequently, we analyze the interplay and interaction that develops between the three policy initiatives, building on the distinct dimensions within the developed conceptual framework.

Cases description

1. Mobility regions

The mobility regions were initiated in Flanders since 2019 as part of a new policy approach in Flemish mobility planning.

The new principle of basic accessibility, that underlies the mobility regions reform, propagates a new policy frame, based on the concept of an integrated network approach of public transport designed along the idea of 'combi-mobility' (Weyts, 2015). Basic accessibility prioritizes the development of a mobility network where combinations of different modes of transport (car, bike, bus, train) are facilitated. To achieve this layered type of transportation, a hierarchic model is established that differentiates between various types of public transportation in the region.

With the creation of 15 mobility regions, the Flemish government decided to deconcentrate delegated tasks for mobility planning and policy to 15 groups of local governments via mobility region councils. So far, those tasks were not part of the autonomous realm of local governments. Local governments therefore are now operating as a politico-administrative deconcentrated branch of the central government. The set of delegated tasks includes an advisory role, a role of co-decision with central government and a role of new responsibilities for the mobility needs of targeted groups. These tasks are therefore a mix of own responsibilities, giving advice to the Flemish government and tasks related to the follow-up, but always within a central framework that allows the Flemish government to overturn decisions taken by the mobility region council. The mobility region councils are co-chaired by a political chairperson from one of the local governments and a chairperson from the central department of Mobility. The final approval of a regional mobility plan, however, is still done by the Flemish Government.

Therefore, the mobility region is based not only on a group of local governments within a territory: all the Flemish actors responsible for mobility, within the political realm of the present minister for mobility, have to take part also in the mobility region. In that regard, the mobility regions do not only affect the cooperation between (groups of) local governments, but also have a strong impact on the Flemish government itself. This impact includes an administrative reorganization, a rearranging of working methods, budgets and the reallocation of the staff in

the Flemish Department of Mobility (MOW), the Agency of Roads and Traffic (AWV) and the Flemish Public Transport Company (De Lijn). That is another novelty compared to the historical institutional heritage: the mobility region institutionalizes the intergovernmental cooperation between the two levels of government that really matter, politically: local government and Flemish government (De Rynck et al., 2021).

From an institutional perspective, the mobility reform is facilitated by the introduction of a new framework in which basic accessibility as a new policy approach is anchored by decree (= a Flemish law) (Flemish Government 2019). The decree of basic accessibility, adopted and implemented in June 2019, stipulates the creation of 15 new mobility regions and mandates cooperation between all local governments in each of the 15 regions.

The decree also gave rise to a new geographical demarcation of mobility regions. The delineation process of the mobility regions was the output of an administrative cooperation between the Department of Mobility and the Department of Environment (competent for spatial planning), a new form of cooperation and an exponent of the pressure towards a more integrated approach towards central policy making. In the first phase, 19 draft regions were delineated based on mobility flows, functional relations and existing types of regional cooperation. In a second round, this proposal became the object of a political deliberation which resulted in a final delineation of 15 mobility regions. The political deliberation did not change the map drastically: the technical-scientific work was retained by approximately 80% in the final choices and the political interventions were not at odds with that work. The scale of the 15 regions, the cooperation and the competences of those regions got therefore all imposed and regulated by the Flemish government itself. This is new as it breaks with a strong tradition of sacrosanct 'autonomy' of local government and the free choice for intermunicipal cooperation (Schraepen et al., 2021).

From a local perspective, a key innovation of the mobility regions reform is that the local authorities should have a more transparent and formal say in and control over Flemish mobility budgets. The idea is to give local authorities more influence in public transport on their territory, with a strong say in shaping the two 'lowest' layers of the hierarchical transport model. This approach stands somewhat in contrast with the previous non-transparent lobbying practices from individual local governments towards the Flemish mobility actors in order to obtain more investments and a better public transport offer for their own local territories. Interestingly, many respondents from local government argue that thanks to their involvement in the Mobility Region Councils, the contacts between Flemish mobility actors and (groups of) local government are now much more numerous and intense than before (Schraepen et al., 2023). There seems to be a growing mutual understanding of local political interests and positions, leading towards a growing mutual trust and an enhanced cooperation between the local and central level throughout the mobility regions, on the condition that agreements within the transport region are subsequently sufficiently honored by ministerial engagements at the central Flemish level.

2. Regionalization reform

The current Flemish government Jambon (2019-2024) stated a strong position on the reform of regional governance. The political ambition is set forth to counter administrative burden and the fragmentation of interorganizational collaborative arrangements on the regional level. In the end, the objective is to achieve fewer but stronger regional cooperation structures, a more simplified government apparatus and a strengthened domestic governance.

These political objectives retraces a long-standing policy discussion regarding the intermediate level in Flanders. A turning point in this debate was a regional 'screening' that was conducted about a decade ago. De Rynck et al. (2011) provided an extensive overview of intermunicipal partnerships, informal forms of cooperation, structures and demarcations in which local government were involved at the time. The inventory resulted in a total amount of 2,229 arrangements involving local governments, and an average of 68 arrangements per Flemish municipality (308 at that time). The study raised a broader awareness among stakeholders regarding the complexity of the Flemish intermediate level, which was framed by some as 'administrative cluttering', and the multitude of activities taking place here. This imbroglio of arrangements at the regional level and the lack of coordination created a sense of administrative burden among local government and led to the identification and problematization of several governance issues at that intermediate level: democratic legitimacy, compartmentalization, insufficient transparency, inefficiency, and a general lack of clarity.

As a response, central government aspires to tackle these problems through the regionalization reform. In order to achieve greater coherence at the intermediate level, the Flemish government set up a policy framework for intermunicipal and intergovernmental cooperation to evolve towards fixed regions, so called 'reference regions' (Flemish Government, 2020). Reference regions are conceived as a scale coordination instrument in which all forms of intermunicipal and supra-local cooperation should be clustered. The underlying policy assumption here is that bringing more coherence and consolidation at the intermediate level by rationalizing intermediary structures will lead to a more simplified and transparent government apparatus, fewer mandates and a strengthened, more effective cooperation at the regional level. As a general rule for scale coordination the so-called 'Russian doll principle' is postulated which states that intermunicipal cooperation should coincide with one or more reference regions or fit within one region, with the aim of enabling coordination at the scale of the reference region (Descamps, 2023).

Despite the ambition to increasingly concentrate and align collaboration forms on the scale of the reference regions, the Flemish government does not want to develop the reference regions as a new tier of government with its proper institutions. The regions do not replace the still existing provincial intermediate level and so far reference regions are merely conceived as a coordination level for various forms of intermunicipal and supra-local cooperation. The Flemish government itself declares to 'lead by example' and will gradually adjusts its regulatory framework for intermunicipal cooperation to align with the reference regions (Flemish Government 2021). In addition, central government imposes local government by decree to align all their cooperation forms within the scope of the reform to align with the reference regions by the horizon of 2030.

3. Region Deals

The Flemish spatial policy currently finds itself in a somewhat schizophrenic situation. On the one hand, significant gaps can be identified in terms of the central policy framework, while on the other hand, we witness also an abundance of policy trajectories, studies, and experiments.

A striking example of a central policy gap is the Spatial Policy Plan Flanders, initiated in 2011 to succeed the Spatial Structure Plan Flanders from 1997, yet in 2024, it has not been fully completed (only a strategic vision has been approved). This situation is often framed as a lack of political courage to proceed with tough central decision-making, for example, regarding the

protection of open space and the compensation issue for affected landowners (Coppens & Vloebergh 2017). At the same time, we observe that similar trends can also be observed in neighboring countries. The Netherlands, often seen as a model case in spatial policy and governance, has also been grappling with its National Spatial Vision for some time. Despite both spatial visions formulating good intentions for major societal transitions, they seem incapable of formulating task-oriented, binding goals, particularly for other policy domains, let alone integrating them all into one central spatial policy.

On the other hand, we observe that spatial challenges in Flanders are being addressed within various trajectories and projects by heterogenous actor constellations. Declerck (2024) distinguishes three prototypical working methods through which spatial societal challenges in diverse policy domains are addressed: (1) incubation projects & platforms; (2) regional area processes & programs; and (3) implementation programs. Within these projects and programs in various qualities, we observe that the concept of 'region' is interpreted in different ways. Intergovernmental area-specific cooperation is on the rise, and the establishment of regional partnerships to address spatial challenges is recommended at regular intervals by various authorities and advisory bodies. All these interpretations given to the concept of 'region' articulate area-based governance forms in which cross-administrative level consultation and area-specific customization are central.

Within this context, thought is also being given to the elaboration of a ‘region deal’- instrument within the spatial domain, in analogy to a similar policy instrument in the Netherlands. The focus is on the development of a contractual approach. The region deal as a possible new instrument in spatial policy is conceived as a policy agreement between different administrative levels. Based on negotiations at the regional level, area-specific agreements are established on spatial choices and cooperation, in accordance with spatial policy plans at the different administrative levels, and which determine how, by whom, and with what resources they will be realized.

Essential to this is that the Flemish central government negotiates with other administrative levels on which instruments will be used to address specific spatial challenges within a particular region, and who will undertake and finance which commitments. In the preparatory study work on this approach, the following principles are proposed (Schoups et al., 2023).

A regional deal is conceived as a form of intergovernmental cooperation. This entails that multiple administrations are involved in the deal, since it is an agreement between various actors. Given the intergovernmental nature, it concerns a government agreement, namely an agreement concluded between parties of which at least one is a government. In addition, a regional deal is goal- and implementation-oriented. It must contribute to the strategic central objectives through area-specific agreements. Given the regional scope of the region deal and the principle of intergovernmental cooperation, the agreements made must exceed the purely local level. Finally, the principle of co-financing is essential. This means that each party participating in a regional deal is expected to make a financial or other contribution. It is conceived not merely a subsidy vehicle from Flanders but a form of co-governance, also financially.

Comparative analysis

Conflicting interests at the central level

When comparing the central policy choices across the various cases, we observe that a lack of coordination and some conflicting administrative visions seem to hinder the potential of the three cases.

In the case of the mobility regions, the lack of coordination between the central administrations of mobility and environment results in a rather weak connection between spatial planning and mobility planning, which potential is not being fully realized. Despite the strong emphasis on coordination and cooperation in the policy discourse of the reform, we note that the effective coordination of mobility planning with the spatial planning policy remains rather limited in practice, with the historically compartmentalized policy approach from the Flemish government still having a strong impact on the current functioning of the policy arrangement.

The ambition of the mobility regions to develop a more efficient mobility system is strongly interwoven with the issue of counteracting urban sprawl, thus requiring a close collaboration between the domains of mobility and urban spatial planning. At an administrative level, we indicated that the delineation of the mobility regions was the result of a close collaboration between the top administrators of both departments, resulting in a mutually agreed scale as a basis for future regional development planning. This collaborative relationship between both domains at the administrative levels is in itself also a breakthrough in administrative traditions, but it stands in contrast with the conflictual interactions within the political sphere of government. For this reason, the delineation of the mobility regions was not retained as a policy scale for spatial planning. The former minister of spatial planning refused to integrate her own plans for a better integrated subregional spatial planning in the concept and the institutional form of the mobility regions. This exemplifying pattern illustrates the way the Flemish Government works and how opposite interests try to find their way throughout the Flemish administrative and political constellation. This feature is reflected directly in the organization and ambitions, but also the ambiguity of the mobility regions.

Also, the relationship with project-based regional arrangements remains unclear due to the policy deadlock and the lack of approved central policy framework within the Flemish spatial policy plan. Moreover, the regionalization reform failed to lead to a breakthrough in the planning domain, as the spatial planning department largely remained outside the scope of this reform, due to numerous exceptions and deviations resulting from political deals between Flemish ministers and departments. Exploring the option of working with regional deals can thus be interpreted as a strategy to make progress within this current setting without getting bogged down in delicate political discussions. This appears to be a politico-administrative strategy also adopted in the Netherlands to develop the Region Deals approach here.

The region as a gap?

When we examine within the three cases how the region is shaped as an intermediate coordination space, we note that certain aspects appear to have been strategically left open, with various causes and motivations seeming to exist for this.

The quest for operational spatial policy frameworks in Flanders, as well as in the Netherlands, appears to be manifestations of a broader crisis within central spatial planning. While both articulate good intentions for all major societal transitions, they appear to lack the capacity to establish binding policy objectives for sectoral administrative actors. Therefore, there also seems to be no consensus on which tasks should be addressed at the central level versus the decentralized level. In addition, the divide between ‘pure’ spatial planning objectives and goals

for other sectoral domains such as water, mobility, healthcare, or energy appears to be increasingly difficult to draw in practice. As a result, many thematic challenges end up at the regional level through bottom-up pressure from local actors, despite a clear central mandate on this matter.

Both within the case of the transport regions and the regional reform, we observe that the institutional design and the governance of the region raises many questions among local stakeholders. The central approach to establish the region not as a governing layer, but as a coordination layer, means that at the regional level, autonomous decisions cannot be made or decisions cannot be implemented autonomously. Therefore, regional consultative bodies for implementing regional agreements usually remain dependent on the policy choices of local, but mostly central policy actors, as well as the instruments and resources they mobilize for this purpose. The lack of clear central task assignment, particularly within regional reform, is a subject of local criticism, given that central administrations, for the time being, do not adopt a clear, joint positioning and commitments towards the region for their own policy objectives. Leaving the institutional design and governance open can therefore also be interpreted as a strategy to conceal the lack of coordination among central administrations, as well as a way to cope with significant differences in central and local path dependencies and administrative cultures.

Institutional incompleteness: room for innovation?

The lack of a clear task assignment and a fixed governance structure poses certain challenges for regional actors but also provides some degrees of freedom. Therefore, a policy space seems to emerge that can be creatively shaped by diverse coalitions of actors, potentially leading to forms of policy innovation.

The discussed cases are policy incentives centrally coordinated by various administrations in parallel, but converge in the region and are generally taken up by the same actor coalitions here, such as regional intermunicipal entities. The latter can therefore act as a 'boundary spanner' to facilitate effective policy linkage for integrated policy coordination. In this way, mutual influence between the different policy tracks, although centrally not initiated in that respect, does indeed occur at the regional level in practice. For example, local experiences with regional cooperation within the transport regions served as a test case and prototype for subsequent collaboration within the reference regions. Furthermore, test cases addressed in the development of regional deals are subsequently taken into account within some reference regions as breakthrough projects to further strengthen intergovernmental cooperation here.

In line with this, we also observe that the framing of the institutional arrangement forming at the regional level is differently contextualized by various actors, wherein we can discern both instrumental, pragmatic, and emergent argumentation lines.

At the local level, the descriptive design view towards the region seems to prevail, wherein the current institutional design is framed as incomplete, given that regional challenges and obligations are primarily oriented towards local authorities. From their perspective, the central Flemish government itself does not sufficiently engage within the region and fails to fulfill its commitments adequately.

From the central perspective of domestic governance, a more pragmatic logic can be discerned. The regional reform, in particular, could only be approved at the level of Flemish government

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by allowing a series of exceptions and deviation rules for sector administrations, resulting in many regional collaborations de facto falling outside the scope of this reform. The current institutional set-up is seen as the most achievable, requiring compromises to be made to obtain approval at the level of the Flemish government.

Additionally, within regional reform, and somewhat in contrast with the mobility regions, some elements of an emergent design line can also be discerned. The central government does not impose a uniform governance structure on regions but allows room for regional coalitions to develop their own approach in the shaping of a regional mayors' conference. This seems to be a starting point for a central approach that is more focused on facilitating and empowering local innovations, rather than stifling them.

Conclusion

We started this contribution from the observation that the region is increasingly being emphasized as a scale for policy coordination and interaction between various levels and coalitions of actors. However, the role of central government towards the region and the compartmentalization resulting from a fragmented approach of various central administrations are elements that are not adequately addressed in the literature. Therefore, this contribution focuses on the interplay emerging at the regional level from the various policy initiatives set up from central government to the regional level and the conflicts and tensions such an approach brings about.

Our analysis focuses on three central policy initiatives that interact at the regional level within the current set-up and together form a complex ensemble. On the one hand, mutual confrontations and tensions can be observed, but also opportunities arise to develop new models of collaboration and policy innovation. The analysis demonstrates that the region cannot only be understood as a space for policy alignment among various stakeholders, but also from conflicting approaches and interests stemming from central policy agendas. It also reflects broader policy issues around planning and which policy ambitions can be successfully addressed at which policy scale. Unraveling the various responses and attitudes of central administrations towards the region is crucial to accurately assess the policy dynamics at this level.

From the literature, we witness that the region is framed within a broader context of an institutional void, where clear norms and frameworks are lacking to achieve political policy alignment. We note that this issue is also present in the dynamics that occur at the regional level in Flanders. However, our analysis leads to the question of whether this institutional setting can be merely considered as a given, or if it stems from a strategy of the central government to avoid taking a uniform stance towards the region due to conflicting interests among central administrations and sectoral logics.

In line with this, the question arises as to how the central government should deal with the current policy dynamics and conflicts at the regional level in the future. Within our analysis, we observe various institutional responses to dealing with conflict, ranging from seeking consensus in planning and scale on the one hand, to accepting various governance models and diverse central path dependencies on the other. The future government will determine which rationale will prevail and whether further steps towards coordination and integration of policy initiatives will be taken, or whether, from a rather agonistic perspective, more degrees of freedom will emerge that promote a further fragmentation of the region.

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DRAFT

Tensions in the original premises of the IAD framework compared to contemporary spatial applications: Revisiting Elinor Ostrom

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Abstract

The IAD framework was developed in circumstances different from contemporary spatial and governance issues. This article systematically compares Elinor Ostrom's work (1965–2017) and contemporary applications in spatial and governance research using the IAD framework. Findings include firstly that action situations and action arenas are applied inconsistently in contemporary research due to evolution of the concepts throughout Ostrom's own work; secondly, that the IAD is in many researches incoherently used where rules are studied in isolation of their configuration or rule configurations in isolation of the community attributes; and thirdly, that the application of IAD is mostly incomplete, specifically as explicit commons dilemmas, common pool resources and community are frequently undefined. A more consistent, coherent, and complete application better allows reproducible research and is fundamental for a better understanding of the relationship between institutions and communities.

Keywords

Institutional Analysis and Development framework; Commons dilemma; Spatial Planning; Action situation; Rule configuration

Introduction

Elinor Ostrom's Institutional Analysis and Development framework (IAD) is frequently used to study an institutional setting for governance practices in spatial planning. Our impression is that this often happens without awareness of or structural incorporation of conditions under which this frame was developed. We believe that these conditions are essential for the applicability of the framework and therefore the reliability of the institutional analysis. For example, the IAD framework emerged out of a particular set of cases, being small communities dealing with a scarce common. This particular setting is not always identical to contemporary spatial and governance issues (Ostrom, 2005). Moreover, applications of the IAD in contemporary research often focus on one of its working components instead of the complete framework. This raises questions on the extent to which the application of Ostrom's IAD framework has departed from its original premises, and consequently the implications for contemporary analysis of spatial and governance issues.

In this paper, we explore the premises of the IAD framework to the institutional setting of spatial and governance issues as described by Elinor Ostrom herself, to identify the differences in contemporary applications of this framework. To that end, we intertwined three research steps. First, key principles of the IAD framework were derived by analysing 15 key publications, including early empirical research, (e.g. Ostrom, 1965), late studies (e.g. Polski & Ostrom, 2017; Schlager & Villamayor-Tomas, 2023) and comprehensive work (e.g. Ostrom, 2005). Secondly, from these principles, we established an analysis scheme which we, thirdly applied to compare a selection of contemporary research based on institutional analysis in or

related to the field of spatial planning. These include ten years of applied IAD research of the Spatial Planning department of the University of Groningen, who have a longstanding tradition of institutional analyses and the IAD in governance practices and spatial planning, other Dutch universities who have a research tradition in spatial and governance-institutional research, and other contemporary applications of the IAD at other research institutes worldwide.

The IAD framework is an instrument to systematically study institutional arrangements to demarcate established governance practices regarding a commons dilemma or the use of a common pool resource (CPR). Here, institutional arrangements or institutions are understood as the rules, norms, and strategies that prescribe how actors must, must not, or may act in an action situation (Polski & Ostrom, 2017).

Our analysis revealed three main findings. First, the framework is frequently applied in cases that do not resemble the criteria identified by Ostrom herself, i.e. the requirement for an action situation to concern a focused commons dilemma or particular common pool resource. From Ostrom's perspective, this is however vital, because the commons dilemma or common pool resource drives the formation and application of the respective institutional arrangement. Secondly, most institutional analyses using the IAD framework only analyse specific variables or rule types and do not use the complete framework. This may result in a lack of coherence between the rules and/or other elements of the framework, which is a premise of the framework. Lastly, Ostrom herself is inconsistent in definitions of the key concepts including action arena, action situation and institutions. As a result, subsequent studies employ different definitions which make the institutional analyses only limitedly comparable and can produce different outcomes.

Ostrom's (sociological) perspective on institutions

Societies are made up of large numbers of actors, who are constrained or enabled in their actions by structures or institutions. Structure refers to the frameworks within which these actors operate. These frameworks include culture, laws, agreements, material and technical possibilities (Kooiman et al., 2008). The definition of institutions is currently still far from a settled issue, with considerable literature addressing how to define institutions (Alvesson & Spicer, 2019).

Sociologically, institutions can be defined as the *rules* (Ostrom, 2005) that guide human interaction or the *constraints* (North, 1990; 1991) that shape human interaction. The most commonly accepted definition in planning practice is that institutions are the rules of the game in a society, together with their enforcement arrangements and include both formal rules such as laws and constitutions, and informal constraints such as conventions and norms.

Individuals interacting within rule-structured situations face choices, regarding the actions and strategies they take (Ostrom, 2005). Ostrom emphasises that institutions not only delineate constraints, but also those which are permitted. Her construction of the concept 'rules-in-use' allows rule takers to exercise a degree of agency in putting rules into practice.

The principal function of institutions is to create order and reduce uncertainty by providing a structure that guides human interaction and leads to a 'stable, valued and recurrent pattern of behaviour' or 'patterned interaction that is predictable' (Lowndes & Roberts, 2013). According to Ostrom, institutions are the prescriptions that humans use to organise all forms of repetitive and structured interaction (Ostrom, 2005).

Ostrom's IAD Framework

One reason for Ostrom to develop the IAD framework was to coherently analyse a wide diversity of problems through a common and coherent set of elements and their relationships (Ostrom, 2007). Central in the IAD framework is the action situation and the action arena. In an action arena, participants (inter)act given an action situation and this interaction leads to outcomes (Ostrom, 1983a; Ostrom, 2005; Ostrom, 2011). Action situations refer to the social space where individuals interact, exchange goods and services, engage in appropriation and provision activities, solve problems, or fight, among the many things that individuals do in action situations (Ostrom et al., 2006). In the action arena participants actually interact given an action situation which results in outcomes (see Figure 1). Most of social reality is composed of multiple arenas linked sequentially or simultaneously.

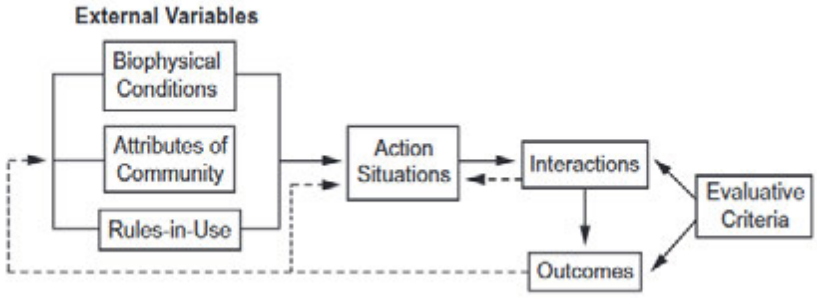

Figure 1: The IAD framework for institutional analysis (adapted from Schlager & Villamayor-Tomas, 2023 and Ostrom, 2005)

An action situation itself can be characterised using (internal) variables (see Ostrom, 2005) such as *actors*, who can be thought of as a single individual or as a group functioning as a corporate actor; *positions*, which associate actors with an authorised set of actions in a process and the *set of (potential) actions* that participants in particular positions can take at different stages of a process; the *information* available to a participant in a position at a stage in a process; the *set of payoffs* that assign benefits and costs to actions and outcomes; the *number of repetitions* of the situation (Ostrom, 1985). According to Ostrom, a particular combination of values for these variables yields an action situation if there is a situation such as 'commons dilemma situation', a 'prisoner's dilemma situation', or a 'free rider situation" (Ostrom, 1985).

A myriad of specific *rules-in-use* (hereafter called 'rules') and *attributes* structure an action situation (see Figure 1). Rules are shared understandings among those involved that refer to

enforced prescriptions about what actions (or states of the world) are required, prohibited, or permitted. All rules are the result of implicit or explicit efforts to achieve order and predictability among participants. Ostrom (2005) discerns seven types of rules that can affect the structure of an action situation. *Position rules* establish the specific positions that actors can fulfil. *Boundary rules* outline the conditions under which actors can access or leave a position. *Choice rules* specify what a participant occupying a position must, must not, or may do. *Information rules* regulate what information is sent and received. *Aggregation rules* influence how actors jointly affect collective decision-making by clarifying the influence of each actor when multiple positions have partial control over the same decision. *Scope rules* define the solution space, the outcomes which may, must, or must not occur. *Payoff rules* affect the benefits and costs that will be assigned to particular combinations of actions and outcomes, and they establish the incentives and deterrents for action. The set of rules is an interdependent configuration (Ostrom, 1983b; 1999; 2005; 2011): changes of one rule can affect other rules.

Attributes of the physical and material world influence what actions are physically possible, what outcomes can be produced, how actions are linked to outcomes, and what is contained in the actors' information sets. Important *attributes of a community* include the norms of behaviour generally accepted in the community, the level of common understanding that potential participants share about the structure of particular types of action arenas, the extent of homogeneity in the preferences of those living in a community, and the distribution of resources among those affected. The term "culture" is frequently applied to this bundle of variables (Ostrom, 2005).

Assumptions underlying the IAD framework

In studying literature about the development of the IAD framework through time we distinguished several assumptions for applying the framework.

A first assumption is that the IAD framework can be used to analyse *institutional arrangements on different 'tiers' or 'levels'* (Ostrom, 2005). A tier or level is not strictly defined by Ostrom. The action situation can be located on an operational tier, consisting of, for example, a free-rider problem, the distribution of a CPR, or a commons dilemma. Alternatively, the problem can be located on a policy tier concerning a collective-choice level. At this tier, policy decisions are made within the constraints of a set of collective-choice rules. These policy decisions affect the structure of the action situation on an operational level, where individuals act. On the institutional tier, decisions concern who is eligible to partake in the policy making process and concern the rules that will be used to undertake policy making (Ostrom, 1999). Actions on the institutional tier influence the action situation on the policy tier. The assumption of tiers poses two premises for institutional analysis. First, the analysed tier must be defined so as to direct the analysis to the appropriate problem and related rules. Secondly, the embeddedness of tiers must be defined, so as to understand the influence of to-be-identified institutions. For example, the nestedness of the operational tier (through the policy tier) in the institutional tier means that institutions of the institutional tier are more inert than those at the operational tier. Without clear tier distinction, such relative inertia may be overlooked.

A second assumption concerns how *the definition of action situations and action arenas* developed over time. Before 2005, the IAD framework was conceptualised as analysing both action arenas and action situations. The action arena consisted of an action situation and the actors acting in that situation. The action situation was defined as an analytical concept to enable the isolation of the direct structure impacting an action arena. However, the definition of action arena and action situation changed between 2005 and 2011 because Ostrom indicated that the difference between the terms generated confusion over the years as it was implicitly understood that action situation include actors. Ostrom started defining action situations identical to action arenas. An action situation is then defined as "the social space where participants with diverse preferences interact, exchange goods and services, solve problems, dominate one another, or fight (among the many things that individuals do in action arenas)" (Ostrom, 2005, p. 13). In her earlier publication this was in fact the definition of an action arena. Her 2005 definition of the action arena is limited to: "in which [...] participants and an action situation interact as they are affected by exogenous variables (at least at the time of analysis at this level) and produce outcomes that in turn affect the participants and the action situation" (Ostrom, 2005, p. 13). Figure 1 represents the latest definition (this evolution is illustrated in subsequently Ostrom, 2005; Ostrom & Schlager, 2014; Schager & Cox, 2018; Schager & Villamayor-Tomas, 2023) showing that interactions structured by an action situation result in outcomes. Despite the turn in definitions, much literature still refers to action arenas as key element in the IAD framework using older definitions. This lack of consistency in definitions may be a cause of inconsequent application of the IAD framework in academic research.

Ostrom refers to the *concept of commons or common pool resources* (CPR) as attractor for community building and enhancer for the creation, development and multi-tier nesting of rules. The term "commons" was popularised by Garrett Hardin in an influential 1968 article called "The Tragedy of the Commons", addressing the problem of humans overusing and depleting a common-pool resource (CPR) even though it is not in their best interest to do so. This trend of over-exploitation particularly plagues commons because the lack of individual ownership and inability to restrict usage incentivises actors to consume as much as possible of the shared resource before others do. The commons can be understood as natural resources that groups of people (communities, user groups) manage for individual and collective benefit (Ostrom, 1990; 2005). Ostrom debunked the inevitability of the tragedy of the commons by the presentation of case after case of resource users effectively self-organising and sustainably managing a common themselves. Successful cases of commons self-governance had in common principles (Ostrom, 1990; 2005) such as clearly-defined boundaries, congruence between the resource environment and its governance structure or rules, the availability of collective-choice arrangements, effective monitoring and rules enforcement and conflict resolution mechanisms. Higher-level authorities recognise the right of the resource appropriators to self-govern the common resource in nested tiers from the lowest level up to the entire interconnected system. These principles imply that a starting point for applying the IAD framework should be a collective action problem (a prisoner's dilemma, a free rider situation or a commons dilemma) positioned in an interconnected nested governance system (Ostrom, 1990; 2005).

Ostrom presents the IAD framework in her publications as *an all-encompassing coherent and interrelated configuration of components*. This implies that one can study a subset only in consideration of the relationship to the other components. Although Ostrom always presented the framework as an integrated set, later studies use components as analytical tools for systematically examining institutional arrangements separate from the framework (see for example Schlager & Villamayor-Tomas, 2023).

A last assumption concerns *the dynamic nature of the IAD framework*. Ostrom's (1990; , e.g.) work emphasises the need for what she refers to as "adaptive governance." Adaptive governance concerns the way in which the structure of rules, norms, strategies and enforcement mechanisms adapt and evolve over time as information about the commons environment expand or change (Ostrom & Jansen, 2004). The term connotes that an institutional arrangement is able to evolve in order to fit current conditions and needs best. As Ostrom puts it: "a set of rules crafted to fit one set of socio-ecological conditions can erode (…) successful commons governance requires that rules evolve" (Dietz et al., 2003). As mentioned above, in her article "A Method of Institutional Analysis" (1985), Ostrom added as variable to characterise the dynamics of an action situation, the number of repetitions of the situation itself. Consequently, to study institutional evolution, one has to apply and compare the IAD framework sequentially.

Methodology

This research aimed to study the use of the IAD framework in planning studies by analysing contemporary (recent 10 years) research articles using this framework. First, we looked into research performed by the Faculty of Spatial Sciences of the University of Groningen (UoG) and research performed by spatial planning departments of other Dutch universities. To make a broader comparison possible we also used a selection of articles based on the diverse application of the IAD framework from different scientific backgrounds.

The book 'Understanding Institutional Diversity' (2005) by Ostrom has served as the start of our study. From this book, key definitions such as action arena, action situation, and rules were derived as discussed above. Based on these definitions, we constructed an analysis scheme[1] (see Table 1) to characterise each article by discipline of the article, compliance to the IAD's original premises and the application of the action arena, action situation, and rules.

We used Google Search and Scopus to retrieve relevant articles from Dutch universities using the search terms "IAD framework" and "Institutional Analysis and Development Framework". This resulted in seven articles from UoG and six articles from the planning departments of other Dutch universities (see reference list). To expand our search to other disciplines we also used Scopus. Again, using the search terms "IAD framework" and "Institutional Analysis and Development Framework", and sorting the results on "Cited" and "Date" we found the following relevant articles: "Stronger together, but how? Lessons from the Walloon dairy

[1] In earlier iterations of the analysis of this paper, the ADICO syntax (Crawford & Ostrom, 1999) was included as criterion. However, the studied empirical material indicated that applying all elements of the ADICO statement often not reflected the studied empirical practice. To avoid verbose theoretical, methodological, and results description of the ADICO statement, ADICO is not further discussed in this paper.

history on the strategic relevance of cooperative models" (De Herde, 2023), "Collective Action within the Household: Insights from Natural Resource Management" (Doss & Meinzen-Dick, 2015), "Governing large-scale marine commons: Contextual challenges in the Coral Triangle" (Fidelman et al., 2012), "A modified diagnostic social-ecological system framework for lobster fisheries: Case implementation and sustainability assessment in Southern California" (Partelow & Boda, 2015). For practical reasons we limited ourselves to four articles outside of spatial planning.

An overview of the studied articles is given in the reference list.

Table 1: Analysis scheme as used in our study to characterise publications

Components		***Application***
1) Research background		From what background is the article written and what is the nature of the similarity with Ostrom's background? For what purpose is the article written, and is the IAD framework (as Ostrom described it, i.e. a CPR) appropriate for this purpose?
2) Research aim		What is the aim of the article?
3) Action arena		Does the article use the concept of action arena?
4) Action situation		Does the use of action situation match Ostrom's premises? How (clearly) is the action situation demarcated in the article?
5) Tier of IAD framework		Is the IAD framework approached from the operational, policy, or institutional tier? How is tier embeddedness addressed?
6) Rules	*General*	How are the rules generally elaborated within the articles, based on the workable definition of Ostrom (2005). Are the definitions corresponding or are there similarities?
	Position rules	How are the rules generally elaborated within the articles, based on the workable definition of Ostrom (2005). Are the definitions corresponding or are there similarities?
	Boundary rules	How are the rules generally elaborated within the articles, based on the workable definition of Ostrom (2005). Are the definitions corresponding or are there similarities?
	Choice rules	How are the rules generally elaborated within the articles, based on the workable definition of Ostrom (2005). Are the definitions corresponding or are there similarities?
	Aggregation rules	How are the rules generally elaborated within the articles, based on the workable definition of Ostrom (2005). Are the definitions corresponding or are there similarities?
	Information rules	How are the rules generally elaborated within the articles, based on the workable definition of Ostrom (2005). Are the definitions corresponding or are there similarities?
	Payoff rules	How are the rules generally elaborated within the articles, based on the workable definition of Ostrom (2005). Are the definitions corresponding or are there similarities?
	Scope rules	How are the rules generally elaborated within the articles, based on the workable definition of Ostrom (2005). Are the definitions corresponding or are there similarities?
7) Focus on rules or action situation		Is the action situation more highlighted or the rules?
8) Function of the rules		What is the function of the *rules* within the article (contextualise, demonstrate, describe)?
9) Correspondence to IAD framework		Does the use of the IAD framework, to achieve the purpose of the article, align with Ostrom's premises? Is there a clear dilemma outlined?

Findings

To identify how Ostrom designed the application of the IAD, we evaluated Ostrom's own applications. However, our desk research indicated that only a limited number of usable case studies exist in which Ostrom clearly applies the IAD framework. Pivotal is her case study analysing the use and governance of the West Basin aquifer in California (Ostrom, 1965). In this (doctorate) study, she approached the action situation from an *operational tier*, and the components as identified in table 1 are applied. Later, Ostrom published three other case studies that were smaller in size (Ostrom, 1988). In all these studies Ostrom applied the framework on an *operational tier*, specifically to a CPR in which a commons dilemma was present. Ostrom described and demarcated the action situations clearly in all her articles where she applied the IAD framework herself. To illustrate, in the case of Ostrom's 1965-study, it is the aquifer of the West Basin in California and the stakeholders that made use of the aquifer for various uses, such as agriculture and drinking water. However, it is important to note that the rule types are mentioned implicitly in this study, potentially because the IAD concepts and their definitions have not been introduced yet. Ostrom approached the rules as a configuration and they are therefore not handled individually. Consequently, the causation between the rules and their effect on the action arena is clearly visualised. Ostrom uses the different parts of the IAD framework to explain the operation of the institutional structures within the action arena, and to explain the relation between the different parts.

Research by the Faculty of Spatial Sciences of the University of Groningen

Each analysed study of the Faculty of Spatial Sciences of the UoG employs the concept of action situations as multiple linked situations, i.e., governance systems. This complicates the demarcation of single action situations. To illustrate, Van Geet et al. (2019) applies the IAD framework to the action situation of "land use and transport integration", which is constructed of linked action situations on different tiers, namely the policy and the institutional tier. Similarly, Neef et al. (2023) apply the IAD framework on multiple Dutch infrastructure networks, specifically aimed at identifying how rule directions influence actors to achieve collective actions on both a policy and institutional tier. Spijkerboer et al. (2019) apply the IAD framework solely on the institutional tier. The study's focus on spatial integration of renewable energy and other land use functions indicates interlinking different action situations at a single tier. Neither of these study's explicitly empirically distinguish the different linked action situations. While this lacking distinction is thus methodologically different from the IAD's premise, it is unclear whether or how problematic this is. However, focussing on the action situation on the operational tier, misses the consequences of the relationships to the policy and institutional tier.

Further, some studied articles employ the term action arena, despite Ostrom's shift in focus to action situation. More so, the concepts action arena and action situation are used interchangeably, and refer to articles before the amalgamation of the definitions by Ostrom. To be clear, the last definition of Ostrom for the action situation was "a social space where individuals interact, exchange goods and services, solve problems, dominate one another, or fight…" (Ostrom, 2011), and no longer "the immediate structure affecting a process of interest

for the purpose of explaining regularities in human actions and results, and potentially to reform them" (Ostrom, 1999, p. 43). The interchangeable use by Leani et al. (2021) start by introducing and focusing on the action situation as "The core analytical concept of the IAD framework is the action situation…" (p. 13). However, later they employ the concept of action arena when introducing the rules. Alternatively, Hijdra et al. (2015) use the concept of action arena, and do not mention the concept of action situation, e.g. "The IAD framework defines the action arena as the relevant unit of analysis …" (Hijdra et al., 2015, p. 66). Other articles do only apply the concept of action situation, such as Van Geet et al. (2019) and Wu et al. (2022). This raises the question on mutual comparability between the articles.

Lastly, the studied material has a strong focus on separate rules, and excludes the influence of attributes of the physical and material world and attributes of a community, and have less emphasis on the configuration of rules. For example, Hijdra et al. (2015), Wu et al. (2022), and Lee et al. (2022) apply the rules of the IAD to describe the action situation. This differs from the IAD's premises, where the *configuration* of rules and *attributes* co-determine the action situation, and indirectly shape the interactions and outcomes of an action situation. Additionally, Neef et al. (2023) applied the IAD framework to identify how rules affect actors to achieve collective actions. Van Geet et al. (2019) stay closer to the original premise of the IAD framework by using rules to contextualise the action situation. The situatedness of the outcomes in particular communities raises the question what communities are actually presented or analysed in the papers, and to what extent the findings can be extrapolated.

Research by Spatial Planning Departments of other universities in the Netherlands

A similar application of the IAD application occurs in the studied articles of Spatial Planning disciplines at other Dutch universities as compared to the UoG. To illustrate, multiple articles apply the IAD framework on two tiers, the policy and institutional tier. For example, Lammers & Hoppe (2019) apply the IAD framework on institutional conditions that enable or disable decision-making processes and the impact of the selection of smart energy systems, applying the IAD framework on both the policy and institutional tier. Alternatively, Vitale & Meijerink (2023) and Van den Hurk et al. (2024) apply the IAD framework on only the institutional tier. They apply the IAD framework to study an action situation of the management of (national) policies. Warbroek et al. (2023) do explicitly mention the tier of focus in their research, being the operational tier defined as concerning "individual actor day-to-day decision-making" (Warbroek et al., 2023, p. 100). Such a clear demarcation did however not withstand an explicit description of the CPR that demarcates the action situation. Rather, the focus is on the decision-making process or the management of policies. Hence, a clear tier demarcation and a clear CPR definition may go hand-in-hand.

Next, also similar to the UoG, the studied articles portray a mixed use regarding action arenas and action situations. To illustrate, Klok & Denters (2018) initially state that the action arena is the central unit of analysis in the IAD framework, but later refer to an action situation. Thereafter, they continue to focus on the action arena. Moreover, whereas Van Karnenbeek & Janssen-Jansen (2018), Lammers & Hoppe (2019), and Warbroek et al. (2023) only use the action situation when applying the IAD framework by referring to Ostrom (2011), Van den

Hurk et al. (2024) and Vitale & Meijerink (2023) use an action arena by referring to Ostrom (2005). To add to the mixed image, while Warbroek et al. 2023 do focus on action situations, action arenas are mentioned in an undefined manner. Hence, contemporary applications of the IAD in the Netherlands do appear to raise a mixed use of action arenas and action situations.

The reason to conduct institutional analysis differs per article, but two main differences may be distinguished. On the one hand, Vitale & Meijerink (2021), and Klok & Denters (2018) apply the IAD framework in order to contextualise the action situation, which corresponds with the defined use as determined by Ostrom. Alternatively, and similar to the UoG, the other studied articles aim to reveal institutional rules, conditions, barriers, and/or opportunities with a focus on the institutional design of the action situation or action arena (Van den Hurk et al., 2024; Lammers & Hoppe, 2019; Van Karnenbeek & Janssen-Jansen, 2018; Warbroek et al., 2023). This subtly, but crucially, departs from the premise of the IAD. Whereas, originally, the institutional rules *reflect* the institutional situation as is, here, the institutional rules are to be redesigned so as to *change* the institutional situation. This is different from Ostrom's understanding of rules contextualising an action situation: other rules presuppose other action situations. This different use of the AID raises questions on the appropriate use of the IAD (further discussed below).

Furthermore, the rule configuration is assessed in most articles, such as Warbroek et al. (2023), Lammers & Hoppe (2019), and Klok & Denters (2018). Van Karnenbeek & Janssen-Jansen (2018) apply the rules in an individual manner in which the rules are analysed individually, however they do not consolidate the rules as a configuration afterwards. They argue that this application of the framework "reveals a hierarchy in the rules" (Van Karnenbeek & Janssen-Jansen, 2018, p. 408). Vitale & Meijerink (2021) and Van den Hurk et al. (2024) study the rules individually, but recognise the configuration, and put the rules together in their discussion.

Lastly, the analysis highlighted a factor not explicitly incorporated in the analysis scheme. Lammers & Hoppe (2019) acknowledge the static nature of the IAD framework, whereas decision-making commonly comprises a (dynamic) process. They address this nature by applying the framework with causal process tracking. In a follow-up study, Neef & Verweij et al. (2023) also address this dynamic nature by applying a decision-making rounds model. Both approaches introduce a temporal dynamic in the IAD, which merits from further scrutiny into how the IAD addresses this dynamic.

Research outside of Spatial Planning

In comparison to the application of the IAD framework within spatial sciences, the IAD framework is approached differently outside of spatial sciences.

First, it is observed that the IAD framework in the articles outside spatial planning is applied on a single tier. In general, the selected tier is the operational tier, which is directed at a common action problem. For example, Fidelman et al. (2012) applies the IAD framework on the operational tier in order to "examine the contextual complexity facing organisations attempting

to coordinate regional-level action" (p. 43). Also, Partelow & Boda (2015) apply the IAD framework on the operational tier, as they aim to improve the management of the natural resource system. Additionally, the IAD framework is applied on rather static, not consisting of sequentially or simultaneously linked action situations. The demarcation of the action situation is in most articles clearly defined, however varying from an area demarcation to a governance system. To illustrate, in Fidelman et al. (2012) the action situation is demarcated as the Coral Triangle, which allows for a geographic boundary. An exception is De Herde (2023), who applies the IAD framework on the policy affecting the dairy industry in Wallonia. Consequently, this action arena consists of sequentially or simultaneously linked action arenas, resulting in a less concrete demarcation of the action situation.

Moreover, it is found that the articles focus only on the action situation, such as Partelow & Boda (2015). On the other hand, Fidelman et al. (2012) only use the action arena in their application of the IAD framework. The publication date of this article is close to the change in focus initiated by Ostrom, which can explain this focus.

Additionally, most articles outside spatial planning aim at contextualising the action situation by means of the IAD framework. To illustrate, Fidelman et al. (2012), De Herde et al. (2023), and Dos & Meinzen-Dick (2015) applied the IAD framework in order to contextualise the situation at hand. On the other hand, Partelow & Boda (2015) aim at analysing and describing the maintenance of natural resources. Last, there are differences in the application of the rules in the action arena or action situation. In the articles outside spatial sciences, the focus is directed at the action arenas. Therefore, in these articles, the rules are studied in a configuration, and therefore contribute to the contextualisation of the action arena. This is in accordance with the described application of Ostrom. Consequently, by doing so, the aim of the framework of contextualising the action arena, is reached.

Discussion and Conclusion

In this paper we explored the premises of the IAD framework to the institutional setting of spatial and governance issues as described by Elinor Ostrom, to identify the differences in contemporary applications of this framework. To this end we explored literature describing and elaborating the IAD framework to signify key elements as meant by Ostrom when applying the framework. We further explored contemporary articles describing research using the IAD framework both inside and outside spatial planning.

We discovered that Ostrom changed definitions of elements of the frame through time especially concerning her definitions of action arena and action situation. In her most recent description of the framework, she considers the action situation in the centre of the IAD framework. This includes actors, but not the interaction itself. Consequently, the action situation seems static, a photo. Interaction as a separate component in the framework leads to outcomes. However, by adding an extra variable to characterise to the action situation, being the number of repetitions of the situation itself, she defined institutional evolution as a sequence of changing action situations, a film consisting of photos. Rules she positions as variables,

besides physical and community attributes, influencing the action situation and not as part of the action situation itself.

The researches we studied do not use these definitions consistently. Especially, the action arena and the position of the rules, which Ostrom in her earlier publications positioned in the centre of the IAD framework, is regularly used following older definitions. Further, the demarcation of the action situation differs per research, be it a spatial area, a governance system or a cooperative setting. As a consequence, it becomes hard to compare the different studies. Our advice for future studies using the IAD framework is to use the latest description and definitions as given by Ostrom.

In most researches only one action situation is analysed. However, Ostrom explicitly mentions in her publications, the nested nature of an action situation, being different linked tiers and parallel linked action situations. Because these actions situations are linked, they influence each other. Not taking this in account limits the strength of the institutional analysis.

Ostrom presents her IAD framework as a coherent, interrelated and interdependent configuration of components. This means that an analysis using this frame should describe all elements in mutual coherence. Recent publications, for example Schlager and Villamayor-Tomas (2023) even propose to use components of the IAD framework as analytical tools for systematically examining institutional arrangements separate from the framework. However, many of the studies we examined only described and employed a part of the framework, in spatial planning especially focusing on the rules or just some rules. This raises the question on how problematic analysing rules in isolation of the IAD really is.

To feed that particular debate, we suggest to further scrutinize the concept of rules (institutions) and community. One interpretation, found in many of the scrutinized articles, is that rules are mechanisms that structure behaviour. Such an approach allows researchers to propose changes of rules so that behaviour changes, i..e., they propose institutional (re)design. Another interpretation, closer to Ostrom her original work (1965), is that rules *are* communities. This finding is based on the large number of cases where Ostrom herself found that if there is a community, they can be caught in a coherent set of rules, not the other way around. Hence, this metaphysical or philosophical understanding of rules vis-a-vis communities would deter such mechanistic institutional (re)design. Hence, this finding begs the question if, and if so how, the IAD may be applied to inform how to initiate or navigate institutional change. Suggestions may be found in Lammers & Hoppe (2019) and Neef, Verweij et al. (2023) as they provide suggestion on dealing with the temporally static instrument that the original IAD is. A more fundamental answer to how rules (institutions) and community relate does merit further discussion and research.

Ostrom explicitly mentions the necessity of a collective action problem to motivate resource users in effectively self-organising and sustainably managing a common themselves i.e. community forming. Interestingly, in most of the research we studied there was no or hardly

any description of the collective action problem. The question is then what 'drives' the self-organisation of the community and in this the development of rules.

To conclude, our study left us with some questions, which are in our opinion worthwhile to further discuss:

1. Does the framework provide a coherent language for identifying universal elements to analyse and explain how self-organisation in action situations develops or is the framework just limited to specified action situations?
2. Is the framework conceptually 'open' enough to stimulate new theoretical developments, for example in the field of spatial planning?
3. Since we live in an increasingly dynamic world and studying dynamic social and institutional development becomes more important, is the institutional evolution as presented by Ostrom consistent with contemporary theories of system evolution?
4. Does the framework sufficiently support the analysis of multi-tier or multi-level interaction or governance, a field of theoretical research currently strongly in discussion?

Ostrom herself identified these questions as relevant as early as 1999. "I would answer these questions positively, but the real assessment will be made by other scholars over the next several decades" (Ostrom, 1999, p. 63-64).

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ENTERPRISE-LED OR GOVERNMENT-LED? RESEARCH ON THE CHARACTERISTICS AND MECHANISMS OF RURAL GENTRIFICATION IN METROPOLITAN SUBURBS DRIVEN BY SIGNIFICANT PROJECTS， TAKING LIANMIN VILLAGE IN SHANGHAI AS AN EXAMPLE

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Abstract
Under the combined influence of factors such as the implementation of the rural revitalisation strategy, superior geographical location, and the implementation of significant projects such as Disneyland, the suburban villages of Shanghai's metropolitan area have experienced similar characteristics of rural gentrification in rural revitalisation in Western countries. According to the differences in driving forces, rural gentlemen are divided into two types: enterprise-led and local government-led. There may also be complex interactive relationships between the two kinds of gentrification. Then, this article takes Lianmin Village in the suburbs of Shanghai as an example, organises three panoramic surveys on it, summarises the characteristics of rural gentrification, and then constructs actor networks to explain the formation and interaction mechanisms of the two types of rural gentrification.

Key words
actor network; rural gentrification; interaction; social mechanism

Introduction

In recent years, the construction of super-large cities such as Shanghai, Beijing, and Guangzhou has gradually expanded from inner cities to suburbs, and large-scale entertainment projects such as Universal Studios, Chimelong Paradise, and Disney have been put into operation. The strong brand appeal attached to these projects has quickly made them popular tourist destinations, attracting many domestic and foreign tourists [1]. At the same time, with the successive introduction of strategies such as beautiful countryside and rural revitalisation, a large amount of government counterpart funds continue to flow to the countryside. In addition, due to the pressure of urban life in recent years and the promotion of social media such as Xiaohongshu, Bilibili, and Douyin, the rural "pastoral pastoral" in sharp contrast to the fast pace of the city has gradually become a new ideal lifestyle [2, 3]. Under the combined effect of the above multiple factors inside and outside the countryside, the spatial pattern and landscape style of the rural areas in the suburbs of metropolitan areas have been profoundly reshaped, similar to the characteristics of rural gentrification in rural revitalisation in Western countries. Based on differences in driving forces, the rural gentry can be divided into enterprise-led and local government-led [4, 5].

Previous studies on rural gentrification in China often focused only on a single type of rural gentrification. However, gentrification may have various characteristics in China's megacities' suburbs and rural areas. The complex dynamic mechanisms behind them must be further studied using more effective methods. In addition, there may be complex interactions between various types of gentrification, which differ at different stages of development. This article constructs a "conjugate rural gentrification interaction model". Then, this article took Lianmin Village in the suburbs of Shanghai as an example and organised three panoramic

surveys. Based on the survey results, this study summarises the characteristics of rural gentrification and then combines semi-structured interviews and actor networks to explain the formation mechanism of rural gentrification. Finally, this question believes the research results can reference similar rural development around metropolitan areas.

1. Literature review

British urban sociologist Ruth Glass first proposed the concept of "gentrification" in 1964 to explain how the middle class in inner cities replaces the working class and triggers changes in population, society, culture, landscape, and other aspects. Later, "gentrification" was expanded to mean replacing the lower middle class with the upper middle class [6]. Research on rural gentrification began with the rural revitalisation of Western countries in the 1970s and 1990s. China's rural gentrification did not receive attention until 2010, showing many differences from the West [7]. First of all, the characteristics of rural gentrification generally include spatial commodification, changes in economic structure, change or replacement of social structure, increase in rural housing prices and housing shortage, relocation and displacement of original residents, etc. [8-10]. However, in recent years, some studies have found that rural indigenous people are not always victims of gentrification but have become active actors and beneficiaries and can often coexist with indigenous residents [11, 12]. Secondly, in China, the state's will and the government's decisive intervention in rural development are apparent, and much money has been invested in transforming rural space. The government also plays a role in maintaining and promoting rural gentrification. We call it "organised rural gentrification," in which the government plays a leading role.

Rural gentrification in China is still in the initial stage of development, and the phenomenon of "spontaneous rural gentrification" led by enterprises and individual gentlemen is still growing. There is currently an increasing number of studies on the two types of rural gentrification in China. However, they may coexist in the same rural area, especially in rural areas surrounding metropolitan areas with abundant funds and substantial potential markets.

2. Research objects and methods

2.1 Research objects

The case study selected for this study, Lianmin Village, is located in Chuansha New Town, Pudong New District, Shanghai, only 5 kilometers north of Shanghai Disney International Tourism Resort, and contains 23 natural villages(Figure 1). Lianmin Village covers an area of 4.62 square kilometers, rich in natural resources, and crisscrossed by rivers and water bodies. One thousand seven hundred thirty-seven farmers live by the water. In addition, Lianmin Village has also achieved remarkable results in rural construction. In June 2017, based on obtaining the Shanghai Special Industry B&B License No. 01, Lianmin Village has been engaged in "B&B + Internet," "B&B + Cooperation Base," and "B&B + Agricultural Cooperatives." "Three directions go hand in hand. These measures have made Lianmin Village one of the first pilot villages for characteristic B&Bs in Shanghai and the second batch of demonstration villages for rural revitalisation in Shanghai. Especially up to now, there are more than 20 B&B clusters and other individual brand B&Bs under the unified management of Suyu Group.

Figure 1 Location analysis of Lianmin Village
Image source: Author's drawing

2.1 Research methods

Actor-network theory (ANT) regards human and non-human factors that can change things by creating differences as broadly equal actors and incorporating them into a unified action explanation framework. The dynamic process in which actors build networks through actions is defined as translation, in which actors' role functions and value positioning change and are redefined. Translation analysis includes five stages: problem presentation, benefit conferment, recruitment, mobilisation, and elimination of objections (Figure 2). Actors form networks through translation, and the essence of the ANT network is a tool to describe the development of things. The countryside is increasingly understood as a complex space where endogenous and external factors interact, and rural revitalisation requires cooperation between actors within and outside the region. The ANT method based on relationship and process thinking can intuitively, systematically, and dynamically display the interactive connections of actors. Therefore, ANT has become an effective methodological and conceptual tool for studying rural gentrification, which is convenient for capturing the activities of actors and the spatial linkage projection of functional elements in the evolutionary process.

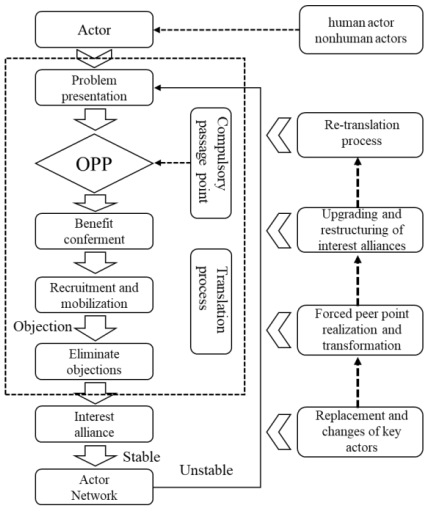

Figure 2 Analytical framework of the evolution of rural gentrification from an ANT perspective
Image source: Reference 11

3. Characteristics of rural gentrification

3.1 The overall pattern continues, but the local texture has been destroyed.

With the rapid development of the tourism service industry driven by homestays as the mainstay, Lianmin Village has continued the overall pattern of "transportation along the road, agglomeration along the line." Most of the natural villages in Lianmin Village are laid out along the river. More than 1/3 of the existing more than 1,000 residential buildings have been built along the water, a typical Jiangnan water town. Residential self-built houses are mainly located on the east side of Liufeng Highway, relegated to the second-line area along the river. The better-looking residential houses and iconic B&Bs are primarily distributed along both sides of Liuzao Port, enjoying the first-line riverside scenery (Figure 3). In addition, most of the B&Bs in the village were mainly renovated based on the original buildings, so they have little impact on the overall living pattern. However, there is still a tiny number of B&Bs that are newly built and mainly distributed on both sides of Wuzao Port. Their top contours differ from traditional houses, so they present new planar features based on continuing and strengthening the conventional residential pattern built along the water (Figure 4).

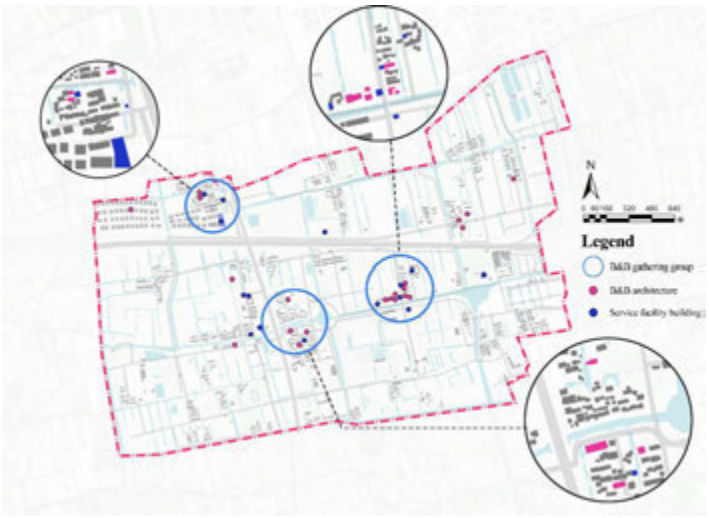

Figure 3 Spatial texture of Lianmin Village
Image source: Author's drawing

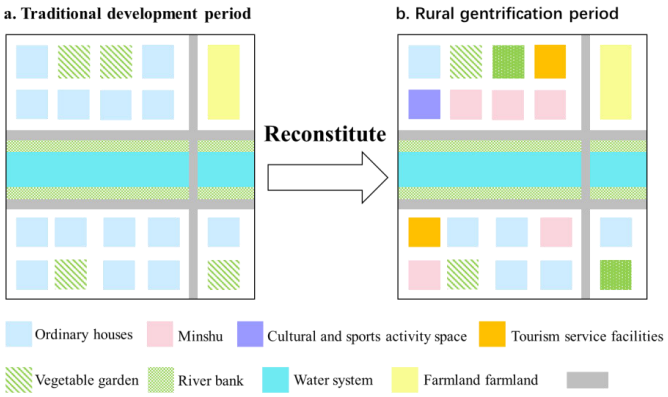

Figure 4 Spatial pattern reconstruction model of Lianmin Village
Image source: Author's drawing

3.2 Architectural diversification and urban aesthetic interest

With the successive intervention of B&B owners and other rural operators, the rural architectural style of Lianmin Village has been diversified, and the urban aesthetics have become more attractive. Diversification is reflected in the current situation of Lianmin Village, which includes not only traditional architectural styles and new rural residential styles but also a certain number of modern architectural styles and collage architectural styles that combine traditional local elements and contemporary elements. White walls and black tiles with strong Jiangnan charm characterise the traditional architectural style. The modern architectural styles in the village are mainly consumer spaces such as B&Bs, cafes, and wedding halls. Their

architectural forms mostly adopt simple and contemporary forms, with pure white paint as the background color and large-area glass windows, and rarely use other complex decorations. On the one hand, this design caters to the cultural aesthetics of urban tourists. In cities, simple style is usually synonymous with high-end. When simple modern buildings suddenly appear among many ordinary houses in the countryside, it is easier to become the visual focus and popular. Second, to meet the needs of tourists for taking pictures, simple and clean buildings are more suitable as background boards for taking photographs, reducing the visual interference of other decorations and highlighting the main image of tourists to a greater extent in the composition (Figure 5).

Figure 5 Modern buildings in Lianmin Village
Image source: Author's own photo

4. Explanation of social mechanisms

There are complex social mechanisms behind the spatial representation of rural gentrification. First of all, multiple subjects are participating in the process, as well as different economic and social attributes and interest demands. Secondly, various subjects gradually form complex social networks in daily interactions and interest games, and development factors such as capital and human resources also flow and make active choices through social networks. Furthermore, multiple actor networks may coexist in rural areas, co-constructing each other to form a more complex actor-network. Therefore, it is necessary to conduct further research on the explanation of social mechanisms of rural gentrification, and actor networks can be used to visualise rural social mechanisms due to their intuitive, systematic, and dynamic characteristics. In the actual investigation of Lianmin Village, it was found that there are two types of actor networks led by enterprises and elites and actor networks led by local governments.

4.1 Composition of actors

A complete actor network generally includes human and non-human actors (Figure 6). The human actors in the actor-network led by enterprises and elites in Lienmin Village and the actor-network led by the local government mainly include the government and village committees, villagers and elites (returning college students, individual entrepreneurs, etc.), and comfortable immigrants (rural pension, taking care of children in the countryside, periodic vacations, etc.), as well as enterprises (collective enterprises, private enterprises, etc.) and tourists. Non-human

actors are mainly environmental resources and stock projects, including land resources, characteristic dwellings, water system networks, farmland, and unique rural features and lifestyles.

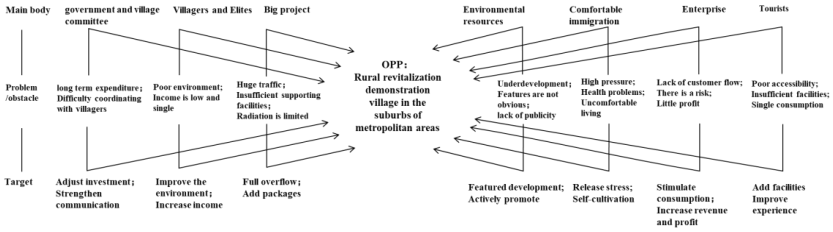

Figure 6 Composition of Lienmin Village activists
Image source: Author's drawing

4.2 Translation, recruitment and mobilisation

Actors will encounter various problems or obstacles. Among them, the actors with the most significant demands for solving their problems are most likely to become the key actors that guide the establishment of actor networks. Key actors also differ between business- and elite-dominated actor networks and local government-dominated actor networks. Among them, urban tourists who are tired of urban work and life and come to the countryside to pursue the poetic life of "pastoral pastoral" are the initiators of rural gentrification led by enterprises and elites in Lienmin Village. The enormous potential of the rural tourism market, which tourists form, attracts companies, villagers, and elites to join it. The critical actors in the actor network led by local governments are local governments, mainly village committees and town governments. As the rural tourism industry in Lianmin Village gradually takes shape and expands, local grassroots governments have also begun to encourage and control rural construction actions through policy means. In the end, the two types of gentrification form the only way to jointly build a demonstration village for rural revitalisation in the suburbs of a metropolitan area (OPP), to give full play to the local high-quality natural environment and cultural resources, creating economic benefits and improving the quality of life.

Recruitment and mobilisation are critical steps in the translation process. Key actors try to respond to and coordinate the interest demands of various actors through the OPP vision. Multiple actors can clarify their roles and assign tasks during the interest negotiation and action connection between recruiting and being recruited. At the same time, they can mobilise resources, implement actions, and respond to tasks. Specifically, rural enterprises and elites sent to the countryside have become the most active promoters and actual implementers of the entire actor network. They coordinate with other actors to strengthen cooperation during the implementation process and, at the same time, avoid friction and conflicts as much as possible to fully utilise the value of the natural and cultural resources of the countryside and form interest connections. These connections are constantly adjusted and strengthened through interaction.

4.3 Actor Network

Various actors establish weak and strong ties through translation, recruitment and mobilisation. The connections between critical actors, as well as between key actors and other

actors, are usually strong ties, which form stable strong ties that fit or evolve strong ties that conflict.

In rural gentrification led by enterprises and elites, enterprises and elite villagers are key actors (Figure 7). There are direct economic connections between tourism companies and tourists, and between village elites and tourists, thus forming solid ties. Since corporate operations have relatively sufficient funds, the consumer products such as homestays they can provide are generally higher in scale and quality than those hosted by elite individuals, thus giving tourists more confidence when making consumption choices. Therefore, forming relatively stable and robust ties between village elites and tourists is easy. However, due to the limited funds of the village elite, the image of homestay decoration and other products is more straightforward, and their appeal to tourists needs to be improved. Moreover, the management and services are also quite different from similar products operated by enterprises, making it difficult to form "repeat customers." Therefore, the solid and unstable ties formed between village elites and tourists are usually unstable. Tourism companies and local elites will also communicate in a long-term relationship, thus establishing social connections.

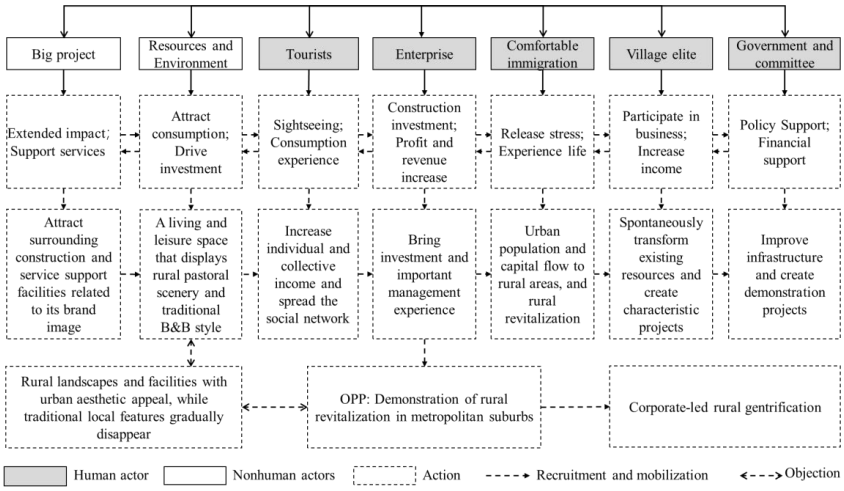

Figure 7 Actor network behind corporate- and elite-led rural gentrification
Image source: Author's drawing

In government-led rural gentrification, local grassroots governance represented by village committees and town governments are vital actors (Figure 8). Although they did not provide direct financial subsidies to village enterprises and individual elites for order management and promoting prosperity, they supported their industrial development by constructing basic service facilities such as roads and environmental governance. In addition, grassroots governments are also responsible for attracting investment and mediating conflicts, acting as an "intermediary" for housing rentals and labor hiring, and coordinating and promoting win-win cooperation between new and old residents. If the government aligns with the original villagers, it will support new villagers who carry out new business activities. This overall macro control combined with practical problem mediation leaves much room for rural development and allows the market to choose suitable industries independently. In addition, the local government

of Lianmin Village has also taken the initiative to negotiate brand cooperation with Shanghai Shendi Group, the developer of Shanghai Disney.

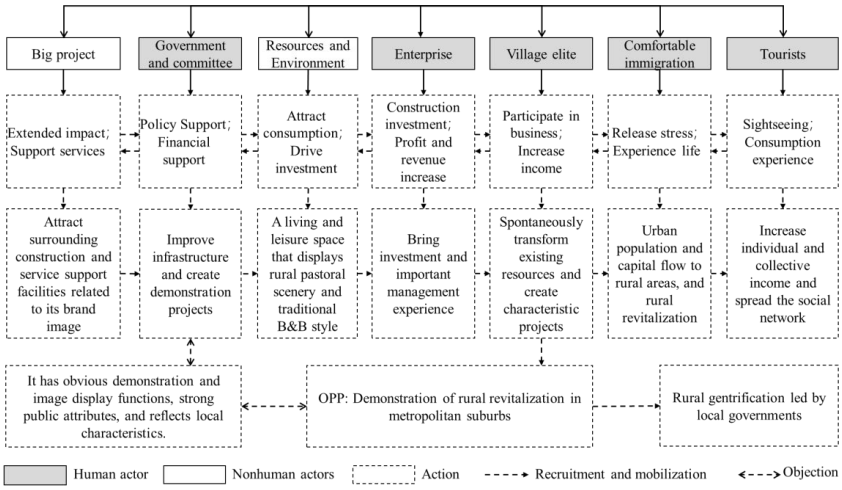

Figure 8 Actor network behind government-led rural gentrification
Image source: Author's drawing

5. Conclusion and discussion

This article uses the case of Lianmin Village. It uses the actor network analysis method to explore the characteristics and mechanisms of rural gentrification: rural gentrification led by enterprises and elites and rural gentrification led by the government. The research found many things. Firstly, Lianmin Village has the characteristics of enterprise-led rural gentry and local government-led rural gentrification in terms of rural population structure, industrial structure, and landscape style. The former has higher flexibility and reflects more urban aesthetic interest. Organised rural gentrification, with local government investment and construction as the primary mode of participation, focuses on public actions such as road widening, blackening of basic service facilities, and river ecological improvement, showing obvious public attributes and local characteristics preferences. Second, the mechanism behind the above characteristics may differ from local enterprises and governments' independent driving roles in their respective fields. Instead, the above two main actors are interconnected through other actors such as village elites, comfortable immigrants, tourists, etc., forming a complex joint action network. Market resources and government resources are efficiently allocated and reorganised through the actor-network.

In the context of China's rural revitalisation policy, rural gentrification has become the only path for developing most rural areas in our country. It is also helpful under our country's urban-rural dual-land system. However, most rural gentrification in China is still in the brewing or initial stages, and its subsequent development results and sustainability remain to be further observed and demonstrated. This article only selects a typical case in the suburbs of Shanghai, a megacity, for in-depth comparative discussion, but China also has vast underdeveloped and underdeveloped areas. Whether the two rural gentrification development models are applicable in their rural revitalisation process still requires in-depth research by multiple parties.

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Awareness and Willingness of Chinese Households to Reduce Carbon Footprint in Daily Life

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Abstract

This study investigates variations in carbon reduction willingness among households across different regions of China, exploring associations with household structure, economic status, and living conditions. A methodology was developed to calculate households' willingness to reduce carbon emissions. Efforts were made to assess carbon reduction willingness across various provinces and cities in areas such as transportation, food, products, energy usage, and awareness of carbon neutrality. The findings suggest that while Chinese households demonstrate a proactive willingness to reduce carbon emissions related to food and products, there is an evident need to enhance their willingness in the areas of transportation and energy usage. Furthermore, the research identifies household income, geographic location, residential area, and length of residence as significant determinants of household carbon reduction willingness.

Keywords

Households carbon footprint; Carbon reduction willingness; Household structure

1 Introduction

The substantial increase in carbon emissions constitutes one of the most urgent challenges faced by the contemporary world. Since the Industrial Revolution, human activities, particularly the combustion of fossil fuels, have become the primary drivers of increased greenhouse gas emissions. The IPCC's Sixth Assessment Report underscores that in 2019, atmospheric concentrations of carbon dioxide (410 parts per million) exceeded levels from any time in the past two million years. Managing carbon emissions has thus become central to mitigating climate change (IPCC, 2022). Excessive carbon emissions not only contribute to global warming but also heighten the risk of extreme weather, climatic, and hydrological events (Miner et al., 2021; UK-China Cooperation on Climate Change Risk Assessment, 2021). In response to this crisis, nations worldwide have formulated various international policies and agreements, such as the Paris Agreement (UNFCCC, 2015), aiming to limit the global temperature increase to within 2 degrees Celsius and thereby promote a low-carbon economic transition globally. These agreements stipulate that greenhouse gas emissions must peak by 2025 at the latest and reduce by 43% by 2030. The severity of climate change necessitates immediate and large-scale carbon reduction actions by the international community to alleviate the escalating impacts of climate change (An et al., 2024).

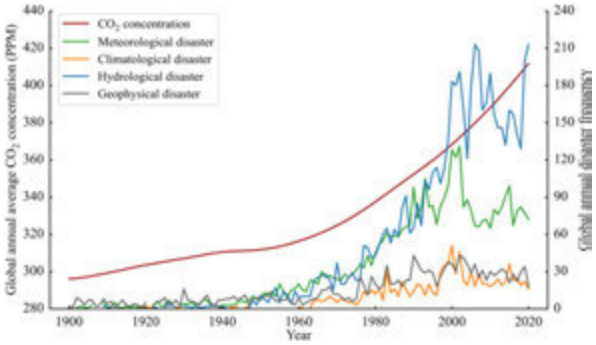

Figure 1: The correlation between extreme events caused by global climate change and the increase in CO2 concentrations(Jiang et al., 2022; SCPRC, 2021)

Facing stringent carbon reduction targets, household carbon footprints (HCF) constitute a significant portion of overall emissions, with households being major contributors to greenhouse gas emissions (Ivanova et al., 2016). The HCF measures the greenhouse gas emissions produced by households in daily life, encompassing both direct consumption of fossil fuels and indirect emissions from the use of products and services, typically calculated in terms of carbon dioxide equivalents (CO2 eq) (An et al., 2024). Reducing household carbon emissions can mitigate climate change and contribute to achieving carbon neutrality. According to research by the Potsdam Research Institute for the Effects of Climate Change, in 2021, China emitted 14.3 billion tonnes of CO2 equivalent, making it the largest emitter globally. Over the past two decades, alongside significant economic growth and urbanization, household carbon footprints have not only increased substantially but also varied greatly (Wang et al., 2022), necessitating greater focus on the potential for household carbon reduction. However, proposing effective, accurate, and reasonable policies for reducing household carbon footprints presents a complex challenge for policymakers.

Understanding the composition and determining factors of household carbon footprints (HCF) has become crucial. Existing research has explored the impact of socio-economic characteristics, such as household income, as well as household features including the age of members, household size, and education levels, and geographical factors like the location of the household (Zhang et al., 2015). There is also scholarly focus on the inequalities within HCF, highlighting that affluent households emit significantly more carbon than poorer ones (Wiedenhofer et al., 2017). However, there has been limited investigation into the role of lifestyle changes on HCF. To date, only a few scholars have studied the awareness of households regarding reducing their carbon footprint. Khanam et al. assessed the awareness and willingness to reduce HCF in daily consumption from an expert perspective (Khanam et al., 2022), while Brounen et al. discovered that awareness of social and environmental issues can inspire lifestyle changes (Brounen et al., 2013). Li et al. examined the impact of different subjective social awareness indicators on the carbon emissions of Chinese households (Li et al., 2019). This indicates that under the goal of carbon neutrality, adopting sustainable lifestyles and consumption behaviours can significantly reduce carbon emissions (Koide et al., 2021). For example, using energy-efficient appliances (Dias et al., 2019), reducing the use of disposable plastic products (Senturk & Dumludag, 2022), opting for local seasonal food (Tantiwatthanaphanich et al., 2022), minimizing food waste (Parashar et al., 2020),

and reducing car ownership are all sustainable practices that can significantly control HCF. Therefore, it is necessary to conduct focused research on the behaviours and awareness of Chinese households in reducing their carbon footprint in daily life, to thoroughly understand how different levels of awareness impact HCF and thus develop tailored emission reduction strategies and sustainable development plans for diverse families.

Consequently, this study aims to assess the willingness of households across different regions of China to reduce their carbon footprints (CF), categorizing this willingness into five levels: transportation, food, products, energy, and carbon neutrality awareness. It also provides a regional distribution of these indices, seeking to identify which type of willingness in different regions can encourage families to adopt low-carbon lifestyles, thus proposing suitable policies for household carbon reduction in various areas to balance the reduction of HCF with climate change mitigation. To this end, the study collects baseline data on China's HCF for 2021, including various household characteristics (such as number of family members, ages, gender, and employment status) and socio-economic levels (such as household income, geographical location, and living area). It combines these with a regional analysis of the five fundamental sectors: transportation, food, products, energy, and carbon neutrality awareness. The HCF considered in this study includes CF based on daily and usual consumption (for example, the transportation category considers the everyday and regular modes of transport used by people, while the food category accounts for local sourcing and packaging levels). The study attempts to identify the factors influencing HCF in different regions and their emission reduction potential. It also advocates assigning higher reduction tasks to households in high-emission areas, which is crucial for mitigating climate change, ensuring social equity, and maintaining sustainable development.

2 Method

2.1 Questionnaire Design and Data Collection

The primary data for this study was collected as part of a summer social practice project, "Exploring HCF Potential," conducted by a university from July to October 2022. The project received university approval, and the HCF questionnaire was disseminated online. A total of 3,839 respondents from 1,132 households participated in the survey, with 1,099 of the responses being valid, yielding a response validity rate of 97.0%. The data collection did not involve any sensitive information such as respondents' names, focusing solely on households' daily consumption habits. To ensure the ethical standards of the survey, all participants were provided with an informed consent form before participating.

Given that the data originated from a questionnaire survey, the questionnaire's validity was ensured through a pilot survey, which led to revisions based on the findings. The pilot phase also revealed a significant number of incomplete responses, prompting a revision of the approach to actively contact respondents by phone before the official survey. This method encouraged respondents to read questions carefully before answering, to prevent casual or incomplete responses and ensure the accuracy and authenticity of the data provided.

The questionnaire data was divided into two main parts: (1) Basic Household Information: This section collected data on basic demographic and socio-economic conditions, including population, gender, age, and employment status. (2) Household Consumption Preferences: This section gathered information on daily lifestyle choices, such as dietary habits, the proportion of organic foods consumed, frequency of dining out, use of disposable products, choices of reading materials,

clothing purchases, and frequency of household appliance updates. It also included data on carbon neutrality behaviours and awareness, such as the frequency of community promotions on low-carbon knowledge.

Through the data collected via the questionnaire, this study aims to understand Chinese households' awareness of carbon neutrality and their everyday behaviours to explore the drivers behind the transition towards household carbon neutrality in China. Compared to previous studies based on expert samples (Bai & Liu, 2013; Khanam et al., 2022), the sample size of the current study is significantly larger, providing a more robust basis for analysis.

2.2 HCF calculation formula

The questionnaire comprised a total of 37 questions, with questions 1-11 dedicated to gathering basic information about the respondents. This section included questions on household population size, gender, age, and employment status. Questions 12-37 were related to carbon reduction willingness (WRCF), divided into categories of transportation, food, products, energy, and carbon neutrality awareness, as detailed in Table 1. The questionnaire can be found in the supplementary file.

Table 1. WRCF Questionnaire and Scoring

Category	Question	Scoring				
		Strongly disagree	Disagree	No opinion	Agree	Strongly agree
Transportation	Q12: Does your family own a private car?	Yes=0 No=2				
	Q13: Is your family's private car electric?	Yes=2 No=0 (For those without a private car, score this item as 0)				
Food	Q14: Does your family often eat meat?	2	1.5	1	0.5	0
	Q15: What percentage of your family's food is unprocessed/natural?	100%=2	75%=1.5	50%=1	25%=0.5	0%=0
	Q16: How much of the food your family consumes is unpackaged?	100%=2	75%=1.5	50%=1	25%=0.5	0%=0
	Q17: What percentage of the food your family consumes is locally sourced?	100%=2	75%=1.5	50%=1	25%=0.5	0%=0
	Q18: How often does your family consume takeout/dining out?	2	1.5	1	0.5	0
Household Products	Q19: What new clothes, shoes, or sports equipment does your family purchase monthly?	2		1	0.5	0
	Q20: How often does your family purchase new household items?	2		1	0.5	0
	Q21 How frequently does your family purchase household appliances	2		1		0
	Q22: How frequently does your family purchase electronic devices	2		1		0

	Q23: How frequently does your family purchase paper-based books, magazines, and newspapers?	2		1	0.5	0
	Q24: Does your family engage in paper recycling?	0	0.5	1	1.5	2
	Q25: Does your household engage in plastic recycling?	0	0.5	1	1.5	2
	Q26: Does your family use second-hand clothes and books?	Yes=0 No=2				
	Q27: Does your family have heating/cooling equipment?	Both heating and cooling=2 Only one type=1 No=0				
	Q28: Does your family's electricity come from renewable sources?	0	0.5	1	1.5	2
Energy	Q29: How would you rate your family's energy efficiency?	0	0.5	1	1.5	2
	Q30: Is the energy label an important factor for you when purchasing appliances?	2		0		1
	Q31: Do you understand the meaning of carbon neutrality?	2		1		0
	Q32: Do you believe that household carbon emissions contribute to global warming?	2		1		0
	Q33: .Do you prioritize comfort in your daily life over energy consumption?	0		1		2
	Q34: Are you willing to change your personal lifestyle for energy efficiency and participate in family energy-saving and emission reduction activities?	2		1		0
Carbon Neutrality Awareness	Q35: Does your family include individuals working in the environmental industry?	Yes=2 No=0				

Q36: How often do you pay attention to energy and environmental issues?	2	1	0
Q37: Does your residential community or neighborhood take relevant low-carbon actions?	2	1	0

2.3 Measuring Household.WRCF

This article references the definitions of willingness to pay (WTP) values as outlined by Le Gall-Ely and Venkatachalam (Le Gall-Ely, 2009; Venkatachalam, 2004). WTP is the maximum amount an individual is willing to sacrifice or pay for a service or product. It serves as a crucial indicator for measuring consumers' perceived value and demand intensity for a good or service. WTP represents the peak of a consumer's demand curve, indicating the price point at or below which a consumer is prepared to purchase a particular good or service. Consequently, this paper, drawing upon Khanam et al.'s discussion on European carbon reduction behaviours and awareness (Khanam et al., 2022), employs the term Willingness to Reduce Carbon Footprint (WRCF) to denote the inclination of households to reduce carbon emissions in their daily lives. The calculation of WRCF involves dividing the total scores obtained across various sectors by the total number of questions in those sectors, encompassing current daily activities, performances, and consumption habits of households.

$$WRCF_t = \frac{WRCF_T}{q_t} \quad (1)$$

$$WRCF_f = \frac{WRCF_F}{q_f} \quad (2)$$

$$WRCF_p = \frac{WRCF_P}{q_p} \quad (3)$$

$$WRCF_e = \frac{WRCF_E}{q_e} \quad (4)$$

$$WRCF_n = \frac{WRCF_N}{q_n} \quad (5)$$

Equations (1), (2), (3), (4), and (5) each represent the willingness to reduce carbon emissions in the areas of transportation, food, products, energy, and carbon neutrality awareness, respectively. The calculation of WRCF for each sector involves dividing the total scores obtained in that sector by the total number of questions for that sector. The total scores for different sectors are denoted as $WRCF_T$、$WRCF_F$、$WRCF_P$、$WRCF_E$ and $WRCF_N$, which represent the sum of all values within each section as detailed in Table 1. The number of questions in each part is represented by qt, qf, qp, qe, and qn respectively (with a total of q=26, excluding demographic questions). Thus, $WRCF_t$、$WRCF_f$、$WRCF_p$、$WRCF_e$ and $WRCF_n$ each reflect the willingness of households in various provinces to reduce their carbon footprint in the areas of transportation, food, products, energy, and carbon neutrality awareness.

$$WRCF_{total} = \frac{WRCF_t + WRCF_f + WRCF_p + WRCF_e + WRCF_n}{q} \quad (6)$$

In Equation 6, the overall willingness of households to reduce their Carbon Footprint (CF) is estimated. Here, WRCFt, WRCFf, WRCFp, WRCFe, and WRCFn represent the willingness of

individual respondents from specific sectors to reduce their CF in transportation, food, products, energy, and carbon neutrality awareness, respectively. The total number of questions is represented by q (total q=26).

Based on the calculated scores, values below 0.5 indicate almost no willingness to reduce the carbon footprint (WRCF), scores from 0.5 to 1 indicate a low level of willingness, scores from 1 to 1.5 suggest a moderate level of willingness, and scores above 1.5 denote a strong willingness to reduce the carbon footprint. This scoring system provides a quantitative measure to assess the degree of engagement across different areas of carbon reduction efforts.

2.4 Correlation Analysis of Household WRCF

Considering that household WRCF may be influenced by various demographic factors such as age and gender, this paper employs SPSS software to process and analyze the data. This analysis evaluates the correlation between different factors and HCF to identify the most significant factors impacting carbon reduction behaviours in households.

$$r = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum(X - \bar{X})^2(Y - \bar{Y})^2}} \quad (7)$$

Where

r represents the Pearson correlation coefficient. X and Y represent the values of WRCF and various household characteristics, respectively. $\bar{X}$ and $\bar{Y}$ are the mean values of WRCF and the different household characteristics,

3 Result

3.1 Questionnaire

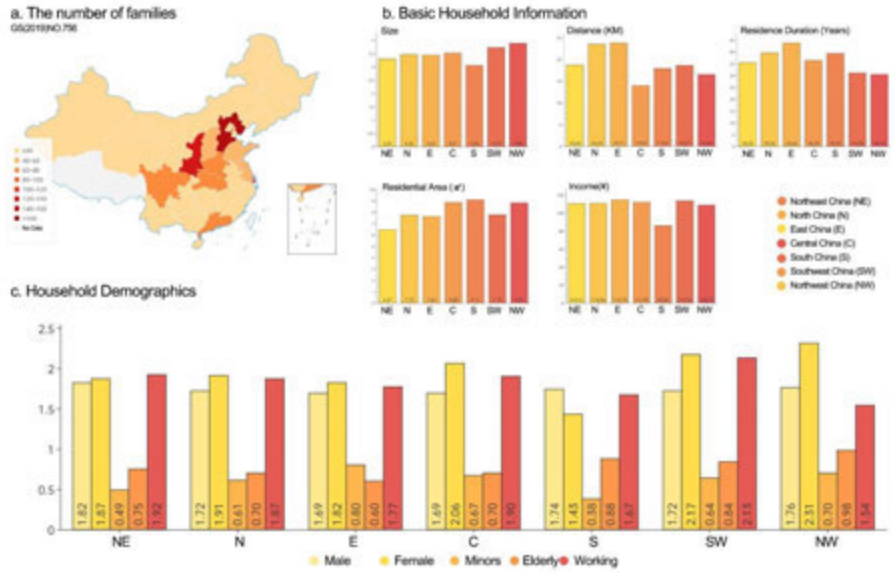

Figure 2: Basic Household Information. a. The number of families; b. Basic Household Information; c. Household Demographics

Figure 2 presents the foundational results of the survey. In terms of household composition, families of three constitute nearly 40% of the household population, with an average household size of 3.5 people. On average, each household comprises 0.67 children, 0.74 elderly individuals, and 1.85 working adults. Forty-six per cent of households have children, with an average annual family income of 186,500 RMB. Seventy per cent of respondents live within 20 kilometres of urban centres, and 57% of households occupy homes smaller than 100 square meters. Given that the survey encompasses the entirety of China, for ease of calculation and analysis, this paper divides the study area into the following eight regions based on geographical and climatic differences: Central China, Eastern China, Southern China, Northeast China, North China, Southwest China, Northwest China, and the Hong Kong, Macau, and Taiwan regions. Specific provinces and areas included are listed in Table 2. The questionnaire did not gather data from the Hong Kong, Macau, Taiwan, and Tibet regions; hence, these are treated as no data.

Table 2.The study area

Region	Included Provinces and Cities
Northeast China (NE)	Liaoning, Jilin, Heilongjiang, Inner Mongolia
North China (N)	Beijing, Tianjin, Hebei, Shanxi, Shandong
East China (E)	Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong
Central China (C)	Henan, Hubei, Hunan
South China (S)	Guangdong, Guangxi, Hainan
Southwest China (SW)	Sichuan, Guizhou, Yunnan, Chongqing, Tibet
Northwest China (NW)	Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang
Taiwan, Hong Kong and Macao regions of China(THM)	Taiwan, Hongkong, Macao

Overall, Regarding household size, regional differences are relatively small, with the average household size in the Northwest being 3.88 people, slightly higher than 3.29 people in the Northeast, suggesting a more relaxed family structure in the Northwest. There are more significant differences in living space. Data indicates that the living area in North China is the largest, nearly 34% higher than in South China, reflecting differences in economic development levels and living conditions between regions. The duration of residence in homes varies from 6.47 years in the Northeast to 9.11 years in South China, which may relate to the stability of the real estate market and residential migration habits in these regions. Differences in the distance from residential areas to city centres are not substantial, but the greatest variance between North China and Northwest is about 13 kilometres, with the furthest distance in North China being 43.64 KM and the closest in Northwest being 30.44 KM, indicating that residents in North China may tend to live further from city centres.

Regarding household demographic composition, the Southwest region has the highest number of employed individuals, averaging 2.13 per household. Across all surveyed regions, the proportion of elderly in households generally exceeds that of minors, with the most significant difference in South China, where the elderly population is 1.3 times that of the minor population. Additionally, the male-to-female ratio also shows notable differences across regions; the Northwest region has 30% more females than males, while South China is the only region where the male population exceeds the female population. These data reveal regional characteristics and differences in family structure, living conditions, and gender ratios across various areas of China. These differences reflect the diverse impacts of economic development, cultural backgrounds, living habits, and social policies between regions.

3.2 WRCF in different regions

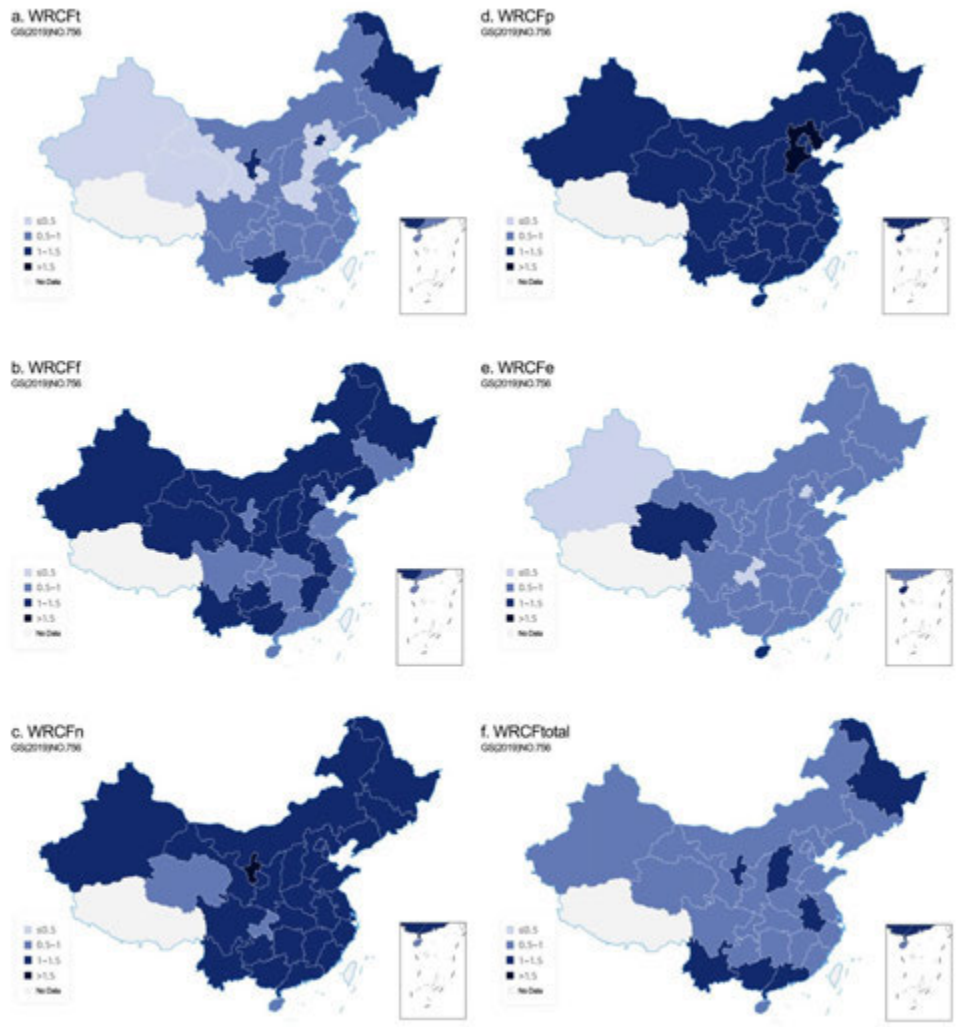

Figure 3 Different categories of WRCF

The study on the distribution and impact of WRCF demonstrates significant regional variations in different types of WRCF. Specifically, in the transportation sector, Heilongjiang Province, Beijing, Ningxia Hui Autonomous Region, and Guangxi Zhuang Autonomous Region exhibit strong

WRCF, likely due to aggressive local government promotion of low-carbon transportation policies. However, in other provinces and regions, the WRCF related to transportation is relatively low, possibly due to a lack of effective incentives or insufficient public awareness of the importance of carbon reduction in transportation.

Compared to transportation, the willingness to WRCFf is more pronounced nationwide. A substantial number of families across almost all regions show a willingness to reduce their food carbon footprint, especially notable in North China, Northeast China, and Southwest China. This reflects the growing concern among Chinese families about the carbon footprint associated with food consumption and their willingness to adopt measures to reduce food-related emissions. The willingness to reduce carbon emissions from household products (WRCFp) is similar to that for food, with a positive attitude observed across all provinces, particularly pronounced in Hebei Province. This indicates that an increasing number of consumers prefer eco-friendly and low-carbon products, reflecting a rise in public environmental awareness and market demand for such products.

However, the WRCFe across the country is not ideal. Apart from Qinghai Province, the desire to reduce energy consumption is generally low throughout the country, especially in Chongqing, Beijing, and Xinjiang, where there is almost no inclination to reduce energy consumption. This could be related to the energy structure and pricing policies in these areas, or possibly due to inadequate public understanding of the importance of energy carbon reduction. Apart from Qinghai Province, the national willingness to reduce energy consumption is low, with almost no willingness observed in Chongqing, Beijing, and Xinjiang. Regarding WRCFn, there is a strong awareness of carbon neutrality nationwide, particularly in the Ningxia region. This indicates that national campaigns on carbon neutrality have been somewhat effective, with most families having a fair understanding and support for it.

In terms of overall WRCF (WRCFtotal), only a few provinces like Yunnan, Guangxi, Shanxi, Heilongjiang, Gansu, and Anhui show significant overall WRCF, while other provinces exhibit lower WRCF. This disparity highlights the uneven distribution of environmental awareness and practices across China, suggesting that future efforts should not only maintain the willingness to reduce carbon in food and products but also enhance the promotion of energy carbon reduction.

3.3 Correlation-based influences on WRCF

To further analyze the primary factors influencing WRCF, we employed Pearson correlation analysis to explore how household characteristics (such as household size, ages of members, gender, and employment status) affect the willingness to reduce carbon emissions in various aspects including transportation, food, products, energy, and carbon neutrality awareness across different provinces. Figure 4 illustrates the main influencing factors for different categories of WRCF, where the significance levels (two-tailed) indicate whether these relationships are statistically significant. Except for household population, gender, elderly, minors, and working population, the correlations for all other factors were found to be significant (p-value <0.05 or <0.01).

Figure 4 Main influencing factors for different categories of WRCFs

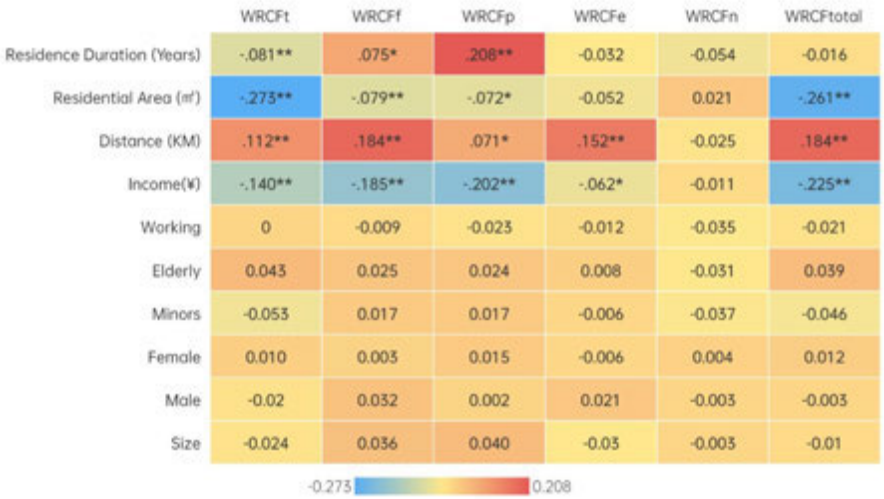

Figure 4 indicates that the gender ratio, total population, and number of employed individuals in households do not significantly influence the WRCF, suggesting that these factors may not directly determine a family's carbon reduction behaviours. However, other aspects such as household income, geographical location, residential area, and duration of residence significantly affect carbon reduction awareness in households. Specifically, the size of a household's living area shows a significant negative correlation with their awareness of transportation carbon reduction. This may be because families with larger living areas typically own more vehicles or use private cars more frequently, which reduces their focus on reducing carbon emissions in transportation. Additionally, such families are likely to reside in suburban or peripheral urban areas, increasing their dependency on vehicles. The proximity of residences to city centres is positively correlated with the household's awareness and actions toward reducing carbon emissions in transportation, food, and energy. Families living near city centres tend to adopt a low-carbon lifestyle, such as using public transportation, opting for local food, and utilising energy more efficiently, likely because of better accessibility to transport and environmental resources in city centres. Household income is also a crucial factor affecting carbon reduction consciousness. Data shows that higher-income families demonstrate a lower willingness to reduce carbon emissions in food, products, and energy, possibly because such families have greater financial flexibility for consumption, may not focus on conserving resources and protecting the environment, or their lifestyle and consumption patterns are closely linked with higher carbon emissions. This observation aligns with the findings of researchers like Wiedenhofer et al(An et al., 2024; Gao et al., 2024; Wiedenhofer et al., 2017). The duration of residence is positively correlated with the willingness to reduce the carbon footprint of products; families residing longer in their homes are more likely to adopt measures to reduce product carbon footprints, such as choosing sustainably produced goods and reusing products. Overall, the general awareness of carbon reduction negatively correlates with the size of a family's residential area but positively with their geographical location. This suggests that families living in smaller residences closer to city centres are likely to exhibit

stronger environmental awareness and behaviour, possibly due to stricter environmental policies in these areas or because residents in smaller spaces focus more on efficient resource use.

Overall, the general awareness of carbon reduction is negatively correlated with the size of a family's living area and positively correlated with their geographical location. This suggests that households with smaller living spaces and those closer to city centres are more likely to exhibit stronger environmental consciousness and behaviours. This could be due to stricter environmental policies in these areas or because residents in smaller spaces focus more on efficient resource use.

4 Discussion and Conclusion

This study integrates the WTP approach and survey methods to explore the variations in WRCF among different types of households across various regions of China, and their relationship with household structure, economic status, and living conditions, providing a basis for future differentiated low-carbon policies. The results show that while there is little variation in family size across regions, there are significant differences in living space, duration of residence, and distance from city centres. These variations reflect regional differences in economic development, real estate market stability, residential migration habits, and urban planning. Additionally, the composition of household populations in terms of gender ratios and age structures also shows regional characteristics; in South China, the elderly population exceeds the minor population, while in Northwest China, the female population significantly outnumbers the male population. These findings reveal the diversity and specificity of family structures and living conditions across different regions of China.

Significant regional differences are evident in the types of WRCF. Chinese families have made some progress in WRCF related to food and products, but there is still room for improvement in transportation and energy use. Nevertheless, there is a strong national consciousness about carbon neutrality, and promotions regarding carbon neutrality have been somewhat effective, with most families having a fair understanding and support for it. Future efforts should maintain the progress in food and product WRCF while enhancing the promotion and policy guidance on energy carbon reduction to ensure a comprehensive advancement of low-carbon lifestyles.

Factors such as household income, geographical location, residential area, and duration of residence significantly correlate with household carbon reduction consciousness. Families with larger living areas tend to have a lower awareness of transportation carbon reduction, possibly due to greater reliance on private vehicles. Meanwhile, families living closer to city centres are more likely to adopt low-carbon lifestyles due to convenient transportation and efficient resource utilization. This insight suggests that policymakers should consider carbon reduction factors in urban planning and housing policies, such as encouraging the development of compact cities and enhancing the convenience and efficiency of public transportation systems (Souaid et al., 2024). Research has found that high-income families generally have lower WRCF, which may be related to their greater consumption power and lifestyle choices (Sommer & Kratena, 2017). Therefore, enhancing environmental education and improving the availability of eco-friendly products and technologies might be effective strategies to increase WRCF among higher-income groups (Wiedenhofer et al., 2017).

Future government carbon reduction strategies could consider the specific circumstances of households, such as income level, residential location, and type of housing, to design more targeted incentive measures. For example, families living in small residences in city centres could be provided with more low-carbon lifestyle conveniences, such as discounted public transportation services and expanded public resource-sharing facilities. Simultaneously, differentiated educational and promotional strategies should be launched for various income levels, particularly emphasizing the importance of a low-carbon lifestyle to high-income families to motivate their participation in carbon reduction. In addition, effective carbon reduction promotional activities should be implemented to widely communicate the importance and urgency of carbon reduction to the public. Currently, China has introduced a series of policies to reduce Household Carbon Footprint (HCF), such as promoting low-carbon buildings, developing new energy vehicles, advocating low-carbon lifestyles, enhancing energy conservation, and using new energy sources, aimed at reducing HCF, promoting sustainable development, and improving the quality of life. These measures not only aim to reduce carbon emissions, promote sustainable development, and enhance the quality of life but also make significant contributions to global climate governance and international cooperation, advancing global efforts to combat climate change and helping achieve the long-term goals of reaching carbon peak by 2030 and carbon neutrality by 2060.

This paper still has some limitations, such as potential biases in the survey or questionnaire design that might affect the respondents' answers, thus impacting the reliability and validity of the data. Future research should consider improving the design issues in the survey to enhance the reliability of the study.

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Statements and Declarations

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Stakeholders of participatory planning: a comparison between Megacities and Cities in Europe

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Abstract

Participatory planning is regarded as an accelerator of sustainable development, it comes however with its own set of challenges. In this paper, we study the challenges that are explicit to the case of Megacities. As they are more prominent in our current years, megacities form a large portion of their countries' population, not to mention they constitute an issue when combatting climate change. In the context of megacities, the analysis of the participation process requires a breakdown of the biggest difference between its application in cities and that in megacities: the stakeholders and their extrapolation. At the end, a solution for its conduction in megacities is proposed following the learnings from the city of "Vinnytsia" and applying them to the case of the megacity of "London".

Keywords: *Participatory Planning – Megacities – City Development – Planning Stakeholders*

Introduction:

As urban areas are rapidly growing, with more than 4 billion people, representing more than 50% of the world's population currently living in urban areas (Ritchie et al., 2018), handling each type of urban space individually is necessary for sustainable planning. This is to allow the shaping of processes tailor-made to fit the type of communities living in it and most importantly to keep up with its rate of expansion. An extraordinary phenomenon of urbanization is the formation of Megacities. Megacities are defined by their population size, which crosses the threshold of 10 million inhabitants (World Urbanization Prospects The 2018 Revision, 2018). Other than their defining aspect, the unique characteristics of megacities include their expansive size, intricate infrastructure, rapid growth, and socio-economic diversity ((Wenzel et al., 2007) and (Buehler, 2003.)). These necessitate a re-evaluation of traditional planning methods including participatory planning approaches. As megacities form a complex eco-system, their development elements are usually differentiated between one another during the planning process. This is already true in other types of cities and leads to the shift of power structures between the different stakeholders depending on the objective of the development. This division of elements shows, nevertheless, a higher level of disconnect in megacities due to their high level of complexity, which results in most cases in a top-down approach in decision making. Megacities are furthermore characterised by two attributes, their high population density, and the speed in which they expand. Currently, there are 33 megacities worldwide, a number expected to rise to 44, as projected by the United Nations Department of Economics and Social Affairs (United Nations, 2018). A megacity forms a complex organism where the race between sustainability and growth is fierce. With high speed expansion, pollution becomes just as fast on the rise. This is then worsened by the difficulty of controlling and maintaining sustainable development with the high number of stakeholders involved. A common trend to overcome this obstacle in recent years, has been to regard megacities as agglomeration of neighbourhoods.

Planners breakdown the megacity into neighbourhood islands, where development could be controlled and to an extent monitored. This has proven however ineffective in recent studies, as the case in the research conducted in Eastern megacities such as Hong Kong ((Edermann et al., 2023). Such methods tackle the centres of neighbourhoods and fail at their border. In their attempts to remedy such failures, the authorities create new masterplans with overarching policies. These in turn suffer under the magnitude of the challenge and resolve into one of two faults: failing to account for the individuality of established communities in each neighbourhood or expanding the city more to cater for the residents' needs, an endless loop as the megacity becomes even more difficult to contain and manage. On the other side of the spectrum, small cities have mastered the art of maintaining an identity whilst creating their overarching plans. As planning methods were created with cities of medium and small scale in mind, their application proves more effective. Adaptations are in any case needed to match with socio-economic and administrative contexts, nevertheless, the tools in themselves do not need to change. A good witness is reflected in the use of participatory planning as a sustainable development method.

In this research, we discuss the use of small cities to provide a blueprint for the translation of urban planning processes. The focus point in this method is to tackle the division and boiling down of stakeholders in small cities and allocating their counterparts in a megacity as a whole. As part of the SURPRISE project[1] we will investigate the research question at hand by dissecting the processes taking place in the Ukrainian city of Vinnytsia and translating the learnings into the European Megacity of London.

To tackle this challenge, we will start by understanding participatory planning and the stakeholders that are involved. We will then move on to studying the two cities in question, mapping out their stakeholders and comparing them to one another. At the end, we will be deriving conclusions, highlighting what solutions megacities could adopt and what could be enhanced in small cities planning.

2. Participatory Planning:

2.1 – Its definition and principles

Participatory planning signifies the involvement of all stakeholders and end-users of an area in its development plan. This method has been commonly used since the 1960s and has been referred to as a tool for sustainable development. In itself, participatory planning was the result of the shift from urban planning to strategic planning development. The main pillar of this method is the inclusion of different stakeholders in the decision-making process while urban planners play the role of mediators between the different stakeholders (Steinberg, 2005).

Researchers such as Jane Jacobs (Jacobs, 1961) and Sillak et al (Sillak et al., 2021) have studied how the involvement of citizens is related to the durability of the development. Jacobs has discussed this topic from the perspective of ownership. She explains in her book how citizens who are involved in the planning phase tend to protect said developments, e.g. against vandalizers in the case of small developments, and maintain the developments as a community. Sillak et al, amongst other researchers, have perceived the question of sustainability from a knowledge perspective. They have investigated participatory planning in topics such as energy planning and perceived the citizens as holders of first-hand experience on the place, and therefore having communicated to them any missing knowledge such complex topics and

[1] The Sustainable Urban Planning and Resilient Reconstruction In Ukraine with Spatial Data Science (SURPRISE) project is conducted by HafenCity University in Hamburg, Germany. It focuses on creating a pathway for sustainable planning in Ukrainian cities.

through working with the experts, are guaranteed to communicate a development masterplan that will correspond to the needs of the place. This helps prevent the repetition of work through the modification and readaptation of development plans during the operational phase.

2.2. - Obstacles in participatory planning:

Whether in megacities or small towns, participatory planning forms consistently a challenge for modern-day planners. From the start of the process, the challenge rises in managing and engaging stakeholders into the conversation (Cohen et al., 2015). The risk is this challenge resulting in only having a small sample of the society joining the decision-making process. More often than not, if this issue is not resolved, the sample in itself is then over-dominated by city officials and authoritative figures (Innes and Booher, 2004).
The second challenge is apparent when discussing more technical sectors related to planning, such as energy topics, governance, and economic issues among others. In this scenario, it is the case that there is a gap between the knowledge required for an effective debate, and that which the general public possesses. In energy topics for example, this problem is caused due to the discrete nature of the field. From complicated energy bills, lack of available open-data on the topic, to the complex theories behind its planning process, many energy topics present a black box for the normal citizen (Crippa et al., 2021). This to say that such lack of knowledge is not of the citizen's fault and therefore the job of the mediator urban planner in the participatory process is to ensure a levelling of all involved stakeholders in terms of knowledge. This solution adds in turn to the timespan of the planning process as a whole. This latter issue of time, with its different scales is one of the challenges in every planning process as they are viewed by experts as lengthy add-ons to the development process. To tackle this issue, developers resolve to the inclusion of citizens at the last phase which is the reviewing of the resulting plan, leading to a frustration from the citizens end and with it a lack of enthusiasm in joining the conversation for future projects and thus the cycle continues. The last common challenge of participatory planning is the translation of plans made by citizens into effective plans that could be used on site. This issue related and adds to two of the previously mentioned challenges: the lengthening of the process due to reformation of the plans, and the overruling of some of the citizens additions resulting once again in their frustration.

2.3- Breakdown of participatory planning stakeholders in megacities vs cities:

Finding the solution to the first obstacle of the subsection above, starts with understanding the stakeholders necessary for participatory planning. In its essence and as presented by Jacobs in her book (Jacobs, 1961), participatory planning is only effective if all samples of the community take part, arguing that minorities are often overlooked although they bring a unique perspective to issues at hand. Other researchers, such as Siliak et al (Sillak et al., 2021) and Voorberg (Voorberg et al., 2015) have expanded on the need for experts to join the conversation in the technical development areas such as energy and traffic. Since our research is discussing the overarching concept of city developments, we have also taken into the work of researchers tackling large-scale issues of development, such as the work of Arlati et al in discussing the CLEVER Corridor project in Hamburg, Germany (Arlati et al., 2021). From merging the literature, we can divide the stakeholders into 4 different categories: Experts, planners, stakeholders with economic interest, Authorities.

- Experts:
  Needed especially in complex technical issues, such as sustainability, water management, energy, traffic, among others. This category of holds deeper knowledge

on the topic in question. Their presence helps with asking and answering case-specific questions which then bridges the gap between the resulting masterplan and what can be realized on site.

- Planners:
  Planners are first and foremost mediators of the conversation. Equipped with the right tools, they guide the different stakeholders to reach the wanted results. They are sometimes hired by the city directly or are part of development consultancy and planning offices that are responsible for the project.
- Authorities:
  Comprised of government representatives and city offices, the level of authoritative figures involved on a project depends to its scale and its implication on local politics
- Economic-Interest Stakeholders:
  This last category is for private entities including, among others, funding agencies, energy companies and real estate developers. Despite them not being present in all types of projects, their involvement provides a challenge as the ideals they are reflecting has economic interest in their centres instead of general-interest questions such as sustainable development. Their contribution, however, provides a good inside on the feasibility of suggested plans.

The citizens, despite being at the centre of the process, constitute several intersections with each of the 4 mentioned categories, as they are workers, experts, city officers as well as citizens. They are therefore encompassing all the categories, as shown in Figure 1 below.

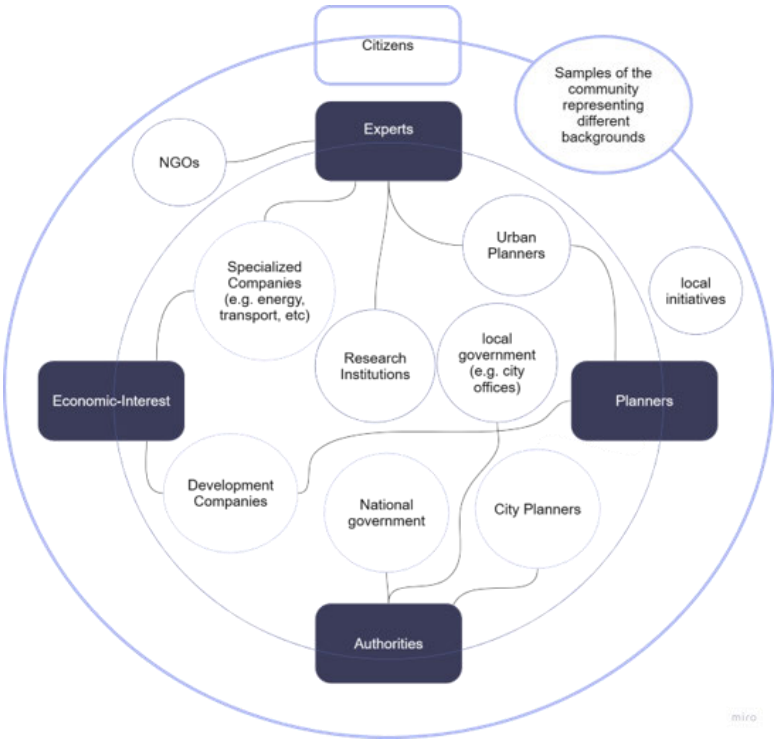

Figure 1: Categories of stakeholders in participatory planning

3 – Stakeholders distinction between cities and megacities

This stakeholder's breakdown, has been made in studying participatory planning in cities. The question rising here, is whether this categorization could be applicable to megacities in their large-scale development processes. In this section, we will study the 2 examples of Vinnytsia, Ukraine, and London, England to view what the above-mentioned categories translate into in the small city and how such learnings can be applied into the megacity.

3.1- Vinnytsia, Ukraine as a city example:

The first city of our study, is the city of Vinnytsia located in west-centre Ukraine. As Ukrainian administrative boundaries follow the hierarchy adopted from the traditional Soviet planning, the name Vinnytsia is given to both the Oblast and the Hromada as shown in Figure 2. With a population of over 350000 in the Hromada and 1.5M in the Oblast, the general population density of Vinnytsia amounts to 56.98/km² (City Population, 2022). As is the case in most post-Soviet cities, Vinnytsia currently faces a shift in identity where the current population is inclined to a more European image and development trends. A change is also obvious in its economy, where traditional industries are fading and their sources of income are shifting. Previously known as "Small Kyiv", the actors in Vinnytsia are conducting big movements to

reassign the city's urban identity. It is currently regarded as a power-player in its local region and in Ukraine (Melnychuk and Gnatiuk, 2019)

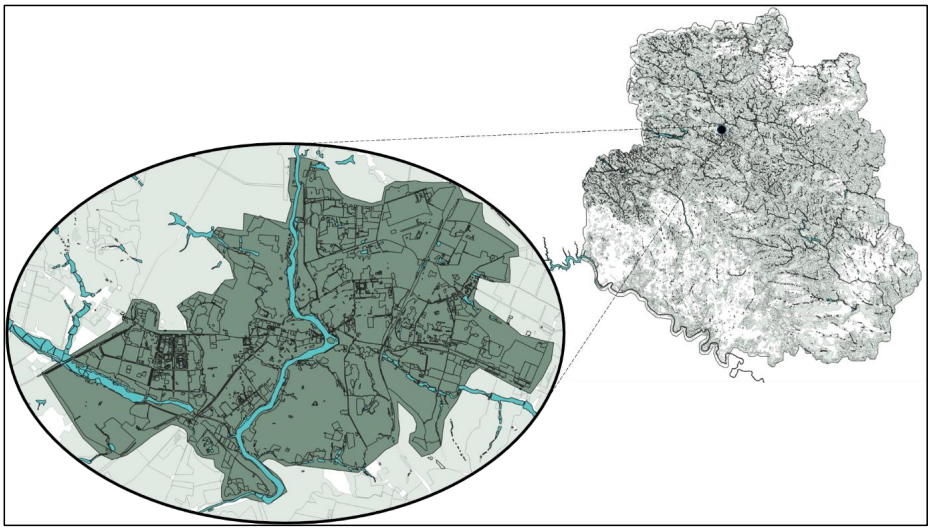

Figure 2 Map showing the position of the Hromada Vinnytsia in the Oblast of Vinnytsia using OpenStreetMap data

3.2 – Stakeholders in Vinnytsia, Ukraine

Currently in a wake of development, the Ukrainian city is following a plan to derive a more sustainable development path for its citizens. One of the pillars of which is the planned increased involvement of citizens in decision-making. To carry this task, and in the frame of work of the SURPRISE project, the degree of involvement of different stakeholders has been identified through conversations held with the local representatives. As explained in Figure 3 below, some stakeholders in Ukraine contribute only at the Oblast level. Translated into Western European planning definition, an Oblast could signify a municipality while the Hromada is the city. In the context of Vinnytsia, it could be regarded as an Oblast encompassing a town, prompting two different layers of intervention depending on the project. One main learning from from this division, is the stakeholders' categories themselves do not differ based on the development scale, but rather stakeholders themselves are distributed throughout the different scales. For example, authorities are needed at both scales, however the level of jurisdiction needed is the variable.

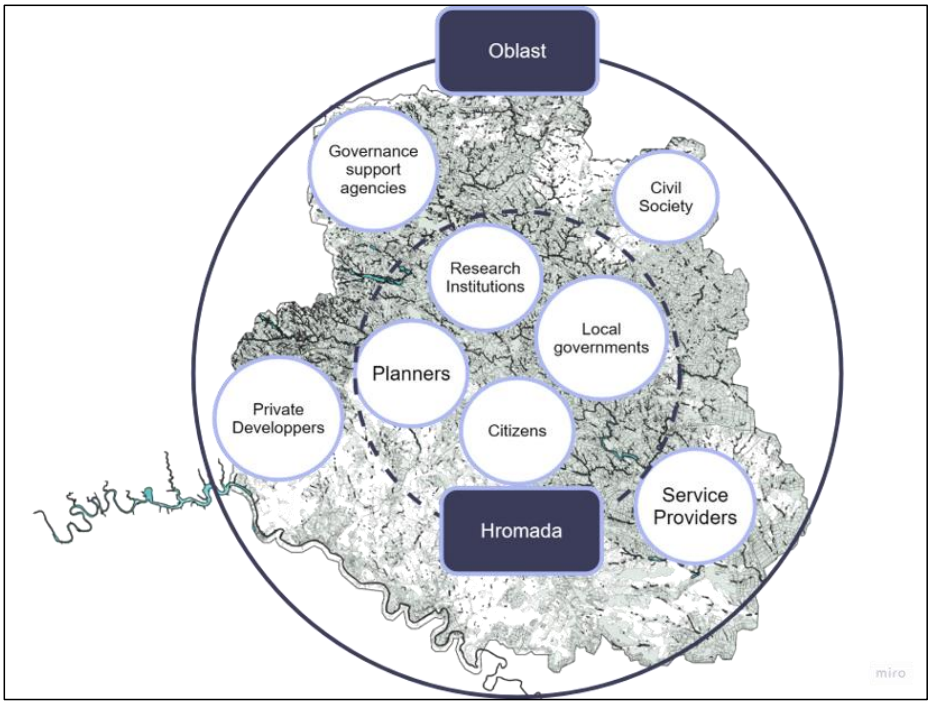

Figure 3 Distribution of participatory planning stakeholders between the Oblast and the Hromadas based on conversations with local actors in the frame of the SURPRISE Project

3.3- The Greater London area as an example of Megacity:

England's London is one of the two megacities of Western Europe, the other one being Paris, France. In 2024, London is house to a population of 9.7 million. The megacity encompasses the greater London area which has the city of London at its centre, forming only 2.9 sq.KM out of the 1569 sq.Km of the Greater London Area. London (referring to the greater London area in this research) has a population density of 5596 residents per sq.Km. (World Population Review, 2024). It encompasses an exceedingly diverse population, with 41% of its population formed by immigrants. With a very rich history, London is currently a global economic hub. As a megacity, London faces challenges such as traffic congestion, housing affordability, air pollution, and income inequality (Wenzel et al., 2007). Urban planning and sustainability initiatives are being implemented to address these issues. Although London is technically not a coastal city, it is often studied as a coastal megacity thanks to the Thames river crossing the city, connecting it to the North Sea, and its very close proximity to the coast.

3.4 – Comparison between stakeholders of Vinnytsia and London:

To understand the development of megacities, researchers have distinguished between the megacities in the western and eastern parts of the world. The development of the megacity of London has been studied as shown in Figure 4 (Li et al., 2019). A trend that has been spotted amongst them, is the tackling of problems through construction of satellite cities to fulfil the needs of the residents. The question we are investigating however is focused on a process encompassing the megacity as a whole.
Following the blueprint of the city of Vinnytsia, the inclusion of all stakeholders' categories remains a defying aspect to achieving effective participatory planning. To understand the difference between the two different city types, we resolve to extracting the stakeholder examples from Vinnytsia and assigning their counterparts in London as seen in Table 1.

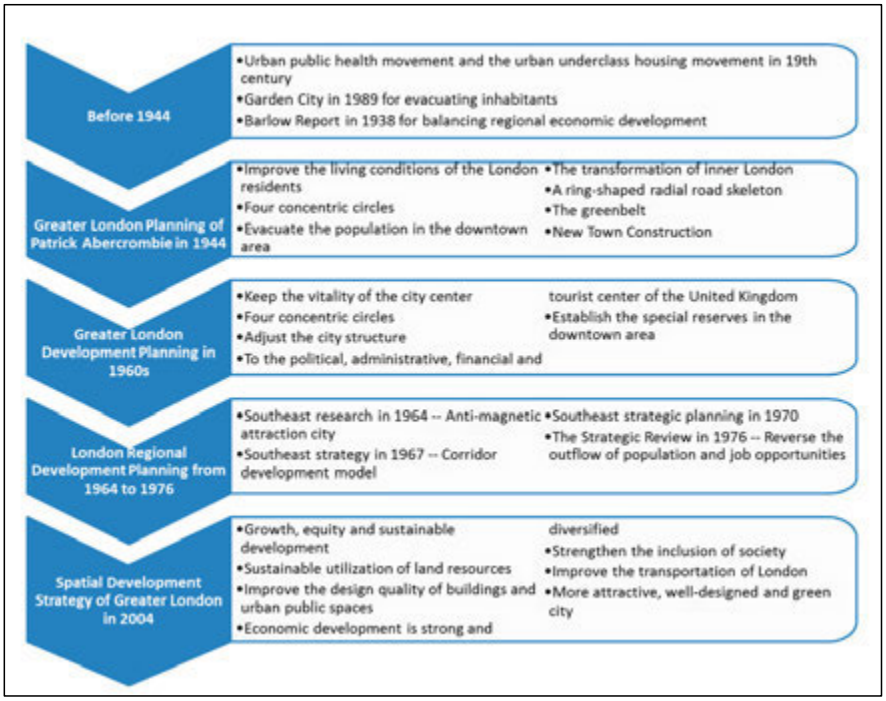

Figure 4 Development history of the Greater London area - Extract from Li et al (2019)

One stakeholder category that stands out as differing greatly between the megacity London and the city of Vinnytsia, is the "Authorities" category. In the example of Vinnytsia, Ukraine, the authorities are divided into local authorities and central government (Vinnytsia City Council, 2024). Their bodies are divided such as:

- Local authorities:
  - Mayor's office
  - City Council: includes several deputy mayors responsible for the different sectors, such as the deputy mayor of urban mobility and transport.
  - Executive bodies of the city council: working under control of the city council

- Central government:

The central government in Ukraine is divided into several ministries that are involved to different degrees in urban planning development. Some ministries such as Ministry of Restoration and the Ministry of Infrastructure, are conducting more fast-paced work in the domain of sustainable development. The involvement of ministries in participatory planning can only happen at the oblast level.

In the city of London, and as the case in metropoles and large cities, the city is divided into several boroughs, signifying the different neighbourhoods with their different uses. The division of authorities and their inclusion in planning processes in London are as follow (London Councils, 2022):

- The boroughs: they manage the neighbourhoods, and are in charge of planning applications, maintain the roads and deliver environmental and leisure services. They can be regarded as a union of the different neighbourhoods.
- The city of London: works on a smaller scale than the boroughs but is responsible for the communication of the image of London to the outside world.
- Greater London Authority: includes the mayor and is the authority responsible for the overall development vision of the megacity. We can understand from there their indispensability in the participatory planning process.
- Local government association: representing the council on the national level. As it deals with issues concerning England as a whole, its presence in the development process can be referred to at the later phases.

3.5 – Process differences between cities and megacities:

Taking the case of Vinnytsia as an example, we can see how the Hromada involved less stakeholders in its process than the Oblast. This is however justified by the character of these two different spatial contexts, where each Hromada comprises one centre, specific communal characteristics, and specific challenges. This scenario is different when breaking a megacity like London into boroughs. Despite the different boroughs facing different sets of challenges, their impacts on one another are inevitable. The points elaborated upon provide examples of the aspects that result in the difference of the processes between the cities and megacities.

(a) Financial centres:

A city centre is easily allocated on the map of a small city. In the case of Vinnytsia, tackling issues regarding the centre of the city can be done individually by each Hromada, meaning the participatory process can be divided by Hromada, with a bigger set of contribution to tackle the Oblast as a whole. The city of London, however, not estranged to other megacities around the world, comprises of several financial centres (Roberts, 2008). Such centres are visited on a daily basis by inter-city commuters. These are residents of the city of London, who live in a residential borough but work in one of the many financial centres. The further development of London's industrial district for example cannot be carried without the inclusion of neighbouring citizens that are not part of this specific district but are influenced by its impact on pollution and on the traffic condition among others.

(b) Environmental issues:

Environmental sustainability is a subject controlled first and foremost by local developments. In the megacity, the degree of contributions of different neighbourhoods to the issue at hand

varies. As explained in previous sections, such issues are mostly tackled by further development of the megacity with minimum contributions to existing constructions.

Stakeholder	Vinnytsia (Hromada)	London
Governments	- City offices - Local governments for Oblast - Central government ministries	- Wards - The boroughs - The city of London - Greater London Authority - Local government association - Transport for London
Private Entities	- Private businesses	- Private businesses
Research Institutes	- Research Institutes in the Hromada - Research Institutes in the Oblast - International Partners - Institute of development studies as a main player	- Research Institutes and university all over the Megacity act independent of their location - International experts
City Planners	- Government assigned planners (Oblast) - Private planning offices	- The mayor's planning consultants (London.gov.uk) - Private planning offices
NGOs	- Working together with research institutes on development topics - Shift in focus into post-war and post-soviet developments - International NGOs with presence Vinnytsia	- A big focus of NGOs is the raising of the voice of minorities - A focus on human rights issues on the local and international level

(c) Energy issues:

In Europe, and with the provided legislations for energy communities, small cities residents have proven to have more ownership over the energy discourse in their cities. Energy communities, defined as stakeholders of energy in the urban setting, are more prominent in cities where ownerships of houses are more common than apartment buildings. This provides cities with the characteristic of having residents with more knowledge and involvement in such a technical topic than a megacity. This solves, to a certain degree, the knowledge issue prominent in participatory planning.

(d) Community engagement:

The sense of community in the megacity is far from non-existent. It is however more obvious on small scales, such as a sense of community in the neighbourhoods themselves. Small city communities possess feelings of ownership over the city as a whole. This makes the inclusion of citizens an easier task.

Table 1: assigning the stakeholders to the contexts of Vinnytsia and London

4 - Proposed Stakeholders involvement strategy in megacities

The challenge at hand is understanding how megacities can conduct an effective participation process on its large scale. Studying the two examples at hand, it can be seen how the involvement of all stakeholders' categories is easier to be achieved in smaller cities than in megacities. To achieve the up-scaling of the process without losing its integrity, a proposed solution can be the division of the process through the timeline rather than spatially as shown in the figure 5 below. This solution is proposed to tackled the obstacles elaborated upon in section 3.

As opposed to the usual spatial division of stakeholders, the timeline division attempts the inclusion of all categories of stakeholders concerned with the megacity. It solves the issue of the enlarged scale by dividing the process into 2 phases. In the first phase, directly-impacted stakeholders are included to have a first-hand discussion of the needs and problems of the development location. The first phase would include the definition of the problem at hand, the co-creation of a solution through collaborative work with the stakeholders, and the reduction of the knowledge gap on the topic which is easier to achieve with the smaller group.

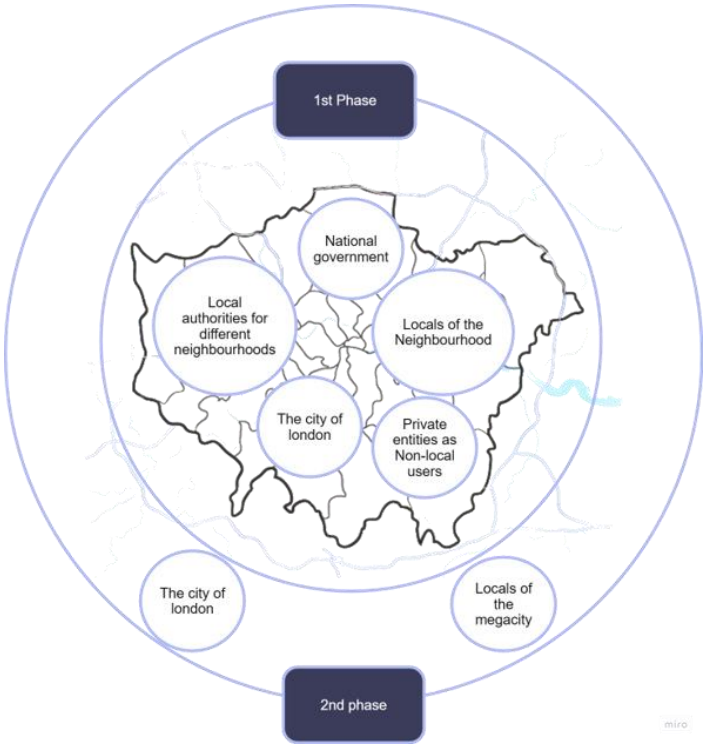

Figure 5 Proposed division of stakeholders through the development timeline of the megacity of London

Whereas the second phase involves larger contributors to the decision-making. It assures the acknowledgment of the impact of the development on the larger scale, be it a larger radius of neighbourhoods or the megacity as a whole. The involvement of larger scale authorities in the second phase ensures the feasibility assessment of the development and prevents the overshadowing of the voices of local communities that are more involved during the first phase.

4.1 - Digital tools as a future solution

Smart cities have been an expanding concept in cities regardless of their scale. They are regarded as a solution to a big portion of the sustainability question. One of the tools in which this is achieved is the introduction of digital tools for sustainable planning, including digital tools for participatory planning. Initiatives have been carried out in both of our study cities to accelerate their development into smart cities and their use of digital tools to ensure a better inclusion of the public in participatory planning. In this regard the movement towards such tools depends greatly on the political and economic contexts. Nevertheless, the methods to conduct this shift can be learned from set examples.

5 - Conclusion:

This paper has revisited the planning method that is participatory planning from the perspective of megacities, by studying the European city of Vinnytsia and the megacity of London. Through the analysis, differences were extracted between the two cities in respect first and foremost to stakeholders, but also with regard to the general challenges faced by the two cases when it comes to sustainable development. It is important to note that some factors were not considered in this analysis, as is the case that, despite the inclusion of the city governance structures in both scenarios, some political constraints still do exist that could limit the participation of some of the mentioned stakeholders. A number of political and socio-economic differences also exist between the two cities, that affect highly the public perception of such exercises. The goal of the study remains to showcase the possibility to derive learnings from cities and to adapt them into the cases of megacities instead of regarding megacities as islands in urban planning learnings.

In the case of Vinnytsia, it was concluded that the inclusion of stakeholders, namely authoritative figures, is dependent on the scale of the development. This was then explained as a symptom of the scale of the city (mentioned as a Hromada) and its individuality in the municipality (or the Oblast). This individuality is shared by all small cities, and result in the lack of justification for the inclusion of residents and stakeholders from outside the city itself if the development is of small scale. Different actors are then called upon for Oblast development projects. These can share similar categories as those included for Hromada development but are of different specialities and interests.

While studying the city of London, it was noted how the development of satellite cities followed the trend set by western megacities. It also corresponds to the pattern of megacities to fulfil their residents needs through further development. We addressed therefore the challenge of attempting to regard the megacity as a unified entity during the participatory planning process. The blueprint derived from Ukraine was therefore altered to a different concept which is the distribution of stakeholders through the phases of the project, to allow for a more inclusive

process. Such alterations allow the carrying of successful processes and their exchange between different cities.

Adding to this, more research needs to be carried out to study the tools used for conducting participatory processes. One remarkable addition is the introduction of digital tools for participatory planning, which provide a fast solution for large-scale citizens inclusion as is the case for megacities.

Lastly, understanding the history of cities developments and the reasoning behind the methods used in conducting urban planning are a mandatory step to their re-adaptation. This could however only be achieved when transparency exists in the planning process, which allows for a more in-depth look on the conditions in which planning decisions were made.

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Planning for proximity in a fragile urban context. The case of Tirana

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Abstract (up to 125 words)
Tirana is the only city in Albania to have experienced a steady population increase over the past thirty years, due to strong internal migration and its attractiveness due to its great economic, social and cultural development. Its urban development is recent and relates to its political history. The demographic context nevertheless shows a high percentage of families at risk of poverty The contribution attempts, by analysing one of the strategic projects of the new Tirana2030 Urban Plan, the one concerning schools and education, to reflect on the role of planning in the challenge towards the transition to an urban proximity model.

Keywords
Proximity, urban planning, governance

Introduction

In Western cultures, as Bernardo Secchi states in his book *The City of the Rich and the City of the Poor* (Secchi, 2013), the city has always represented the ideal place for social and cultural integration but, in its evolution, it has also become the scene of phenomena of separation and marginalisation, both physical and social. The geographer Edward Soja, in his book *Seeking spatial* justice (Soja, 2010) defines the concept of Spatial Capital as that wealth, or poverty, dependent on a person's ability to access social, cultural and professional life in the urban context in which he or she lives. The strong relationship between the city and the communities that inhabit it is thus evident. Sennett refines the reflection on the relationship between context and community in the book *Building and Dwelling, Ethics for the City* (Sennett, 2018) by introducing the concept of *ville* and *cité. The* term *ville* can be used to indicate the city as a whole, the built territory, understood in its physicality and spatiality, while the term *citè* indicates all the ways in which the territory is experienced, and therefore all the relationships that are established within it. The crises that the city has faced in the course of history are numerous, they are more or less of an economic, financial, institutional, political, social and cultural nature…

During the 20th century, cities developed following an idea, based on efficiency maximisation, of polarisation and hyper-specialisation of urban functions, a phenomenon that caused the monofunctionalisation of certain areas of the city such as, for example, areas entirely devoted to work, commerce, university, health, residence, and so on. In 2000, Nobel laureate Crutzen and biologist Stoermer[1] proposed the term 'Anthropocene' to indicate that human impact had become predominant on the earth's ecosphere. The result is that the way in which the city is used has been changed to include the use of the private car. The city structured in this way is defined by Ezio Manzini as the *city of* distances (Manzini, 2021). Further disrupting the dynamics of city development and organisation is the Covid-19 pandemic in 2020. The limitation of travel and the lack of a capillary network of services and commercial activities have made all the limitations of contemporary urban systems, based on the aforementioned concept of polarisation and hyperspecialisation, evident. In fact, urban

[1] Paul J. Crutzen and Eugene F. Stoermer, The Anthropocene, 'Global Change. NewsLetter', No. 41, 2000

areas were the most affected with over 90% of confirmed Covid cases concentrated in cities. The economic consequences of the pandemic will also mainly affect urban areas with over 120 million people at risk of new poverty. According to the report *Cities and Pandemics: Towards a more just, green and healthy future* (UN-Habitat, 2021) the issue is not so much human (and thus urban) density but the disparity between urban density and adequate services, and thus local governments play a key role. In particular, the report focuses on four main points with related policy proposals:

- Rethinking urban form and functions, in this sense the idea is one of compact design, widespread and accessible mobility and diversification of functions.
- The issue of poverty and inequality, through a widespread dissemination of services, both physical and digital
- Supporting the urban economy at the neighbourhood scale
- The need to improve multi-level and multi-actor planning and governance systems.

In recent years, partly and certainly as a result of the pandemic crisis, but also as a result of a heightened awareness of environmental issues and questions of how to work (Manzini, 2021) the so-called urban model of *distance* has been strongly challenged.
The urban model that has emerged as an opportunity for change and regeneration of urban systems is that of proximity. The term proximity refers to the condition of being physically close in space. Proximity understood in its plural sense, in all the forms in which it can present itself at the urban scale (Manzini, 2021). In the urban model of proximity, the key points are: the enhancement of public space that becomes a space for relationships, the progressive disincentivisation of the use of private vehicles in favour of slow and public mobility, the creation of neighbourhood networks, the spread of public services and commercial activities.
The transition to an urban proximity model has entered the public agendas of many cities around the world, with different implementation methods and instruments. Consider that according to data collected by c40, a global network of large cities working to develop and implement policies and programmes aimed at reducing greenhouse gas emissions and environmental damage and risks caused by climate change, which have been collected, analysed and classified, the implementation modalities of initiatives towards more sustainable cities can refer to: urban projects, urban plans, architectural projects, infrastructure projects, landscape projects and strategic programmes.
The core principles that c40 presents[2] are:

- Residents in every neighbourhood have easy access to services.
- Each neighbourhood has a variety in the type of housing and different levels of accessibility to it.
- Residents in every neighbourhood have access to green spaces within walking distance of their homes.
- The possibility of working close to one's home or having spaces for those working remotely.

Among the best-known initiatives is certainly that of the city of Paris, which, starting in 2020 under the leadership of mayor Anne Hidalgo, is experimenting with the transition to the *15-minute city* theorised by Carlos Moreno. The project envisages that all urban residents can perform the six essential functions (living, work, commerce, health care, education, and entertainment) in about fifteen minutes on foot or by bicycle from their homes. The model theorised by Moreno is based on four main components: proximity, density, diversification of functions and digitisation (Moreno et al., 2021). As an example, and useful for the analysis of

[2] https://www.c40knowledgehub.org/s/article/How-to-build-back-better-with-a-15-minute-city?language=en_US

the case study, one of the main actions of the Parisian project is the one centred on schools. There are mainly two strategies: the pedestrianisation and landscaping of the urban area near the school buildings in order to generate public and relational space, and the opening up of schoolyards to increase the amount of public space[3] .
The contribution, through the case study analysis of the plans and projects underway in the city of Tirana, aims to deepen the ongoing projects and strategies that aim at the transition towards an urban model of proximity and in particular the relationship of the urban plan in the management of these processes. Specifically, the contribution will delve into policies, projects and strategies that have the school as a protagonist and that respond to objective 07 of the Urban Plan TR2030 "A new and wide network of open schools".

Tirana, a brief analysis of the context
Tirana is the capital of Albania, a state on the Balkan peninsula bordering the Adriatic and Ionian Seas. The urban area of Tirana is home to more than a third of the Albanian population and is also the only city to have a positive demographic variation, due to the strong internal migration that began in the early 1990s. Albania's political history has greatly influenced the country's demographic and spatial dynamics. Albania was under communist rule for almost fifty years, from 1946 to 1990, and during these years the country remained completely isolated from the rest of the world, including the other countries of the Soviet area. Before the communist period, Albana was mainly a rural state, while during the regime the first significant urbanisation undergone by the nation began, in this case homogenous throughout the territory and not concentrated only in the main cities; furthermore, there was a strong policy of controlling the territory and, above all, the location of families, which is why, following the fall of the regime, a strong movement of internal migration began (Dino, 2020). In this sense, it is interesting to focus research and analysis on the city of Tirana, which since the fall of the regime and particularly in the last twenty years has practically doubled its population and experienced a major transformation from a car-free *garden city* (Battiata, 1992) communist style to a city full of commerce, new buildings, and a vibrant social life (Pojani, 2010). The fall of communism in Albania marked the beginning of a complex transition from a centralised socialist state to a free market economy (Pojani, 2010). On an urban planning scale, a new phenomenon developed, that of illegal construction, due to the reintroduction of private property and a total absence of development plans, it is estimated that over 70% of the buildings constructed after 1990 were built without building permits (Aliaj et al., 2003). The result of this phenomenon is massive urban and suburban *sprawl.* The process of demographic increase due to internal migration, which also causes urban sprawl, renders the capacity of the city's infrastructure networks insufficient. The result is a disastrous situation from a sanitary and environmental point of view. Moreover, these areas, being unplanned, lack schools and public services. The Albanian socio-demographic situation is not the most rosy, Albania being one of the poorest states in the Balkan Peninsula. Moreover, although slowly improving, the data on indicators of risk of poverty and social exclusion remain worrying, in 2021, in fact, more than 40% of the population was at risk of poverty or social exclusion, and the percentage increases greatly when talking about families with dependent children[4] .
Turning to urban planning, a key element in these transformations and the new vision for the city is the entry into force of the new Urban Plan, Tirana 2030, in April 2017.
The premise of the planners is that the TR2030 plan should, while following in the footsteps of previous *zoning* plans, govern complexity while avoiding the rigidity typical of a *zoning*

[3] https://www.paris.fr/dossiers/paris-ville-du-quart-d-heure-ou-le-pari-de-la-proximite-37
[4] https://www.instat.gov.al/media/11137/silc-2021_final_anglisht.pdf

plan. Within it will be the territorial strategies and vision of Tirana to 2030 and will serve as the basis for the development of sectoral and detailed plans. In this sense, therefore, drafting a plan that provides a master plan for the city becomes unsuitable when considering the dynamism of urban development and economic, demographic, social and environmental changes. Therefore, the plan will be useful in re-establishing a norm for future urban development but will also be flexible in being able to be supplemented and implemented by new actions.
The plan identifies and defines ten strategic objectives to guide Tirana's urban, economic, and social development:

- An intensive, polycentric city
- An accessible city
- A city with biodiversity
- A sustainable city
- A Mediterranean centre
- A creative city
- A smart city
- An inclusive city
- A Balkan garden
- A 24-hour city

The plan document then contains a framing and cognitive analysis section from a geographical, demographic, social, urban planning, environmental, economic perspective...

- Strategic Project 1 - Metrobosco
- Strategic Project 2 - Nature Oases
- Strategic Project 3 - Second and Fourth Green Ring
- Strategic Project 4 - New World Park
- Strategic Project 5 - Three Green and Blue Rings
- Strategic Project 6 - New Dynamic Epicentres
- Strategic Project 7 - A New and Wide Network of Open Schools
  This strategic project, which is also the one that will be explored in this contribution, has schools as its main focus. The current situation is that of a highly densified city with few services. The idea of this strategic plan is to start from the school building in order to build the public city, in particular to diversify the functions within the schools with openings beyond school hours and to redevelop the urban space next to the schools so as to take it away from car traffic and transform it into public space. For the construction of new schools, the plan envisages the use of the PDV instrument with transfer of public space, instead of expropriation. In addition, the possibility for the administration to collaborate with local associations and NGOs to develop these projects is expressly provided for.
- Strategic Project 8 - Preserving the Architectural Richness of the 20th Century
- Strategic Project 9 - A new agricultural system and a new network of farmers' markets
- Strategic Project 10 - High-Quality Transport
- Strategic Project 11 - Mobility Networks
- Strategic Project 12 - Tirana City for All
- Strategic Project 13 - A New Energy Corridor

A new and extensive network of open schools. Current situation, regulations for new construction and current policies

The current situation presents a serious shortage of school facilities in terms of capacity in relation to the population concerned. In order to cope with this shortage and to avoid excessive, albeit present, class overcrowding, with all the consequences of the case, it has been necessary for the secondary school to provide teaching in two shifts, one in the morning and one in the afternoon, again with not a few difficulties, including the poor concentration of the children. The policies and strategies implemented by the administration about education and school buildings are presented below.

Construction of new schools
One of the objectives of the Urban Plan is to implement the school network so that the capacity is adequate for population growth and the distribution allows everyone to access school services, with the goal that they become community centres within neighbourhoods. The location of new schools is defined by the PPV tables and the locations defined by the *Visibility Plan,* the rules for the construction of new schools are regulated by Article 83 of the Cabinet Act (VKM) No. 671/2015.

Act of the Council of Ministers (VKM) No. 671/2015- Article 83
Article 83 of the aforementioned regulation defines rules for the location and design, on an urban scale, of school buildings. The parameters are: definition of the number of inhabitants (non-students) for each school, definition of the size of the radius of influence of each school, declined on urban and rural areas, and the square metres per student to be guaranteed in the building.

	Kindergartens	Secondary schools	High schools
Building per tot. inhabitants	1500 inhabitants	6000 inhabitants	9000 inhabitants
Urban area of influence	250/350 metres	500/600 metres	1000/1500 metres
Rural area of influence	500/600 metres	1000/1500 metres	2000/4500 metres
Square metres per student	18/25 square metres per student	20/25 square metres per student	20/30 square metres per student

PPV/PDV
The new TR030 Plan divides the territory into minimum intervention units and defines their intended use. Regarding the realisation of public services, the urban planning instrument is similar to the Italian system that provides for the free transfer of areas to the municipality, in the event of the start-up of a subdivision plan. The system is that of the PDV (*Plane të Detajuar Vendore)*, i.e. local detailed plans of public or private initiative that allow the development and implementation of the plan. The administrative units that define the boundaries of the PDVs are detailed in the plan documents and on the Tirana Municipality's webGIS[5] . Each area is identified by a unique code (e.g. TR/01-TR/02...) and by a use destination, to which the functions defined in the plan are to be incorporated in case of PDV implementation.

Visibility plan
Given the demographic growth, the increase of informal settlements and the emptying of some peripheral areas, also as a result of the administrative reform of 2014, the Municipality

[5]https://akpt.maps.arcgis.com/apps/webappviewer/index.html?id=ff270e99f5be45f19c7b7a1e3e618b27

of Tirana has prepared a study, the *Visibility Plan, with the* aim of identifying the medium and long term needs for the construction of educational facilities of the pre-university cycle. In particular, the plan foresees, according to the provisions of Law No.125 of 2013, the possibility of granting and activating a public-private partnership, in order to achieve the objective, considering the impossibility of bearing all the expenses. The plan starts from the analyses already made in 2016 for the drafting of the previous urban plan, which localised the new interventions in the most peripheral and informal areas of the urban fabric; in this update, however, the entire municipal territory is analysed. The plan, in its public-private partnership mode, became necessary considering the insufficiency of funds collected through the Temporary Tax for Educational Infrastructure, which, as of the beginning of 2016, collects funds useful precisely for improving the school system. An analysis of the data showed that in order to solve the problems of school sizing, 17 new schools need to be built in Tirana Municipality, 10 of which are secondary schools. The total cost of building these schools is estimated at over six billion lek[6] , a figure that is unsustainable for municipal budgets. In Albania, the Public Private Partnership (PPP) is regulated by Law 125/2013, which aims to create a favourable and sustainable framework for the promotion and facilitation of investments made as concessions or partnerships between public and private entities. The model used is the *Design-Build-Finance-Operate (DBFO)* model*,* in which contractors assume responsibility for the design, construction, financing and maintenance of the work for the duration of the contract. In this way, the schools can be built quickly and the burden on the municipal budget diluted over time, making the operation sustainable.
The *visibility plan* is based on the four main pillars defined in the TR2030 Urban Plan:

- Intensive and polycentric city
- Tirana Smart city
- Accessible city
- Inclusive city

The specific objectives that, based on these four pillars, the plan pursues are:

- The elimination of two-shift teaching due to the high number of students and the shortage of school buildings
- The normalisation of the student to class ratio, with the goal of an average of thirty students per class
- Improving accessibility and distribution of schools
- Improving learning conditions and thus the quality of school facilities (gyms, canteens, laboratories, etc.)
- Improving the quality of teaching following the normalisation of the number of students per class
- Regenerating urban areas around school buildings, following the idea that they can also *become* centres for the development of social activities, also with the help of the *School as a community* project

[6] 1 EUR = 100.562 ALL (2024)

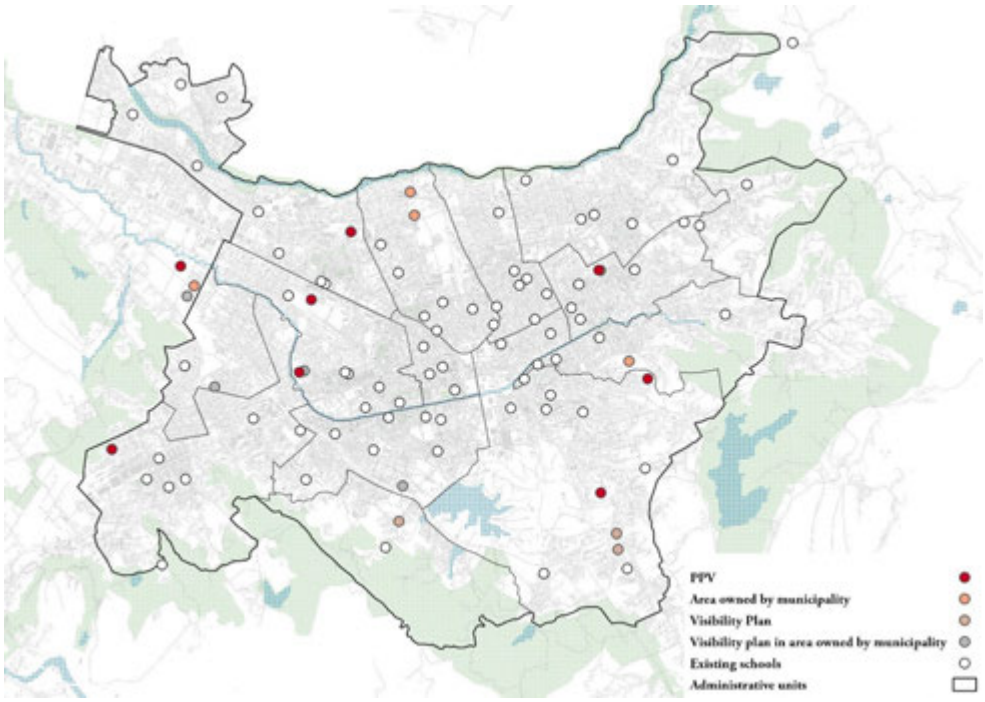

Figure 1 - Mapping of secondary schools planned to be implemented and the method of implementation. Source: author's elaboration

Policies in place

School as a community

With City Council Resolution No. 144 of 23/12/2022 'For the approval of the use of pre-school gyms for extracurricular sports activities and on days off', the *School as a Community* project was launched.

The Project envisages the possibility for Sports Federations, Associations, Sports Clubs to use the sports facilities of the public schools of the Municipality of Tirana to practise their activities but also to educate and raise awareness on sports issues. Specifically, gyms and complementary facilities (changing rooms, toilets, material storage areas) can be used during extracurricular hours and on holidays up to a maximum of five hours per week for each Federation free of charge. The aim of this project is to promote sport as an opportunity for physical education but also for social inclusion and integration for all those children and young people who find themselves in situations of hardship. Hence, a project that aims on the one hand to develop the idea of the school as a community centre, as a multifunctional place open even beyond school hours, and on the other hand to generate a culture of sports education to combat sedentariness and promote sociality and social integration.

The application process is relatively simple: at the beginning of each month, the Municipality of Tirana publishes a call for applications on its notice board, and interested parties have three weeks to submit their application by filling in an annex. The only requirement to be able to participate is to be a duly registered organisation in accordance with current legislation, and the documents to be attached to the application are: a deed of registration with the Court, a copy of the Statute, a programme of activities to be carried out, documentation proving at

least three years of activity in the provision of sports services, fiscal regularity and court certifications.
There are currently more than fifty gyms involved in the project.

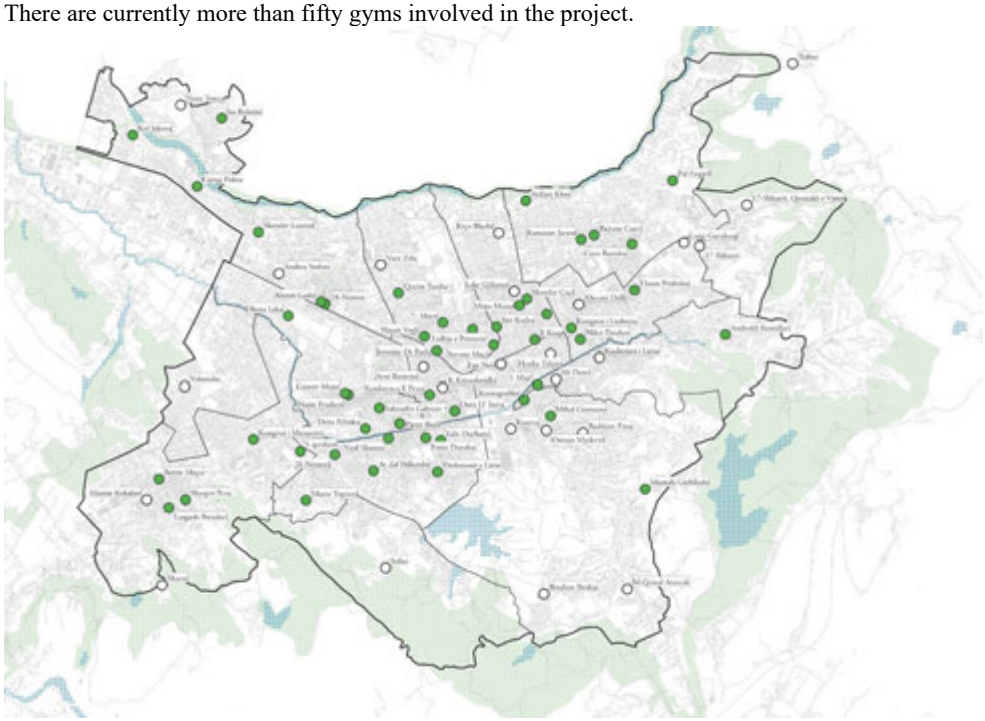

Figure 2 - Mapping of secondary schools involved in the "School as a Community" project. Source: Author's elaboration

Streets for schools and streets for kids
Another important strategy that the administration is implementing relates to the redevelopment and pedestrianisation of some streets near the school buildings. The projects have different funding and actors. An important reality in the Albanian context is the presence of NGOs[7] that, through access to funding from large foundations or European cohesion projects, implement projects and processes in different sectors. The pedestrianisation projects of the streets around schools in Tirana were mainly implemented by the NGO *Qendra Marrëdhënie*[8] with the support, in addition to the municipal administration, of foreign

[7] Non-governmental organisation is a non-profit organisation that is independent of states and international governmental organisations. They are very diverse organisations engaged in a wide range of activities, often of a humanitarian or social character, taking different legal forms in different parts of the world: some may have the status of charities, others may be registered for tax exemption based on recognition of social purposes. Still others may constitute fronts for political, religious or other interests. They are typically financed by donations or handouts from philanthropists, while the larger ones are also supported by public money.
[8] https://www.qendra-m.org/en

foundations and associations such as: NACTO[9] , BVLF[10] , FIA[11] , UN UNHABITAT[12] , GIZ Albania, Bloomberg, European Community through European Education and Culture Executive Agency and others.
Qendra Marrëdhënie (QM) is a non-profit urban design and research group based in Tirana. The organisation consists of architects, urban planners, geographers, community organisers, graphic designers, experts in nutrition and food systems, transport engineers and social workers. Their main objective is to improve the quality of the environments in which children live and to do this they provide technical assistance and design services to local authorities and neighbourhood institutions such as parents' councils, student governments, residents' committees, and other associations.
Foundations, as referred to above, are, in general, bodies constituted by assets preordained for the pursuit of a specific purpose. The way in which foundations, each according to its purpose, intervene as actors in this project is through the allocation of funds, which NGOs can access, to implement projects. Specifically, therefore, QM had access to funds that enabled the realisation of projects for the pedestrianisation and landscaping of the perimeter roads of some schools. The Administration, through the Infrastructure and Mobility, Urban Planning and Public Works sectors, verifies, approves and implements the projects.
The first funding is from the BVL Foundation for the implementation of the Urban95 Agenda. Urban95 is an initiative to help administrations and planners understand how their work can influence the development of children, 95 being the average height of a three-year-old child, Urban95 takes an integrated approach combining the improvement of urban spaces and the provision of services. Additional funding comes from NACTO's *Streets for Kids* programme within the *Global Designing Cities Initiative. Streets for Kids* is a multi-year programme to develop guidelines and promote street designs that create safe and fun streets for all children to learn, play and move around the city. A third grant also comes within the *Streets for Kids* project from GIZ Albania. Another interesting intervention, financed by Bloomberg Philantrophies as part of the *Asphalt Art* project, is the renovation of the space around the Gustav Mayer and Naim Frasheri schools. The project consisted of the landscaping and pedestrianisation of 1700 square metres of school yard and almost 2000 square metres of driveway within a block shared by four schools.

[9] National Association of City Transportation Officials
[10] Bernard van Leer Foundation
[11] Foundation for the Automobile and Society
[12] United Nations Human Settlements Programme

Figure 3 - Aerial photo of the situation before and after the Asphalt Art intervention Source: https://asphaltart.bloomberg.org/projects/tirana-albania-creating-safe-spaces-to-walk-for-students-at-four-schools/

By design, schools in Tirana all have, in most cases, large courtyards and open spaces. QM's goal is to be able to open up these courtyards to make them public space. According to Ray Koci, a QM member interviewed during the research, opening up school courtyards in Tirana would double the amount of public space available.
There are currently eight secondary schools on which road repair projects have been implemented through foundation support and administration funding: Gjon Buzuku, Osman Myderizi, Fan Noli, Shkolla and Kuqe, Edith Durham, Gustav Mayer, Naim Frasheri, and Mihal Grameno. The idea, however, is to assimilate this practice at the administrative level so that it no longer depends on external funding but can become a practice implemented directly by the municipality.

Figure 4 - Mapping of secondary schools involved in the "Streets for kids" project. Source: Author's elaboration

The relationship between the Urban Plan and current policies

The analysis of current policies and strategies about schools in Tirana, as shown by the analysis made, demonstrate that they fit perfectly with the strategies outlined in the Urban Plan to pursue its strategic objectives. Municipal regulations, European policies, public-private partnerships and other instruments work together to achieve the Plan's objectives. In this process, a great responsibility lies with the urban planning and public works sectors of the Municipality of Tirana, which are responsible for coordinating the various actions in the field. As can be seen from the conceptual image (Fig. 5) all the policies and strategies in place (PDV, *visibility plan*, *school as a community* and *streets for kids* project) respond to and follow the vision defined by the objectives of the urban plan. In this sense, the evaluation of the tool of strategic objectives is interesting insofar as it defines strategic actions and objectives giving the public administration the possibility of activating numerous solutions for their pursuit. The complexity of urban transformations, therefore, is not only relegated to the spatialisation and norms of the plan but to the possibility for the Administration to evaluate and define the instruments and actors with which to implement the actions. This type of planning is open to pathways and experimentation of new ways of doing urban planning, which makes consolidated urban planning tools adaptive and flexible (zoning, subdivision plans, etc.) but leaves room for the affirmation of innovative instances and practices that arise from the reading of urban and human needs.

If the PDV tool is related to the classical rules of a town-planning scheme, with the well-known mechanisms of disposals and service provisions, the projects, implemented by the NGO *Qendra Marrëdhënie* working on the school building and the urban space close to it, are in the vein of those practices of 'social innovation' from below that have emerged on the urban

scene in recent years (Orioli & Massari, 2023). The *visibility plan* strategy, on the other hand, uses public-private partnerships to speed up the construction of new schools, the main objective of the urban plan, while the *school as a community* project is one of those *top-down practices* promoted by the administration with the active involvement of sports associations and the community, fitting in as a practice that relates to both spatial and *welfare* policies.

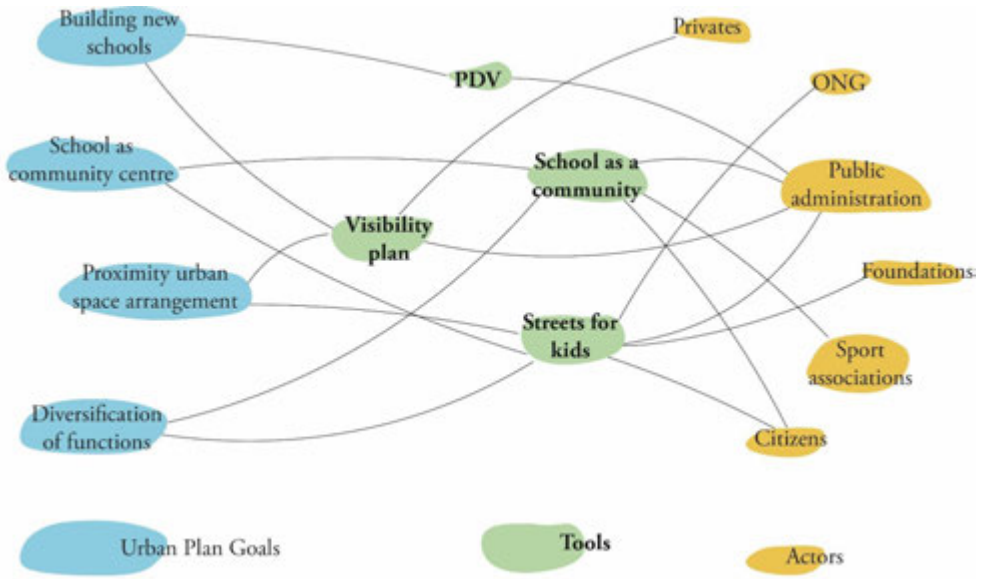

Figure 5 - Overview of the Tirana Urban Plan's objectives, instruments and strategies and the actors involved. Source: Author's elaboration

Conclusions

Urban issues are complex, if we understand the discipline of town planning "not so much as a set of works, projects, theories or norms" but as "the traces of a vast set of practices: those of the continuous and conscious modification of the state of the territory and the city" (Secchi, 2000) and as 'the science that studies urban phenomena in all their aspects, having planning as its aim' (Astengo, 1966) then a contemporary reflection on the role of the Urban Plan in the governance of the territory, and of the transitions with which cities (and Administrations) are called to deal, becomes fundamental. As Orioli and Massari state, "If, therefore, we want to resume reflection on the plan, questioning its credibility and its possible forms today, we must start from this node: from the relationship with policies and the project(s)." (Orioli & Massari, 2023). The context in which cities live today is a complex one, made up of transversality, interrelationships, and interdependencies (Moreno, 2024). A Plan must be able to hold together the complex dimension of policies and projects. The dimension in which the Plan, of course, is placed is the municipal one, the Plan is a political act and as such entrusts much responsibility to Administrations and Mayors, as Moreno states in his last book: "Mayors are not a transmission belt between national political life and local life: they are the backbone and the full protagonists of political life in our countries. Urban life requires strategic vision, dynamism, commitment and constant participation of the community. (Moreno, 2024)". Today, as Edgar Morin stated, we live the tendency of reductive thinking, the one that reduces the city to questions of architecture and circulation, the challenge of the Plan today, instead, is

to get rid of the restrictive "zoning questions" and leave more space and listening to social innovation, to new practices, to the so-called *cité* defined by Sennett (Sennett, 2018).
If, therefore, the challenges of innovation call for more reflection on issues such as environmental sustainability, mobility, education, work, and care (Moreno, 2024), then the proximity model appears as a valid response to this urban challenge and the Plan as the tool through which to govern this complexity.
The case of Tirana shows how an Urban Plan capable of defining strategic thematic objectives for urban development and leaving room for a variety of implementation practices and tools such as: public-private partnerships, cooperation with associations, bottom-up projects involving local communities, and more 'classic' projects, can be the answer and the key in the hands of Administrations to govern the new urban challenges. The issue of education and schooling is of particular interest when one finds oneself in contexts, such as Tirana, of strong social inequalities and a high rate of poverty. Working as a public administration on the school that becomes not only a public service available to all but also the community centre in which the public life of the local community develops is a fundamental issue. The work carried out by the Municipality of Tirana on schools has therefore achieved several objectives among those that hinge on the proximity model expanding the network of services through the construction of new school buildings and the upgrading of existing ones, improving the quantity and quality of public space through the opening up of large schoolyards and the landscaping and pedestrianisation of the threshold space around schools, differentiated the functions of the school building and offered *welfare* services with the project of entrusting the gyms to sports associations, woven a network of communities into the relationship through the work of the NGO *Qendra Marrëdhënie*, which took care of both the physical design of the space and the involvement of the communities in the co-design.
The Plan, therefore, puts itself at the service of a transition process that builds on the existing and tries to indicate a direction in which to direct transformations. (Bianchetti, 2021) (Orioli & Massari, 2023).

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The Publicness of Urban Commons. Insights from the Brussels Commoning Scene.

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Biographical Note: Verena Lenna, a post-doctoral researcher at Brussels Centre for Urban Studies, is interested in how rights shape the city and its governance as an instituting process. She currently investigates emerging forms of welfare as a cultural shift between community empowerment and the reclamation of urban vacancy.
She has a PhD in Architecture and Urbanism from Università IUAV di Venezia and KU Leuven. For her doctoral research, she explored the relationship between property rights, space and the architectural project in the Community Land Trust of Brussels case. Since 2011, as an activist, designer and researcher, she has been building transversal expertise on urban commons by contributing to various projects and initiatives, such as the foundation of Commons Josaphat in Brussels (2012-2017); gE.CO, a European project for the generativity of urban commons (2019-2022); a regional study aiming at designing policies and regulations to support commons in the Brussels Capital Region (2022-2023). She researched the dynamics of inclusion and individual and collective emancipation through participatory action research, as well as art and cultural projects in Rome, Venice, Milan, Brussels, New York, and Athens.

Abstract

If care is one dimension of welfare we need to reappropriate to protect the foundations of a democratic society and democracy, publicness is the other. As Ota De Leonardis pointed out, the final consolidation of the institutions and the operating systems of the welfare state corresponded to the loss of a lively public sphere - as an essential, fundamental public good.
While her observations were formulated at the end of the 90s, in the context of an emerging welfare mix season and growing privatisation, they appear very relevant today, given the more recent developments of the welfare systems, particularly the proliferation of urban commons. While almost inherently representing a complementary layer of existing welfare infrastructures, their operational systems and conditions may fuel the risk of increasing privatism in the welfare sphere.
Vis-à-vis, such a risk, looking at the case of Brussels, I will investigate the publicness of the urban commons as a capability to contribute to the identification of welfare problems and issues and the elaboration of solutions in the public sphere.

Keywords: urban commons – publicness – public sphere – welfare - Brussels

1. Introduction

If care is one dimension of welfare we need to reappropriate to protect the foundations of a democratic society and democracy (Tronto, 1998, 2009, 2013), publicness is the other. Well before and independently from the current privatisation processes resulting from the market intervention, 'the organisational mould of the welfare state at the various levels in which it translates collective, public values, interests, and goals - from everyday practices to systemic organisational effects - tends to generate communication blocks, separations, and segmentations of social relations, isolation, irresponsibility, indifference, privatisation of issues - in short, privatism' (De Leonardis, 1998, p.18). The final consolidation of the institutions and the operating systems of the welfare state corresponded, in fact, to the loss of a lively public sphere - as an essential, fundamental public good - which was animated and precisely constituted around the collective definition of welfare problems and solutions.
While these observations were formulated at the end of the 90s, in the context of an emerging third sector, of a welfare mix season and its ambiguities, they appear to be still very - or even increasingly- relevant today, given the more recent developments of the welfare systems and in particular, given the proliferation of urban commons. Centred on care practices and fuelling social cohesion while improving the conditions of our living environments, urban commons almost inherently represent a complementary layer of existing welfare infrastructures - as the working hypothesis at the core of my ongoing research project. However, their operational systems, rationalities and conditions may fuel the risk of increasing privatism in the sphere of welfare.

Vis-à-vis such a risk, I will investigate the publicness of the urban commons as a capability to contribute to the identification of welfare problems and issues and the elaboration of solutions in the public sphere, as they concern the very social bond we share. To critically assess such a capacity, I will examine the commoning scene of the Brussels Capital Region (BCR), based on my direct implication as an activist and researcher since 2011 and having co-coordinated a regional study on the local urban commons (2022-2023)[1]. I will focus on three initiatives, considering their long-lasting and mature trajectory, which led them from being bottom-up, precarious initiatives and the initiators of the commons movement in Brussels to becoming influential policymakers. The Community Land Trust of Brussels (since 2012) is an organisation aiming at making homeownership accessible for low-income families; États Généraux de 'Eau de Bruxelles (since 2002) aims at the collective and individual re-

[1] *Etude Participative sur les communs bruxellois* (2022-2023), realized by the CLTB, Communa, Ecores and Equal partners, funded by Bruxelles Environnement and Bruxelles Economie et Emploi.

appropriation of water management infrastructures, from the micro-scale of a private garden to the macro-scale of a valley; Communa (since 2013) operates as a platform for the temporary occupation of vacant buildings.

After having briefly framed urban common's contribution to the welfare system, based on De Leonardis's analytical grid for the so-called *impresa sociale* – social enterprise- (De Leonardis 1998), I will address the following levels: the first level is about the existence of a public mandate, coherently supported by public funds and accompanied by administrative interfaces. The second level is the political one, and it is about creating the conditions for the negotiation of different interests and the interpretation of needs as rights as part of larger societal projects. The third level is about institutional care, creating the conditions for the continuous work of institutional transformation, institutions being meant as constructs of social intelligence, domains in which this is deposited, and employed in elaborating shared versions of common goods and further social learning.

2. Questioning the publicness of urban commons

The last 10 to 15 years have seen the proliferation of urban commons as political and civic laboratories generated for a variety of reasons, spanning from the reclamation of abandoned buildings to the expression of new individual and collective needs and rights, as well as organisational capabilities. In many ways and from many angles of observation, urban commons developed in the voids left by an overstretched welfare system[2] because of its inefficiency vis-à-vis well-known expectations, or incapable to define and give an answer to emerging needs. Institutions can be stupid and stop working (De Leonardis, 2011). Before introducing the research question addressed by this paper, as part of my current research project[3], it is important to mention here a few almost self-evident arguments supporting on a substantial level the understanding of urban commons as a complementary or additional layer of existing welfare systems[4]. To begin with, the needs urban commons respond to are quite close to those traditionally fulfilled by welfare systems since the early days of welfare history. A community garden is probably the answer to the need for green and community spaces within the neighbourhood, where people can get in contact with the other, both the human and the non-human. Cultivating vegetables is almost an excuse to get the body active and busy while meeting neighbours and like-minded inhabitants. Also, the community-based organisation of cultural activities provides the occasion for creative expression, artists looking for a space to produce their art, and new newcomers joining the local inhabitants while offering their traditional cuisine. On a more engaged level, other initiatives are developed to provide material support and solidarity to the most fragile individuals: refugees, people experiencing homelessness, and people in precarious life conditions. More complex and solid initiatives -

[2] I use the expression welfare system to include welfare infrastructures and approaches including and beyond the state mechanisms.

[3] WELCOMIN investigates the potential in Brussels of what I call community welfare infrastructures -whence the acronym-, as another way to depict urban commons to highlight their contribution to the welfare system. The complete title is *Reclaiming vacancy, federating capacities and empowering communities towards an ecological welfare*. The project is funded by the Brussels Regional administrative actor for research and innovation Innoviris. https://welcomin.brussels

[4] Commons and urban commons are conceptualised as fundamental resources for the fulfilment of basic needs, for individual and collective emancipation (Rodotà, 2013; Rodotà, 2013; De Angelis, 2017; Stauridēs, 2019) -thus, in this sense, implicitly supporting the purpose of the welfare systems, allegedly.

such as CLTs- finally programmatically address needs classically covered by welfare infrastructure, such as housing or daycare centres.
Besides what they do deliver, at the level of their core values and ethics, what they all have in common is care. Looking at the activities commoning initiatives are concerned with, we can recognise pretty accurately the definition of care as provided by Fisher and Tronto (1990, p.40): 'On the most general level, we suggest that caring be viewed as a species activity that includes everything that we do to maintain, continue, and repair our 'world' so that we can live in it as well as possible'. Federici in fact, famously theorised the work of commons as a work of care (Barbagallo and Federici, 2012; Federici and Linebaugh, 2019)
While care work has been appropriated at some point first by the welfare state and subsequently by the market—including the hybrid forms of welfare mix—in the last 15 years, urban commons have reclaimed care at the core of their practices and in the hands of the concerned communities.

Last but not least looking at their genealogy, urban commons represent in fact the resurgence of the solidarity mechanisms and forms of reciprocity suffocated by private property, a paternalistic welfare state (Grossi, 2017) and the development of the service market subsequently, but required as an interstitial layer to complement public and privately provided forms of social support, the State and the market dynamics, as theorised by Polanyi (Polanyi, 1944).
These arguments framing urban commons as a complementary layer of the existing welfare system are on the level of a theoretical conceptualisation of these initiatives, built around their core values and speculating on their potential societal role, before any measurement of their actual impact on or inclusion in the existing welfare system and programs[5]. On the other hand, on the level of urban governance, the multiplication of policies and funding programs supporting urban commons seem to demonstrate that their value is increasingly appreciated and finally strategically promoted on the side of public administrations. Across many European cities policies supporting the commons emphasise their direct or indirect contribution to the overall and final well-being and emancipation of individuals and collectives. While in their narratives welfare is not necessarily explicitly mentioned as the realm urban commons are supposed to contribute to, the needs they are *de facto* called to fulfil are those usually covered by a welfare system -and in particular by the spatial infrastructures or the welfare space [6], as suggested in the above mentioned few examples: housing, leisure, a good living environment, daycare centres, green spaces, spaces for public debate and gathering. Because of their highly

[5] The appreciation on a conceptual and theoretical level of the urban commons' potential in relation to a decaying welfare system and austerity regimes is frequent in the literature and narratives produced by engaged scholars and activists. While their interest in the measurement of their actual economic performance or impact is debated, the appreciation of their contribution to dynamics of social inclusion and individual and collective empowerment is often highly advocated, to counterbalance a purely efficiency-centred or market-oriented evaluation of their activities (Castro Coma and Forné Aguirre, 2021). The definition of performance measurement systems is a crucial step in the process of trust building between administrations and commoners willing to collaborate around new forms of management of public or shared resources (Patti and Polyak, 2015; Petrescu *et al.*, 2021).
[6] In the Western world, welfare systems traditionally provide social security and support to individuals' emancipation not only through the financial redistributive system but also through spatial infrastructures, such as mobility infrastructures, spaces for leisure, schools and hospitals, and social housing. Amongst others on the topic of the welfare space, see the work of Munarin and Tosi (Munarin and Tosi, 2014) and Swenarton (Swenarton et al., 2015). Focusing on urban commons as the commons built around spatial resources, this paper addresses their contribution as happening through or at the level of the welfare space.

innovative profile, being generated to respond to specific and emerging needs, and because of their ecological approach to the management of resources, urban commons not only complete but additionally redefine and reinvent the scope of welfare in the direction of what I suggest defining as an ecological welfare.[7]
To conclude: the collective generation and protection of resources that sustain well-being and emancipation; the centrality of care, solidarity and forms of reciprocity in these practices; the increasing number of funding and support programs provided by public administrations validating their contribution allow us to reasonably assume that urban commons are increasingly recognised and integrated into existing welfare systems.

While commoning practices provide an occasion to re-appropriate and bring care back home, as advocated by Tronto, as a condition for a more democratic society, this paper would like to address another dimension of welfare, also supporting a democratic societal project jeopardised by privatisation processes and austerity regimes. Publicness is not a dimension that derives from the implication of the public administration in the delivery of welfare services. In other words, the state does not equal the public, as it is clear by now. Publicness is meant here as the capability to generate and fuel the Habermas' public sphere as a condition allowing citizens to gather and discuss common concerns (Habermas, 1989). As pointed out by De Leonardis, what the welfare state represented until the 80s and before the beginning of privatisation processes and austerity regimes, was not limited to the material and social infrastructures required for the well-being and safety of all individuals. It was the very process and the forum where to discuss about common problems and experiment with solutions, continuously under transformation. The making of the welfare state provided the occasion for the public sphere to exist and take shape, identifying the social quality of life as essential for a good life. Without a well-developed social dimension that allows balance and redistribution of wealth, economic growth is unsustainable and leads to injustice. While this is increasingly acknowledged, the conditions for a continuous debate around the form welfare infrastructures should take must be created and cherished. It is more in the debates that precede and accompany the making of welfare infrastructures and institutions that a societal project unfolds rather than in delivering those infrastructures per se. As Nancy Fraser pointed out (Fraser, 1989), talking about needs is even more important than the needs themselves, as it is during the talking phase that those needs can be properly shaped and defined, including in the definition process the concerned individuals and communities.
On the background of a shrinking public sphere (De Leonardis, 1997), the increasing interest and support of public administrations towards urban commons and the embedding of these initiatives and the related policies in the larger schemes of the welfare system raises a question: to what extent and under which conditions are urban commons creating an opportunity for publicness? Publicness -in this case- being meant as the capability to fuel or contribute to a public debate and public sphere around the ongoing re-organisation and re-definition of welfare as a societal project, whose shared values, needs and rights require to be collectively discussed and negotiated before pursuing their very realisation as a collective responsibility.

What most of the current scholarly debate and even the activists' attention is focusing on is the emergence of new public-collective institutional arrangements and the organisational aspects making them suitable to the needs and expectations of both commoners and public

[7] This is in fact the working hypothesis of my research project WELCOMIN. I understand the word ecological as meant by the deep ecology theorizations (Naess, 1973; Capra, 1997), which urban commons represent quite effectively because of their systemic and transcalar governance schemes. (Lenna, 2023, 2024)

administrations. From defining the deliverables and criteria for performance measurement to the systems allowing the building of trust and shared responsibility between collective and public actors: what seems to be mostly at stake is to design policies and programs where the two opposed risks of institutionalisation of the commons on the one hand, and commonification of the public on the other are satisfactorily negotiated for all involved parties. However, no attention is dedicated to critically evaluating if the emerging policies and programs will, in fact, contribute to fuelling publicness around the needs and rights at stake, towards a new societal project and the welfare system that could support it. The collaboration with a public actor does not necessarily mean a public debate is engendered: on the contrary, it may in fact mask a privatist approach under the form of a multiplication of public-collective partnerships. Beyond the specific needs of a given initiative, the singularities of pilot projects, the proliferation of temporary arrangements, and the pacts culture, what is the space left for a societal project? Is the design of larger frameworks such as urban policies and programs supporting commons sufficient to evoke a public sphere around topics such as how we live together, fulfil different or even conflicting needs, care for ourselves and our living environment, and talk about all these?

While the proliferation of unique, site-specific projects may be considered typical of an experimental or transition phase during which indeed innovative arrangements require case-specific approaches and tests, we cannot avoid considering that in many cases the policies and programs designed to sustain the urban commons are inherently conceived to valorise the site-specificity and uniqueness of the concerned initiatives[8]. Furthermore, we must consider that this is the very first requirement by many activists involved in commoning experiences, who believe the core potential of commoning initiatives would be lost under prefabricated protocols or infrastructures.
If the organisational modalities are a good prefiguration of the societal project that is meant to be achieved and its underlying culture, then the ongoing embedding of urban commons initiatives within welfare systems requires an evaluation of their capacity to fuel publicness on two levels. On the first level, what needs to be addressed is the publicness of urban commons per se, at the level of their original organisation, before and independently from any policy or program. On a hierarchically second, more complex level, the publicness of the conditions generated by the commons supporting programs and policies should be addressed -where possible- as they may amplify, reduce, and, in any case, alter the urban commons original organisational modalities and, therefore, their publicness potential.

3. The making of welfare as a societal project

The relevance of collectively discussing needs and care practices at the core of welfare infrastructures and programs was initially pointed out by Nancy Fraser from a feminist point of view in 1989 (Fraser, 1989,p.292). ‘Needs-talk has been institutionalised as a major vocabulary

[8] In many cases, they are, in fact, taking the form of pacts or agreements specifically designed to respond to the site-specific conditions of a given urban commons. See, for example, the regulations produced in many Italian cities. In other cases, the programs specifically emphasize their flexibility as an answer to the concerned communities' different needs -or even political orientations and origins. This is the case of the Patrimoni Ciutada policy in Barcelona for example, whose design explicitly aimed at keeping into account the variety of practices of commoning(Castro Coma and Forné Aguirre, 2021). Finally, in Brussels, the mentioned study on the urban commons’ conditions funded by the Region, which I contributed to design and develop, revealed the resistance of many initiatives to preconceived frameworks or protocols, whilst on the other hand advocating for platforms and networking structures that could allow for an exchange of tools, knowledge, forms of expertise, ways of doing things.

of political discourse. It coexists, albeit often uneasily, with talk about rights and interests at the very center of political life. Indeed, this peculiar juxtaposition of a discourse about needs with discourses about rights and interests is one of the distinctive marks of late-capitalist political culture.' In her article, Fraser points out that much before the (third) struggle for the fulfilment of a given need, the first struggle is to validate and legitimate a given need as a matter of legitimate political concern and subsequently, as a second struggle, to collectively define how to fulfil such a need. These processes necessarily allude to the need for an inclusive conversation allowing different publics to share their interpretations of needs as a precondition for these needs to be recognised and finally addressed by the welfare system.
Once the needs become the objects of a purely administrative, competent or expert service to be provided, once care becomes a private or market matter, instead of being everybody's business and responsibility, as pointed out by Tronto (Tronto, 1998, 2013), the occasion is lost to seize and change the unjust societal mechanisms trickling down to care dynamics. Though from slightly different perspectives of feminism[9], both Fraser and Tronto argued about the need for care practices to be publicly framed and discussed -the public in both cases not coinciding with the State- as an occasion to dismantle power dynamics, reveal the roots of unjust mechanisms and collectively discuss possible solutions, and through these processes lay the foundations for a truly democratic societal project[10].

A few years later, in 1998, in Europe, these arguments were embedded by Ota De Leonardis in her investigation on the transformation of the European welfare state, on the background of the emergence of the social economy, as a combination of state, market and third sector (De Leonardis, 1998). Also defined as a welfare mix, they represented a main object of observation for the post-welfare speculations. To what extent do the different forms of welfare mix fuel the *social* characterisation of the goods, the actions and the actors implied in the social policies? What matters in De Leonardis's investigation is not an evaluation of the performance of services and policies delivered under the welfare mix approach. The point is rather to capture the publicness of the transformation of social policies. How policies and social services are organised and function determines whether goods, problems, and solutions can be considered common or objects of collective, social, and public action and discussions. The risk to be vigilant about and addressed by De Leonardis's analysis is that of privatist attitudes that could be recognised beyond privatisation, even in formally "public" apparatuses and that are leading to 'indifference towards social bonding, de-responsibilisation towards common goods, withdraw of the individual aspirations within the domestic sphere, separation of different conflicting communities, avoidance of mediation processes and of the otherness they make possible […] Beyond the threshold of privatism, there is no public life and no shared world, but only winners and losers and the competitive dynamics of the market.' (De Leonardis, 1998, p.19)

At the end of the 90s, the risks of privatism and the shrinking of the public sphere were associated with the rise of the third sector, the proliferation of not-for-profits, and the hybrid dynamics of the welfare mix. Today, the new phase in the process of welfare transformation - possibly building on the previous one- is characterised by the increasing implication of urban commons in the delivery of care and welfare infrastructures. The public-collective nature of

[9] Fraser is ultimately concerned about recognizing differences and the creation of conditions that allow interpreting the needs of even marginal communities as rights.
[10] Nancy Fraser uses the expression social welfare, possibly to depict a different version of the welfare different than the welfare state, where needs would not be addressed and defined only by the State as an administrative agent but taken care by society and the different public spheres.

policies and programs involving the urban commons and their potential molecular organisation similarly prompts the question of their publicness -beyond the public support. The analytical grid suggested by De Leonardis – which I will introduce in the following lines- is centred on the organisational dimension, as 'it is through these that social relations are shaped and shared meanings are generated'. Organisations are not simply efficient machines, but they are cultural devices. Even before a given service is delivered, how it is delivered is, *per se*, the expression of a given purpose and cultural imprint. In this case, the question is, are care and welfare practices delivered in ways that foster a culture of the public or, rather, a culture of the private? Learning from what she calls impresa sociale[11], De Leonardis suggests three levels of observation to seize the publicness a given organisational form engenders. Not all of them necessarily fully adhere to the operational conditions of any urban commons.

This proves that the social enterprises -*imprese sociali*- and urban commons are not the same[12], thus pointing out a cultural and political shift, the beginning of another welfare season, making it necessary to ask the same questions again[13].

The first level concerns their public mandate, coherently supported by public funds and accompanied by administrative interfaces. Such a public-state profile allows these organisations to operate at the level of rights, to legitimate needs as rights, even as a result of conflictual dynamics that are, in fact, typical of the public sphere.

The second level is the political one and concerns creating the conditions for the negotiation of different interests and for the implied actors to have a role and impact in the decisional projects.

The third level is about institutional care[14], about creating the conditions for the continuous work of institutional transformation. It is essential to point out that De Leonardis defines institutions from a sociological point of view as social practices structured by - and generative of - shared norms, cultures, and meanings. In this key, institutions are constructs of social intelligence: domains in which this is deposited, partly crystallised in routines, and employed in elaborating shared versions of common goods, problems and solutions; and domains, therefore, of possible, further social learning (De Leonardis, 1998, p.25)

[11] The social enterprise as meant by De Leonardis is a form of organisation strongly valorising and fostering the public statute of (their) actions in the realm of social services.

[12] I refer here to a possible overlapping between third sector initiatives and urban commons. While this aspect cannot be addressed in this paper, it is important to stress a major difference as pointed out by many commoners (but not necessarily shared by all). While the third sector initiatives by definition are delivering a service, very often for/in collaboration with local administrations, urban commons are initiated with a purpose of organising activities that would first of all directly benefit the commoners and their communities, therefore not in a service logic, though not excluding a collaboration with local administrations. Nonetheless, given the variety of political orientations and operational conditions -juridical frameworks, funding programs, policies- amongts commoning initiatives, ambiguities are increasingly possible.

[13] While the topic of commons was already well-known in the 90s, those years represented somehow the protohistory of the movement of urban commons emerged after the financial crisis of 2008, responding to increasing privatisation processes and austerity measures.

[14] According to De Leonardis, as repositories of consolidated knowledge and shared meanings, intitutions necessarily exclude other ways of doing things, as during the time something consolidates in finally shared and recognised rules, protocols, organisational structures, the context is already changed and new cultural triggers or needs already started to emerge. Insitutional care is necessary when insitutions do not work anymore. They teherfore 'become visible and object of collective elaboration' (De Leonardis, 2011, p.157). For this reason, conditions should be provided for a continuous exchange of practices and ways of doing and thinking, so that insitutions could constantly evolve.

This grid indicated proves pertinent and suitable to address the publicness of urban commons, not only to continue the investigations of a fruitful line of research which started at the end of the 80s[15] but also in consideration of the constitutive, foundational value of sharing[16] in the case of commons-oriented initiatives. As a value, sharing shapes not only the way a given pool of resources is made accessible but the very life of the commons initiative built around it. Sharing is not only a purpose but also a way of operating and an organisational principle[17]. It is about structuring caring practices by sharing knowledge; it is about communicating and creating the conditions for communication to be effective; it is about access, justice and distributing responsibilities. It is expressed in organisational modalities continuously and reflexively evolving, producing shared meaning and knowledge, potentially fostering publicness, but whose concrete modalities and operating contexts may reduce or alter. Vis-à-vis these general and abstract characterisations, each form of commoning and the context within which they operate – and therefore their organisational cultures – are necessarily unique. The purpose of this paper, looking at the case of Brussels, is to question to what extent the culture of publicness of urban commons is enacted through their operational conditions and to what extent they could allow reclaiming the publicness of the societal project previously implied in the making of the welfare system.

4. The molecular scene of Brussels: three case studies.

The word commons started to circulate in Brussels around 2011, revealing a subterranean landscape of still isolated, disparate and very fragile micro initiatives, mostly based on the curiosity and activism of small groups of citizens, some of them coming from local civil society organisations. The seeds of the urban commons I will synthetically analyse in these pages were planted in those years, and even before in the case of EGEB.

A Community Land Trust (CLT) is a non-profit organisation that aims to acquire, develop and steward property for the common good. Operating for the benefit of a community, CLT's core purpose is to make real estate ownership -particularly homeownership for most of the initiatives situated in an urban context- accessible for low-income households (Davis and Lincoln Institute of Land Policy, 2010). According to the classic model (Davis and Lincoln Institute of Land Policy, 2010), a CLT achieves its goals by dividing the ownership of land from the ownership

[15]In fact we should go back to the work of Habermas on the public sphere -which Fraser criticised and updated from her feminist perspective in the same years of her article on the need-talk (Fraser, 1990). De Leonardis also mentions Marshall and Titmuss for their theorisations on the relationship between democracy and social policies. Given the relevance and continuity of this line of research, and given the increasing relevance of commons-oriented policies and programs, raising the question of their publicness seems not only necessary but also timely.

[16] As a matter of fact deeply intetwined with caring: there is no sharing witout caring, and viceversa, there is no caring without sharing.

[17] Commons are consituted or instituted around the need to jointly establish rules, forms of governance, practices with the purpose of preserving a pool of shared resources. The dimension of sharing defines a porous organisation, whose organisational modalities, rules and the decisional system are continuously evolving as a result of changes affecting the commoners or the pool of resources and therefore requiring adjustments for the sustainability of the commons as a whole. Because of their reflexivity that allows their sustainability Dardot and Laval define commons as instituent practices (Dardot and Laval, 2014).

of built structures. The land is permanently removed from market dynamics, making ownership of the built parts affordable in perpetuity[18].
The Community Land Trust of Brussels (CLTB), the first European CLT, was established in 2012 as a result of the mobilisation of local organisations and grassroots initiatives aiming to address a long-standing housing issue, therefore based on solid political and institutional motivation. Supported by the political constellation of those years, from the very beginning, the CLTB has been established as a "foundation d'utilité publique" (FUP) or a public interest foundation, with a mission centred on the right to housing as recognised in the Belgian constitution. While having a public-regional mandate, the CLTB manages to preserve a commons-oriented governance system, as the decisional power is equally distributed amongst the public, private and civil society involved actors, both in the non-profit organisation and in the FUP[19]. On the level of funding, the solid and regular public support allows them to operate at the large scale of the Region. However, the number of projects is still limited by land availability and accessibility, as well as by some operational conditions.

The political dimension of the CLTB is substantially defined by its effort to provide accessible homeownership to the families that need it most in a global city exposed to intense real estate speculation. It, therefore, characterises the whole process of delivering the projects and the organisation's life.
The tripartite governance structure of the two boards, the Assemblies, the participatory activities supporting the realisation of their projects, the membership campaigns, the site-specific frameworks of collaboration established with other local organisations for the realisation of each housing project: all these activities are conceived and organised and create a public space to talk about and define different needs, to transcend them from an individual to a collective or regional level, to negotiate them across scales and social segments, to distribute the (care) responsibilities. The operational levels of the CLTB – from the microscale of a single housing project to the macroscale of lobbying towards a more supportive framework in terms of policies and land accessibility- articulate the right to housing within the larger urban and societal projects. Homeownership is made possible *through* addressing speculative dynamics and the need for a more inclusive and porous urban project (Lenna, 2020).
Finally, on the level of institutional care, the very approach to property rights and the strong implication of the regional public, together with the mentioned transversal political work, necessarily produce a multifaceted institutional transformation. To begin with, as I have shown (Lenna, 2019), the very concept - the institution - of (private) property rights as a way of protecting a given asset is reshaped from the right to exclude to the right to govern, by equally distributing the decisional power across public, collective, and private actors. While such a change is mainly established by a combination of technical and juridical arrangements, it does make possible a cultural shift regarding homeownership and land tenure models. By contributing at different levels to making real housing projects, all involved actors and inhabitants reappropriate the use value over the speculative value. Material and organisational conditions are provided for a mentality and approach change to individual property, the ownership of land as a commons, and the right to own as a right to govern, between recognition and shared responsibilities. As a result of their multiscalar operational conditions involving various actors and communities, the CLTB managed to influence the land tenure model of other

[18] The land is leased to property owners, who can be private individuals but also other juridical persons.
[19] The CLTB has a dual legal structure: the FUP acquires and holds property, while the non-profit organization handles the development of housing projects. This includes organizing project calls and supporting future homeowners with various participatory activities from the start of their application process.

regional real estate administrators and developers. Recognised by Royal Decree, the model has also finally been established in other Belgian cities, such as Ghent and Leuven. The process of diffusing the realisation of the model – at the national and international level- also substantially fuelled public conversations about the right to housing as part of a societal project.

The second urban commons are the Etats Généraux de l'Eau à Bruxelles (EGEB)[20]. EGEB slowly originated from the political mobilisation of a small group of citizens willing to react to the realisation of a *basin storage,* a water retention basin in the area of Place Flagey, a decision taken by the Region without proper public communication and debate (2002). As an alternative to this decontextualised technological device, the inhabitants proposed to address the issue of flooding with a hydro-ecological approach by considering the hydrography and topography of the whole concerned valley. This would have meant taking into account not only technical issues of the water infrastructures at the scale of the whole valley or the morphological characteristics of the valley and of the urban fabric but also the anthropic components: the culture of water management from the macro scale of the competent administrative actors to the micro-scale of individual households dealing with flooded basements or watering their gardens. At the core of such an approach, EGEB proposed the concept of reclaiming water ecologies and their landscapes as a commons [21], which means establishing a transcalar, multilayered governance system based on the recognition of multiple competencies and forms of expertise and distribution of responsibilities. Their approach developed and was refined through the years through a variety of projects and initiatives: from regionally funded projects in collaboration with local organisations, universities, civil society and municipalities of the BCR; to collective cartographies and walks across the most problematic neighbourhoods designed to increase the awareness and exchange knowledge about water management and water ecologies, between the human and the non-human.
Each activity has a political profile by creating the conditions for negotiating different interests and reframing individual and specific needs into larger societal and ecological projects. The nature of many of their activities also creates a public arena where water management and water ecologies can be addressed from different perspectives and angles, taking into account the similarities and differences of diverse hydrographic conditions, the conflicting interests, and the unequal wealth distribution across the Region.
The purpose of EGEB's activities and their *raison d'être* is deeply institutional and oriented towards what De Leonardis defines as institutional care (De Leonardis, 2011). From the beginning, their goal has been to reshape the culture of water management in the BCR by instituting a common-public perspective to avoid the risk of a private and technographic approach. Each of their projects, particularly those involving actors from the regional public administration, is conceived to prefigure and possibly enact new approaches to water management. Independently from their results, they offer the occasion to explore different mindsets and the hypothesis of a cultural shift: from pipe-based water management to a landscape-based generative[21] governance. Such a clear mission is not always adequately supported. The discontinuity and irregularity of public funding -in contrast to the case of the CLTB- jeopardises and slows down the transformative process, which therefore occasionally shrinks on the level of small-scale, informal initiatives, perhaps more accessible to other social segments and nevertheless relentlessly contributing to a capillary mentality change.

[20] EGEB is the acronym for Etats Generaux de l'Eau de Bruxelles. The organisation is regularly mentioned in the plural form on the web page and other official documents. https://www.egeb-sgwb.be

[21] I use the word generative as De Leonardis does (De Leonardis, 1998), to refer the richness and resourcefulness of organizational arrangements focused on fostering sharing, relational exchanges, debate and publicness.

Despite not having a public mandate, the EGEB are increasingly recognised as a valuable expert in establishing ecologically sustainable water management systems. Their holistic approach to the living environment of humans and non-humans embeds the complexity of interweaving scales, forms of competencies, and the pedagogical frameworks to develop and support them. EGEB are increasingly involved as experts in the elaboration or revision of regional policies and Master Plans or in the implementation of pilot projects, thus furthering the required cultural change.

The third case study is Communa, established in 2013 by the initiative of a few students willing to experiment with sharing a living space while organising activities for the neighbourhood. Today, Communa is a professional actor organising temporary occupations of vacant sites and buildings in the BCR. As the landscape of temporary occupations can be very diverse in terms of purposes and, as a consequence, organisational modalities, it is important to point out that while not defining themselves as an urban commons, the organisational profile and the core values of Communa substantially align with the spirit of commoning: sharing and taking care of resources, learning how to live together, empowering involved individuals and communities. To briefly synthesise the occupation process here, once an agreement has been made with the owners, the building is renovated to comply mainly with safety regulations, and a public call is launched to invite local collectives and organisations to join the occupation. Meanwhile, many activities are organised to develop knowledge about the neighbourhood and establish relationships so that the project can respond to local needs. Within such a process, the shared pool of resources is not only the empty buildings they occupy -mostly publicly owned[22]- but also the forms of knowledge and financial capacities of the involved actors, the site-specific resources and forms of local expertise of a given neighbourhood, the economic contribution of all the involved initiatives contributing to the functioning of the project.

Not only does Communa operate as a commons, but its purpose is to enable communities so that each project can progressively learn how to govern itself and become autonomous. Therefore, it could be said that Communa operates as an infrastructure facilitating the establishment of urban commons. However, to this day, the core team continues to be involved in each of its projects.

On a political level, we may say Communa projects live—and therefore politically expose and deal with—the contradictions of a global city, whose vacant sites simultaneously and paradoxically experience the tension between speculative projects and the needs of the local inhabitants for housing, social and recreational facilities, and good-quality public spaces.

The open configurations of their projects result in heterogeneous mixes of initiatives, combining a diverse range of needs and interests[23]. The morphological quality of their projects reflects and sustains the spirit of their commoning approach. It is the physical space of a building that provides the conditions for the negotiations of different needs and interests. Their porosity combines safety and privacy for the most fragile inhabitants with the public accessibility of other spaces serving as neighbourhood facilities. In the projects of Communa, inner courtyards, wherever possible, tend as much as possible to stay open, as a continuation of the public space. Thorugh space and because of space, living together becomes a political project as these different needs and rights while being recognised, are reshaped within a larger collective project. While this may remind the case of CLTB projects (Lenna, 2019), the

[22] “On a des lignes éthiques assez fortes derrière ça. Quand le projet immobilier n’a pas de sens pour la ville selon notre perspective on fait un choix et en général nous avons une préférence pour les pouvoirs publics ou pour des privés mais qui ont une vision sociale” (interview, July 2022).

[23] Initiatives are chosen based on Communa's social mission, while ensuring compatibility with building activities and the neighbourhood.

operational conditions of Communa are different, primarily because of their projects' short and uncertain duration.
Finally, according to their words, Communa does have an institutional goal. Through their projects and lobbying strategy, their objective is to change the culture of temporary occupations beyond the simple management of an empty building and towards the experimentation of long-lasting infrastructures for social cohesion and the neighbourhood's well-being. Towards this goal, specific juridical frameworks and tools should be provided to improve the feasibility of socially oriented temporary occupations. Vis-à-vis these ambitions, Communa, despite being very well known and involved in a growing number of projects involving regional actors and other community-based organisations, is still suffering because of the irregular funding opportunities or the short duration of their projects.
However, as the CTLB and EGEB, they are also increasingly recognised for their expertise. In addition to their projects and numerous activities open to the large public, their implication in research projects and regional studies represents an occasion to influence further the culture and the public debate on issues such as urban vacancy and waste, the problems of temporary frames of occupations, speculation and gentrification processes.

To conclude, a few transversal observations. While these cases today do not represent the average operational conditions of urban commons -particularly in Brussels- they were also initiated by small groups of individuals. The success of their projects, the support of local and regional public actors, and the lobbying and networking capacity made them grow. Their political impact and their action of institutional transformation started in the embryonic stage of their existence. Relentlessly, project after project, they became more robust as a result of continuously sharing resources and problems, supported by the thin, invisible fabric of commoning that characterises the Brussels scene. Therefore, their projects represent shared solutions, and innovations emerged through public debates and mobilisation around care, welfare and well-being issues. Far from being solidified in a final set of rules, protocols, and ways of doing, their experimentation will continue to address and involve different communities and actors, evolving according to new needs and site-specific conditions. Their projects are multilayered and transcalar operations, enacting the conditions for talking about needs and rights while taking care of care (pun intended). On another level, these urban commons or commons-oriented initiatives, being increasingly recognised as regional experts in their domains of activity, are in the position to influence the public debate when this takes the form of a master plan, a new urban policy or funding program, a study on a given urban issue.
Overall, in addition to the specific and concrete achievements of their projects, they contribute to reclaiming the publicness of welfare as a system in the making and a neverending societal project.
On the other side, different forms of fragility affect them, potentially reducing their publicness. The precarity of funding in the case of EGEB and Communa diminishes their range of actions, impacts their sustainability as organisations and slows down the processes of institutional change as the duration of the projects does have an impact in terms of changing mindset, building shared vocabularies and new ways of doing things. In the case of CLTB, the limited number of realised housing units conveys the idea of a limited impact on the target public. While the narrative is about the right to housing and homeownership for the most fragile households, only a limited number of applicants can have access.
Their recognition of urban commons being increasingly apparent[24], the public-regional actor could also play a re-distributive role (Fraser and Honneth, 2003) by providing more continuous

[24] As expressed by number of programs and policies. In Brussels, waiting to be realised, they have been formulated in the *Etude participative sur les communs bruxellois* (2022-2023).

or substantial financial support, possibly complementing other funding systems for the commons to achieve greater autonomy. This would mean reclaiming the public's- state classic redistributive capacity to fuel societal, decentralised work of welfare transformation.

5. A research plan

As a piece of ongoing research and given the limitations of a paper, the reflections developed in the previous pages are necessarily incomplete, also considering the embryonic stage of the development of policies and programs supporting the urban commons in the BCR. While having been suggested in the mentioned study, they are far from being implemented. Rather than offering an exhaustive evaluation of the publicness of urban commons in Brussels, this paper traces a research plan. In this final paragraph, I suggest two additional levels to be further investigated.

The first one should consider the molecular quality of the commoning landscape in Brussels. While I only addressed three well-established commoning initiatives in this paper, even their understanding remains incomplete without considering the multiplicity of other urban commons that sustain and amplify their actions, possibly increasing their publicness capability. I use the word molecular to describe a condition that is indeed primarily fragmented, characterised by very diverse conditions -but also many similarities- not rarely engendering fragility or a sense of isolation, but that simultaneously allows the more introverted initiatives to stay protected and small. While knowing about other initiatives, many do not have the time and resources to commit to larger projects, networking, or knowledge exchange. What are the characteristics of publicness for such a thin but resilient fabric, if any? Or do they represent another form of privatism? How do smaller urban commons contribute to the life of the larger?

The second level concerns necessarily the policies and forms of public-collective shared governance that still have to be implemented in Brussels. For this reason, in my analysis, I could only address the publicness of urban commons initiatives per se rather than as embedded in supporting policies or programs. On the one hand, this indicates further research and comparative approaches addressing those cities where supportive frameworks operating at a larger scale are already in place: Barcelona, Turin, Bologna, Naples, Grenoble, and Paris, to mention a few well-known cases. Then, having learned from other cities, in the case of Brussels this second level of inquiry becomes, for the moment, an invitation to share the phase of implementation of tools and policies so that in the process of defining needs, rights and finding solutions, welfare could be reclaimed as an instituting -as in French, *instituent*- societal project.

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Urban Development Strategies: Navigating the Complexities of Multi-Level Governance in Northern Italy

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Abstract (up to 125 words)
This study examines multi-level governance in Sustainable Urban Development Strategies (SUDs) across Lombardy, Veneto, Emilia Romagna, and Piedmont in Northern Italy. Utilising stakeholder interviews, document analysis, a CAWI survey, and a thematic laboratory, it explores regional implementation of SUDs. Despite regional variations, two primary needs emerge: policy and planning reforms towards participatory, integrated, and strategic approaches aligned with multi-level governance principles, and strengthened institutional capacity through training to integrate SUD principles and assess their impact. The study concludes by advocating for a cohesive SUD framework with enhanced regional collaboration and capacity building.

Keywords:
Sustainable Urban Development Strategies, Multi-Level Governance, Regional Managing Authorities, Cohesion Policy, Northern Italy

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1. Introduction

This contribution delves into the intricacies of multi-level governance for Territorial Strategies (TS) in Northern Italy, with a particular focus on the four key regions of Lombardy, Veneto, Emilia Romagna, and Piedmont.
Our analysis draws upon a rich tapestry of data sources:

- **The EU-funded REPLACE project:** This project provides valuable insights through stakeholder interviews, source analysis of Sustainable Urban Development Strategies (SUDs) in Northern Italy, a nationwide urban data collection via a Computer-Assisted Web Interview (CAWI) survey, and an operational thematic laboratory dedicated to urban and non-urban areas within the four target regions.
- **Author expertise:** The authors' professional experience with TS in Veneto and Lombardy further strengthens the research foundation.

Qualitative research forms the backbone of this study, incorporating principles of grounded theory. Additionally, elements of action research are employed.
It's important to clarify that our primary focus is on **Urban Strategies**, not non-urban strategies. We aim to dissect the political and administrative approaches adopted by each region, specifically examining the governance and development process of their urban strategies within the 2021-2027 programming period. This focus stems from two key considerations:

- The urban strategies and their associated actions are yet to be implemented.
- Our primary objective is to navigate the complexities of multi-level governance and assess institutional capacities for planning and managing SUDs effectively.

This exploration will offer valuable food for thought, informing future strategies and strengthening institutional capacities for successful SUD implementation.
The first part lays the groundwork by examining the broader context. It explores the role of Territorial Strategies within the framework of the EU Cohesion Policy, highlighting the goals and funding mechanisms that support regional development. This is followed by a section dedicated to Sustainable Urban Development Strategies themselves. Here, we'll delve into the principles and requirements that guide these strategies, emphasizing their focus on integrated and sustainable urban development.

The core of the analysis lies in Chapter 4. This section zooms in on the specific approaches taken by the four Northern Italian regions. We'll explore how each region implements SUDs, examining their political and administrative frameworks. This chapter draws on a rich data set, including stakeholder interviews, document analysis, and potentially survey data and thematic laboratory findings (depending on availability). Through these diverse sources, we aim to understand the intricacies of multi-level governance within each region.

Finally, the concluding section synthesizes the key findings and takeaways. By analyzing how each region tackles SUDs, the article aims to provide valuable insights for future strategies and strengthen institutional capacities for effective urban development.

2. The Territorial Strategies within the EU cohesion policy

The European Union’s cohesion policy, as is known, develops along a seven-year programming timeline. It is structured on the basis of agreements concluded between the EU and individual Member States (so-called Partnership Agreements - PA) in compliance with shared rules (so-called regulatory package) and it assigns to each programming cycle the

European financial resources of the Structural and Investment Funds (ESI Funds, ESIFs) to which national and regional ones are added. ESIFs includes five main funds, among which two are involved in the SUD: the European Regional Development Fund (ERDF), aimed to promote balanced development in the different regions of the EU, and the European Social Fund (ESF), aimed to employment-related projects throughout Europe and invests in Europe's human capital, focusing on young people, on all those seeking a job, on fragile populations etc.

The 2021-27 programming sets 5 Policy Strategic Objectives (PO) to be pursued through various National and Regional Programs. Territorial Strategies falls within the scope of PO 5 "Europe closer to citizens" through sustainable and integrated development of urban, rural, and coastal areas through local initiatives. The PO 5 supports tailor-made investment strategies at the territorial level, in cities and local communities, to address their diverse challenges, and tap into their development potentials. It offers local authorities or territorial bodies opportunities to build their policy mix to the challenges they are.

PO 5 is realized by Territorial Strategies (TS). A TS is a document that describes (as defined in Article 28 of EU Regulation 2021/1060[1]): the geographical area affected by the strategy (e.g. a specific neighborhood of a city, or an inter-municipal area, if it refers to a grouping of municipalities); the analysis of the development needs and potential of this area, including economic, social, and environmental interconnections (with the support of statistical data, indicators, maps, etc.); the description of the integrated approach to address the identified development needs and to realize the potential of the area (which would be the actual description of the strategy that is intended to be pursued in relation to the achievement of some specific objectives, and through the implementation of a list of operations/actions/projects as well); and the description of the involvement of partners in the preparation and implementation of the strategy. Normally the document includes attachment such as territorial framing maps, project diagrams ad tables (especially in relation to the financial plan), and the list of the implementation projects with further detailed information.

Specific Objective *SO 5.1* is focused on "Fostering the integrated and inclusive social, economic, and environment development, culture, natural heritage, sustainable tourism, and security *in urban areas*". On the other hand, the specific objective *SO 5.2* aims to address the unique challenges and potentials of *non-urban areas*, promoting their sustainable development and enhancing their cultural and natural heritage. Notably, in Italy, has been promoted the National Strategy for Internal Areas (NSIA), which is an innovative policy for development and territorial cohesion that aims to counteract the marginalization and demographic decline typical of the internal areas of the country. National resources have been made available in addition to the allocations from the ESI Funds and other public and private funds, pursuing social cohesion objectives and aiming to slow down and reverse the depopulation phenomena of the Internal Areas in Italy. The NSIA will not be taken into account in this contribution, because it refers to specific objectives and peculiar found mix which differs from urban areas, which are at the core of this research.

ESI funds finance the SUD strategies through multi-year Regional and National Programs. At regional level, they are fund by the RP ERDF and, since the new programming period (2021-

[1] The REGULATION (EU) 2021/1060 of the European Parliament and of the Council lays down common provisions on all the ESI Funds (the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy).

2027), by the RP ESF+ as well. The Regional Programs are promoted by each region autonomously and they are submitted for approval to the European Commission. Along with the RPs, SUD strategies in Italy are also fund by the new National Programme referred to metropolitan cities and extended to medium-sized cities in less developed regions (NP Metro Plus e Città Medie Sud 2021-2027) and, at the European level, by the Urban Innovative Actions through the European Urban Initiative (EUI). All these programs[2] are sustained by ESI Funds and notably by the ERDF.

3. The Sustainable Urban Development Strategies

The SUDs consolidate the EU perspective on the urban question (*urban acquis*) starting from the 2007-2013 programming (Fioretti et al., 2020). Since the ratification of the Leipzig Charter on sustainable European cities in 2007, the European cohesion policy has integrated into its regulatory framework the article relating to Sustainable urban development: first in an optional form (EU Regulation 1080/2006, art. 8), then in a mandatory form in the subsequent 2014/2020 (Regulation 1301/2013, art. 7) and 2021/2017 (EU Regulation 2021/1058, art.11) programming periods. In order to address the economic, environmental, climate, demographic, and social challenges posed by the tendency of 'the complete urbanisation of society' (Lefebvre in 1970), the EU promotes integrated local development strategies for the sustainable development of urban areas; where "integrated" means capable of combining a multi-sectoral approach, multi-level governance, and multi-actor participation. The innovation of this perspective lies in the consolidation of this specific approach and its institutionalization within the cohesion policy (through ESI funds), such recognising it as an ordinary one instead of an extraordinary one, as it was before. Indeed, this approach found reference in the 90s in the Urban Pilot Projects and in the Urban programs financed by the ERDF; which, in turn, moved within the so-called Italian season of "complex programs" partly related to the French policies of the *quartiers en crise* (Saccomani, 2004).

This approach, as implemented by the Urban Agenda for the EU of 2016, suggests integrated strategies for the most disadvantaged urban areas. It follows some fundamental criteria that we can summarize in three points:

(i) the respect for the principle of *partnership*, according to a multi-level governance approach. It respects the principle of subsidiarity as well, which is implemented through the involvement of the local stakeholders and the civil society, making them collaborate in the preparation and implementation of the local development strategies; and

(ii) *the integration* between different sectors of intervention (operating the strategy's objectives and projects not only in different fields and sectors, but also integrating various objectives and projects of the same strategy each other); and the integration between different sources of financing (ERDF + ESFplus + other sources), which also imply a logic of integration between the physical dimension and the social dimension of the interventions; and

(iii) *a place-based approach* (Barca, 2009) focused on the socio-economic, institutional, and spatial peculiarities of places, as well as on local resources and capacities; allowing to develop unique solutions for the specific needs of each territory.

[2] To have an idea of the amount of money involved for SUD within these programs, consider that the EUI involves up to 5M € for all the European cities; while at national level, the NP Metro plus involves for SUDs (referring to the Priority n.7 Urban regeneration of the NP) in metropolitan cities around 10M € (medium cities don't have to develop territorial strategies but sectorial actions), the PRs total size is almost 2B€, and the NSIA's amount is 797.250.529€.

Through territorial instruments (such as Integrated Territorial Investments (ITI), which are the most common in Italy, or Community-Led Local Development (CLLD) or other territorial tools), the SUD can be funded directly from other specific objectives under Policy Objectives (PO) 1-4, in addition to PO 5. They can provide linkages already at specific objective level, which ensures that sustainable urban development strategies demonstrate their contribution to EU and global agendas. Support to territorial instruments under PO1 and PO2 complies with thematic concentration, or with the thematic enabling conditions linked to specific objectives of PO1-4.

The SUDs can be co-financed by additional autonomous regional funds and local funds. The co-funding depends on the type of programme (RP, NP) or action (European Urban Initiative - EUI) which is promoting the SUDs: for example, some regions subsidize 100% of the costs, while other regions subsidize different percentages (from 50% up to 100%) depending on the type interventions; and EUI offers 80% of direct co-funding.

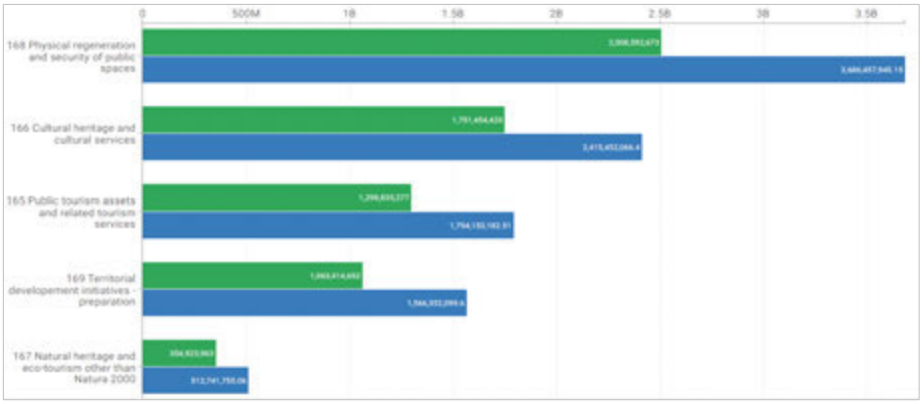

Fig. 1. Sustainable urban development - SO 5.1 Intervention fields and funding[3]

4.1 Regional SUD Strategies in northern Italy

In the 2021-2027 Partnership Agreement (PA) between Italy and EU is taken into great consideration the concept of integrated territorial development, increasing 3 points (over the 8% target[4] required by EU) the national allocation to support Sustainable Urban Development (Cohesiondata, 2023)[5]. In this contribution, as we pointed out in par.2, we will focus on territorial strategies in urban areas, and precisely the ones managed at regional level, without considering the NP Metro plus or the Innovative Actions from the EUI.

Italy in the 2021-2027 includes three levels of regional development, as sown in the image, clearly splitting the country between north and south. This partition implies different levels of EU co-funding and different requirements and targets to observe for the RPs. For example,

[3] https://cohesiondata.ec.europa.eu/stories/s/Sustainable-Urban-development-2021-2027/iw5n-dss9/#:~:text=PO5%20specific%20objective%201%20is,billion%20to%20this%20specific%20objective

[4] This percentage is provided by Article 11 of Regulation 1058/2021, which increases the 5% target of the national allocation of the European Regional Development Fund (ERDF) to sustainable urban development required for the programming period 2014-2020.

[5] Consider that only 13 countries on 27 overcame the threshold of 8%, outstanding Portugal with 25%.

within the ERDF, the less developed regions will benefit from co-financing rates of up to 85% of the cost of projects, while for transition regions and more developed regions it will be up to 60% and 50% respectively (Europarl, 2024)[6]; and 30% of ERDF should be allocated to PO 2 A greener, low carbon transitioning towards a net zero carbon economy.

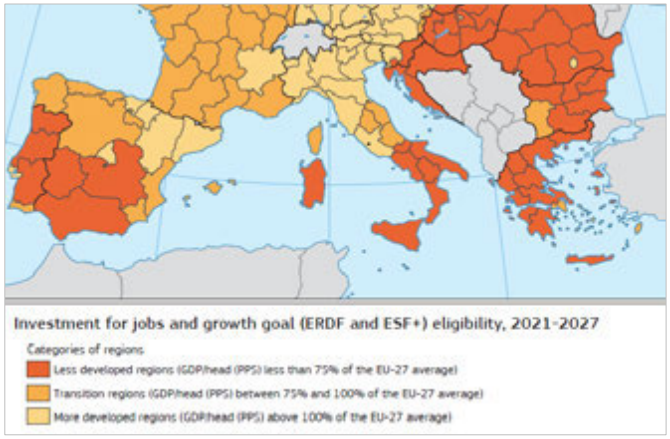

Fig. 2. Level of development of Italian regions within the 2021-2027 programming period[7]

The 2021-2027 SUDs managed by the regions in Italy present different nomenclatures[8] and a significant variety of approaches, in alignment with the place-based model characterizing the European perspective on the urban issue. This variety affects also the other two criteria (partnership and integration) in each local context. However, the progress of their planning and management is not aligned in all the Italian regions: Lombardy is the first region which approved all the SUD Strategies in December 2022; and Emilia Romagna follows approving them in May 2023; but up until today many regions still have to reach the complete approval of all their SUD strategies, including some of the most developed region, such as Piedmont[9].

4.2 Insights from stakeholders' interviews and source analysis

In this paragraph, we will focus on the empirical research made through indirect sources analysis and interviews conducted with the stakeholders of the SUSs of the four main regions of northern Italy (Lombardy, Veneto, Emilia-Romagna and Piedmont). The three key criteria of the European approach to the urban issue introduced in the third paragraph (partnership, integration, place-based approach) will be used here as elements of comparison for the regional approaches.

Regarding to the first criteria, each region has activated different procedures for promoting *partnership*:

[6] https://www.europarl.europa.eu/factsheets/it/sheet/95/il-fondo-europeo-di-sviluppo-regionale-fesr-
[7] Extract from EU regional funding 2021-2027 available at https://ec.europa.eu/regional_policy/information-sources/maps_en#1
[8] Sustainable Urban Development Strategies could be named in different ways in each region. For example, in Lombardy are actually named SUD, but in Emilia Romagna they are called Transformative Urban Agendas for Sustainable Development (ATUSS), while in Veneto are labelled Integrated Strategies for Sustainable Urban Development (SISUS) and in Piedmont Urban Area Strategies (SUA).
[9] We should consider that this delay is affected by the contemporary approval of many actions from the National Recovery and Resilience Plan (NRRP) all over Italy.

(i) at the level of strategy programming, by the management authority of the programme, previewing different methods and weights of involvement of the beneficiaries; and
(ii) at the level of design and then implementation of the single strategies, demanding local authorities the activation of different forms of local partnership, especially in relation to citizen participation; and
(iii) eventually supporting (also economically) the local institutional capacity for the governance of the SUDs. Indeed, the direct participation of citizens and adequate forms of citizens consultation are not binding for all regions. They are encouraged with different degrees of intensity or autonomously promoted by the beneficiaries.

Regarding the principle of *integration*, the region's approach differs for:

- *Intervention Sectors*: different mix of types of interventions (such as new green areas, energy efficiency, cyclable path etc.) and different combination of Policy Objectives (PO from 1 to 5) are included in the SUDs;
- *Resource Types and Amounts*. SUDs imply: (i) different mix of funds types (ERDF, ESF+, other sources) and different amount of financial resources (depending on the development of the region but also on the regional policy); (ii) different emphasis given to the physical and social value of the urban transformations promoted; and (iii) various percentage of co-funds to the total cost. This last factor implies: (a) a different orientations regarding the commitment of the beneficiaries (if the beneficiaries are required to co-finance the SUDs, according to some, they demonstrate greater commitment and interest in its realization); and (b) a more complex administrative management of resources and targets to be achieved;
- *Programming and Design Procedures*: this aspect refers to the different level of flexibility of planning. Some regions imposed top-down elements, such as the articulation and consistency of funds offered in relation to the already decided sector of intervention, while others chose a bottom-up approach offering a range of free choices in terms of internal articulation of resources and topics, with a total fund cap for each single strategy;

Furthermore, we refer to the *place-based approach*, which recognizes that "strategic policy frameworks that support place-based approaches recognise that urban challenges manifest themselves differently in different places." (Fioretti et al., 2020, p.13). In this case the variety among regions concerns the type of urban areas involved within the SUDs. This variety depends on the specific territorial context (historical, economic, social, and cultural) of the region, but also on specific policy choices made by the regional authorities. Areas' typology varies between single municipalities, selected by size or administrative hierarchy (eg. medium-size city of 130,000 inhabitants or provincial capitals over 50,000 inhabitants), and coalitions of smaller municipalities led by a main municipality (for a total number of maximun 20,000 inhabitants in general).

The areas interested by the SUDs differs for an additional factor: the process that has been adopted to select them. The selection has been prior or posterior to the approval of the PRs and it varies by procedure and timing. In most cases, a manifestation of interest has been published, followed by the effective identification of the areas which has been often accompanied by a draft TS. The beneficiaries potentially responding to the call where already identified by name in the most part of cases, with rare exceptions of open call to municipalities not already identified.

Finally, another theme has significant implications in terms of territorialization, it is the institutional capacity:

(a) of the regional institutions who manage the SUDs and their complex internal organization, which often lacks of integration among the various sectors included in the planning and managing of the SUDs; and

(b) of the local municipalities beneficiaries, which often shown a lack of human resources and or specific competencies related to European funds. In response to these institutional weaknesses, some regions promoted forms of direct (or indirect) support to urban authorities rather than for themselves, with RP resources or other funds.

4.3 Insights from the questionnaires collected on SUD.

During March 2024, an online questionnaire was administered to explore various aspects related to the process of formulating and approving Sustainable Urban Development Strategies within the framework of the 2021-2027 Programming. The questionnaire was completed by representatives from six Italian regions: Piedmont and Veneto (North), Tuscany and Lazio (Center), and Calabria and Sardinia (South and islands). In total, approximately 22 million people reside in the regions included in the sample, representing 37% of the Italian population.
This paragraph will analyze the responses gathered to the questions related to local partnership and institutional capacity.

The opening question of the survey investigated the role played by Urban Authorities and Municipalities during the development of the 2021-2027 Regional Programmes. The frequency of responses (indicated in brackets) offers valuable insights into their level of engagement.

In the development phase of the 2021-2027 Regional Programmes, what role did the Urban Authorities and Municipalities play?

They have been involved in the evaluation of the past Programming	3
They were consulted for the acquisition of spatial data	3
They have been actively involved in deliberative processes	2
They have been involved in information and communication activities towards citizens and businesses	2
They were consulted for the acquisition of opinions and strategic guidance	2
They were not involved	1

- **Evaluation and Data Acquisition (3 out of 6):** A high level of involvement was evident in evaluating past programs and contributing spatial data. This suggests Urban Authorities and Municipalities played a significant role in assessing past initiatives and informing the new programs.
- **Deliberation and Communication (2 out of 6):** Engagement in deliberative processes and information/communication activities was moderate. This indicates potential for improvement in actively incorporating their perspectives and contributions throughout the development phase.

While Urban Authorities and Municipalities participated in some key areas, the survey results suggest a **moderate level of overall involvement**. There's an opportunity to strengthen their

engagement, particularly in deliberative processes and communication activities. This could lead to richer programme development that better reflects local needs and priorities.

The second question of the survey focused on the instruments used to implement Local Partnerships for the Regional Programmes. The responses, again weighted by frequency (shown in brackets), reveal the prevalence of different tools:

Which of these tools have been implemented for the implementation of Local Partnerships?

Participatory co-design workshops	3
Listening and interest-gathering groups	2
Co-deliberative arenas	1
Not yet activated	1

- **Widely Used:** Participatory co-design workshops were the most frequently employed tool (3 out of 6). This suggests a collaborative approach where stakeholders actively participate in designing the programs.
- **Moderately Used:** Listening and interest-gathering groups were used somewhat frequently (2 out of 6). This indicates efforts to gather input from various stakeholders.
- **Limited Use:** Co-deliberative arenas, which involve in-depth discussions and potential for consensus building, saw the least reported use (1 out of 6).
- **Non-existent Use:** One region reported not yet activating any of these tools.

The emphasis on participatory co-design workshops highlights a focus on collaborative programme development. However, the limited use of co-deliberative arenas suggests there might be less emphasis on in-depth discussions and consensus building. Additionally, some regions haven't yet implemented any of these tools, indicating potential areas for improvement in fostering local partnerships.

The third question of the survey explored the involvement of various actors in Local Partnerships for the Regional Programmes. The responses, again weighted by frequency (shown in brackets), reveal the prevalence of different stakeholder groups:

Which actors were involved in the Local Partnership?

Local Government Bodies	3
Volunteering Groups	3
Nonprofit Organizations	3
Cultural and Recreational Associations	2
Trade Unions and Professional Associations	2
Research Institutes and Universities	1

- **Core Participants:** Local Government Bodies, Volunteering Groups, and Nonprofit Organizations were all involved in a majority of the partnerships (3 out of 6). This highlights the strong engagement of these key actors in fostering local collaboration.
- **Active Participants:** Cultural and Recreational Associations and Trade Unions and Professional Associations were involved in two-thirds of the partnerships (2 out of 6). This indicates their significant role in bringing diverse perspectives and expertise to the table.

- **Limited Involvement:** Research Institutes and Universities were the least frequently mentioned participants (1 out of 6). This suggests a potential gap in incorporating their knowledge and research capacity into Local Partnerships.

The broad involvement of local government bodies, volunteering groups, and nonprofits demonstrates a strong foundation for community engagement. However, the lower involvement of research institutions and universities suggests an opportunity to better leverage their expertise in informing and supporting Local Partnerships.

The fourth question of the survey explored perceptions of the effectiveness of multi-level co-design between the Region and Urban Authorities in developing the Regional Programmes. The results provide two key pieces of information:

From 0 to 10, how effective do you think the multilevel co-design between the Region and the Urban Authorities has been?

Average	5,80
Standard Deviation	1,64

- **Average Effectiveness:** The average score was 5.80 (out of 10). This suggests a generally positive perception of the co-design process, with most regions viewing it as moderately successful.
- **Variations in Perception:** The standard deviation of 1.64 indicates some variation in responses across the regions. Some regions have had more successful experiences with co-design than others.

The average score suggests that the co-design approach has been perceived as somewhat valuable in facilitating collaboration between the regional and urban levels. However, the standard deviation highlights potential areas for improvement. Some regions might be struggling with implementing effective co-design practices.
The fifth question delved into the specific methods employed by regions to implement multi-level co-design between the Region and Urban Authorities. The responses, again weighted by frequency (shown in brackets), reveal a range of approaches used:

Through what technical and participatory methods was the co-design of the Strategies concretely carried out?

Technical assistance from specialised professionals or consultants	3
Public consultations	3
Support and coaching from experts	2
Participatory workshops open to stakeholders	2
Online collaboration platforms	2
Regular public meetings for monitoring and alignment	1
Thematic seminars and conferences	1

- **Core Techniques:** Technical assistance from external specialists and public consultations (3 out of 6) were the most frequently used methods. This suggests a reliance on expert knowledge and gathering public input as foundational elements of the co-design process.
- **Supportive Measures:** Support and coaching from experts and participatory workshops (2 out of 6), and online collaboration platforms (score: 2) were also used

by two-thirds of the regions. These methods likely aimed to enhance stakeholder engagement and facilitate collaborative discussions.
- **Limited Use:** Regular public meetings for monitoring and alignment, and thematic seminars and conferences, were used less frequently (1 out of 6). This suggests potential areas for improvement in fostering ongoing communication and knowledge sharing throughout the co-design process.

The survey results indicate a focus on technical expertise and public input, which are crucial elements of co-design. However, the less frequent use of methods like regular meetings and seminars suggests opportunities to strengthen ongoing communication and knowledge exchange between regional and urban levels.

The final question of the survey explored the perceived need for strengthening specific institutional capacities related to planning, management, and monitoring of Territorial Strategies. The responses, again weighted by frequency (shown in brackets), reveal key areas for improvement:

Which of the following institutional capacities would you consider most useful to strengthen in relation to the planning/management/monitoring of Territorial Strategies?	
Identify priorities and strategic objectives in line with the principles of Cohesion Policy	5
Develop an implementation plan consistent with regional programming and constraints imposed by Regulations	4
Assess the socio-territorial impacts of implemented operations	4
Monitor the progress of operations and identify effective solutions to unforeseen challenges	3
Collect and identify the needs and opportunities of the territory	3
Evaluate the quality of collected project proposals	3
Analyse data and information	1
Develop transparent and impartial selection criteria	1

- **Top Priorities:** Identifying priorities and strategic objectives aligned with Cohesion Policy principles (5 out of 6) emerged as the most crucial area for capacity building. This suggests a need for stronger skills in aligning territorial strategies with broader European development goals.
- **High Importance:** Developing implementation plans that consider both regional programming and regulatory constraints and assessing the socio-territorial impacts of implemented operations (4 out of 6) were also highly ranked. These highlight the importance of effective planning and understanding the social and territorial effects of strategies.
- **Moderate Importance:** Three areas shared equal weight (3 out of 6): collecting and identifying territorial needs and opportunities, evaluating project proposals, and monitoring progress to address unforeseen challenges. These represent foundational aspects of territorial strategy management.
- **Least Important:** Analyzing data and information, and developing transparent selection criteria received the lowest scores (1 out of 6). This may indicate that some regions already have established data analysis and selection processes, or it might highlight a gap in these areas that requires further investigation.

The survey results suggest a strong desire to strengthen capacities in aligning territorial strategies with broader development goals, effective planning, and impact assessment. While

core management functions are perceived as important, there appears to be less focus on data analysis and transparent selection processes.

4.3.1 Insights and final remarks

This survey of six Italian regions, representing 37% of the national population, provides valuable insights into local partnerships, territorial governance, and institutional capacities for Sustainable Urban Development Strategies (SUDS) within the 2021-2027 Programming framework. The findings reveal a landscape with promising elements alongside areas for improvement.

Local Partnerships: A Foundation with Room to Grow
While Urban Authorities and Municipalities actively contribute spatial data and participate in programme evaluations, their involvement in deliberative discussions and communication during programme development seems limited. This suggests a missed opportunity for richer collaboration.
The widespread use of participatory co-design workshops highlights a commitment to collaborative approaches. However, the limited use of co-deliberative arenas and the absence of these tools in some regions indicate a gap in fostering deeper discussions and consensus building. Additionally, lower involvement of research institutions and universities represents a missed opportunity to leverage valuable academic expertise and research in programme development.

Territorial Governance: Advancing Multi-Level Co-Design
The survey results suggest a moderately successful application of multi-level co-design between regional and urban authorities. However, variations across regions highlight inconsistencies in implementation. This underscores the need for a more standardized approach that leverages best practices in multi-level co-design, ensuring all regions benefit from effective collaboration.
While technical assistance and public consultations are core methods, a reliance on expert knowledge and public input at specific points could be enhanced by fostering ongoing communication and knowledge exchange. Less frequent use of regular public meetings and thematic seminars suggests potential for improvement in these areas. Strengthening these aspects would promote transparency, inclusivity, and a more informed co-design process.

Institutional Capacities: Building on Strengths, Addressing Gaps
The top priority identified by the survey is aligning territorial strategies with Cohesion Policy principles, reflecting a strong desire for coherence with broader European development goals. Additionally, developing effective implementation plans that consider both regional programming and regulatory constraints, alongside assessing the socio-territorial impacts of operations, are seen as crucial for effective planning and impact assessment.
Core areas like identifying territorial needs, evaluating projects, and monitoring progress are considered moderately important, suggesting a foundation for territorial strategy management. Interestingly, data analysis and developing transparent selection criteria received lower importance scores. This might indicate either existing competency or a gap requiring further investigation.

A Call to Action
The survey results paint a picture of regional administrations that are engaged but face challenges in fostering deeper local partnerships, implementing consistent territorial

governance practices, and strengthening certain institutional capacities. The emphasis on capacity building, particularly in aligning with Cohesion Policy and improving planning and impact assessment, reflects a commitment to enhancement.
However, the moderate success of multi-level co-design and the mixed use of participatory tools suggest that significant room for improvement exists. By strengthening local partnerships, promoting more consistent and inclusive territorial governance practices, and enhancing institutional capacities, regions can develop more effective and sustainable SUDS that are better aligned with local needs and broader European objectives. This, in turn, can lead to more innovative, evidence-based, and impactful urban development strategies.

4.4 Findings arisen from the thematic laboratory on the territorial development strategies

4.4.1 Introduction and Methodology

A workshop titled "Territorial Strategies of Cohesion Policy" was held in Milan, Italy on April 15, 2024. Organized by the Craft Competence Centre Anti-Fragile Territories and the Politecnico di Milano's Department of Architecture and Urban Studies, the event brought together 54 stakeholders from diverse backgrounds for a series of afternoon workshops. Representatives from local authorities, trade associations, universities, research centres, and private companies participated, contributing a wealth of experience in territorial governance, cohesion policies, and local development. This rich mix of professions fostered lively discussions on key challenges.

The workshops employed a structured approach, focusing on identifying thematic challenges and then discussing four key aspects of intervention logic: evidence, objectives, solutions, and strategies. Evidence involved analysing data and identifying the consequences of inaction. Objectives outlined desired outcomes and benefits. Solutions cantered on the tools and resources needed to achieve the objectives. Finally, strategies focused on the methods for implementing these solutions.

4.4.2 Participation, Governance, Capacity: Building Blocks of Territorial Strategies

Topic 1: Participation and Engagement of Local Actors
Workshop 1 explored the heart of territorial strategies – the involvement of local actors. Participants examined the structure of local partnerships, delving into the extent of civil society's engagement and the mechanisms in place to ensure the inclusion of vulnerable and disadvantaged groups. The workshop delved into the conditions necessary to guarantee broader participation in the development of strategies, paying particular attention to discriminated or at-risk groups. Methods for addressing informational asymmetry across different levels of the institutional architecture were also explored, ensuring that all voices are heard and considered.

Topic 2: Territorial Governance and Policy Integration
Workshop 2 shifted the focus to the governance and integration aspects of territorial strategies. Participants explored whether regional administrations had the opportunity to fully express their strategic and political vision in defining territorial strategies and how this integration with European and national provisions was achieved. The importance of strengthening policy integration within territorial strategies by creating synergies between

sectors from the outset was highlighted, promoting a holistic and coordinated approach to public policy planning and implementation.

Topic 3: Institutional Capacity for Development and Cohesion
Workshop 3 placed institutional capacity at the forefront, recognizing its pivotal role in developing and implementing territorial strategies. The workshop took the premise that the institutional capacity of entities and actions aimed at its reinforcement, particularly in the context of developing and implementing territorial policies and utilizing European funds, is essential for success. Participants discussed the identified weaknesses in the institutional capacity of regions and local entities during the programming and development of the 2021-2027 territorial strategies, comparing them with the previous 2014-2020 programming period. The workshop also examined the actions taken to address these weaknesses, including collaborations with external entities.

The thematic workshops revealed strong interconnections between the explored topics, and the emphasis on inclusive participation and engagement, which underlines the need for strong territorial governance and policy integration. All workshops highlighted the crucial role of institutional capacity as a foundation for effective policy development and implementation.

4.4.3 Overcoming Challenges in Participatory Processes for Territorial Development

The challenges identified from **Thematic Workshop 1** revolve around the critical themes of inclusivity and standardized practices, insufficient time and resources, and difficulty in demonstrating impact. The workshop highlighted the need to design participatory processes that are inclusive of marginalized populations and youth, while also establishing standardized tools and methodologies to ensure consistency and accessibility. Additionally, effective facilitation of participatory processes requires addressing limitations in time and resources, including securing adequate timeframes, budget, and skilled personnel. Finally, there is a need to design clear and measurable indicators to demonstrate the impact of participation on project outcomes, supported by robust monitoring and evaluation frameworks to track progress and communicate results effectively to stakeholders.

Challenge	**How might we design participatory processes that are inclusive of marginalized populations and youth, while also establishing standardized tools and methodologies to ensure consistency and accessibility?**
Evidence	Marginalised populations and youth face difficulty in engaging with current participatory processes. Lack of standardised tools and methodologies leads to inconsistencies and exclusion of certain groups.
Objectives	Increase participation from marginalized groups and youth. Develop standardized tools and methodologies that are inclusive and adaptable.
Solutions	Implement targeted outreach campaigns and alternative engagement methods. Develop a toolkit of standardized methodologies for inclusivity.
Strategies	Partner with civil society organizations experienced in working with marginalized groups. Organize training workshops for regional authorities on inclusive participatory methodologies.

Challenge	**How might we ensure effective facilitation of participatory processes with limited time and resources, including securing adequate timeframes, budget, and skilled personnel?**
Evidence	Time constraints hinder meaningful participation. Insufficient budget and personnel for facilitation are identified as obstacles.

Objectives	Allocate sufficient time and resources for participation. Secure budget and personnel for effective facilitation.
Solutions	Define realistic timeframes and allocate sufficient budget. Secure dedicated personnel with necessary skills.
Strategies	Develop clear timelines for each stage of the process. Conduct cost-benefit analysis to justify budget allocation. Advocate for dedicated positions within regional authorities.

Challenge	**How might we design clear and measurable indicators to demonstrate the impact of participation on project outcomes, while also developing robust monitoring and evaluation frameworks to track progress and communicate results effectively to stakeholders?**
Evidence	Difficulty in demonstrating the impact of participation on project outcomes. Absence of proper monitoring and evaluation practices.
Objectives	Establish clear indicators to demonstrate impact. Develop robust monitoring and evaluation frameworks.
Solutions	Establish clear indicators to demonstrate impact. Develop robust monitoring and evaluation frameworks.
Strategies	Conduct pilot projects to refine frameworks. Regularly monitor and evaluate processes. Communicate impact effectively to stakeholders.

4.4.4 Enhancing Participatory and Collaborative Frameworks for Effective Territorial Governance

The challenges identified from **Thematic Workshop 2** focus on designing a participatory and collaborative framework for territorial governance, achieving cohesive territorial development through integrated policies, and ensuring transparency, accountability, and efficiency in public resource management. These challenges underscore the importance of inclusive engagement of diverse stakeholders to enhance policy effectiveness, the need for integrated policies and collaborative governance to achieve territorial development objectives, and the necessity of transparent and accountable management of public resources to build trust and ensure impactful interventions.

Challenge	**How might we design a participatory and collaborative framework for territorial governance that effectively integrates diverse stakeholders, considering the complexity of their involvement and the potential for increased policy effectiveness through inclusive engagement?**
Evidence	The complexity of the stakeholders involved necessitates inclusive engagement. Lack of participation can undermine policy effectiveness.
Objectives	Strengthen territorial governance through a participatory and collaborative approach.
Solutions	Establish negotiation and consultation forums. Promote online platforms to facilitate collaboration.
Strategies	Conduct awareness campaigns; promote training on participatory practices. Develop collaborative networks among entities and organisations.

Challenge	**How might we achieve cohesive territorial development through integrated policies and collaborative governance?**
Evidence	Lack of integration can hinder the achievement of territorial development objectives.
Objectives	Promote integration between policies and levels of government to maximise the impact of interventions.

Solutions	Foster collaboration between public, private, and third-sector entities; adopt evaluation and monitoring tools.
Strategies	Develop coordinated planning and programming tools; create networks of entities and organisations for the exchange of experiences.

Challenge	**How might we ensure transparency, accountability, and efficiency in public resource management for territorial development?**
Evidence	Lack of transparency can generate distrust and inefficiency. Dispersing resources on minor projects reduces the overall impact of interventions.
Objectives	Increase transparency and accountability. Focus resources on high-impact interventions.
Solutions	Publish accessible data and information. Establish clear criteria for project selection.
Strategies	Implement a system of participatory governance. Establish a guarantee fund for multi-year projects.

Challenge	**How might we design interventions that are adaptable and sustainable over time, ensuring informed political decisions and achieving lasting impact?**
Evidence	Discontinuity in interventions can hinder the achievement of objectives. Lack of political involvement in the technical phase can lead to uninformed decisions.
Objectives	Ensure the stability and sustainability of interventions. Base political decisions on a deep understanding of issues.
Solutions	Fund multi-year projects; promote continuous learning and capacity-building for policymakers and technicians.
Strategies	Promote co-design and co-management of interventions; develop evaluation and monitoring tools to measure impact.

4.5.5 Strengthening Institutional Capacity and Collaboration for Effective Territorial Strategies

The challenges identified from **Thematic Workshop 3** emphasize the need to bridge gaps in institutional capacity within public administrations, overcome siloed knowledge and limited tools, streamline territorial strategy implementation, and enhance collaboration on supra-municipal strategies. These challenges highlight the importance of capacity building, knowledge sharing, and collaboration to ensure effective management and implementation of territorial strategies, thereby promoting cohesive and sustainable development across regions.

Challenge	**How might we bridge the gap in public administrations' institutional capacity to effectively manage territorial strategies?**
Evidence	Need for strengthening institutional capabilities. Emphasis on structural changes in policy programming and planning. Need for updated recruitment profiles and cultural training identified.
Objectives	Strengthen capacity and foster a collaborative culture. Implement structural changes for better efficiency.
Solutions	Develop and implement capacity-building programs for public administration staff involved in territorial strategies. Invest in cultural training programs to equip staff with the necessary skills and knowledge. Review recruitment profiles to prioritize skills relevant to territorial strategy development and management.
Strategies	Partner with universities and research institutions to design and deliver capacity-building programs. Establish mentorship programs to allow experienced staff to share knowledge with new recruits. Advocate for policy changes that promote collaboration and knowledge exchange across different sectors of public administration.

Challenge	**How might we overcome the siloed knowledge and limited tools that hinder territorial development efforts?**
Evidence	Need for sharing existing analytical tools. Emphasis on developing new integrated tools and indicators.
Objectives	Establish knowledge-sharing platforms. Develop new tools and indicators.
Solutions	Create a central repository for sharing existing analytical and evaluative tools. Invest in research and development to create new integrated tools and territorial indicators. Foster collaborative projects between public administrations and research institutions.
Strategies	Develop an online platform for sharing resources, case studies, and best practices in territorial development. Organize workshops and training sessions on the use of existing and new territorial development tools. Establish joint research projects between public administrations and universities to address specific territorial development challenges.

Challenge	**How might we streamline territorial strategy implementation by addressing workload, skill gaps, and reliance on external expertise?**
Evidence	High workload and lack of personnel. Weak technical skills and over-reliance on consultants.
Objectives	Reduce workload and strengthen technical skills. Reduce reliance on external consultants.
Solutions	Streamline administrative procedures for territorial strategy implementation. Invest in training programs to improve the technical skills of public administration staff. Explore alternative models for accessing expertise, such as knowledge-sharing networks or secondments.
Strategies	Conduct a review of administrative procedures to identify and eliminate redundancies. Develop training programs tailored to the specific needs of staff involved in territorial strategies. Establish partnerships with other public administrations or research institutions to share expertise and resources.

Challenge	**How might we bridge the gap between public administrations to enable effective collaboration on supra-municipal territorial strategies?**
Evidence	Difficulties in cross-boundary collaboration. Individual interests prevailing over collective benefits.
Objectives	Promote systemic approaches and collaboration. Reduce dependence on external assistance.
Solutions	Develop guidelines and frameworks for inter-municipal collaboration in territorial strategy development. Establish mechanisms for conflict resolution and consensus building among stakeholders. Invest in capacity building for inter-municipal cooperation and joint planning.
Strategies	Organise workshops and training sessions on inter-municipal collaboration and shared vision building. Develop model agreements and best practices for collaboration between different levels of government. Provide incentives for local entities to work together and share resources.

4.3.6 Learnings and takeaways

Key Criticisms: Thematic workshops identified several critical issues hindering effective territorial development. First and foremost is the urgent need for inclusive participatory processes that actively engage marginalized populations and youth. Current methods lack the necessary standardized tools and methodologies, resulting in inconsistencies and exclusion of these key groups. Additionally, resource constraints pose a significant challenge. The

facilitation of participatory processes and implementation of territorial strategies is frequently hampered by insufficient time, budget, and skilled personnel.

Another major concern is the difficulty in demonstrating the impact of participation on project outcomes. This is compounded by the absence of robust monitoring and evaluation frameworks, making it hard to track progress and communicate results effectively. Furthermore, the existing siloed knowledge and limited tools are significant obstacles to territorial development. There is a notable gap in effective collaboration between public administrations, especially for strategies that span multiple municipalities.

Identified Solutions and Commonalities: To address these challenges, several common solutions emerged. Investing in capacity-building programs is crucial. These programs should focus on public administration staff, providing cultural training and developing technical skills tailored to territorial strategy implementation. Developing standardized tools is another key solution. Creating comprehensive toolkits and methodologies will facilitate inclusive participation and ensure consistency across processes.

Establishing knowledge-sharing platforms is also essential. These platforms, which could include online repositories, will allow the sharing of analytical tools, resources, case studies, and best practices, thereby fostering a more collaborative environment. Furthermore, promoting collaborative projects and networks between public administrations and research institutions will enhance experience exchange and resource sharing.

Emerging Methodologies: Several methodologies are emerging as effective approaches to these challenges. Leveraging partnerships with civil society organizations and research institutions is a key strategy. These partnerships can help design and deliver capacity-building programs and develop inclusive participatory methodologies. Additionally, pilot projects and workshops are valuable tools. They can refine monitoring and evaluation frameworks while providing training and knowledge exchange opportunities.

Advocacy for policy changes is another important methodology. Promoting policy shifts that enhance collaboration, knowledge exchange, and resource allocation across different sectors of public administration is vital for long-term success. Finally, establishing mentorship programs and exploring alternative models like secondments can reduce reliance on external consultants and foster internal expertise.

5. Final considerations

This analysis has delved into the complexities of multi-level governance within Sustainable Urban Development Strategies (SUDs) in Northern Italy. We examined the approaches adopted by the four key regions of Lombardy, Veneto, Emilia Romagna, and Piedmont, drawing upon a rich data set of stakeholder interviews, document analysis, and potentially survey data and thematic laboratory findings (depending on availability).

Our journey began by establishing the broader context. We explored the role of Territorial Strategies within the framework of the EU Cohesion Policy, highlighting the policy's goals and funding mechanisms that support regional development efforts. We then delved deeper into the principles and requirements of SUDs themselves, emphasizing their focus on achieving integrated and sustainable urban development.

The core of the analysis resided in Chapter 4. Here, we shifted our focus to the specific approaches adopted by each region. By delving into the data, we illuminated the intricacies of multi-level governance within each regional context. This examination revealed a significant variety in how each region implements SUDs, influenced by factors such as nomenclature, partnership approaches, integration of intervention sectors, resource types, and programming procedures.

Key Findings and the Need for Change
The analysis yielded two critical findings that demand attention:

1. **Rethinking Urban Policies and Planning:** The current landscape necessitates a fundamental shift in conventional urban policies and planning practices. The EU's approach to SUDs calls for a more participatory, integrated, and strategic approach grounded in multi-level governance principles. This necessitates a move away from siloed approaches towards a more collaborative and inclusive model.
2. **Institutional Capacity Building:** Strengthening institutional capacities is paramount for effective SUD implementation. This requires comprehensive capacity-building initiatives within institutions, enabling them to seamlessly integrate EU SUD principles into both ordinary and extraordinary urban policies. A particular focus should be on aligning territorial strategies with Cohesion Policy principles, developing effective implementation plans, and assessing the socio-territorial impacts of operations.

These findings raise a crucial question: **how does the diversity of SUD approaches adopted by different regions impact the actual territorial impact of these strategies on SUD and cohesion policy?** Further research is needed to explore this question in greater depth.

The Road Ahead: A Call for Cohesion and Capacity Building
As we look towards the future of SUDs in Northern Italy and beyond, it is essential to address the challenges identified in this analysis. By fostering a more cohesive and effective SUD implementation framework, we can unlock the full potential of these strategies. This necessitates embracing a participatory, integrated, and strategic approach, coupled with robust institutional capacities.
Here are some key recommendations for moving forward:

- **Strengthen local partnerships:** deeper collaboration between regional and urban authorities, research institutions, and civil society organizations is crucial. This can be achieved through co-design workshops, public consultations, and knowledge-sharing platforms.
- **Promote inclusive participation:** it is essential to actively engage marginalized populations and youth in the participatory processes. Developing standardized tools and methodologies can ensure consistency and inclusivity.
- **Invest in capacity building:** programs focusing on cultural training and technical skills tailored to territorial strategy implementation are crucial for public administration staff.
- **Develop standardized tools:** comprehensive toolkits and methodologies can facilitate inclusive participation and ensure consistency across processes.
- **Establish knowledge-sharing platforms:** online repositories for analytical tools, resources, case studies, and best practices can foster a more collaborative environment.
- **Advocate for policy changes:** promoting collaboration, knowledge exchange, and resource allocation across public administration sectors is vital for long-term success.

By implementing these recommendations, we can move towards a future where SUDs are a powerful driver of sustainable and equitable urban development in Northern Italy and beyond.

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Tiers Lieux And Wijkhubs: infrastructures for a "Situated Democracy" ?

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Abstract
To accelerate the transitions needed to alter current economic and cultural destructive patterns, our social, organisational and democratic structures have to be adapted, which includes a more profound collaboration between public institutions, private actors and citizens. French national and territorial institutions in Marseille and municipal councils in Rotterdam are, each in their own way, introducing and empowering new physical spaces (Tier Lieux and Wijkhub) with the intention to facilitate conditions that enhance active citizenship. In this research we critically analyse both attempts in order to see if these initiatives can be regarded as a form of "external and contextual" Situated Democracy; These places should have the potential to make a contribution towards new forms of situated citizenship, truly transformative based on its multi-scalarity, involving a specific *mixité* of publics and communities and accessible to the majority.

Full text

SITUATED DEMOCRACY - POLITICAL MATERIALITY - TIERS LIEUX - WIJKHUB

1. Introduction

1.1 Purpose of the article : how to realise the "Situated Democracy"?

In the face of *climate emergency*, there is a need for institutional and collective citizen engagement to be able to realise the multiple transitions that are needed to reach a more sustainable and just world. At the same time, we see a generalised and global representative-democracy crisis, where distrust between citizens and institutions is growing and democratic participation is dwindling (Lardeux 2019, Bertolone and Winock 2015, Gallo 2021).

Reinterpreting the Situated Knowledge (Haraway 1988) and Actor-network (Latour 2005) theories' principles, we can say that cultural contexts may provide a different way to frame and express needs in lifestyle changing. At the same time, in a globalised world, these are related and dependent on each other. A multi-scalar perspective towards problem definitions is fundamental to realise sustainable and just transitions. This vision of transitions makes explicit that participation of every "visible" or "invisible" actor and public is essential, making the contemporary "right to the city" principle mandatory for the transition paradigm (Lefebvre 1968).

Scholars and practitioners advocate that this shift regards a different way to both relate to Earth and to each other; a relationship based on reciprocity and empathetic understanding (Boella 2006). We are conscious that especially in this Anthropocene era that we as human beings need to rethink our relationship with Earth in order to survive as a species (Crutzen 2006).

However, for transitions to accelerate, an effective re-democratising of our societal organisation that includes collective citizen involvement (in the form of 'publics' or communities) plays a significant role (Horizon Europe …).

This article analyses the role that places can fulfil in contributing to exactly this societal organisation gap in practice, considering and giving consistency to the diversity of publics and communities of a defined context.

Places represent the tangible and local dimension for ‘transition management ‘to materialise (Wittmayer 2016). In addition, the notion of ‘*places of social innovation’ (POSI) can be described as places* where the planning of both physical and social public infrastructure take place (Ardill 2021). In order to be able to measure and understand the transformative social impact of such places of social innovation with transformative power, we should also evaluate the *situated* and contextual dimension of places, as externalised social and ecological assemblages as the building blocks of democratic and just transitions (Haraway 1989). The concept of “Situated Democracy” links both ‘place’ with ‘reimagining and reforming democratic structures’ and has therefore the potential to contribute to analysing this transformative potential of places. These places of ‘situated democracy' are “specific urban spaces, at a neither public nor private use, that looks specifically for concretising inhabitants aspirations in their own cadre de vie fabric”. They are localised, but have at the same time the ambition to influence their own urban scale fabric (Besson et Al 2022).

In Marseille we can detect a number of emergent places of “Situated Democracy”. These places are localised, but have at the same time the ambition to influence their own urban scale. This concept wants to stress the importance of an “internal” place where an initiative is set (not only their public space dimension as it is the case for protests) and where people experience “other ways *of faire la ville, faire société*” in order to build new common values. In other words, the democratic contribution to the urban fabric of places of situated democracy is being "A community of practice, capable of transforming the representation of the problem and constructing the procedural rules likely to solve it. This represents the first stage of the process of empowering actors/publics” (Besson et Al 2022).

This corresponds to the tangible and local “democratic” dimension that is needed for a transformative transitions management perspective (Wittmayer 2016), as an internal practical experience to be linked to complex transitions. The “situated and contextual” notions are in this respect related to an external and diffuse dimension of the local initiative, to how it enters in relation with the complexity of the urban fabric.

The original concept of “Situated Democracy” explains the “internal” democratic contribution of places (the tangible and local dimension), but not the “external” one (the situated and contextual), which is essential in re-imagining democratic structures.

Taking this original concept of “Situated Democracy” as a starting point, we want to add the definitions of “external and contextual” dimensions by deepening the following point:

Places of “Situated Democracy” are close to *Espaces Communs de Proximité - ECP* (Vignes 2021) ou *Communs de capabilités* (Lafontaine 2019), two visions of places inspired by J. Dewey and A. Sen theories. These places multiply occasions of meeting and practising activities with different people, stimulating cognitive *capabilities*. As a consequence, *mixité* (the variety of different social groups in a same area) should be a fundamental defining characteristic of places of “Situated Democracy”.

This article analyses how two European situated contexts and places, “Tiers Lieux” in Marseille and Wijkhubs-network in Rotterdam, foster transformative citizen’ engagement and imagination (“basic” situated democracy), but also to evaluate their kind of mixité, expanding the concept of “Situated Democracy” to its “external and contextual” multi-level dimension.

“Tiers Lieux” have hybrid forms of institutionalisation, Wijkhubs at the other side, are an institutional infrastructure. How do the two typologies of places attract a variety of social groups? How does their (inter)dependency on institutional infrastructure influence this? And

to what degree do these places contribute to a Situated Democracy and, in other words, contribute towards a re-imagining of democratic structures?

This research argues that for these places to really realise this re-imagining of democratic structures, and in order to be able to initiate and sustain these places as places that function as essential building blocks in transitions to a sustainable and just society, there is an apparent need of an institutional involvement that fosters the long duration of the projects and their network dimension.

1.2 Theoretical background - *situating* problems and purpose leading to the the analytical framework

1.2.1 Social or Ecological problems?

Transition or Sustainability are perceived and pursued, in different cultural (or geographical) contexts, in France and in the Netherlands. Generalising the discourse on the international debate, we see how the term “Sustainability” has lost frequency compared to the term “Transition”. The first is more related to development, to a given direction to take (UN 1987). The other seems to keep this discourse more open, in dialogue with anti-system rhetoric (Markard 2012).

In France ‘Sustainability’ is literally translated into “Durable”, focusing on a time dimension of future generations of projects. The associated discourse in planning calls for a real participation of citizens, and a change in procedures to get a less rigid and distant bureaucratic institutional structure (Grimaud and Stavrianakis 2021). Within the historical centralisation of the French government, citizens strive for liberty and appropriation. The “social” side of Sustainability supports hybridisations, fostering citizens' appropriation-participation in processes, where social innovations aim to find new more “personalised” and “alternative” ways of doing. The accent is on the social and organised communities that look for other ways out of the technocratic and capitalistic way of living.

In the Netherlands ‘Sustainability’ is primarily linked to ecological and economic concerns. The focus is related to changing the way human beings produce and consume. Large parts of the Netherlands were built by controlling water, which necessitated a close collaboration and consensus between public institutions, private companies and citizens. This collaboration, often referred to as' Polder mentality’ traditionally stands for this need to reach a shared understanding in order to survive. It results in an attachment to work, on doing concrete things together. Producing economic value is not perceived as “bad” as it could be in France.

1.2.2 Cultural context approach and problematization on transitions

In order to analyse and define the mixité as the external and contextual component of “Situated Democracy”, as Situated Knowledge (Haraway 1988) and ecological-political theories say, cultural context matters.

The “Situated Democracy” concept was issued from a Marseille based research on citizens' initiatives and contributed to the definition of the *not-defined* hybrid French “Tiers Lieux”. Officially originated as bottom-up initiatives, these places have recently been taken to the attention of the national institution by the Levy-Waitz report (2021) as places where to realise “the sustainable transitions of territories”.

If the original “Third Place” Oldenburg’s concept (1989) meant a different place from home or work to meet, the French contemporary *non-definition* took some more typical characters.

Despite doubts about the institutionalisation of the phenomenon that would affect their true experimental nature (Idelon 2020), these places are considered to be issued from bottom-up initiatives, driving the capacity for hybridization of worlds (Gwiazdzinski 2016) and of a highly celebrated new way of being citizens by "doing" (Burret 2013, Bonnot 2019).

However, the true diversity (the mixité) regarding the nature of publics (as gatherings of citizens, local entrepreneurs and other members of communities) *taking place* here is not clear. Several authors have expressed a risk that these third spaces rather foster gentrification than enhancement of a variety of population types (Correia 2018, Watine 2020, among others...).

Tiers Lieux have been presented by institutions, in a way, as places to realise a “Situated Democracy”, referring to these spaces as “neither public nor private initiatives”, or the so-called hybrid and in-between “third actors”. Despite their interest, local or national institutions are not typically providing structural funding for these often temporary experiences to subsist and have a real long term impact.

Institutions do not offer funding since Tiers Lieux cannot prove that they provide a public service. The risk of public services delegation is also seen as a danger for removing institutional responsibility in fundamental public services from French scholars (Richez-Battesti et al. 2012). Wijkhubs in Rotterdam seem to have what Tiers Lieux are lacking: they are sustained by institutions that provide a temporal duration and a network infrastructure dimension.

We argue that giving a contextual and external definition of “Situated Democracy” based upon Tiers Lieux and the Wijkhubs would also help defining their democratic contribution as a public service, to truly bring new *substance* to democratic and active citizenship.

As a *hybrid* initiative, aiming to be neither public nor private, the un-clarity about the definition of publics that visit or make use of Tiers Lieux seems to be one of its defining characteristics. This corresponds also to the still rather opaque notion of mixité, which would need to be analysed in its contextual and external situated dimensions.

We will analyse these dimensions using the Circular Value Flower - CVF method (Leclercq & Smith 2022), a multi-layered analysis method that starts from the actual community initiative and from there unravels the different layers of stakeholder engagements, spatial relational context and the impact the initiative makes by addressing the multiple values that have been created.

2. Methodology

2.1 Marseille and Rotterdam: second cities, major problems or solutions? Tiers Lieux in Marseille and Wijkhubs in Rotterdam; two case studies

2.1.1 A common “port” story

To apply our analytical framework in defining mixité as a contextual and external character, as we said, cultural contexts comparison is fundamental. We have chosen to compare Tiers Lieux in Marseille with Wijkhubs in Rotterdam, in order to say *how* those places are places of “internal” and “external” “Situated Democracy”.

Analysing the cultural context approaches and problematizations on transitions and how they frame to realise them (global/national political background) is the first step of the analysis, necessary to understand how then this can be applied to the urban dimensions of Marseille and Rotterdam, which have many similarities. They are both “second and port cities” in their own national context. On the other hand, it is on this national level that these two are then very different in how their frame “transitions”.

This helps even more the “contextual and external” (*situated*) point of view of the analysis, as it aims to cross perspectives that are common under some aspects, and opposite for some others, enriching the diversity of point of view and so the veracity of the analysis.

Despite the previous general conceptualisations about the two countries, Marseille and Rotterdam are both considered as the “un-disciplined” and “second cities” of their respective nations. Compared to Paris and Amsterdam, these two port cities are the most multi-ethnic, and industrial, not elitist and “cultural”. It is useful to compare these two cities from two different cultural contexts, since they both have a “second-city” and “alternative” perspective in their own contexts. They both have historically been two “délaissées” cities from the central authority, and developed a large number of vacant port related sites and other abandoned spaces. As a reaction, strong feelings of solidarity, stressed by the migrant influence, related to many bottom-up and autonomous citizens initiatives, regard both the two cities.

The energy crisis in the 70’-80’, the progressive dismantling of the city-centred port infrastructure, and the economic crisis of 2000 and 2008, caused decline of both cities physical, social and financial structures, which was followed in recent decades with new “central” funding to renovate these broken structures and to reinvest, in order to re-dynamize the two cities and making their inhabitants more resilient.

In Marseille, the *établissement public d’aménagement* Euroméditerranée in the 90’ was the starting point of this regeneration programme centred around the renovation of the Joliette Port Area. In Rotterdam its regenerative phase was symbolically kickstarted with the construction of the Erasmus bridge and its masterplan of the Kop van Zuid 1989, which included a variety of waterfront projects, led by private-public partnerships of port authority, municipality and private actors.

Both the two cities, especially Marseille, started attracting young artists, even before the institutional renovation processes, as cities of a certain liberty and “un-control”. Rotterdam, bombed heavily during the first WW2 was postwar literally an “empty” space to where creative talents were invited to come and experiment. Both the two municipalities try, more clearly and explicitly or not, to keep these different “creative class” populations in the city and create a more “mixed” and productive environment (Florida 2002).

2.1.2 “Institutional” or “social” lack of democracy?

The same comparable perspective can be seen on how the contemporary and escalating crises of representative democratic systems is presented.

In the last elections inhabitants’ voting behaviour demonstrated the same trends: the most disadvantaged communities perceive an increasing distrust in government and are increasingly less likely to vote, e.g. only 19% of the people in Rotterdam South voted in recent elections (Rotterdam Gemeente 2024).

In Marseille, the popular culture had a tendency to fight against the Paris-centred central state. The city has always hosted localised protests, that however never aimed to organise and

dialogue with institutions, in order to really have an impact on their purpose (Interstice research –Civis Open Lab 2022).

For Rotterdam, and more generally in the Netherlands, Femke Kaulingfreks in her 2023 academic year opening lecture at the university of Amsterdam, says that democratic crisis here is due to a lack of confidence not from citizens in institutions but vice versa: from institutions into citizens.

A cultural context has the tendency to present and then resolve the problem in a particular way. We make some very general considerations about the French and Dutch national contexts, without an anthropological and social-political in depth analysis.

The French academic visions or narratives on “problematization” of their contexts are based on critical philosophy (Lemieux 2012). This push to critique the government, and focus on collective capacity and solidarity, look for SDGs for changing in institutions

The Dutch are closer to a pragmatism philosophy and think more about doing things on their own, individual effort is the focus. The university of Utrecht (Jordan 2021) for example developed the IDGs - internal development goals, in which the focus lies on the individual and the interchange in the way people act, also in groups, to have an impact on the changes of institutions.

We want to understand both the different movements, how institutions can change to arrive at social initiatives and how social groups can organise themselves to change the system.

By analysing places of social innovation - POSI (Adler 2021) and using the concept of “Situated Democracy” (Démocratie située) we say that community-places can allow for materialisation of aspirations, visions and objectives of these “complementary” (and not anymore conflicting) groups and movements towards just transitions, to work as places of *transformative social innovations.*

Many hopes in situating just transitions *are placed* in two different spatial frameworks represented by places imaginary in the two cities : Tiers Lieux in Marseille and Huiskamer-Wijkhub system in Rotterdam.

In Marseille the idea is that Tiers Lieux can reinvent the industrial or other “friches” (empty spaces) of the city, and subsequently repair the territorial fractures of the not-homogenous city-territory.

In Rotterdam, these multi-scalar typology of spaces are financed by the municipality and work as a diffuse infrastructure of “Palaces for the people”(Klinenberg 2019), to enhance citizens’ engagement at the one hand, but also have a degree of control over them and the neighbourhood at the other hand.

2.1.3 How “Tiers Lieux” work

It is by Ray Oldenburg definition (1989) with which most literature introduces the Tiers Lieu (Third Place) - a place where people gather informally as an alternative to the first (home) and the second (work). Actually, this does not include the contemporary characteristic and process of abandonment and recovery in the circular urban fabric, which is therefore essential to the definition of contemporary French Tiers Lieu.

Gilles Clément and Patrick Bouchain's definition of Tiers Paysage helps to understand this. These two concepts both mean “the abandoned” (*le délessai*), neither formal nor informal, capable of embracing the dimension of uncertainty and provisionality - of *Lieux Infinis* (Infinite Spaces) (French Pavilion at the Venice Biennale 2018 - Encore Heureux) and making it a force for sustainable transformations of territories as a space for perpetual social and ecological experimentation.

The rapport Levy-Waitz officially represents the Institutional and academic appropriation and willing definition from the central-state, within its objectives.

This was requested by Jean Castex - French Prime Minister in 2018 - to understand the phenomenon of Tiers Lieux. The national institution was interested in these places for some main characteristics. They are considered the largest urban movement ever observed in France since the popular education movement, as they give concrete and practical contributions to civil society to address the challenges of transitions in our century in the territories. In Tiers Lieux, the creation of economic activities cannot be separated from social utility. They go beyond institutional frameworks and bureaucracy and therefore succeed where public policies fail.

This classification marks the passage for these experiences from “friches culturelles” and anti-system (Lextrait 2017) to the places of “transitory urbanism” for testing “unconventional” politics.

Despite doubts about the institutionalisation of the phenomenon that would actually affect their true experimental nature (Idelon 2020), since they are runned by “third actors”, that are neither public nor private actors but issued from the so-called “third sector” of the *Economie Sociale et Solidaire - ESS* (Social and Solidarity Economy), these places are considered to be issued from bottom-up initiatives, driving the capacity for hybridization of worlds (Gwiazdzinski 2016). They are presented as contributing to democratic and social innovations giving consistency to a “communautés de pratiques” as a new way of being citizens by "doing" (Burret 2013, Bonnot 2019...). Their aesthetic “contribution” is based on frugal and temporary space design, recalling their “not-conventional” dimensions. Many artists also express themselves through testing new styles in spaces design here.

The Levy-Waits report proposes some points of an analytical grid for Tiers Lieux, in order to define their overall contribution: These are their way to promote entrepreneurship in the territory, experimentation and social innovation, cooperation and free contribution, hybridization of activities, openness and conviviality.

Other analyses by independent and publicly co-financed research firms like Agence Phare, tried to understand their social impact under a territorial approach (Klein et al 2008), standing back to the *situated* dimension of these experiences in places.

The “temporary actions” network created by third actors like Yes We Camp association and Plateau Urbain cooperative, are called by the same actors as “urgency and festival urbanism” actions.

The temporal and transitory dimension of these experiences allows for excepting from rules and experiment, to generate “internal” social innovations. The consequences on how the “external” and contextual component then impact on space and time is not really clear.

2.1.4 How “Wijkhubs” work

The Wijkhub system is supported by the municipality of Rotterdam and works on a multi-scalar system of public infrastructure. The municipality of Rotterdam is separated in 39 ‘Wijken’ (districts) (Rotterdam Gemeente 2024) represented by their own council. Every Wijk has at least one Wijkhub, as a public services centre, and a Wijkhouse, for more social and cultural activities. Then, every citizen can present and submit their own initiative to open a Huiskamer (living room) in the neighbourhood. These are literally some “salons on the street” and cover the “buurthuis” street dimension, that is the very proximity of the street.

This is a way for the governmental system to know more from the territory and to test this system in Rotterdam.

Citizens have the opportunity to use municipal funds to support the opening of a Huiskamer, in light of their own interests and to improve the liveability in their direct proximity, for example by greening activities, as ecological function. They have the occasion to make and work together towards just transitions, and see the effect in their everyday life, just in front of their house.

Aesthetics of these places are really like family living rooms, and make people feel atThe most recent and advanced analytical framework used in literature to analyse Wijkhubs experiences is the CVF.

The value flower method (Leclercq & Smit 2022) seek to measure value of circular activities in these places, measuring the following points: Community aspirations and activation capital; Collaboration methods and processes; Resource cycle (from an ecological perspective); Physical development (how initiatives translate into space); Generated values

2.2 Research approach: Data collection and analysis

The research approach is based on quantitative and qualitative data collection and analysis.

Comparing perspectives from two different cities and cultural contexts demonstrates how “sustainability” means differently depending on this. We focus on France and the Netherlands, looking for associated key words to “Sustainability” and/or “Transition”, in the last 10 years academic discourses. For the French context the research was made on Cairn.info, for the Dutch on TU Delft University and Amsterdam University portals.

We also used literature and quantitative data for general description of Tiers Lieux and Wijkhubs typologies, also using local non academic reports.

Qualitative research is based on a participatory-observation (Bastien 2007) experience, in different time and spatial levels. We focused on the Marseille Coco Velten Tiers Lieu that was temporarily installed in Belsunce central and “prioritaire” neighbourhood, from 2018 to 2023. In Rotterdam we observed the vibrant neighbourhood of Delfshaven and its multi-level Wijkhub network including Het Bollenpadje Huiskamer .

We use our analytical framework, inspired by the CVF, to compare Tiers Lieux in Marseille with Wijkhubs in Rotterdam, in order to say *how* these places are places of “internal” and “external” “Situated Democracy”, through their own and *situated-contextual* definition of mixité.

The analysis consider these following steps:

The chapter number 2.1 defined how these two contexts created two different places of “Situated Democracy” in the “internal” dimension: Tiers Lieux origin and problems, framework analysis that already exist (Rapport Levy-Waitz); same for Wijkhubs. In both cases we put into light the “formality” degree of actors initiating and taking place in the initiatives (from un-organised citizen to multi-level institutions) from the “internal” point of view and how the “internal” innovation (the produced value) is realised (what are the “pratiques” of “the communities of pratiques”...). This also means to analyse the context as relational context (who are involved), enabling capital context in spatial context.

We will now define in chapter number 3 how Tiers Lieux and Wijkhubs create “Situated Democracy” in “external and contextual” mixité dimension. As the Circular Value Flower (CVF) does for “circularity values”, we want to analyse the previous points in Tiers Lieux and Wijkhubs as a “mixité degree” value. How does the “formality” degree of actors initiating and taking place in the initiatives (from un-organised citizens to multi-level institutions) link to the produced values from the “external” point of view ? The external point of view is given by situating, describing the spatialisation (acts in real life) or projection (internet or social

network) of the internal particular “Situated Democracy” value into the different levels of the context. Following the CVF the multiple value creation is based on those 5 elements – economic, social, cultural (in this lies the democratic structure) aesthetic and ecological. The different levels of the context are the “buurthuis” or proximity dimension, the neighbourhood, the city, upon different temporalities. We want to measure this capacity by superposing CVF questions in different space and time levels.

In what way and how the element of ‘mixité’ of places of “Situated Democracy” helps define its contextual and external dimension? Among the mixité of differently organised and formally defined publics or citizens’ communities taking place, what is and how does it take place, the role of institutions in ensuring this ? Which publics are included or excluded? But especially, where and when? How do these scales enter into relation among each other?

This will define the mixité degree of a place as an “external and contextual” dimension of “Situated Democracy”, that is able to measure “spatial” and “temporal” value in order to define a place's relations with other different communities.

2.3 Limitations of the research

The research qualitative analysis does not reach and exhaust the variety of these socially innovative experiences, but tries to define two contextual based typologies related to the respective urban fabric dimension. As an ontological limited point of view and analysis, this calls for more perspectives and experiences to be enriched, in space and time dimensions. This makes on the other hand that even a limited number of points of view has an epistemological value for the research.

The case studies are described here under a very succinct synthesis compared to the complexity of the processes. This text wants to only be a first introduction to them.

3. The analysis - Defining how Tiers Lieux and Wijkhubs create “Situated Democracy” in “external and contextual” mixité dimension

3.1 Coco Velten Tiers Lieu and other Marseille networks

3.1.1 Description of the case

In the Ilot Velten block, between the Porte d’Aix monument square and the limit of Belsunce neighbourhood (figure 1), lies Coco Velten. This place is part of the dynamics of temporary occupation of public-owned urban wastelands, to experiment with new uses other than privatisation, to promote a mix of activities and occupants: it combines spaces for professionals and artists who want to engage in the circular and solidarity economy with temporary housing for people in difficulty.

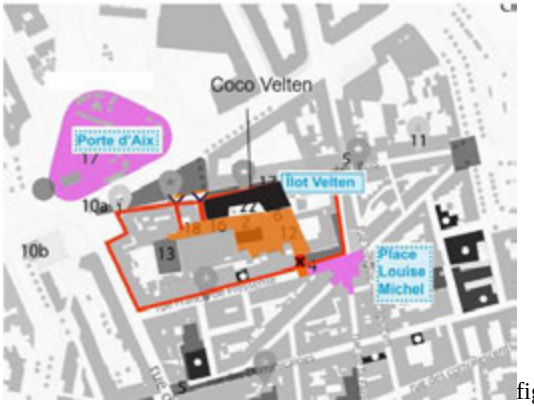

figure 1, schema of the position of the Velten bloc (ilot) in Belsunce neighbourhood nord side, Borrello 2020

3.1.2.Stakeholder network & mixité

The project was led by the association Yes We Camp, supported by the SOS Group and the cooperative Plateau Urbain.Yes We Camp - Ywc was founded in Marseille in 2013 with the acquisition of a temporary permission to occupy a site (that will later become the Foresta project) for camping during the Marseille European Capital of Culture events. However it was in Paris with Les Grands Voisins experience that the “third actor” association model of temporary occupation truly developed. This model was then reproduced and implemented at Coco Velten with the initial support of Lab Zéro, a laboratory of the regional prefecture, and Marseille Solutions, a local association on development of solidarity projects.

Ywc mediates as a third actor as it works by a 60% of self-funding, by the “cantine” bar and restoration sources, and by a 40% of central-state contribution.

Compared to other local actors, they have the possibility to experiment new innovative forms of doing that are still not defined, but they are at the same time structured enough to communicate and have an impact on institutional decisions.

The “internal” innovation of Coco Velten is made by having around twenty regularly paid persons involved in the project (only counting the Ywc side and without counting the other association’s équipes distributed in France), getting open the place almost all week long as any commercial bar activity and also offering a special programmation in week-ends. At the same time employees are often well educated people that chose to earn the minimum wage salary for working in a vibrant environment where competences and skills are, in part, always mixed and evolving following situations.

Inhabitants of the emergency housing have also the privilege to interact with the variety of free cultural activities and participate actively in, becoming strong members of the team.

Also volunteering constitutes a way to integrate the vibrant environment, especially for running the bar during the events. As we said, the bar is the first source of financial support.

Coco Velten is a central-state property building set in a municipality block, where other actors of the ESS take place.

figure 2. La terrasse de la cantine, Yes We camp 2021

figure 3. View of the block “coeur d’ilot” from Coco Velten rooftop - the closed access on Belsunce nord side. Borrello 2022

3.1.3 External and contextual situated democracy

The municipality decided for security reasons to only open the block on the Porte d’Aix side, without relating it with the other Belsunce entrance (figure1). The cantine’s terrace also needed to be protected by some opaque barriers separating from the rest of the bloc-ilot space (figure 2).

Because of these physical barriers and limitations, Coco Velten was not visible for the majority of citizens’ of Belsunce (figure 3)

On the other hand, thanks to Yes We Camp reputation in France and its big network, Coco Velten managed to create some occasions to coordinate and impulse some cultural common activities among the associations of Belsunce, attracting many participants from all the city, like in the occasion of the Babelsunciades Festival, that re-impulsed an ancient local festival initiative (figure 4).

Nevertheless, as it was planned to be, even after a two-years prolongation, this experience only lasted from 2018 to 2023.

The many disadvantaged and excluded people that found here a welcoming and free place where to be appreciated and “valued” are now back to their “abandon”.

figure 4. Communication flyer by Yes We Camp 2020

3.1.4 Other networks

The experience of La cité des Transition is an essay of a municipal initiative network around associations and companies involved in the ecological and social transition in Marseille. The *Transition Ecologique* delegation at the municipality financed a three year research project for tracing local initiatives on the whole urban territory. After having constituted a group of interested and involved organisations, the guide of the project passed to a temporary private or third sector “bureau” that organised the elections of the permanent *Conseil d’Administration*. This initiative is in 2024 at its early stages, but the common objective and “manifest” of the cité is clear: to take Marseille to a just ecological and energetic transition and imagine working on a project-based methodology to collaborate. The democratic participation on this network process shows a private and public collaboration under this objective, as well as the long length of the ongoing process. For the moment, the cité hasn’t found a physical open infrastructure to situate and after an open public meetings phase for building its governance model, and when losing its institutional support, it’s now more retracted and focused into its internal construction.

3.2.2 Het Bollenpadje Huiskamer in Rotterdam Delfshaven Network

3.2.1 Description of the case

As it is the case for many Rotterdam Huiskamers (Avest et Sepp 2015) Het Bollenpadje was born from another project in another location of Rotterdam, before getting permission and funding from the municipality to set up in Bospolder side of Delfshaven neighbourhood.

Three women founded the place in 2021 and are responsible for it, since they have some paid hours from the municipality, even though the time spent for the initiative is never counted. One of them needs to respond to regular municipal controls on activities and demonstrate the positive impact of the initiative on the “buurthuis” street dimension.

3.2.2.Stakeholder network & mixité

This place should be a collective public living room, where everyone can enter and feel at home. Its aesthetic follows this principle as everything is curated and cocooned as we would like to be at home (figure 5). Habitual people from the neighbourhood have keys and can open and go there whenever they want. Everyone that passes in the street is welcome for a coffee. The open and buurthuis-central position of the place invites to get in or to know more about (figure 6)

figure 5. View from the inside. Borrello 2023

figure 6. Het Bollenpadje is situated at the intersection of Rosier Faassenstraat and Catharina Beersmansstraat. Borrello 2023

This place is very important for intergenerational exchange and fighting against isolation. “While making things together, we open our earth to each other” says one of the officially responsible people of the place.

Anyone who has a project can be helped in realising this, and every event is welcomed and can be hosted there.

3.2.3 External and contextual situated democracy

The strong externalised dimension is not only visible from the street, but thanks to many outdoor activities. More than greening, the “Bospolderplein soup time” is a moment when habitual neighbours go together and stay in this huge close open space, that in normal times is not always welcoming for everyone (figure 7).

figure 7. A cart is used to take soup and drinks in the close Bospolderplein

A habitual neighbour explains: “You can organise things yourself as a resident group up to a certain point, after that you need the municipality and systems to tackle bigger things. Entering into that collaboration is possible here.”

All the variety of Huiskamers in Delfshaven, that are an exceptionally high number compared to other parts of the city, are related to the central Pier 80 Wijkhouse, where primary public services are provided.

3.2.4 Other networks

The network dimension of these local experiences, is for example also given by energy cooperatives initiatives, like the DelftshavenCooperatie. This is a grassroots initiative (in some parts financed by the municipality) that links the different wijk of the macro-area of Delfshaven, Bospolder, Spangen and Tussendijken.

In this same neighbourhood we see other examples of both municipal or independent networks to strengthen forces. This is the case of the BoTu alliance of Huiskamers, where Het Bollenpadje is also part, related to the broader programme BoTu (figure 8). This program aims to mix and influence de Tu (Tussendijken) wijk, poorer, with the Bo (Bospolder), where residential renovation has already started and a more mixed population is setting in.

figure 8. Picture of the BoTu Huiskamer network flyer, Borrello 2023

3. Discussion

Analysing the contextual and external dimension of two specific innovative experiences, we want to answer the question of how Tiers Lieux in Marseille and Wijkhubs-network in Rotterdam can contribute to democratic and just transitions, from an institutional perspective and a citizen-communities one, from the Marseille “social” and the Rotterdam “technical-ecological” one. These points of views are all complementary and needed.

To what kind of mixité of communities and publics do these places refer? What is their democratic contribution to it?

The democratic value of Wijkhub-network in Rotterdam seems to be linked to the very strict local scale, the ‘buurthuis’, that privileges a more mixed component of publics especially in age gap.

If the “exhaustive” mixité is not always guaranteed, municipality “officially” gives the possibility to create a large number of different places for differently mixed communities.

Superdiversity is often related to Rotterdam particular identity (Scholten et al 2019) and our analysis showed how this identifies with the ‘buurthuis’ communitarist spatial dimension. It is not clear then how these different communities interact with each other.

Huiskamers in the Wijk-network depend on public financing and have a very “technocratic” way to demonstrate social impact, that exhausts social workers and distorts the “social” and democratic contribution of these initiatives.

For the case of the Tiers Lieu Coco Velten, the autonomous funding by the cantine-bar activity disturbs in a way their democratic component too. In order to offer free public events, bar incomes are very important and the équipes take the habit of inviting the same artists they know, since they have a lot of not preview “social” work and less time.

As a hybrid initiative, the other side of dependence is on institutions. Coco Velten had also a particular case of conflicts among different institutional levels since the building where the initiative set was of the central-state property while the coeur d’ilot block was a municipal

property. The misalignment of visions and wishes contributed to the isolation of Coco Velten from the neighbourhood of Belsunce.

Furthermore, the équipes didn’t have enough competences and the time to focus on the social value of a complicated neighbourhood as Belsunce, without the urban dimension institution of the municipality.

Especially, the contextual and social contribution was not really possible since the experience was imagined as temporary, even though everyone implicated was hoping this not to be the case.

The national Network of Tiers Lieux Cooperative asks for a durable support by institutions as these are places offering a public service, but they are not able to demonstrate social or public impact.

They are places of “the right to test and risk” (Besson 2021), where different people mix and foster hybridity, scaling up “transformative” messages from there to the institutional scale. Technocratic ways to demonstrate mixité or participation of citizens, or to produce economical value are often excluded as qualities of these places.

On the other hand, the street and neighbourhood dimension here seems to be farther. Tiers Lieux are places of the “exception” and are less numerous and diffuse than Wijkhubs-network.

4.Conclusion

Defining how (where and when) places foster “Situated Democracy” allows to define their contribution to the urban fabric as a public service.

Our analysis has shown a method to define the mixité degree of a place as an “external and contextual” dimension of “Situated Democracy”. This answered the two main questions of understanding if these external and contextual elements can be found in these examples of Tiers Lieu and Wijkbub as a form of ‘situated democracy’, and if these dimensions are a valuable contribution to the concept itself.

Wijkhubs are very well contextualised and externalised in their proximity-buurthuis dimension, but less on a neighbourhood and even less on an urban scale. The mixité of publics, if realised, is stuck into these territorial short dimensions. The role of the institutions through its infrastructure should facilitate the network dimension, but in practice this is not really the case.

Tiers Lieux are well connected to the urban-fabric dimension, but not really to their proximity environments. The kind of mixité comes from people from different parts of the city. Indeed they are represented by people having a specific and homogenous aesthetic taste, that looks for the “exceptional” and “alternative”, anti-ordinary-

The role of institution is officially for fostering hybridisation and institutionalisation of bottom-up initiatives, but here we don't know where “the bottom” comes from.

In Marseille Tiers Lieux are not related to elected councils like it is in Rotterdam and they don’t have this “vocation” not even in the institutional narrative. Tiers Lieux are places where to experiment, where institutions meet citizens. Tiers Actors would like these initiatives to stay hybrid on one side, but having structural and long-term public funding on the other. Is this a contradiction or a force point of Tiers Lieux?

(Multi-level) Institutions seem necessary to guarantee coordination among the parties, as different communities are in order to assure the citizen-individual engagement and action, for appropriating future common visions and actualising change. A Rotterdam ‘buurtuis’ institutional approach based on proximity and practical activities to “circularity” foster a mix of participation, but lacks on coordination among the different groups in the city. A Marseille Tiers Lieux approach doesn’t relate to definable territorial or spatially exteriorised dimensions and is a short and limited experience in time. The mixité of people taking place here is not measurable under these dimensions, as is their democratic contributions.

These outcomes open for more research on how defining public(s) identities to realise just transitions and on the role of spatiality, in giving consistencies to identities and so to possible common directions to transitions.

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Track 07: Environment And Climate

ENVIRONMENT AND CLIMATE - Planning for resilience, sustainability, climate change and the environment

Chairs:

- Mauriel Maillefert, Université Jean Moulin Lyon 3
- Francesco Musco, IUAV Venice
- Subhashree Nath, Technische Universität Dresden

Keywords: *circular economy models, nature-based solutions, socio-ecological-technical systems, planetary boundaries, resilience, biodiversity, urban greenery, urban metabolism, social and environmental justice, urban and regional planning, climate change mitigation, sustainability, climate action, climate justice*

Faced with the challenges of climate change at different levels (international, national, regional), public policies and local authorities need to adapt quickly. Various legislative measures have already been put in place, particularly in France, in line with European directives. For example, the Lyon metropolitan area has proposed a territorial climate and energy plan and a health and environment plan to address the health issues associated with air pollution. Measures to reterritorialise agriculture, in line with the challenges of the circular economy, are also being taken. As far as businesses are concerned, circularity initiatives (Vallée de la Chimie) and even model transformation initiatives (textile revival, urban renewal, regeneration of urban wasteland) are under discussion or are starting to take effect.

Public authorities are also putting forward a new argument for accelerating change and making urban areas more resilient and less dependent: promoting a transformation in uses and lifestyles. For example, the city of Lyon offers training courses to its employees to raise their awareness and motivate them to take action. These actions support a number of different initiatives, such as the introduction of organic food programmes in school canteens, which is currently a very important issue, as it highlights different aspects of changing practices and access to healthy food, which also helps to address certain issues of equity in changing models for children.

In academic terms, these issues are addressed in a number of ways: through discussions on transitions, changes in models or, on the contrary, resistance to change. Through work on ways of bringing about change, in particular by favouring a more co-constructed vision of public policy that goes beyond the legal mechanisms for participation. Finally, field experiments are carried out at the local level to initiate and test model changes.

This track aims to address some main issues and innovations in spatial planning coping with current global challenges such as climate change. Theoretical debates and planning practices that make urban and territorial systems more resilient and support the transition towards more sustainable scenarios on a local and global scale may be welcome.

Possible topics to include:

- Circular economy and new urban economic models
- Transition drivers for a sustainable development
- Local actions vs. global imbalances
- Spatial planning for climate resilience
- Methods, tools, and practices to address climate change and disaster risk
- And more.

Urban heat mitigation effect and affordable housing greenery injustice measured by Green View Index (GVI): A case study in Washington, D.C.

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Abstract
The deterioration of living conditions is highlighting the benefits of urban greenery for creating sustainable cities. Using Washington D.C. as a case, we demonstrate the performance of GVI and examine disparities in greening surrounding affordable housing. With the pre-trained segmentation model, we generated GVI based on 54,691 Street View images and applied the Spearman's correlation analysis to examine LST cooling effect. We found that LST shows significant negative correlations ($p<0.001$) with GVI and newly developed GVI-3D with coefficients of -0.60 and -0.73. The distribution of GVI in residential zoning was polarised, affordable housing projects have less greenery. In conclusion, we argue that it is of practical significance to monitor GVI instead of large scale NDVI for urban environments due to its controllability and human-centric attributes.

Keywords: Green View Index, Temperature mitigation, Street greenery, Housing environment, Environmental justice

1 Introduction

Our human society just experienced the warmest decade on record between 2011 and 2020 (WMO, 2023). For the global majority living in cities, urban heat islands represent an issue for both livability and health. Given the heat-absorbing properties of greenery, researcher have developed a range of vegetation-related indices to examine the climate change mitigation potentials such as (Normalised Difference Vegetation Index) NDVI (Yue, W., et al., 2007; Chun, B. and Guldmann, J.M., 2018.), and examine distributional equity such as park areas (Nesbitt et al., 2019), while they are all plat 2-dimensional indices which cannot drill down to accurate small-scale space analysis and vertical vegetation detection. The Green View Index (GVI) (Yang et al., 2009; Li et al., 2015) provided a refined and 3-dimensional metric for quantifying urban greenery by authentically simulating pedestrian's visual experience and perception, thus reflecting the actual exposure of humans to greenery (Cho et al., 2010). Advances in computer vision and image processing tools now make it more feasible to examine the impact of GVI on urban environments. In this paper, we add to the literature by measuring the relationship between urban green space and land surface

temperature (LST). Using Washington D.C. as a case, we demonstrate the performance of the GVI, and use it to examine disparities in urban greening surrounding affordable housing.

2 Literature Review

Urban Heat Island (UHI) effect is the thermal aggregation issue coming with urbanisation and industrialisation, which leads to increased human health risks (Heaviside et al., 2017) and influences socioeconomic development (Rizwan et al., 2008). In the 21st century, an increasingly urbanised population over 3 billion are directly exposed to UHI in worldwide (Rizwan et al., 2008). Simultaneously, cities' physical environment and spatial structure (Shaker et al., 2019; Cao et al.,2022; Gage & Cooper, 2017) greatly influence the distribution of UHI causing environmental justice issue where different groups suffer distinctly due to their locations, greenery environment around housing and demographic characteristics. Affluent neighbourhoods, high-income groups and the white population in United States (Harlan et al., 2007; Mitchell & Chakraborty, 2015; Hsu et al., 2021) were widely considered to have environmental advantages and low heat exposure risks, while the vulnerable populations suffer more.

Even though a large amount of greenery indices were invented (Bannari, 1995; Huete, 2012) to respond the UHI exposure problems based on different criteria, "the most widely used index remains the NDVI" (Bannari, 1995, p.114). The impact of significant greenery index NDVI on the urban environment, especially the thermal environment was meticulously examined by many scholars. Lo et al. (1997) verified that irradiance with an emphasis on commercial and services land cover contributed to the development of urban heat islands, he found there was a negative correlation between NDVI and irradiance of different land covers. In addition, Li et al. (2011), Grover & Singh (2015), Jamei et al. (2019), and Chakraborty et al. (2020) all concluded that NDVI, in conjunction with other built environment indices can significantly predict Land Surface Temperature (LST) on the regional scale.

In contrast, GVI, after the automatic extraction and calculation method revolution by Li et al. (2015), as an emergent index measuring urban vegetation in three dimensions, only limited research investigated its impact on the urban environment. Sabedotti et al. (2023) examined the association between GVI and air pollution such as PM 2.5, nitrogen dioxide, and carbon dioxide, and found an interquartile range increase of GVI can contribute to a 7.4 percent decrease in NO2. Other scholars scrutinised the relationships between GVI and greenery accessibility and environmental justice (Li et al., 2015; Li, 2021), human recreational behaviours (Villeneuve et al., 2018; Lu, Y., 2019), walking time, (Ki & Lee, 2021; Lu, Y., 2018), GVI best path (Zhang, J et al., 2022) and road parameters (Dong et al., 2018). These studies present GVI's significant values and exact measurability to the built environment. However, there is simultaneously a deficiency in the study of applying GVI to measure mitigation of the Urban Heat Island (UHI) effects measured by Land Surface Temperature (LST), especially the contribution of the vertical side view of greenery that can closely represent the real volume of the cooling source.

This study thus focuses on temperature mitigation effects and urban greenery environment measured by GVI, which first examined the distributional and genus difference of GVI in Washington, D.C.'s *'Local North'* and *'Local South'* wards with different residential and housing environment. We tried to explore applying GVI and newly refined metric (GVI-3D) to measure and examine the relationship between urban street greenery and UHI represented by LST, and examine the different contribution from street greenspace measured by GVI, GVI-3D and NDVI toward heat mitigation.

3 Data and methods

3.1 Study areas and background

The real estate risk appraisal program conducted by the Federal Home Loan Bank Board (FHLBB) in 1935 assigned a 4-point grade concerning infamous security (Hillier, 2003), which revealed the modern history of inequality in 239 American cities. Since then, the fourth grade and labels of hazardous areas were assigned to most neighbourhoods with African Americans. Since then, inequality transformed into racial steering. Washington, D.C., *'a city with a legacy of Black plurality'* (King et al., 2022), seemingly disenfranchised its Black residents' rights to socioeconomic and political equality (Conrad & McNeil, 2010; Lloyd, 2014; Kijakazi et al., 2016; King et al., 2016; Golash, 2023). The city's diversity and complexity contribute to its local dilemma as a global city where historical and modern inequality exists extensively, nowadays Washington, D.C. has serious polarisation represented by an expensive housing market (Bright MLS, 2023), lowest homeowenership rate nationwide (FRED, 2023) and high unemployment rate (USAFACTS, 2023). On the other hand, urban greenery, as one of the most important built environments, not only plays the role of public infrastructure but also has economic attributes that could affect people's settlement choices. Scholars found that some special income (Ki, D., et al., 2021) or ethnic groups (Li, X., 2021) lived in neighbourhoods with high or low GVI. Washington, D.C. is a model city in the U.S. where the urban greenery work deserves, many actions such as the District of Columbia Urban Tree Canopy Plan, DC State Forest Action Plan (SFAP), and other management strategies and assessment work (Fang et al., 2020) contributed to the improvement of urban greenery environment. Although 9 percent urban tree cover is desirable (Government of the District of Columbia, 2010), detection of local gaps and equitable development are also important. Therefore, we highlighted *'Local North'* Wards 3 and 4 with poverty and *'Local South'* Wards 7 and 8 with study areas. The poverty rates for Wards 3, 4, 7, and 8 were 9.1 percent, 11.4 percent, 27.7 percent and, 36.8 percent respectively according to D.C. State Data Centre Visualisation Portal (Ilena, 2019).

Fig.1 Study areas in Washington, D.C.

Tab.1 Basic information of selected and unselected areas for study

Label	Ward	Population (2014-2018)	Poverty rate (2019)
Selected study areas	3	85,067	9.1%
	4	87,775	11.4%
	7	81,299	27.7%
	8	85,024	36.8%
Other wards	1	85,134	13.6%
	2	77,791	14.3%
	5	87,850	17.7%
	6	94,558	13.4%

3.2 Data and Source

Our workflow is to apply indicators of urban greenery environment including NDVI, GVI, and GVI-3D to examine their different contribution to the indicator of urban thermal environment represented by LST (Fig.2).

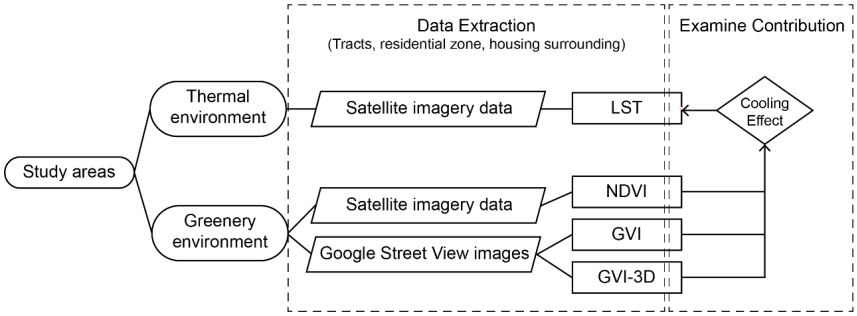

Fig.2 Overall data workflow

3.2.1 Greenery environment data

The image dataset used here is the Auto Arborist Dataset, which is a large-scale dataset extracted from Google Street View images that joins public tree censuses from 23 cities with a large collection of street-level and aerial imagery over 2 million (Beery et al., 2022) taken on or before 1 Jan, 2018. This dataset focuses on street trees containing at least one tree stem captured in each individual image, and Beery, et al. (2022) identified detailed genus information for each image. To align with the image acquisition date from the Auto Arborist Dataset images and conduct comparison analyses with time continuity, we tried to use all other data close to the acquisition time of the street image data. To obtain better resolution for comparison analysis, the Normalised Difference Vegetation Index (NDVI) is calculated based on a cloud-free Sentinel-2 satellite imagery data captured on 30 July, 2017, with 10m*10m grid-cell resolution.

3.2.2 Thermal environment data

Similarly, to respond acquisition time of street view images from the Auto Arborist Dataset and ensure the time continuity of comparison analyses, we calculated the LST based on data collected between 2014 and 2018. The LST dataset is from Open Data DC, it was computed from 2014 to 2018 and the resultant temperatures were averaged together to produce this *'5-year average'* data.

3.2.3 Affordable housing data

Despite there being many policy tools supporting Washington, D.C.'s housing affordability, the 'affordable housing development community relies on heavily is the *Housing Production Trust Fund'* (Brian, 2016). Only in 2003, the HPTF obtained 15 percent of revenue from deed transfer and recordation tax (DC Council, 2004). Housing Production Trust Fund (HPTF) has the form of revolving loan and is entirely funded by money raised within the city, and are therefore closer to the local market and housing supply and demand. HPTF provides developers with "gap financing" to directly build affording housing for low- and extremely low-income groups. Therefore, we believe that the greenery environment around affordable housing projects has strong correlations with HPTF. The HPTF affordable housing data were between 2010 to 2022, their coordinate data and basic information were grabbed from Google Maps using Python programs according to their project names listed in each HPTF annual report. Other Open Data DC datasets include zoning district boundaries in 2016 and ward boundaries in 2021.

3.3 Methods

3.3.1 Street-level indices calculation

With the pre-trained semantic segmentation model of OpenMMLab where the training dataset is Cityscape and the framework is DeepLabV3. Vegetation areas were inferred and GVI was calculated based on 54,691 Google Street View images in study area including Wards 3, 4, 7 and 8. Former studies developed different calculation methods of GVI. Li et al. (2015) revolutionised the calculation method of GVI and the whole workflow by introducing panoramic Google Street View pictures combined with images with more angles and semantic segmentation algorithms, thus automating the extraction of GVI from 6 images

covering the 360° horizontal surroundings. On these bases, some scholars such as Dong et al. (2018), Ki & Lee (2021) and Li (2021) have proposed simplified formula, but they all follow the fundamental logic of calculating the proportion of green pixels in street images using a large amount of data with geospatial locations. This study follows Ki, D. and Lee, S.'s method. The formula is shown below:

$$\mathrm{GVI} = \frac{Number\ of\ Green\ pixels}{Number\ of\ Total\ pixels} * 100$$

The GVI ranges from 0 to 100 percent, where a higher value indicates more greenspace are available in a single image. The green pixels in the example of segmented results represented the greenery on the streets (Fig.3).

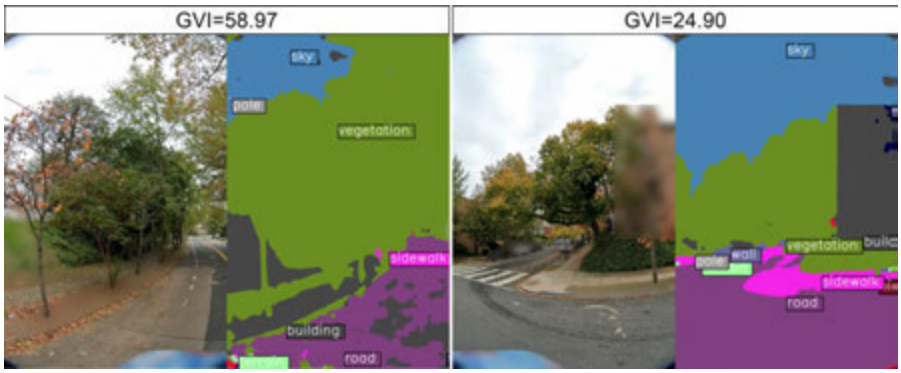

Fig.3 Examples of different GVI images

The NVDI is calculated based on the formula below. In order to better compare NDVI with GVI, we normalise NDVI by multiplying 100, all the following NDVI metrics in this article are normalised NDVI:

$$\mathrm{NDVI} = \frac{NIR - R}{NIR + R} * 100$$

GVI is highly structural data because it is alongside the urban street networks based on Google Street View map. But NDVI and LST are relatively continuous spatial data that cover all land surfaces. Given the width of streets with data collection location and mature tree canopy diameter of less than 18m (Phillip, 2020), we first used segmented street space with 18m width along streets and 30m length perpendicular to extract mean GVI, thus most tree canopy can be included (Fig.4). Same street space was also used to extract mean LST and NDVI. To examine the relationship between the tree genus and LST, other buffer areas with a 10m radius based on each individual image location were used as statistical areas. All analyses were conducted with Python, R, and ArcGIS pro.

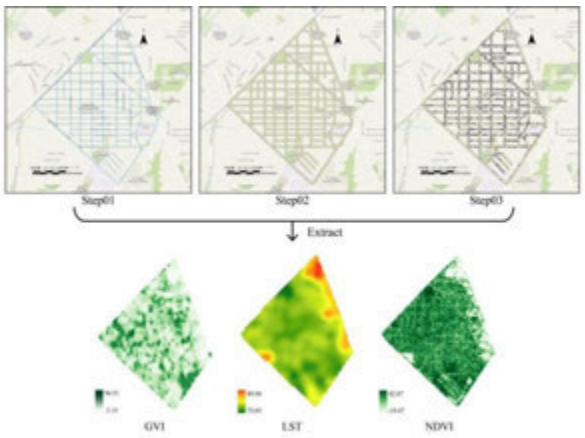

Fig.4 Extracting mean indices from segmented street space in Ward 3's Tract 10.01

Scholars addressed that GVI is a 3-dimensional index, but it virtually only represents vertical greening elevation with depth. To better describe the 3-dimensional greenery volume, we further develop GVI-3D following the logic of calculating the volume of a tree cone (Fig.5). In our study, we think of trees approximately as cones, the NDVI measured from overhead by satellite represents the base area of the cone, the root of GVI represents the height of tree canopy. Therefore, the newly developed GVI-3D can be calculated as follows:

$$\text{GVI} - 3\text{D} = \frac{1}{3} NDVI * \sqrt{GVI}$$

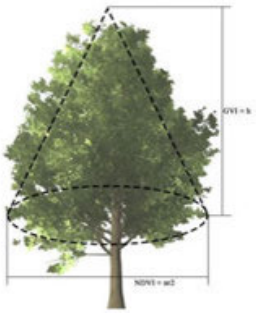

Fig.5 The calculating logic of new developed GVI-3D

3.3.2 Correlation analysis and Linear Regression

This study focuses on the mitigation impact of greenery variables on LST. To investigate the correlation among LST, GVI, and NDVI, Spearman's correlation analysis was applied. To examine and compare the cooling effects, bivariate correlations were first conducted between LST and GVI, and LST and NDVI respectively. To further examine the comprehensive effect of greenery volume measured by GVI-3D, the ordinary least square regression model (OSL) was used to examine the association between LST and GVI-3D. Variables for 4 Wards were calculated both individually and collectively.

3.3.3 Greenery environment examination in residential zones and affordable housing surroundings

Housing greenery environment was conducted at all residential zoning areas including Residential Apartment Zone (RAZ), Residential Flat Zone (RFZ), Residential Zone (RZ), and 22 sub-zoning areas, and 500-meter buffer areas of 98 affordable housing projects between 2010 and 2022 in four wards. We used descriptive statistics to scrutinise the macro-level districts and micro-level housing greenery environment.

4 Results

At the macro-quantity level, the number of street view images containing trees is similar. *'Local North'* Wards 3 and 4 have 12558 and 11559 images respectively, while Wards 7 and 8 have 16871 and 13703 images. However, the urban greenery disparities were clearly revealed in other statistical perspectives including per capita occupancy, mean GVI, temperature cooling effect, tree genus, and residential and affordable housing greening environments. Every 6.79 and 7.32 people share one tree/vegetation point in Wards 3 and 4 compared with every 5.08 and 6.22 for that in Wards 7 and 8 respectively. The spatial distribution of GVI is shown in Fig.5, where the larger radius and greener means the higher GVI. Basically, the GVI under 30 indicates that these vegetation's cooling effects can't break through the threshold of 82.5 Fahrenheit (28.5 degree Celsius) mean LST according to Fig.7, which is nearly at the transition point where Giannros et al. (2014) believed 27 to 29 degrees Celsius can make majority population fell discomfort according to their LST comfort ranges.

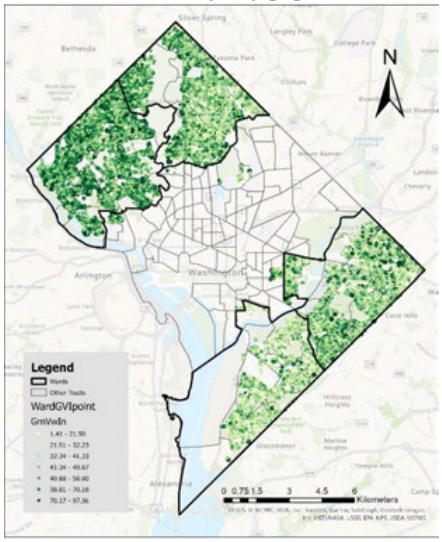

Fig.6 The spatial distribution of GVI in 'Local North' and 'Local South'

4.1 LST Mitigation effect comparison between GVI and NDVI

We next examined the relationship between LST and our two measures of greenspace. We observed negative relationships between LST and these measures, indicating that spaces with greater shares of greening had lower LST relative to areas without. The correlation coefficient of -0.60 between the mean LST and GVI mean was drawn, although less

correlated than that with NDVI (-0.68), their LST mitigation effects are virtually the same as represented by regression lines (Fig.7) and the reduction in LST is between 15 and 20 Fahrenheit degree for both GVI and NDVI. The effective cooling range of GVI is from 15 to 60, and it is from 15 to 75 for that of NDVI, which were manifested by red dash lines in Fig.6. The temperature mitigation effect appears to stop when GVI reaches around 60 representing the 60 percent vegetation proportion, which can guide urban greening work to prevent the tree canopy from becoming excessively large without producing the cooling effect. On the other hand, there is no clear stagnating trend for NDVI, which can be explained by that NDVI is a large spatial scale metric measured by electromagnetic spectrum, while GVI focuses more on middle and micro-scale street space. Meanwhile, the NDVI scatter plot presented an obvious spindle shape when the values were closer to 0.

The newly developed index, GVI-3D, presented the best correlation with LST compared with GVI and NDVI, the coefficient is -0.73 ($p<0.001$), which means this index has high explanatory power for temperature mitigation (Fig.7). The effective cooling range of GVI-3D is from 0 to 175, and GVI-3D scatter plot reflects a better point data distribution than GVI and NDVI.

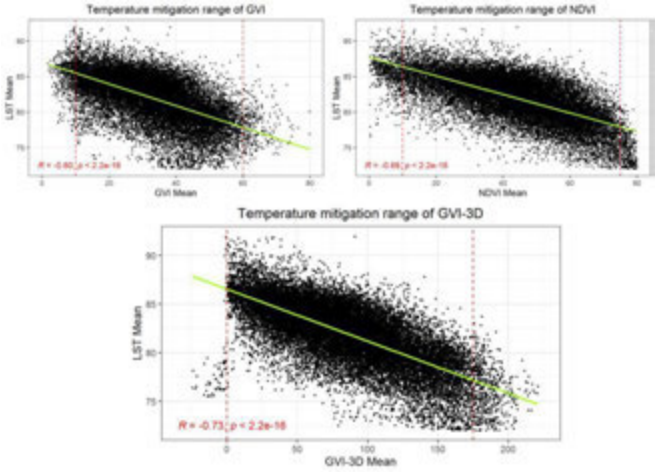

Fig.7 The temperature mitigation effects of GVI, NDVI, and GVI-3D in all wards

4.2 Cooling effect disparity between the 'Local South' and 'Local North'

4.2.1 Disparity by wards

The correlation analysis results by wards demonstrated the greenery environment disparity between the *'Local South'* and *'Local North'*. In Wards 7 and 8, fewer GVI mean values (24.84% and 13.35% respectively) were over than 40, which prevents street-level LST from dropping to 80 degrees Fahrenheit or lower (Fig.8). In contrast, 62.06 percent GVI mean values were over 40 in Ward 3, they played important roles in cooling the surrounding street space. The distribution of point data presented obvious movement to the upper left for Wards 7 and 8 compared with Wards 3 and 4 (Fig.07), which makes the point clusters closer to 90

degrees Fahrenheit, however, there are fewer points close to 90 degrees Fahrenheit in Ward 4, few in Ward 3.

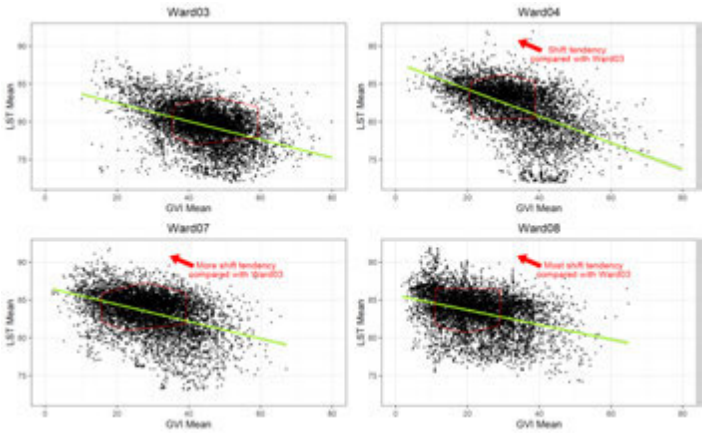

Fig.8 The GVI temperature mitigation effect gaps in Wards 3, 4, 7 and 8

4.2.2 Disparity by tree genus

If we scrutinise the detailed genus of trees in each Ward, we found that the quantity of genus showed a small difference, but GVI by genus showed huge gaps. GVI of all genera was extensively lower in Wards 7 and 8 compared with Wards 3 and 4, and we visualised the GVI of top 20 genera (Fig.09). The value of red dash line is 30, and we found that most top 20 genera have GVI blow 30 in Wards 7 and 8, which the situations are opposite in Wards 3 and 4 (Fig.9). The first-layer genera with the most quantity is either 4 or 3 categories in four Wards. Prunus stood out all genera in Ward 3, followed by Acer, Quercus, and Cercis. Cercis, Zelkova, and Prunus are dominated genera in Ward 4. Acer, Ulmus, Quercus, and Prunus are the first-layer genera in Ward 7, and Quercus, Acer, Prunus and Ulmus are the dominated genera in Ward 8. The number of trees by genus dropped off a cliff in Wards 3 and 8 (Fig.9), suggesting several dominant tree genera, which is closely related to their cooling effect. We used a simple classification to label the cooling effect of different tree genera, and found that the dominant tree genus also presented subtle inequality in terms of their cooling effects on surrounding environments. (Tab.2) More genera with high and medium cooling effects are dominated in Wards 3 and 4, in contrast, Wards 7 and 8 mostly get benefits from genera with medium and low cooling effects, and few genera with high cooling effects are primary in these two Wards. According to Virginia Department of Forestry (2023), the seedling prices for the genus Prunus (with high cooling effect) and Quercus (with medium cooling effect) are both $85 for 50, while Acer with a low cooling effect has the seedling price of $80 for 50, the budget difference might explain the quantity, genus and GVI gaps between the *'Local North'* and *'Local North'* in Washington, D.C.

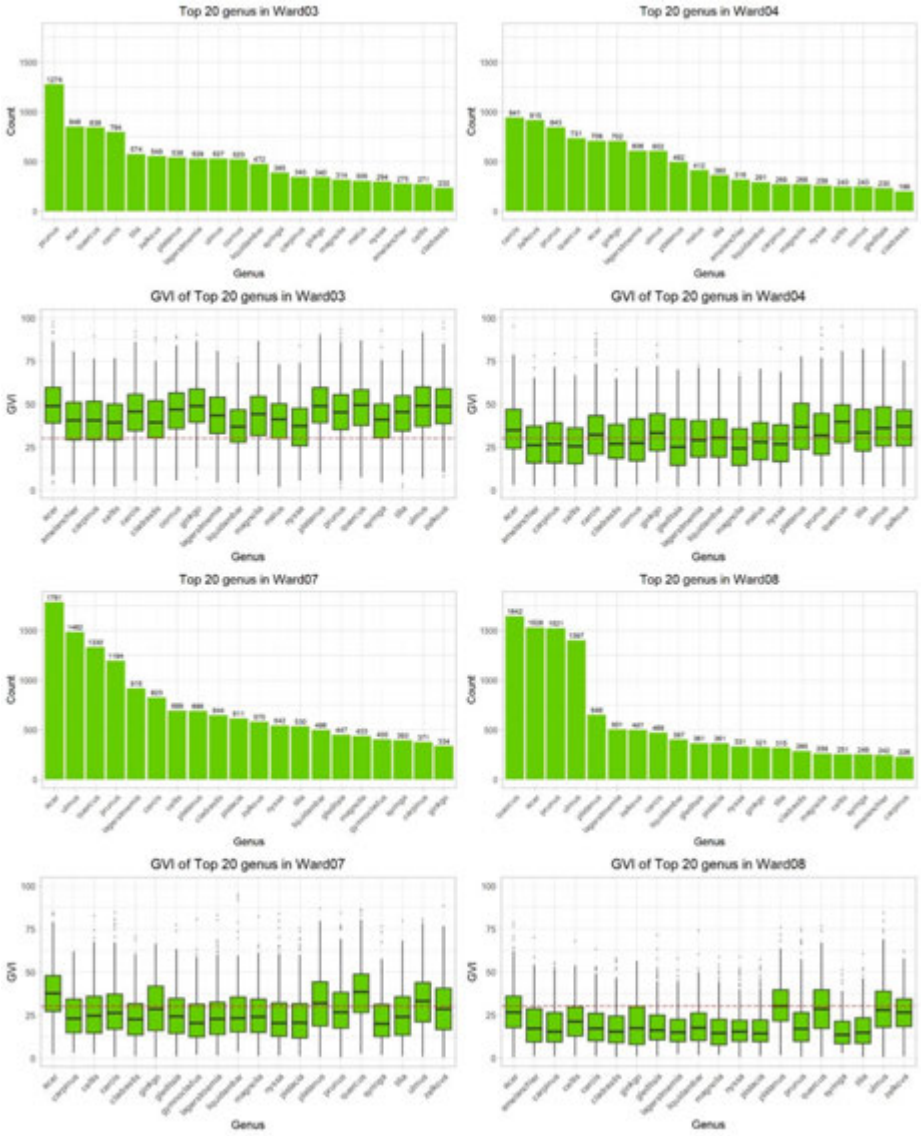

Fig.9 The tree genus distribution and GVI by genus in Wards 3, 4, 7 and 8

Tab.2 The subtle gaps between cooling effect of different dominated genera

Ward	Ranking	Genus	Number	Correlation coefficient (All p < 2.2e-16)	Cooling effect
Ward 3	1	Prunus	1,274	-0.52	High
	2	Acer	848	-0.43	Low
	3	Quercus	838	-0.46	Medium
	4	Cercis	794	-0.49	High

Ward 4	1	Cercis	941	-0.49	High
	2	Zelkova	915	-0.50	High
	3	Prunus	843	-0.52	High
Ward 7	1	Acer	1,781	-0.43	Low
	2	Ulmus	1,482	-0.40	Low
	3	Quercus	1,330	-0.46	Medium
	4	Prunus	1,194	-0.52	High
Ward 8	1	Quercus	1,642	-0.46	Medium
	2	Acer	1,528	-0.43	Low
	3	Prunus	1,528	-0.52	High
	4	Ulmus	1,397	-0.40	Low

4.3 Greenery distribution disparity in residential zones and affordable housing surroundings

The GVI also varies across each different sub-zoning areas. The mean GVI distribution in 3 residential and 22 sub-zoning areas (Appendix) is shown in Fig.10. In general, the mean GVI in the Residential Zone (RZ) is higher than that in the Residential Apartment Zone (RAZ) and Residential Flat Zone (RFZ). The R-1A zone has the highest mean GVI at around 42.5, the RA-1 zone has the lowest mean GVI at around 25. In local perspectives, the opposite mean distribution appears within RZ and RAZ. In RZ, with the increase of housing density, the zoning type transfers from R-1A to R-1B, R-2, and R-3, the mean GVI presented an obvious decrease from around 42.5 to 26, which indicated the normal relationship between land use and urban greenery. All R-1A and variations showed high mean GVI around or above 40, and small deviation from the mean values, the cliffs between R-1A and R-2 or R-3 are distinct.

However, the denser the residential zoning type within RAZ, the higher mean GVI values show out. For example, the RA-4 which provides for areas developed with predominantly medium- to high-density residential has the highest mean GVI of around 37, while the RA-1 which permits low- to moderate-density development, including detached dwellings, rowhouses, and low-rise apartments has the lowest mean GVI around 25. In addition, the mean GVI of RF-1 which belongs to RFZ is neither high nor low, which is around 28.

The distribution difference simultaneously revealed the inequality of residential land use. Zoning types with high mean GVI are mostly located in *'Local North'* Wards 3 and 4, while low mean GVI zoning areas are concentrated in Wards 7 and 8. Wards 7 and 8 have 31 and 26 RA-1 zones (the lowest GVI zoning), in comparison, Wards 3 and 4 only have 7 and 10 RA-1 zones respectively. As for RA-1 zones (the highest GVI zoning), Wards 3 and 4 have 7 and 3 respectively, and Wards 7 and 8 do not have such kind of zoning.

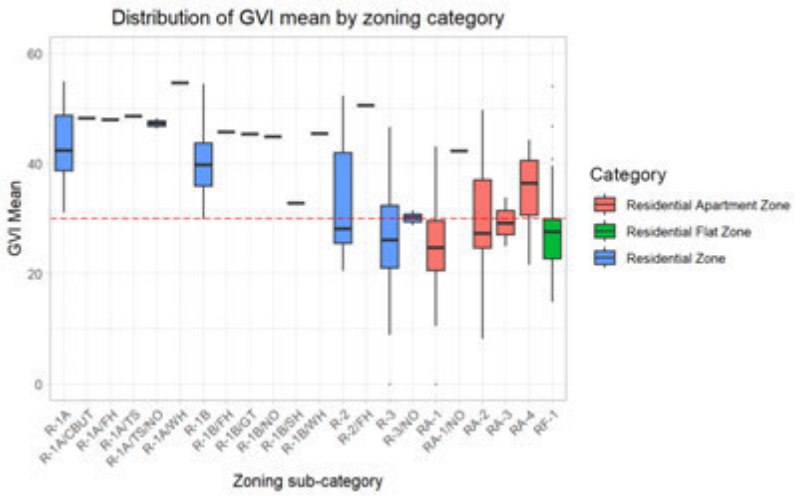

Fig.10 The temperature mitigation effects of GVI, NDVI and GVI-3D

We found that 98 affordable housing projects in different wards and zoning also presented disparity (Tab.3). Due to the wealth of Ward 3, only one HPTF affordable housing project was built between 2010 and 2022, which is Woodley House. Wards 4, 7, and 8 have 38, 32, and 27 affordable housing projects built in during 13 years. The mean GVI of all affordable housing projects is 27.2, which is quite as low as the mean GVI in R-3 zoning. The only project in Ward 3 has a mean GVI of 43.51, the mean GVI of projects in Ward 4 is 31.1, far higher than the projects with the highest GVI of 30.96 and in Wards 7 and 28.24. The average GVI of affordable housing projects in Wards 7 and 8 are only 25.9 and 22.6, indicating the huge gaps between affordable housing projects in different Wards. What's more, the affordable housing project with the highest GVI in Ward 7 is located in Mixed-Use Zones where the commercial and institutional use are prior, the multi-family residential development are secondary residential zoning areas (Appendices).

Tab.3 500-meter buffer GVI differences by HPTF housing projects

Ward	Project name	Zoning	GVI	
			Attribute	Value
Ward 3	Woodley House	RA-2	Only value	43.51
Ward 4	NCCLT-905 R St. NW	R-1A	Highest value	40.20
Ward 7	1847-49 Good Hope Road, SE	MU-7B	Highest value	30.96
Ward 8	Stanton Square Apartments	R-3	Highest value	28.24

5 Discussion

This study contributes to the validation of environmental injustice issues and significant temperature mitigation effects measured by GVI and GVI-3D. Taking Washington, D.C. as an example, we found that the greenery environment inequality, from macro-level to micro-level, extensively existed in the *'Local North'* and *'Local South'* with serious wealth polarisation, which reveals the infrastructure property attributes of street-level vegetation.

GVI and LST are highly correlated, the new index GVI-3D presented a higher correlation with LST, with the increase of these two indices, the street-level space becomes cooler around 10 to 15 degrees Fahrenheit in a linear way. GVI-3D presented a better measurement of LST mitigation, which contributed to establishing the model of a true mathematics mapping of this index to canopy volume in physical urban space. As for the good measurability, we believed that the side views of street greenery images provide more possibilities to measure the actual volume of tree canopies which are the main cooling source for urban street-level microenvironment.

However, the cooling effects of different tree genera differs, some dominant genus has better temperature mitigation effects such as Prunus, Cercis, and Zelkova, while Acer and Ulmus show low mitigation effects. These subtle differences are difficult to spot, and even their cooling effect may be budget-related because we found that affluent wards tend to have more high cooling effect trees compared with non-affluent wards at the local level.

The GVI values also connect with land use type and housing density. The higher the density of detached or semi-detached Residential Zoning, the lower the GVI was found in those areas. In contrast, the higher the density of Residential Apartment Zoning, we get the higher GVI. This may be explained by the degree of intensive utilisation of land that needs to reach a certain value before it can function well. Unlike the average greenery environments of residential areas, the greenery environments of affordable housing were worse measured by GVI. Despite increased greenery is common sense that can mitigate the heat exposure risks, they also mean government or developers need balance investment and budget for targeted neighbourhoods. As for affordable housing, they usually have less accessibility to parks, forests and gardens, thus the urban street greenery becomes the limited or only green environment that affordable housing can directly benefit from so as to decrease heat exposure risks. Therefore, the significance of urban street greenery and its metrics should be addressed.

Some limitations should be addressed. First, despite the accuracy of a similar semantic segmentation model being around 85 percent according to prior research (Ki & Lee, 2021; Li et al., 2019; Zhao et al., 2017), changing the detection image dataset from European based cities to American cities can have an influence on the accuracy of the algorithm. As for the temperature mitigation effect, we only consider the single variable of urban greenery, more variables can be included such as Impervious Surface Area (ISA) (Yuan & Bauer, 2007; Imhoff et al., 2010; Ziter et al., 2019). Besides, more data may give the correlation analysis and regression model better explanatory power. Despite the GVI-3D generated a fine R-squared value of 0.73, the 0.60 R-squared value of GVI still has the possibility of being improved.

6 Conclusion and policy proposals

In conclusion, GVI has virtually the same explanatory power as NDVI when it comes to the LST mitigation effect, while GVI-3D has the best. This study argues that it is of practical significance to monitor GVI and GVI-3D rather than NDVI of small-scale street environments due to their readability, controllability, and human-centric attributes. It is

feasible to adjust GVI by controlling the size, quantity, and density of street greenery, a 60 percent GVI can be a cut-off for urban greening work to prevent excessively large tree canopies concerning their cooling effects. However, large-scale NDVI measurements make it difficult to contribute to improved policy suggestions for street greening. The related housing and greenery policies can have improvements as follows.

6.1 Focus on greenery quality rather than only quantity

According to Fang (2024), *'DC's greenery-related government departments already made huge efforts to plant trees in non-affluent areas such as Wards 7 and 8'*, their achievements can be reflected in the number of tree/vegetation image points mentioned above. However, greenery quality is more essential indicated by GVI and GVI-3D in this study. Through measuring GVI, it is easy to find that vegetation proportion over 60 percent can't produce a substantial cooling effect. Therefore, more emphasis and resources can be invested in the improvements of quality of the greenery environment such as the balance of tree genus and the volume of tree canopies so that we can pursue better temperature mitigation effects by quantifying GVI or GVI-3D. Those resources to manage excessively huge tree canopies can be transferred to *'Local South'* areas by managing the life cycle of the trees.

6.2 Highlight the greenery environment of affordable housing projects

The locations of HPTF affordable housing projects are precise. Ward 3 only built one affordable housing during 13 years. However, the gaps between this only one project and the others were huge. A suitable greenery environment for housing has the significant impact on the health of residents (Hanzl & Rembeza., 2022; Kuchcik et al., 2016), housing values (Zhang & Dong., 2018; Ye et al., 2019), and environmental justice (Schmid & Säumel., 2021; Xiao et al., 2021). The affordable housing projects have the necessitates to set aside a part of the budget and resources for the improvement of the surrounding green environment in terms of tree genus and volume. The density of affordable housing projects can be improved from the evidence that higher density Residential Apartment Zone tends to have better greenery environment measured by GVI. In addition, the assessment of the difference between affordable housing projects and normal housing projects is necessary.

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Appendices

Tab.4 The description of residential zoning categories in Washington, D.C.

Zoning	Sub-Category	Description
Residential Apartment Zone	RA-1	The RA-1 zone provides for areas predominantly developed with low- to moderate-density development, including detached dwellings, rowhouses, and low-rise apartments.
	RA-2	The RA-2/RC zone is intended to provide for areas developed with predominantly moderate- and medium-density rowhouses and apartments.
	RA-3	The RA-3 zone provides for areas developed with predominantly medium-density residential.
	RA-4	The RA-4 zone provides for areas developed with predominantly medium- to high-density residential.
	RA-1/NO	The RA-1/NO zone provides for areas predominantly developed with low- to moderate-density development, including detached dwellings, rowhouses, and low-rise apartments in the vicinity of the U.S. Naval Observatory.
Residential Flat Zone	RF-1	The RF-1 zone is to provide for areas predominantly developed with row houses on small lots within which no more than two (2) dwelling units are permitted.
Residential Zone	R-1A	The R-1A zone is intended to provide areas predominantly developed with detached houses on large lots.
	R-1A/CBUT R-1A/FH R-1A/TS R-1A/TS/NO R-1A/WH	All R-1A variations permit detached houses on large lots. They also have the purpose to protect specific areas' low density, natural topography, historic or ceremonial importance, or special missions, including Chain Bridge Road/University Terrace, Forest Hills, Tree and Slope Protection zones, Naval Observatory/Tree and Slope Protection zones and Wesley Heights.
	R-1B	The R-1B zone is intended to provide areas predominantly developed with detached houses on moderately sized lots.

	R-1B/FH R-1B/GT R-1B/NO R-1B/SH R-1B/WH	All R-1B variations permit detached houses on moderately-sized lots. They also have the purpose to protect specific areas' low density, natural topography, historic or ceremonial importance, or special missions, including Forest Hills, Georgetown National Historic Landmark District, Naval Observatory, Sixteenth Street Heights and Wesley Heights.
	R-2	The R-2 zone is intended to provide for areas predominantly developed with semi-detached houses on moderately sized lots that also contain some detached dwellings.
	R-2/FH	The purposes of the R-2/FH zone are to preserve the natural topography and mature trees to the maximum extent feasible in the Forest Hills neighbourhoods, which permit semi-detached houses on moderately sized lots that also contain some detached dwellings.
	R-3	The purpose of the R-3 zone is to allow for row dwellings, while including areas within which row dwellings are mingled with detached dwellings, semi-detached dwellings, and groups of three or more row dwellings.
Mixed-Use (MU) Zones	MU-7B	The MU-7B zone is intended to permit medium-density mixed-use development with a focus on employment.

Urban heat mitigation effect and affordable housing greenery injustice measured by Green View Index (GVI): A case study in Washington, D.C.

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Abstract

The deterioration of living conditions is highlighting the benefits of urban greenery for creating sustainable cities. Using Washington D.C. as a case, we demonstrate the performance of GVI and examine disparities in greening surrounding affordable housing. With the pre-trained segmentation model, we generated GVI based on 54,691 Street View images and applied the Spearman's correlation analysis to examine LST cooling effect. We found that LST shows significant negative correlations ($p<0.001$) with GVI and newly developed GVI-3D with coefficients of -0.60 and -0.73. The distribution of GVI in residential zoning was polarised, affordable housing projects have less greenery. In conclusion, we argue that it is of practical significance to monitor GVI instead of large scale NDVI for urban environments due to its controllability and human-centric attributes.

Keywords: Green View Index, Temperature mitigation, Street greenery, Housing environment, Environmental justice

1 Introduction

Our human society just experienced the warmest decade on record between 2011 and 2020 (WMO, 2023). For the global majority living in cities, urban heat islands represent an issue for both livability and health. Given the heat-absorbing properties of greenery, researcher have developed a range of vegetation-related indices to examine the climate change mitigation potentials such as (Normalised Difference Vegetation Index) NDVI (Yue, W., et al., 2007; Chun, B. and Guldmann, J.M., 2018.), and examine distributional equity such as park areas (Nesbitt et al., 2019), while they are all plat 2-dimensional indices which cannot drill down to accurate small-scale space analysis and vertical vegetation detection. The Green View Index (GVI) (Yang et al., 2009; Li et al., 2015) provided a refined and 3-dimensional metric for quantifying urban greenery by authentically simulating pedestrian's visual experience and perception, thus reflecting the actual exposure of humans to greenery (Cho et al., 2010). Advances in computer vision and image processing tools now make it more feasible to examine the impact of GVI on urban environments. In this paper, we add to the literature by measuring

the relationship between urban green space and land surface temperature (LST). Using Washington D.C. as a case, we demonstrate the performance of the GVI, and use it to examine disparities in urban greening surrounding affordable housing.

2 Literature Review

Urban Heat Island (UHI) effect is the thermal aggregation issue coming with urbanisation and industrialisation, which leads to increased human health risks (Heaviside et al., 2017) and influences socioeconomic development (Rizwan et al., 2008). In the 21st century, an increasingly urbanised population over 3 billion are directly exposed to UHI in worldwide (Rizwan et al., 2008). Simultaneously, cities' physical environment and spatial structure (Shaker et al., 2019; Cao et al.,2022; Gage & Cooper, 2017) greatly influence the distribution of UHI causing environmental justice issue where different groups suffer distinctly due to their locations, greenery environment around housing and demographic characteristics. Affluent neighbourhoods, high-income groups and the white population in United States (Harlan et al., 2007; Mitchell & Chakraborty, 2015; Hsu et al., 2021) were widely considered to have environmental advantages and low heat exposure risks, while the vulnerable populations suffer more.

Even though a large amount of greenery indices were invented (Bannari, 1995; Huete, 2012) to respond the UHI exposure problems based on different criteria, "the most widely used index remains the NDVI" (Bannari, 1995, p.114). The impact of significant greenery index NDVI on the urban environment, especially the thermal environment was meticulously examined by many scholars. Lo et al. (1997) verified that irradiance with an emphasis on commercial and services land cover contributed to the development of urban heat islands, he found there was a negative correlation between NDVI and irradiance of different land covers. In addition, Li et al. (2011), Grover & Singh (2015), Jamei et al. (2019), and Chakraborty et al. (2020) all concluded that NDVI, in conjunction with other built environment indices can significantly predict Land Surface Temperature (LST) on the regional scale.

In contrast, GVI, after the automatic extraction and calculation method revolution by Li et al. (2015), as an emergent index measuring urban vegetation in three dimensions, only limited research investigated its impact on the urban environment. Sabedotti et al. (2023) examined the association between GVI and air pollution such as PM 2.5, nitrogen dioxide, and carbon dioxide, and found an interquartile range increase of GVI can contribute to a 7.4 percent decrease in NO2. Other scholars scrutinised the relationships between GVI and greenery accessibility and environmental justice (Li et al., 2015; Li, 2021), human recreational behaviours (Villeneuve et al., 2018; Lu, Y., 2019), walking time, (Ki & Lee, 2021; Lu, Y., 2018), GVI best path (Zhang, J et al., 2022) and road parameters (Dong et al., 2018). These studies present GVI's significant values and exact measurability to the built environment. However, there is simultaneously a deficiency in the study of applying GVI to measure mitigation of the Urban Heat Island (UHI) effects measured by Land Surface Temperature (LST), especially the contribution of the vertical side view of greenery that can closely represent the real volume of the cooling source.

This study thus focuses on temperature mitigation effects and urban greenery environment measured by GVI, which first examined the distributional and genus difference of GVI in Washington, D.C.'s *'Local North'* and *'Local South'* wards with different residential and housing environment. We tried to explore applying GVI and newly refined metric (GVI-3D) to measure and examine the relationship between urban street greenery and UHI represented by LST, and examine the different contribution from street greenspace measured by GVI, GVI-3D and NDVI toward heat mitigation.

3 Data and methods

3.1 Study areas and background

The real estate risk appraisal program conducted by the Federal Home Loan Bank Board (FHLBB) in 1935 assigned a 4-point grade concerning infamous security (Hillier, 2003), which revealed the modern history of inequality in 239 American cities. Since then, the fourth grade and labels of hazardous areas were assigned to most neighbourhoods with African Americans. Since then, inequality transformed into racial steering. Washington, D.C., *'a city with a legacy of Black plurality'* (King et al., 2022), seemingly disenfranchised its Black residents' rights to socioeconomic and political equality (Conrad & McNeil, 2010; Lloyd, 2014; Kijakazi et al., 2016; King et al., 2016; Golash, 2023). The city's diversity and complexity contribute to its local dilemma as a global city where historical and modern inequality exists extensively, nowadays Washington, D.C. has serious polarisation represented by an expensive housing market (Bright MLS, 2023), lowest homeowenership rate nationwide (FRED, 2023) and high unemployment rate (USAFACTS, 2023). On the other hand, urban greenery, as one of the most important built environments, not only plays the role of public infrastructure but also has economic attributes that could affect people's settlement choices. Scholars found that some special income (Ki, D., et al., 2021) or ethnic groups (Li, X., 2021) lived in neighbourhoods with high or low GVI. Washington, D.C. is a model city in the U.S. where the urban greenery work deserves, many actions such as the District of Columbia Urban Tree Canopy Plan, DC State Forest Action Plan (SFAP), and other management strategies and assessment work (Fang et al., 2020) contributed to the improvement of urban greenery environment. Although 9 percent urban tree cover is desirable (Government of the District of Columbia, 2010), detection of local gaps and equitable development are also important. Therefore, we highlighted *'Local North'* Wards 3 and 4 with poverty and *'Local South'* Wards 7 and 8 with study areas. The poverty rates for Wards 3, 4, 7, and 8 were 9.1 percent, 11.4 percent, 27.7 percent and, 36.8 percent respectively according to D.C. State Data Centre Visualisation Portal (Ilena, 2019).

Fig.1 Study areas of four wards in Washington, D.C.

Tab.1 Basic information of selected and unselected areas for study

Label	Ward	Population (2014-2018)	Poverty rate (2019)
Selected study areas	3	85,067	9.1%
	4	87,775	11.4%
	7	81,299	27.7%
	8	85,024	36.8%
Other wards	1	85,134	13.6%
	2	77,791	14.3%
	5	87,850	17.7%
	6	94,558	13.4%

3.2 Data and Source

Our workflow is to apply indicators of urban greenery environment including NDVI, GVI, and GVI-3D to examine their different contribution to the indicator of urban thermal environment represented by LST (Fig.2).

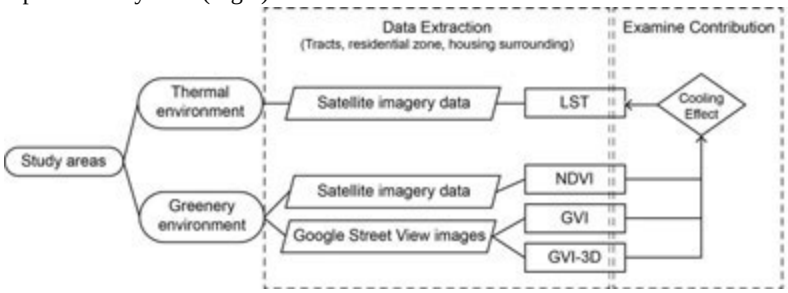

Fig.2 Overall data workflow

3.2.1 Greenery environment data

The image dataset used here is the Auto Arborist Dataset, which is a large-scale dataset extracted from Google Street View images that joins public tree censuses from 23 cities with a large collection of street-level and aerial imagery over 2 million (Beery et al., 2022) taken on or before 1 Jan, 2018. This dataset focuses on street trees containing at least one tree stem captured in each individual image, and Beery, et al. (2022) identified detailed genus information for each image. To align with the image acquisition date from the Auto Arborist Dataset images and conduct comparison analyses with time continuity, we tried to use all other data close to the acquisition time of the street image data. To obtain better resolution for comparison analysis, the Normalised Difference Vegetation Index (NDVI) is calculated based on a cloud-free Sentinel-2 satellite imagery data captured on 30 July, 2017, with 10m*10m grid-cell resolution.

3.2.2 Thermal environment data

Similarly, to respond acquisition time of street view images from the Auto Arborist Dataset and ensure the time continuity of comparison analyses, we calculated the LST based on data collected between 2014 and 2018. The LST dataset is from Open Data DC, it was computed from 2014 to 2018 and the resultant temperatures were averaged together to produce this *'5-year average'* data.

3.2.3 Affordable housing data

Despite there being many policy tools supporting Washington, D.C.'s housing affordability, the 'affordable housing development community relies on heavily is the *Housing Production Trust Fund'* (Brian, 2016). Only in 2003, the HPTF obtained 15 percent of revenue from deed transfer and recordation tax (DC Council, 2004). Housing Production Trust Fund (HPTF) has the form of revolving loan and is entirely funded by money raised within the city, and are therefore closer to the local market and housing supply and demand. HPTF provides developers with "gap financing" to directly build affording housing for low- and extremely low-income groups. Therefore, we believe that the greenery environment around affordable housing projects has strong correlations with HPTF. The HPTF affordable housing data were between 2010 to 2022, their coordinate data and basic information were grabbed from Google Maps using Python programs according to their project names listed in each HPTF annual report. Other Open Data DC datasets include zoning district boundaries in 2016 and ward boundaries in 2021.

3.3 Methods

3.3.1 Street-level indices calculation

With the pre-trained semantic segmentation model of OpenMMLab where the training dataset is Cityscape and the framework is DeepLabV3. Vegetation areas were inferred and GVI was calculated based on 54,691 Google Street View images in study area including Wards 3, 4, 7

and 8. Former studies developed different calculation methods of GVI. Li et al. (2015) revolutionised the calculation method of GVI and the whole workflow by introducing panoramic Google Street View pictures combined with images with more angles and semantic segmentation algorithms, thus automating the extraction of GVI from 6 images covering the 360° horizontal surroundings. On these bases, some scholars such as Dong et al. (2018), Ki & Lee (2021) and Li (2021) have proposed simplified formula, but they all follow the fundamental logic of calculating the proportion of green pixels in street images using a large amount of data with geospatial locations. This study follows Ki, D. and Lee, S.'s method. The formula is shown below:

$$\mathrm{GVI} = \frac{Number\ of\ Green\ pixels}{Number\ of\ Total\ pixels} * 100$$

The GVI ranges from 0 to 100 percent, where a higher value indicates more greenspace are available in a single image. The green pixels in the example of segmented results represented the greenery on the streets (Fig.3).

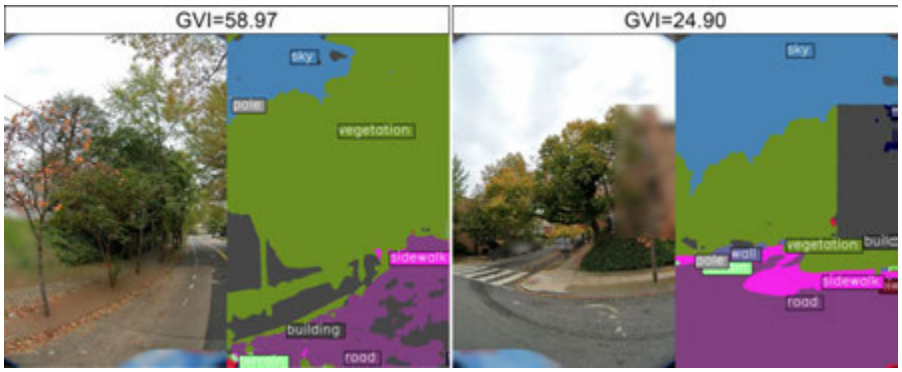

Fig.3 Examples of different GVI images

The NVDI is calculated based on the formula below. In order to better compare NDVI with GVI, we normalise NDVI by multiplying 100, all the following NDVI metrics in this article are normalised NDVI:

$$\mathrm{NDVI} = \frac{NIR - R}{NIR + R} * 100$$

GVI is highly structural data because it is alongside the urban street networks based on Google Street View map. But NDVI and LST are relatively continuous spatial data that cover all land surfaces. Given the width of streets with data collection location and mature tree canopy diameter of less than 18m (Phillip, 2020), we first used segmented street space with 18m width along streets and 30m length perpendicular to extract mean GVI, thus most tree canopy can be included (Fig.4). Same street space was also used to extract mean LST and NDVI. To examine the relationship between the tree genus and LST, other buffer areas with a 10m radius based on each individual image location were used as statistical areas. All analyses were conducted with Python, R, and ArcGIS pro.

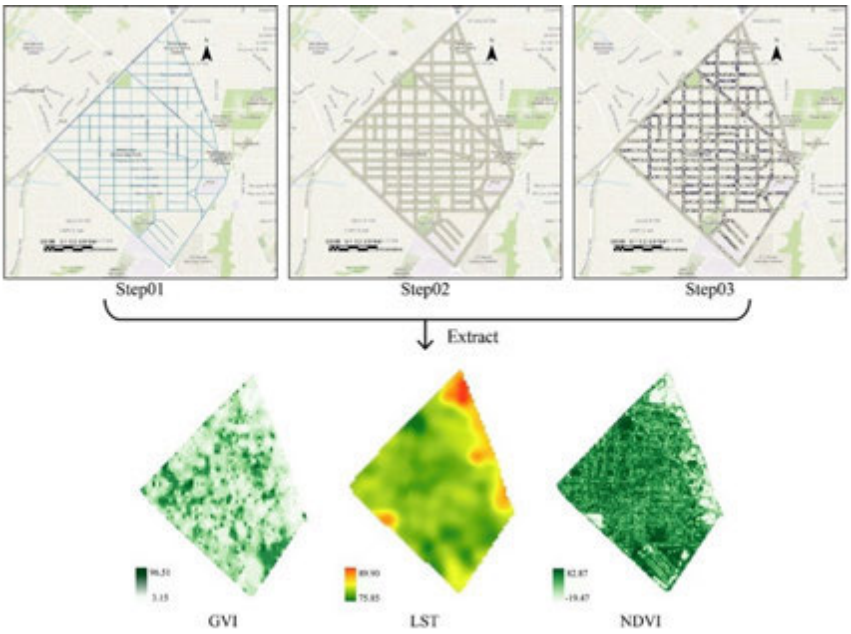

Fig.4 Extracting mean indices from segmented street space in Ward 3's Tract 10.01

Scholars addressed that GVI is a 3-dimensional index, but it virtually only represents vertical greening elevation with depth. To better describe the 3-dimensional greenery volume, we further develop GVI-3D following the logic of calculating the volume of a tree cone (Fig.5). In our study, we think of trees approximately as cones, the NDVI measured from overhead by satellite represents the base area of the cone, the root of GVI represents the height of tree canopy. Therefore, the newly developed GVI-3D can be calculated as follows:

$$\text{GVI} - 3\text{D} = \frac{1}{3} NDVI * \sqrt{GVI}$$

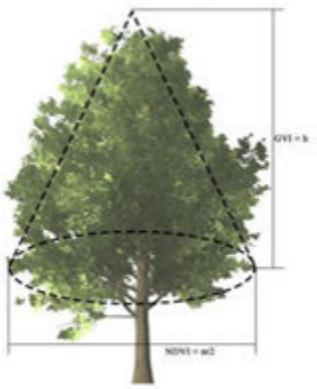

Fig.5 The calculating logic of new developed GVI-3D

3.3.2 Correlation analysis and Linear Regression

This study focuses on the mitigation impact of greenery variables on LST. To investigate the correlation among LST, GVI, and NDVI, Spearman's correlation analysis was applied. To examine and compare the cooling effects, bivariate correlations were first conducted between LST and GVI, and LST and NDVI respectively. To further examine the comprehensive effect of greenery volume measured by GVI-3D, the ordinary least square regression model (OSL) was used to examine the association between LST and GVI-3D. Variables for 4 Wards were calculated both individually and collectively.

3.3.3 Greenery environment examination in residential zones and affordable housing surroundings

Housing greenery environment was conducted at all residential zoning areas including Residential Apartment Zone (RAZ), Residential Flat Zone (RFZ), Residential Zone (RZ), and 22 sub-zoning areas, and 500-meter buffer areas of 98 affordable housing projects between 2010 and 2022 in four wards. We used descriptive statistics to scrutinise the macro-level districts and micro-level housing greenery environment.

4 Results

At the macro-quantity level, the number of street view images containing trees is similar. *'Local North'* Wards 3 and 4 have 12558 and 11559 images respectively, while Wards 7 and 8 have 16871 and 13703 images. However, the urban greenery disparities were clearly revealed in other statistical perspectives including per capita occupancy, mean GVI, temperature cooling effect, tree genus, and residential and affordable housing greening environments. Every 6.79 and 7.32 people share one tree/vegetation point in Wards 3 and 4 compared with every 5.08 and 6.22 for that in Wards 7 and 8 respectively. The spatial distribution of GVI is shown in Fig.5, where the larger radius and greener means the higher GVI. Basically, the GVI under 30 indicates that these vegetation's cooling effects can't break through the threshold of 82.5 Fahrenheit (28.5 degree Celsius) mean LST according to Fig.7, which is nearly at the transition point where Giannros et al. (2014) believed 27 to 29 degrees Celsius can make majority population fell discomfort according to their LST comfort ranges.

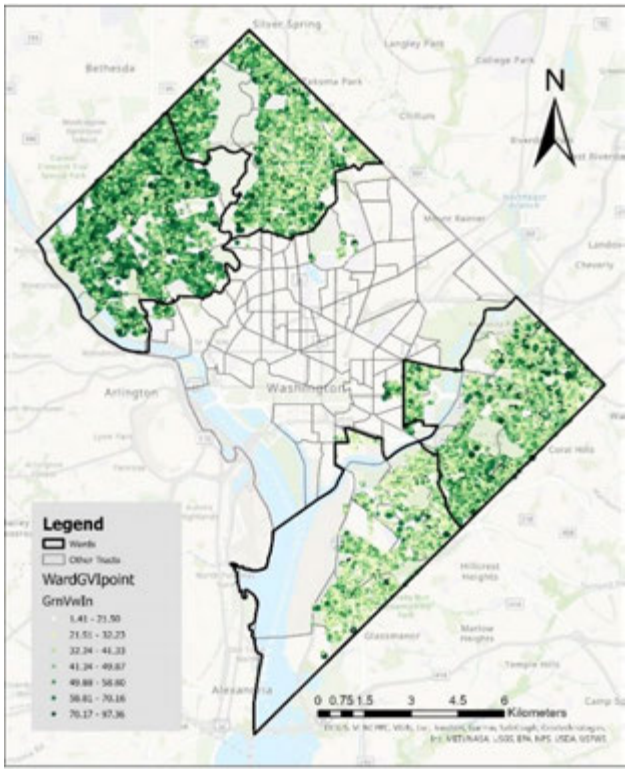

Fig.6 The spatial distribution of GVI in 'Local North' and 'Local South'

4.1 LST Mitigation effect comparison between GVI and NDVI

We next examined the relationship between LST and our two measures of greenspace. We observed negative relationships between LST and these measures, indicating that spaces with greater shares of greening had lower LST relative to areas without. The correlation coefficient of -0.60 between the mean LST and GVI mean was drawn, although less correlated than that with NDVI (-0.68), their LST mitigation effects are virtually the same as represented by regression lines (Fig.7) and the reduction in LST is between 15 and 20 Fahrenheit degree for both GVI and NDVI. The effective cooling range of GVI is from 15 to 60, and it is from 15 to 75 for that of NDVI, which were manifested by red dash lines in Fig.6. The temperature mitigation effect appears to stop when GVI reaches around 60 representing the 60 percent vegetation proportion, which can guide urban greening work to prevent the tree canopy from becoming excessively large without producing the cooling effect. On the other hand, there is no clear stagnating trend for NDVI, which can be explained by that NDVI is a large spatial scale metric measured by electromagnetic spectrum, while GVI focuses more on middle and micro-scale street space. Meanwhile, the NDVI scatter plot presented an obvious spindle shape when the values were closer to 0.

The newly developed index, GVI-3D, presented the best correlation with LST compared with GVI and NDVI, the coefficient is -0.73 ($p<0.001$), which means this index has high explanatory power for temperature mitigation (Fig.7). The effective cooling range of GVI-3D is from 0 to 175, and GVI-3D scatter plot reflects a better point data distribution than GVI and NDVI.

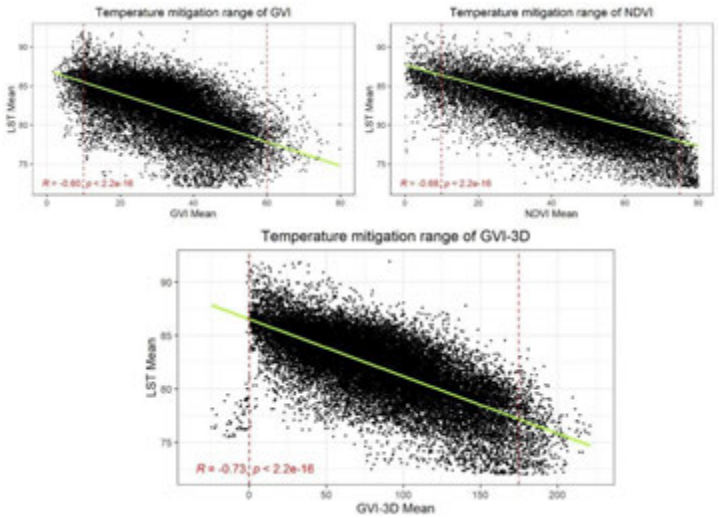

Fig.7 The temperature mitigation effects of GVI, NDVI, and GVI-3D in all wards

4.2 Cooling effect disparity between the 'Local South' and 'Local North'

4.2.1 Disparity by wards

The correlation analysis results by wards demonstrated the greenery environment disparity between the *'Local South'* and *'Local North'*. In Wards 7 and 8, fewer GVI mean values (24.84% and 13.35% respectively) were over than 40, which prevents street-level LST from dropping to 80 degrees Fahrenheit or lower (Fig.8). In contrast, 62.06 percent GVI mean values were over 40 in Ward 3, they played important roles in cooling the surrounding street space. The distribution of point data presented obvious movement to the upper left for Wards 7 and 8 compared with Wards 3 and 4 (Fig.07), which makes the point clusters closer to 90 degrees Fahrenheit, however, there are fewer points close to 90 degrees Fahrenheit in Ward 4, few in Ward 3.

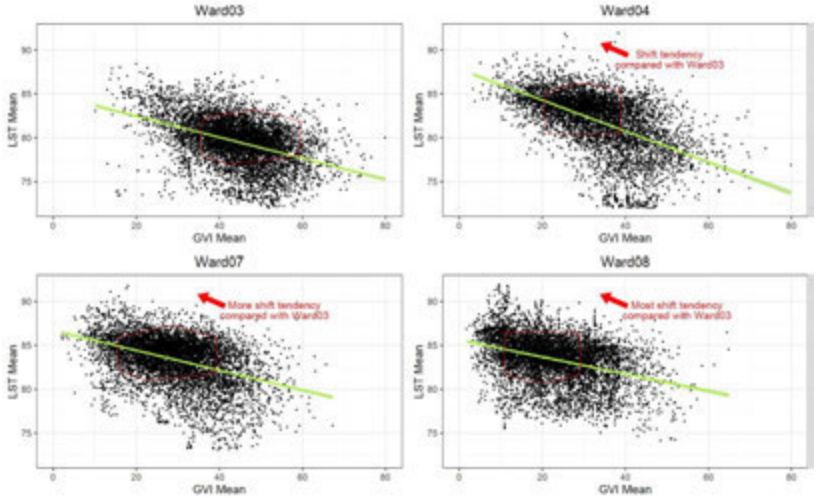

Fig.8 The GVI temperature mitigation effect gaps in Wards 3, 4, 7 and 8

4.2.2 Disparity by tree genus

If we scrutinise the detailed genus of trees in each Ward, we found that the quantity of genus showed a small difference, but GVI by genus showed huge gaps. GVI of all genera was extensively lower in Wards 7 and 8 compared with Wards 3 and 4, and we visualised the GVI of top 20 genera (Fig.09). The value of red dash line is 30, and we found that most top 20 genera have GVI blow 30 in Wards 7 and 8, which the situations are opposite in Wards 3 and 4 (Fig.9). The first-layer genera with the most quantity is either 4 or 3 categories in four Wards. Prunus stood out all genera in Ward 3, followed by Acer, Quercus, and Cercis. Cercis, Zelkova, and Prunus are dominated genera in Ward 4. Acer, Ulmus, Quercus, and Prunus are the first-layer genera in Ward 7, and Quercus, Acer, Prunus and Ulmus are the dominated genera in Ward 8. The number of trees by genus dropped off a cliff in Wards 3 and 8 (Fig.9), suggesting several dominant tree genera, which is closely related to their cooling effect. We used a simple classification to label the cooling effect of different tree genera, and found that the dominant tree genus also presented subtle inequality in terms of their cooling effects on surrounding environments. (Tab.2) More genera with high and medium cooling effects are dominated in Wards 3 and 4, in contrast, Wards 7 and 8 mostly get benefits from genera with medium and low cooling effects, and few genera with high cooling effects are primary in these two Wards. According to Virginia Department of Forestry (2023), the seedling prices for the genus Prunus (with high cooling effect) and Quercus (with medium cooling effect) are both $85 for 50, while Acer with a low cooling effect has the seedling price of $80 for 50, the budget difference might explain the quantity, genus and GVI gaps between the *'Local North'* and *'Local North'* in Washington, D.C.

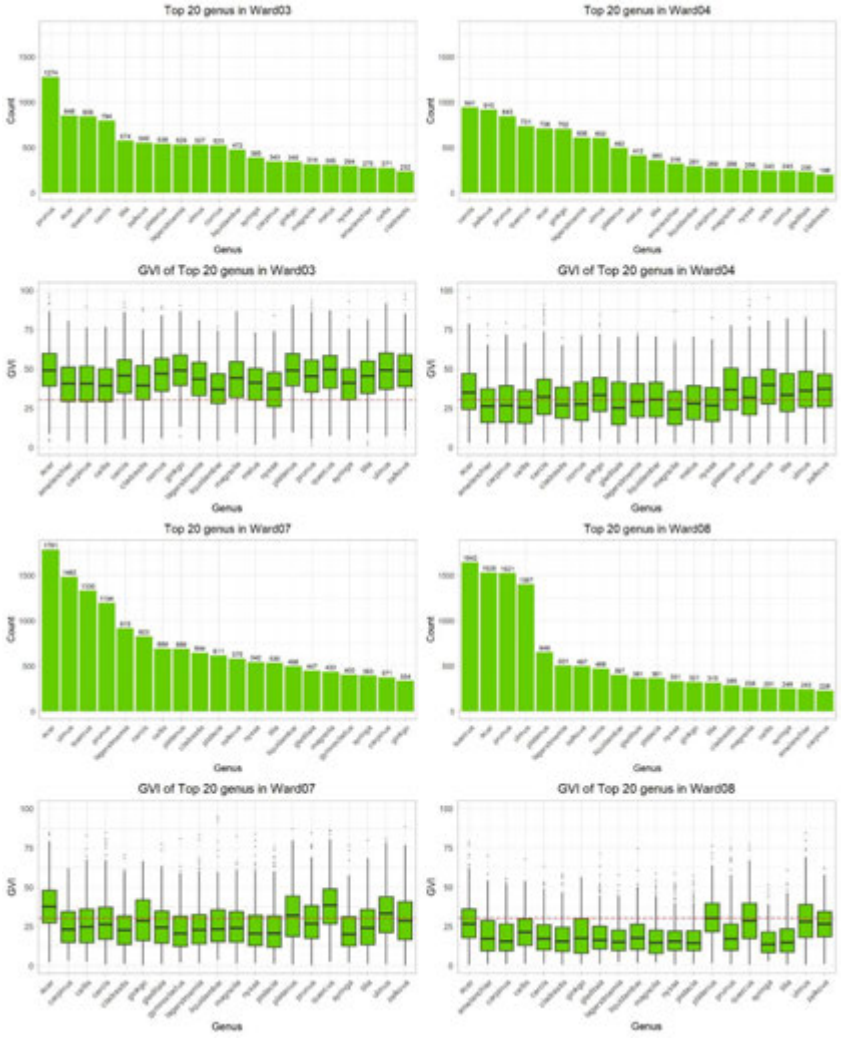

Fig.9 The tree genus distribution and GVI by genus in Wards 3, 4, 7 and 8

Tab.2 The subtle gaps between cooling effect of different dominated genera

Ward	Ranking	Genus	Number	Correlation coefficient (All p < 2.2e-16)	Cooling effect
Ward 3	1	Prunus	1,274	-0.52	High
	2	Acer	848	-0.43	Low
	3	Quercus	838	-0.46	Medium
	4	Cercis	794	-0.49	High
Ward 4	1	Cercis	941	-0.49	High
	2	Zelkova	915	-0.50	High

Ward 7	3	Prunus	843	-0.52	High
	1	Acer	1,781	-0.43	Low
	2	Ulmus	1,482	-0.40	Low
	3	Quercus	1,330	-0.46	Medium
	4	Prunus	1,194	-0.52	High
Ward 8	1	Quercus	1,642	-0.46	Medium
	2	Acer	1,528	-0.43	Low
	3	Prunus	1,528	-0.52	High
	4	Ulmus	1,397	-0.40	Low

4.3 Greenery distribution disparity in residential zones and affordable housing surroundings

The GVI also varies across each different sub-zoning areas. The mean GVI distribution in 3 residential and 22 sub-zoning areas (Appendix) is shown in Fig.10. In general, the mean GVI in the Residential Zone (RZ) is higher than that in the Residential Apartment Zone (RAZ) and Residential Flat Zone (RFZ). The R-1A zone has the highest mean GVI at around 42.5, the RA-1 zone has the lowest mean GVI at around 25. In local perspectives, the opposite mean distribution appears within RZ and RAZ. In RZ, with the increase of housing density, the zoning type transfers from R-1A to R-1B, R-2, and R-3, the mean GVI presented an obvious decrease from around 42.5 to 26, which indicated the normal relationship between land use and urban greenery. All R-1A and variations showed high mean GVI around or above 40, and small deviation from the mean values, the cliffs between R-1A and R-2 or R-3 are distinct.

However, the denser the residential zoning type within RAZ, the higher mean GVI values show out. For example, the RA-4 which provides for areas developed with predominantly medium- to high-density residential has the highest mean GVI of around 37, while the RA-1 which permits low- to moderate-density development, including detached dwellings, rowhouses, and low-rise apartments has the lowest mean GVI around 25. In addition, the mean GVI of RF-1 which belongs to RFZ is neither high nor low, which is around 28.

The distribution difference simultaneously revealed the inequality of residential land use. Zoning types with high mean GVI are mostly located in *'Local North'* Wards 3 and 4, while low mean GVI zoning areas are concentrated in Wards 7 and 8. Wards 7 and 8 have 31 and 26 RA-1 zones (the lowest GVI zoning), in comparison, Wards 3 and 4 only have 7 and 10 RA-1 zones respectively. As for RA-1 zones (the highest GVI zoning), Wards 3 and 4 have 7 and 3 respectively, and Wards 7 and 8 do not have such kind of zoning.

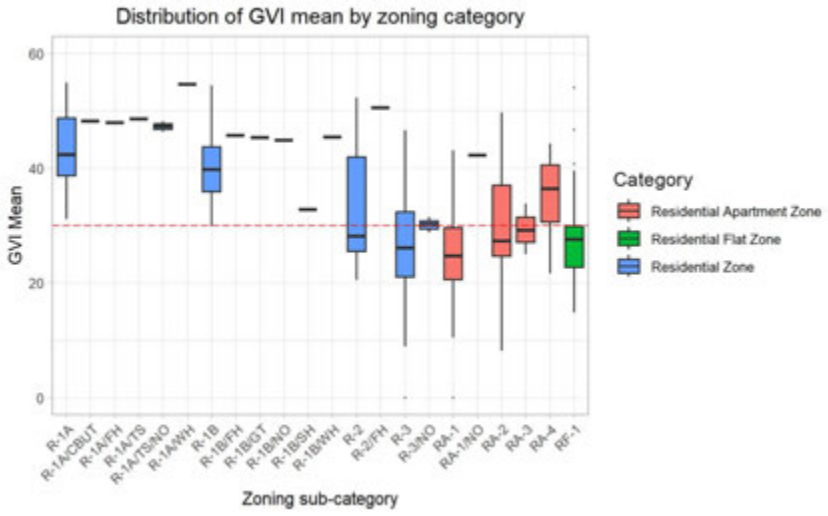

Fig.10 The temperature mitigation effects of GVI, NDVI and GVI-3D

We found that 98 affordable housing projects in different wards and zoning also presented disparity (Tab.3). Due to the wealth of Ward 3, only one HPTF affordable housing project was built between 2010 and 2022, which is Woodley House. Wards 4, 7, and 8 have 38, 32, and 27 affordable housing projects built in during 13 years. The mean GVI of all affordable housing projects is 27.2, which is quite as low as the mean GVI in R-3 zoning. The only project in Ward 3 has a mean GVI of 43.51, the mean GVI of projects in Ward 4 is 31.1, far higher than the projects with the highest GVI of 30.96 and in Wards 7 and 28.24. The average GVI of affordable housing projects in Wards 7 and 8 are only 25.9 and 22.6, indicating the huge gaps between affordable housing projects in different Wards. What's more, the affordable housing project with the highest GVI in Ward 7 is located in Mixed-Use Zones where the commercial and institutional use are prior, the multi-family residential development are secondary residential zoning areas (Appendices).

Tab.3 500-meter buffer GVI differences by HPTF housing projects

Ward	Project name	Zoning	GVI	
			Attribute	Value
Ward 3	Woodley House	RA-2	Only value	43.51
Ward 4	NCCLT-905 R St. NW	R-1A	Highest value	40.20
Ward 7	1847-49 Good Hope Road, SE	MU-7B	Highest value	30.96
Ward 8	Stanton Square Apartments	R-3	Highest value	28.24

5 Discussion

This study contributes to the validation of environmental injustice issues and significant temperature mitigation effects measured by GVI and GVI-3D. Taking Washington, D.C. as an example, we found that the greenery environment inequality, from macro-level to micro-level, extensively existed in the *'Local North'* and *'Local South'* with serious wealth polarisation, which reveals the infrastructure property attributes of street-level vegetation. GVI and LST are highly correlated, the new index GVI-3D presented a higher correlation with LST, with the increase of these two indices, the street-level space becomes cooler around 10 to 15 degrees Fahrenheit in a linear way. GVI-3D presented a better measurement of LST mitigation, which contributed to establishing the model of a true mathematics mapping of this index to canopy volume in physical urban space. As for the good measurability, we believed that the side views of street greenery images provide more possibilities to measure the actual volume of tree canopies which are the main cooling source for urban street-level microenvironment.

However, the cooling effects of different tree genera differs, some dominant genus has better temperature mitigation effects such as Prunus, Cercis, and Zelkova, while Acer and Ulmus show low mitigation effects. These subtle differences are difficult to spot, and even their cooling effect may be budget-related because we found that affluent wards tend to have more high cooling effect trees compared with non-affluent wards at the local level.

The GVI values also connect with land use type and housing density. The higher the density of detached or semi-detached Residential Zoning, the lower the GVI was found in those areas. In contrast, the higher the density of Residential Apartment Zoning, we get the higher GVI. This may be explained by the degree of intensive utilisation of land that needs to reach a certain value before it can function well. Unlike the average greenery environments of residential areas, the greenery environments of affordable housing were worse measured by GVI. Despite increased greenery is common sense that can mitigate the heat exposure risks, they also mean government or developers need balance investment and budget for targeted neighbourhoods. As for affordable housing, they usually have less accessibility to parks, forests and gardens, thus the urban street greenery becomes the limited or only green environment that affordable housing can directly benefit from so as to decrease heat exposure risks. Therefore, the significance of urban street greenery and its metrics should be addressed.

Some limitations should be addressed. First, despite the accuracy of a similar semantic segmentation model being around 85 percent according to prior research (Ki & Lee, 2021; Li et al., 2019; Zhao et al., 2017), changing the detection image dataset from European based cities to American cities can have an influence on the accuracy of the algorithm. As for the temperature mitigation effect, we only consider the single variable of urban greenery, more variables can be included such as Impervious Surface Area (ISA) (Yuan & Bauer, 2007; Imhoff et al., 2010; Ziter et al., 2019). Besides, more data may give the correlation analysis and regression model better explanatory power. Despite the GVI-3D generated a fine R-squared value of 0.73, the 0.60 R-squared value of GVI still has the possibility of being improved.

6 Conclusion and policy proposals

In conclusion, GVI has virtually the same explanatory power as NDVI when it comes to the LST mitigation effect, while GVI-3D has the best. This study argues that it is of practical significance to monitor GVI and GVI-3D rather than NDVI of small-scale street environments due to their readability, controllability, and human-centric attributes. It is feasible to adjust GVI by controlling the size, quantity, and density of street greenery, a 60 percent GVI can be a cut-off for urban greening work to prevent excessively large tree canopies concerning their cooling effects. However, large-scale NDVI measurements make it difficult to contribute to improved policy suggestions for street greening. The related housing and greenery policies can have improvements as follows.

6.1 Focus on greenery quality rather than only quantity

According to Fang (2024), 'DC's greenery-related government departments already made huge efforts to plant trees in non-affluent areas such as Wards 7 and 8', their achievements can be reflected in the number of tree/vegetation image points mentioned above. However, greenery quality is more essential indicated by GVI and GVI-3D in this study. Through measuring GVI, it is easy to find that vegetation proportion over 60 percent can't produce a substantial cooling effect. Therefore, more emphasis and resources can be invested in the improvements of quality of the greenery environment such as the balance of tree genus and the volume of tree canopies so that we can pursue better temperature mitigation effects by quantifying GVI or GVI-3D. Those resources to manage excessively huge tree canopies can be transferred to 'Local South' areas by managing the life cycle of the trees.

6.2 Highlight the greenery environment of affordable housing projects

The locations of HPTF affordable housing projects are precise. Ward 3 only built one affordable housing during 13 years. However, the gaps between this only one project and the others were huge. A suitable greenery environment for housing has the significant impact on the health of residents (Hanzl & Rembeza., 2022; Kuchcik et al., 2016), housing values (Zhang & Dong., 2018; Ye et al., 2019), and environmental justice (Schmid & Säumel., 2021; Xiao et al., 2021). The affordable housing projects have the necessitates to set aside a part of the budget and resources for the improvement of the surrounding green environment in terms of tree genus and volume. The density of affordable housing projects can be improved from the evidence that higher density Residential Apartment Zone tends to have better greenery environment measured by GVI. In addition, the assessment of the difference between affordable housing projects and normal housing projects is necessary.

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Appendices

Tab.4 The description of residential zoning categories in Washington, D.C.

Zoning	Sub-Category	Description
Residential Apartment Zone	RA-1	The RA-1 zone provides for areas predominantly developed with low- to moderate-density development, including detached dwellings, rowhouses, and low-rise apartments.
	RA-2	The RA-2/RC zone is intended to provide for areas developed with predominantly moderate- and medium-density rowhouses and apartments.
	RA-3	The RA-3 zone provides for areas developed with predominantly medium-density residential.

	RA-4	The RA-4 zone provides for areas developed with predominantly medium- to high-density residential.
	RA-1/NO	The RA-1/NO zone provides for areas predominantly developed with low- to moderate-density development, including detached dwellings, rowhouses, and low-rise apartments in the vicinity of the U.S. Naval Observatory.
Residential Flat Zone	RF-1	The RF-1 zone is to provide for areas predominantly developed with row houses on small lots within which no more than two (2) dwelling units are permitted.
	R-1A	The R-1A zone is intended to provide areas predominantly developed with detached houses on large lots.
	R-1A/CBUT R-1A/FH R-1A/TS R-1A/TS/NO R-1A/WH	All R-1A variations permit detached houses on large lots. They also have the purpose to protect specific areas' low density, natural topography, historic or ceremonial importance, or special missions, including Chain Bridge Road/University Terrace, Forest Hills, Tree and Slope Protection zones, Naval Observatory/Tree and Slope Protection zones and Wesley Heights.
	R-1B	The R-1B zone is intended to provide areas predominantly developed with detached houses on moderately sized lots.
Residential Zone	R-1B/FH R-1B/GT R-1B/NO R-1B/SH R-1B/WH	All R-1B variations permit detached houses on moderately-sized lots. They also have the purpose to protect specific areas' low density, natural topography, historic or ceremonial importance, or special missions, including Forest Hills, Georgetown National Historic Landmark District, Naval Observatory, Sixteenth Street Heights and Wesley Heights.
	R-2	The R-2 zone is intended to provide for areas predominantly developed with semi-detached houses on moderately sized lots that also contain some detached dwellings.
	R-2/FH	The purposes of the R-2/FH zone are to preserve the natural topography and mature trees to the maximum extent feasible in the Forest Hills neighbourhoods, which permit semi-detached houses on moderately sized lots that also contain some detached dwellings.
	R-3	The purpose of the R-3 zone is to allow for row dwellings, while including areas within which row dwellings are mingled with detached dwellings, semi-detached dwellings, and groups of three or more row dwellings.
Mixed-Use (MU) Zones	MU-7B	The MU-7B zone is intended to permit medium-density mixed-use development with a focus on employment.

Research on spatial optimization strategies of rural settlements in the Loess Plateau from the perspective of disaster prevention and reduction—A case study of Gaoxigou Village,China

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Abstract: The Loess Plateau is one of the regions with the most serious soil erosion and the most fragile ecological environment in the world. In recent years, the fragile rural settlement space is increasingly challenged by extreme weather, and various natural disasters occur frequently.Therefore, exploring spatial optimization strategies for rural settlements in this area from the perspective of disaster prevention and reduction is of great significance to ensuring the safety of residents and achieving sustainable development of rural settlements.Based on the results of natural disaster risk assessment in Gaoxigou Village, this paper analyzes the coupling relationship between different risk areas and various types of current village Spaces, and puts forward spatial optimization strategies from living space, ecological space and road space.

Keywords: Loess Plateau, rural settlement, spatial optimization

Introduction

In recent years, affected by factors such as global climate change and some human behaviors, urban and rural spaces have faced increasingly unstable threats of natural disasters. According to statistics from the United Nations Office for Disaster Risk Reduction, between 2000 and 2019, a total of 7,348 natural disasters were recorded around the world, causing 1.23 million deaths, a total of 4 billion affected people, and causing global economic losses of up to $2.97 trillion.In the urban and rural space, rural areas have the closest contact with the ecological environment and are therefore disaster-prone areas. However, at the same time, rural areas are the weakest areas in disaster prevention, reduction and relief, and their level of natural disaster prevention and control is relatively low. Therefore, studying the optimization of rural settlement space from the perspective of disaster prevention and reduction is of great significance for promoting rural safety development.

At present, the existing relevant research on disaster prevention and reduction is a

combination of disaster systematics, economics and sociology. Through the research on the formation mechanism, occurrence mechanism, damage characteristics and disaster characteristics of various disasters, it combines social disciplines and population , social environment, economy, resources, etc., and for the purpose of disaster prevention and reduction, relevant technologies, measures and policy methods for disaster prevention and reduction are proposed.Scira Menoni evaluated the urban lifeline system from three aspects: organizational, physical and functional vulnerability, and proposed comprehensive planning and improvement of disaster prevention and reduction based on geospatial technology[1].Grange Ken quantitatively analyzes the influencing factors of snowstorm disasters from basic data, construction, material supply and community safety data, and studies ways to improve disaster prevention and reduction capabilities from the perspective of factors[2].Chi Tenglong, Zeng Jian, and Wang Sitong combined the actual conditions of the villages and took Zhujiaying Village in Fuping County as the research object. They analyzed the social, economic, natural and other development conditions of the village through data obtained from field surveys, identified development bottlenecks and safety hazards, and formulated Corresponding industry, site selection and village transformation strategies[3]. However, existing research currently lacks research on resisting and reducing disaster risks through spatial adjustment of potential disaster risks.

The Loess Plateau is a typical ecologically fragile area in my country, with criss-crossing ravines, broken surface, loose soil, and serious water and soil erosion. The depth of the channels in the area is 100-300m, and the average erosion intensity is about 10,000-25,000 tons/square kilometer per year, making the local ecological environment extremely fragile[4]. Under the influence of long-term natural conditions of strong winds, drought and little rain, rapid rainy seasons, and unreasonable utilization, rural settlements in the Loess Plateau face high ecological threats and frequent natural disasters. Therefore, conducting research on the optimization strategies of rural settlement space in this region from the perspective of disaster prevention and reduction has strong practical significance in guiding the optimization of rural space in this region, improving the ability to withstand disaster risks, and achieving sustainable rural development.

1. Reflection on practical issues in rural settlements on the Loess Plateau

The Loess Plateau is located in the northern part of central China, spanning seven provinces and regions: Qinghai, Gansu, Ningxia, Inner Mongolia, Shaanxi, Shanxi, and Henan. It has an altitude of 800 to 3,000 meters and a total area of 640,000 square kilometers.The Loess Plateau is a highly ecologically sensitive area and one of the areas with the most severe soil erosion in the world. It is soil erosion area reaches 230,000 square kilometers, accounting for thirty-four percent(34%) of the Loess Plateau's land area. In addition, the area has been severely eroded by running water for a long time, gradually forming a special natural landscape with thousands of ravines and fragmented terrain. The ravine density is about 2.35-10.9km/km^2. It has typical loess collapsible

geological characteristics and various natural disasters occur frequently. With the continuous advancement of urbanization, urban and rural construction space has further expanded. In addition, this area is an important energy base in China and the area with the greatest coal production potential. Its rich mineral and tourism resources have further promoted the industrial, mining and cultural tourism industries in the area. These reasons have increased the human disturbance of the originally fragile ecological environment.

In recent years, as the global precipitation line gradually moves northward, rainfall continues to increase, and rainfall changes significantly in space and time. In addition, regional instantaneous rainfall in summer is relatively large, which has led to a significant increase in local natural disaster risks. Rural areas are disaster-prone areas, and they are the weakest link in disaster prevention, reduction, and relief. With the continuous advancement of urbanization and the rapid changes in village production and lifestyle, ecologically fragile rural settlements are facing more severe disasters. As a result, rural settlements on the Loess Plateau will face greater disaster threats in the future. Therefore, how to deal with the impacts of fragile ecological background, increased human disturbance, and intensified climate change and minimize disaster risks has become the biggest practical problem facing rural areas on the Loess Plateau.

2. Optimization path of rural settlement space in the Loess Plateau from the perspective of disaster prevention and reduction

Climate change and the original fragile background conditions have caused local rural settlement space to face a high degree of threat. First, local disaster risks were assessed based on factors such as slope, slope aspect, slope type, rock formation, and disaster development density. Then, based on the risk assessment results, a rural space optimization strategy is proposed to reduce the impact of disasters from three aspects: ensuring residential safety, enhancing ecological service functions, and improving road emergency capabilities.

First of all, in terms of residential safety, by identifying areas where medium and high risk areas conflict with the current living space, the layout of the living space is adjusted to avoid medium and high risk areas, and at the same time, hidden danger points of residential disasters are rectified to ensure the safety of residents.Secondly, in terms of ecological space, through coupling analysis of the current ecological space and different disaster risk levels, the functions of ecological space are re-adjusted, and through potential ecological hydrological analysis, the breaking points of ecological space are repaired and the overall service function of rural ecological space is improved.Finally, in terms of road space, the medium and high-risk areas of the existing roads will be renovated, and the road system will be reorganized to improve the emergency disaster relief capabilities of the roads.

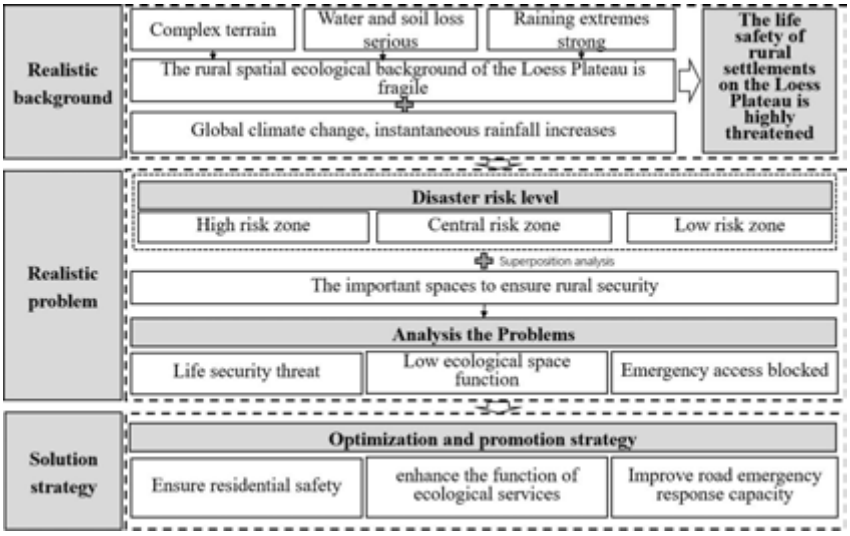

Fig. 1 Rural settlement optimization path

3. An empirical case of spatial optimization in Gaoxigou Village from the perspective of disaster prevention and reduction

3.1 Overview of research objects

Gaoxigou Village is a typical Loess Plateau area located in Mizhi County, Yulin City, Shaanxi Province, China, with a total area of 406.93 hectares. There are 40 mountains in the village. The terrain in the village is undulating and fragmented. The density of ravines is about 5-7 kilometers per square kilometer, and the depth of the gullies is between 100-200 meters. In recent years, with the increase in rainfall, geological disasters such as landslides and collapses have occurred frequently, posing a high threat to the safety of residents' production and life.

Based on the data from the Xi'an Geological Survey Center of the Bureau of Geological Survey, combined with factors such as slope, slope aspect, slope type, rock group, and disaster development density, the Gaoxigou disaster risk area and level were comprehensively evaluated. The evaluation results show that the village area with high disaster risk covers an area of 19.41 hectares, accounting for four point eight percent(4.8%)of the study area. It is mainly distributed on both sides of the ditch, close to the bottom of the ditch, and distributed in a dendritic shape;the medium-risk area is 51.65 hectares, accounting for twelve point six nine percent(12.69%) of the study area, mostly adjacent to high-risk areas and distributed on the slopes on both sides of the ditch; the low-risk area is 335.87 hectares, accounting for eighty-two point five one percent(82.51%) of the study area, and is widely distributed, mainly in areas with gentle slopes within the village.

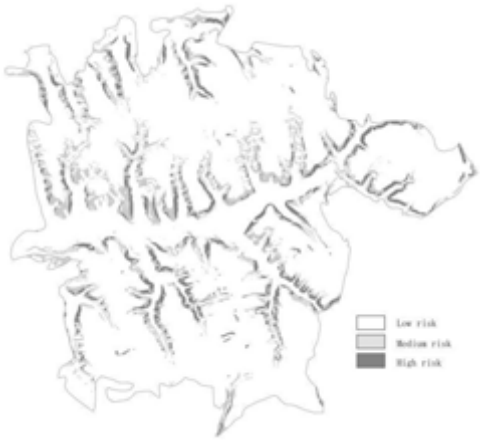

Fig. 2 Disaster risk zoning in Gaoxigou Village

3.2 Analysis of real problems

3.2.1 Lack of planning for living space and high threat to life safety

The risk assessment results were superimposed on the current construction space to identify residential space and medium-risk and high-risk conflict areas.Among them, 15 high-risk residences are located on the north side of the village, 5 of which are located in the main channel of the village, and the remaining 10 are located in the village.There are 27 medium-risk houses in the branch ditch, 2 are located on the north side of the main ditch, 10 are located in the branch ditch on the south side of the village, and 15 are scattered in the north side ditch.

In addition, after on-site investigation, it was found that although some residential spaces are not in medium-risk or high-risk areas for geological disasters, due to the special loess type and the cutting of slopes for building houses, some residences still have disaster hazards.Through household surveys, it was found that 8 houses in the village located in low-risk areas in the branch ditches on the north and south sides of the village still have potential disaster safety risks.

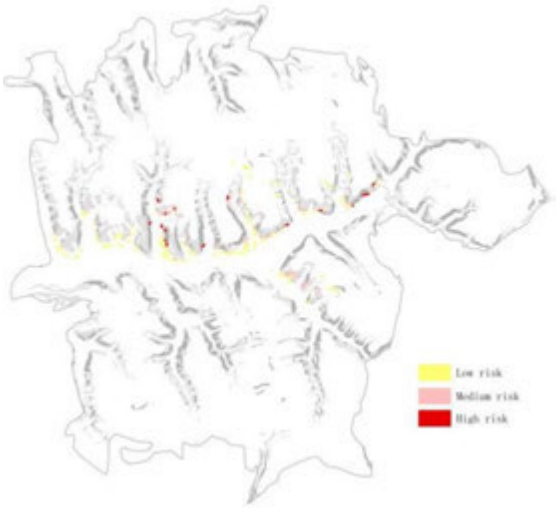

Fig 3. Construction disaster risk level

Fig 4. Hidden danger points of construction disasters in low-risk areas

3.2.2 The ecological environment is fragile and the functional efficiency of ecological space is low

The woodland, grassland, pond water surface, and inland tidal flats within the village area were extracted as ecological land, with an ecological land area of 217 hectares.Superimposing disaster risk zoning and ecological space, the coupling area of high-risk areas and current ecological space is 16.30 hectares, with a coupling degree of approximately eighty-four percent(84%), the coupling area of medium-risk areas with ecological space is 33.05 hectares, and the coupling degree is approximately sixty-four percent(64%).The degree of coupling between medium and high risk areas and the current ecological space is at a medium level.This shows that the coupling relationship

between ecological space and disaster risk in this region is fragile, and it is necessary to further improve its coupling degree and disaster resilience through ecological space adjustment.

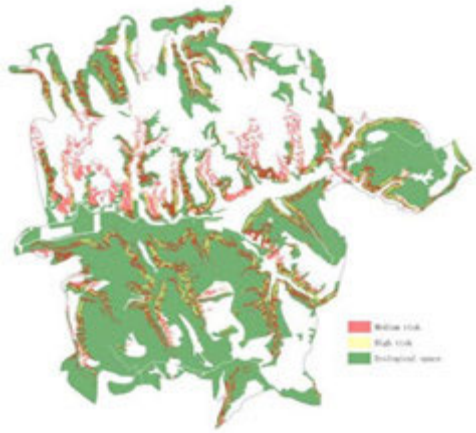

Fig 5. Coupling situation of ecological space and medium- and high-risk disasters

In addition, the local ravines are criss-crossed and the instantaneous rainfall is large. Therefore, the gully space assumes the drainage function during the rainy season and is a potential hydrological space.Through GIS spatial analysis, this paper extracts the hydrological space of three levels in Gaoxigou and compares the ecological space with the hydrological space.Superimposing ecological space and hydrological space, it was found that there are fractures in the existing three-level hydrological space. Among them, the length of the first-level hydrological space is about 3.04km, the length of the second-level hydrological space is about 2.93km, and The length of the third-level hydrological space fault is approximately 1.93km.

Fig 6. Current status of hydrological spatial distribution and systematics

Fig 7. Current status of hydrological space fractures

3.2.3 Road space is not smooth and emergency and disaster relief capabilities are

insufficient

Through the overlay analysis of the existing roads and disaster risk areas in the village, it was found that the existing roads do not have high-risk hidden dangers, but there are moderate-risk hidden dangers in disasters, with the risk area being about 0.39 hectares.In addition, the road space on the Loess Plateau serves as an important lifeline and plays an important emergency rescue function.However, there are many dead-ends roads and the road network cannot meet the needs of emergency rescue.

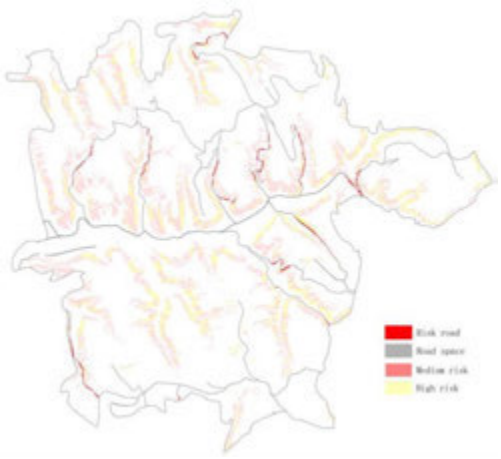

Fig 8. Road disaster risk levels and distribution

4. Space optimization strategy of Gaoxigou Village from the perspective of disaster prevention and reduction

4.1Ensure residential safety

Based on the overlay analysis of residential space and risk areas, the buildings located in high-risk areas are relocated and set aside. Corresponding safety precautions should be taken for areas that are temporarily unavailable to move out, and construction and expansion should be strictly controlled to cause the area to shrink, and ecological restoration should be carried out to gradually restore it to an ecological space.For buildings located in medium-risk areas, ecological retreat can be adopted. On the premise of ensuring safety, the ecological space can be gradually returned by changing the use of the building. For example, it can be used as agricultural housing in the early stage, and the ecological space can be gradually returned to the ecological space as time goes by.

Fig 9. The building layout adjustment

Tab1. Construction risk control measures

Risk source number	Suggestions on risk management and control measures
1	Conduct regular inspections, strengthen monitoring
2	Conduct regular inspections, Clear dangerous rock mass
3	Conduct regular inspections, strengthen monitoring, surface drainage
4	Conduct regular inspections and strengthen monitoring
5	Conduct regular inspections, strengthen monitoring, surface drainage
6	Conduct regular inspections, strengthen monitoring, surface drainage
7	Conduct regular inspections, strengthen monitoring, surface drainage
8	Conduct regular inspections, strengthen monitoring, Clear dangerous rock mass, surface drainage

4.2 Enhance ecological service functions

Based on the risk assessment results, the functions of the existing ecological space should be rearranged. For ecological spaces located in high-risk disaster areas, priority should be given to protecting and maintaining the integrity and functionality of the ecosystem.A strict ecological protection system should be implemented, and any form of farming and construction activities should be strictly prohibited and implement enhanced management measures. For ecological spaces located in medium-risk areas,

ecological spaces for productive restoration can be set up. During the development process, terraces can be constructed to effectively reduce the speed and amount of rainwater runoff, and some fruit tree varieties with better soil-fixing capabilities can be selected to grow. At the same time, some fruit tree varieties with better soil-fixing capabilities can be chosen to plant. This can reduce soil erosion while increasing the scale of agricultural production land. For ecological spaces located in low-risk areas, without destroying their ecological integrity, by combining them with local natural and ecological values, they should appropriately incorporate sightseeing, recreation and other functions, which not only ensures that the ecological environment is effectively protected and restored, but also Significantly improve residents' quality of life.

In view of the actual situation of ecological fracture points, ecological land restoration is required for the fracture areas of the primary hydrological space, and strict ecological priority policies should be implemented. At the same time, the buildings already constructed in the fracture areas should be demolished, and the current production land in the fracture areas should be returned to forest and grassland to ensure the continuity of the primary hydrological space and ecological security.

4.3 Improving road emergency response capabilities

Combined with the results of road risk identification, for road spaces located in medium-risk areas, it is necessary to comprehensively consider the actual road conditions, select appropriate protection measures, prevent the occurrence of disasters such as landslides and collapses, and deal with potential risks in a timely manner to ensure smooth and safe roads.First of all, these road disaster risk types are mainly landslides and collapses. According to the disaster types, the stability of road slopes can be strengthened by using slope protection forms such as mortar-laid stone, mesh shotcrete, and mesh sprayed ecological technology to effectively prevent disasters.At the same time, by strengthening patrol supervision, regularly checking road conditions, and promptly discovering and resolving potential hidden dangers, we can ensure that the roads are always in good condition and provide residents with a safe and smooth travel environment.

In addition, the road system within Gaoxigou Village was reorganized, dead-end roads were opened up, and a circular series road system that conforms to the terrain was adopted. This will help increase the redundancy of emergency escape routes and effectively improve the road emergency response capabilities.While providing villagers with more convenient and safer travel conditions, rescue operations can be launched more quickly when faced with emergencies, thereby improving the village's overall disaster prevention and relief capabilities and protecting the lives and property of villagers.

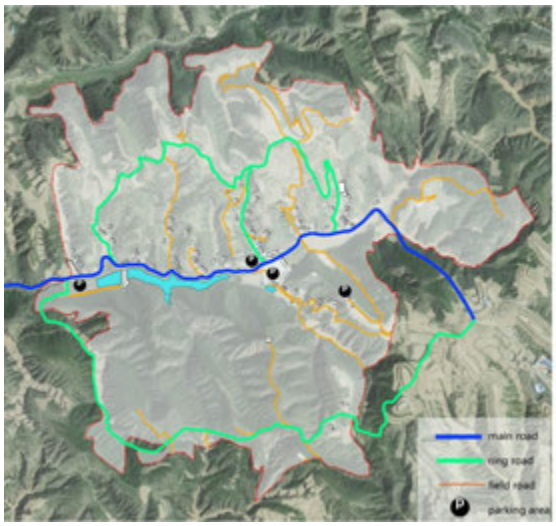

Fig 10. Reorganization of road traffic system

5. Conclusion

Combined with the results of the disaster risk assessment of Gaoxigou Village, the residential space, ecological space and road space in the village were coupled and superimposed, and it was found that there were real problems such as hidden dangers to residential safety, broken ecological space, and insufficient road emergency support capacity in the village.In response to practical problems, a village optimization strategy is proposed to ensure residential safety, enhance ecological service functions and improve road emergency response capabilities, thereby reducing local disaster risk threats and effectively ensuring the safety of residents. Overall, this idea is highly applicable to rural settlements in the Loess Plateau where the ecological background is fragile.

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A GIS-based Method for Prioritising Brownfields Transformation into Multifunctional Urban Green Infrastructure: The Case of Rouen Metropolis

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Abstract

The spatial expansion of cities results in the loss of natural resources. It is therefore crucial to maintain ecological performance by balancing the land used for human purposes with efforts to restore or protect natural habitats. Here, we investigate how to transform brownfields into multifunctional urban green infrastructure. We use a GIS-based multi-criteria evaluation model to prioritise the brownfields in Rouen metropolis. We show that (1) the integration of site suitability and urban ecological demand is required, (2) Coupling Coordination Degree serves as an appropriate model for determining the interaction and coordination of site suitability and urban ecological demand.

Keywords Brownfield, Urban Green Infrastructure, Site Suitability Analysis, Multifunctionality, Spatial Planning

1. Introduction

Promoting reasonable land development while reducing land use challenges is a fundamental component of sustainable development (Wei & Ewing, 2018). The EU declared its policy of No Net Land Take by 2050, which France adopted in its national law with the policy “Zéro Artificialisation Nette” to encourage the reuse of developed lands (Science for Environment Policy, 2016). To follow these policies, the brownfields need to be redeveloped and given new life (Loures, 2015). It is recognised that brownfield redevelopment could bring a range of environmental, economic and social benefits (Wang et al., 2011). The integration of green infrastructure in brownfields, presents an attractive nature-based solution for addressing environmental concerns at brownfields (Hou et al., 2023). But is there a practical tool to prioritise brownfields for transformation into multifunctional urban green infrastructure? This question becomes crucial as costs involved in brownfield redevelopment can be significant (Bacot & O’Dell, 2006) and to avoid random allocation. We therefore investigated a GIS-based multi-criteria model to calculate the coupling coordination degree between site suitability and urban ecological demands. We demonstrated that 15 high priority brownfields exhibited a significant coupling coordinate degree and matching relationship to develop green infrastructure. This approach can be used as part of a spatial planning process, applicable to any city that faces similar problems. It provides support to identify suitable areas for green infrastructure expansion.

2. Methodology

The Green infrastructure decision-support tool derived from (Feng et al., 2023) is implemented in three phases. During the first phase, site suitability analysis of each brownfield assessed with seven criteria. In the second phase urban ecological demands was considered that could be addressed through green infrastructure planning. Finally, the coupling coordination model is used followed by an analysis of their matching degree through quadrant division.

The study is conducted in the Rouen metropolis, Normandie region, France, which covers approximately 663.8 km2 and includes 71 municipalities *(Figure 1).* Located in the south of the Seine-Maritime department, the area had a total population of 496,629 inhabitants at the end of 2020. The distribution of brownfields within the metropolis aligns with the location of the rivers and valleys, with a few brownfields existing in the plateaus. Specifically, the municipalities situated on the left bank of the Seine, such as Oissel, Rouen (left bank), and Petite and Grand Quevilly, contain a large number

of brownfields, while several brownfields are also present in the municipalities surrounding the Cailly river. In the latest Cartofriches dataset, within the Rouen metropolis, a total of 416 sites have been identified as brownfields.

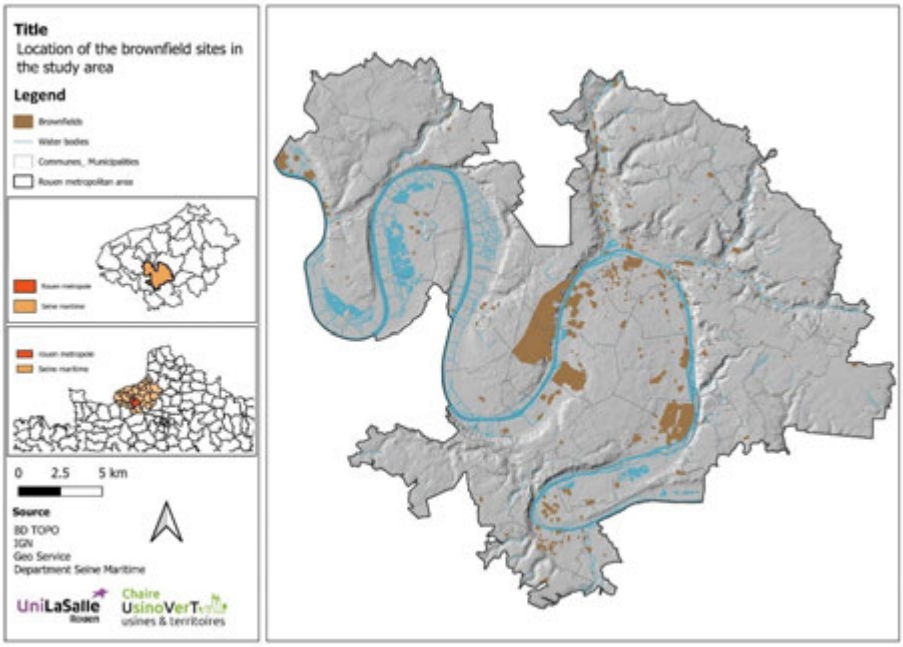

Figure 1: Map of the brownfields' location (Source: Done by the author)

For the site suitability analysis, we developed an index system with seven criteria comprising area, slope, NDVI, suitability of construction land, proximity to green area, proximity to settlement area, and soil contamination. Following this, we examined the attributes of each criteria based on literature and established a rating system. Then we determined the weights for each criteria through pairwise comparisons using the Analytic Hierarchy Process (AHP). For multifunctional green infrastructure planning, four indicators have been selected, including flooding risk, high land surface temperature, habitat fragmentation and air pollution. The urban demand values of brownfields were calculated by the zonal statistical tool in QGIS, which were then divided into five levels using the natural breakpoint method (Figure 2). Then, we calculated the weight of each index with AHP. To establish the coupling coordination degree model, the calculation was done with:

$$C = \frac{\sqrt{S \times D}}{(S + D)}$$

$$T = \alpha \times S + \beta \times D$$

$$CCD = \sqrt{C \times T}$$

S: Site suitability value
D: Comprehensive demand value
C: Coupling degree
T: Comprehensive coordination index
CCD: Coupling coordination degree
(α = β = 0.5)

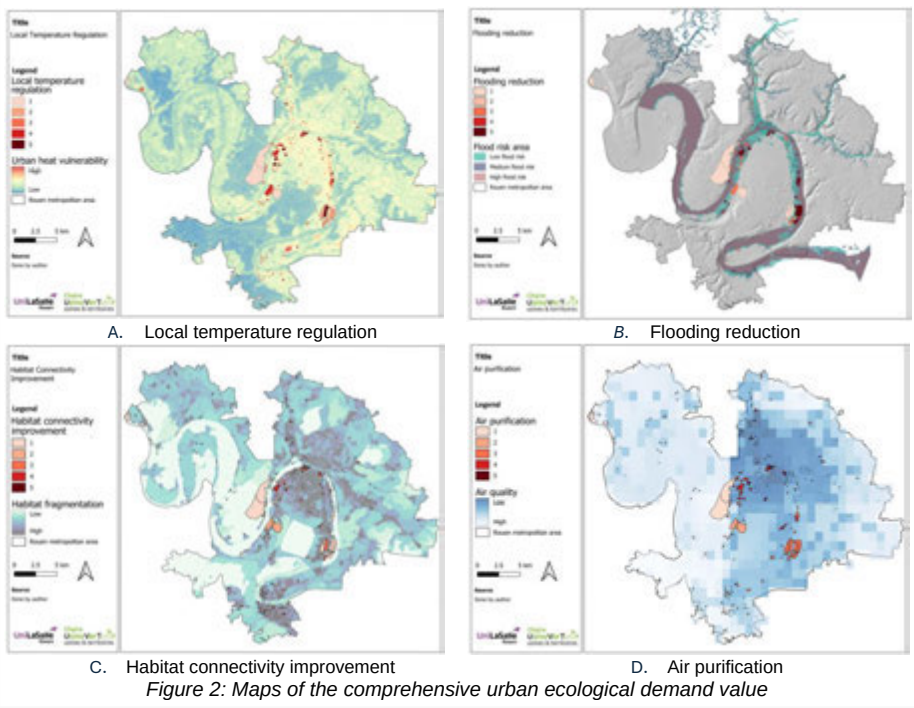

Figure 2: Maps of the comprehensive urban ecological demand value

Furthermore, quadrant division is being used to assess the position of points which represents site suitability and urban demands within a coordinate system. Lastly, we identified the brownfields with coupling coordination degree value greater than or equal to 0.85, and located in either quadrant “high demand–high suitability” or quadrant “high demand–low suitability”.

3. Results

Site suitability analysis was carried out for brownfields. The suitability values ranged from 1.64 to 4.52, while these scores varied, the general trend indicated favorable suitability overall. The analysis revealed that 115 brownfields, 36.05% of the total, had suitability values greater than 3.5. There was no clear spatial pattern of site suitability values, but brownfields located near the Seine river, specifically close to the Rouen and Elbeuf cities, tended to be more suitable for green infrastructure development. For the comprehensive urban demand value, the brownfields with values between four and five comprise 31 sites, representing 9.7% of the total number of brownfields, and there are 71 brownfields with values between three and four, representing 22.2% of the total. The coupling coordination between site suitability and urban demand values range from 0.50 to 0.95, indicating an almost ideal coupling relationship between them. This spatial pattern indicates a harmonious trend between the suitability of brownfields and the ecological demands of the surrounding area. Considering matching relationship (Figure 3), quadrant “high demand- high suitability” consists of 82 brownfields, with 25.86% of the overall total. Quadrant “high demand- low suitability”, hosts 69

brownfields, constituting 21.76% of the total. When considering the high-demand regions, the total count reaches 151.

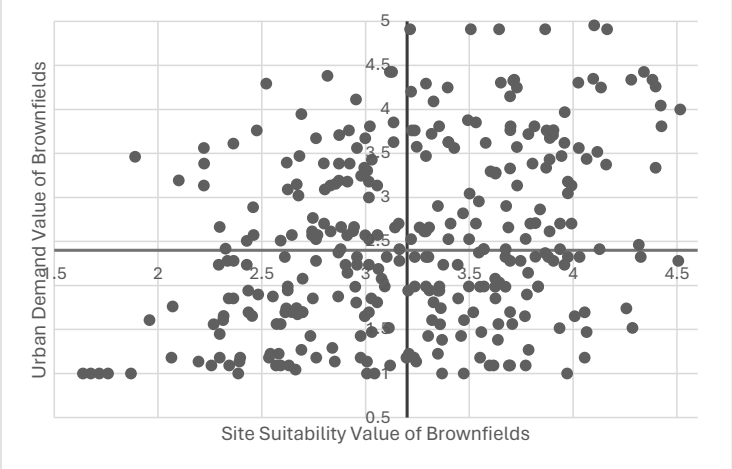

Figure 3: The matching relationship

The model shows 84 brownfields to be integrated into green infrastructure in Rouen metropolis. The brownfields with high site suitability and high urban demand values were categorized into three priority levels based on their coupling coordination degree. Specifically, 15 brownfields were identified as high-priority sites, having a CCD above 0.9. In addition, 28 sites fell into the medium priority category, with CCD values between 0.85 and 0.9, while 41 sites were classified as low priority, characterised by CCD values between 0.75 and 0.85. The spatial distribution of high priority brownfields interestingly shows an agglomeration of eight brownfields located in the Rouen city, in the industrial zone of the Rive gauche. The other priority sites do not show a clear trend but are all located within the alluvial terraces of the Seine and tributaries.

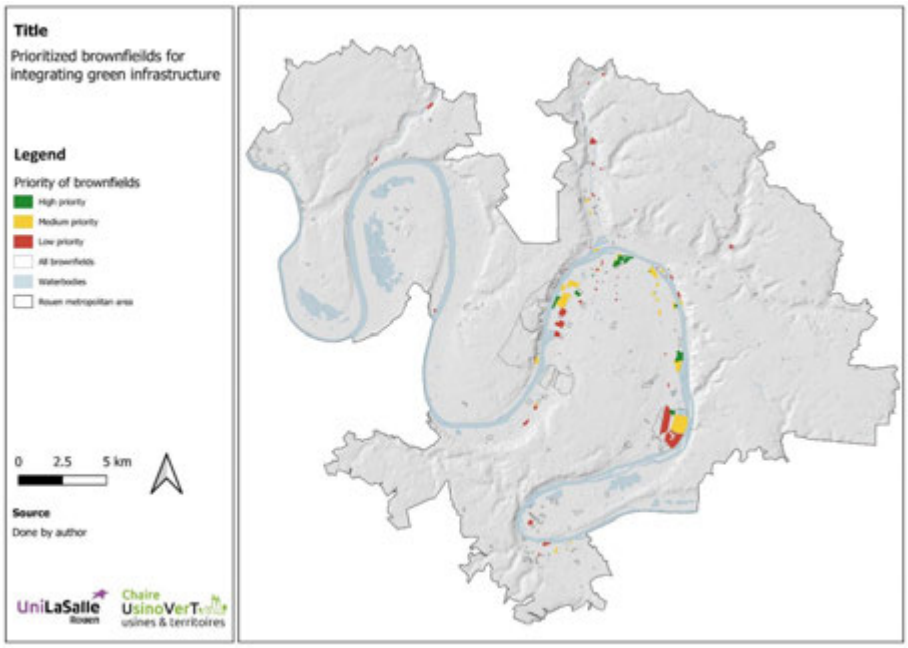

Figure 4: Map of the prioritized brownfields

4. Discussion

In the literature, previous studies have focused on either site suitability analysis or green infrastructure planning. However, the integrated outcomes present a unique perspective distinct from either the site suitability results or the findings on urban ecological demands when considered individually. Using this methodology, we can not only identify sites that are suitable for the implementation of green infrastructure based on a range of criteria such as area, slope, NDVI, etc., but also highlight sites that need intervention to meet multifunctional ecological demands of the area. The emphasis on multifunctionality represents a departure from the conventional approach observed in many previous studies, and potentially unlocks a wider range of benefits that green infrastructure can provide.

High priority brownfield sites are concentrated within the cities of Oissel, Saint-Étienne-du-Rouvray, Sotteville-lès-Rouen, Rouen (left bank), Le Petit-Quevilly, and Le Grand-Quevilly. Notably, all six municipalities out of a total of 71 are situated in close proximity to each other, south of one of the Seine river loops. While the medium and low-priority brownfields are more distributed, a significant portion of them are also concentrated in the same cities. Brownfields are all situated in close proximity to the rivers Le Seine, Le Cailly, and L'Austreberthe. They represent locations where green development is needed to complete the network of natural and semi-natural areas.

The Coupling Coordination Degree Model is a widely used method in environmental studies to determine the interaction and coordinated evolution of different systems, particularly in the Chinese literature. Numerous scientific papers have used the CCDM

to integrate complex systems across a range of disciplines, demonstrating its versatility and applicability (T. Li et al., 2022; Y. Li et al., 2012; Shi et al., 2020; Tang, 2015; Xing et al., 2019) . Despite its widespread use and high citation rate in the Chinese literature, this methodology has not penetrated the academic literature of other countries to any significant extent. Our study sheds light on the effectiveness of the CCDM by demonstrating its utility in analysing the complex relationship between site suitability and urban ecological demands.

This tool is a basis for decision-makers to explore and evaluate options and to conduct different scenarios that can easily be assessed by planners and developers at the beginning of the planning process.

On the one hand, there is a need to explore the application of the model in different regions, especially in different urban settings. On the other hand, it is necessary to collect socio-economic data in order to assess the sustainability of the interaction between brownfield regeneration and the development of multifunctional green infrastructure.

5. Conclusion

In this study, we propose a model to guide practitioners and researchers in identifying and prioritising brownfields suitable for transformation into green infrastructure. The proposed methodology has been developed by overlaying seven site attributes, with ecological demand considerations. Through the application of the coupling coordination degree model and quadrant division, the most suitable brownfields for transformation into green infrastructure have been identified. A total of 84 brownfields were selected for integration into green infrastructure within the Rouen metropolis. Among these, 15 brownfields were designated as high-priority sites, while 28 sites were categorized as medium priority, and 41 sites as low priority.

Acknowledgements

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Climate and transport planning: a messy junction

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Abstract:

The European Green Deal's ambition for climate neutrality by 2050 necessitates robust action at all levels of governance. This paper examines the intersection of climate planning and transport actions in European cities, emphasizing the critical role of local authorities in driving sustainable urban development. Drawing on data from 50 European climate plans, the analysis reveals geographical disparities in climate planning efforts. Methodological variations in climate planning approaches are identified, alongside gaps in linking actions to emission reduction targets. Priority transport actions, categorized under the Avoid-Shift-Improve framework, highlight a focus on active mobility, electrification, and public transport enhancements. Recommendations for integrating climate and transport planning underscore the need for clearer target-setting and stakeholder engagement. Future research directions include exploring the efficacy of public participation methods and assessing planning system legitimacy. Overall, this paper contributes insights into advancing climate action agendas in European cities, crucial for achieving the objectives of the European Green Deal and fostering sustainable urban futures.

Keywords: climate plans, transport planning, strategic planning

The EU Parliament and Commission agreed to the European Green Deal in 2020 (EU, 2019), aiming to be climate-neutral by 2050. While National governments are required to develop national long-term strategies, cities and local authorities are the ones dealing with actions to decarbonise urban transport, housing, and waste at the local level.

Transport in particular plays a very important role. The global transport sector is responsible for a quarter of EU CO2 emissions, and while most sectors have started a downward trend to decarbonise, we find that in road transport this is not the case (European Environment Agency, 2022).

Since 2020, with the new net zero vision and the declaration of climate emergencies from local authorities, planning processes aimed at dealing with the emergency have surfaced (Gudde, et al., 2021). Some cities are implementing measures to try to achieve some reductions, but these are scattered, and a systems approach is needed, not only to think about the technological or

operational solutions (innovations) but also to be more democratic and include stakeholders views.

Moreover, all sectors need to be working in collaboration to achieve a net zero goal for the whole city. Therefore, at the strategic level, transport-specific planning tools such as sustainable urban mobility plans (SUMP), transport strategies, and local transport plans need to be integrated into climate plans. Such integration and the implementation of actions within the plans depend on local capabilities and resources (Lee, 2024). A interesting initiative born in Germany in the 1990's called the A-S-I approach can be used to structure policy to reduce the impact of transport on the environment. This is done through a three-pillar strategy: avoiding/reducing the need for motorized travel and trip length by improving the efficiency of the transport system as a whole, shifting/maintaining towards more environmentally friendly modes of transport to improve individual trip efficiency, and improving vehicle and fuel efficiency as well as the operational efficiency of public transport while introducing renewable energy sources (Bongardt, et al., 2019).

Some planning tools such as the Sustainable Energy and Climate Action Plans from the Covenant of Mayors, do include transport as one of their main sectors. This initiative has been growing gathering more than 7,000 local and regional authorities across 57 countries. In 2016 the 5,403 CoM signatories' overall commitment for 2020 was a reduction of the total GHG emissions of 27%, 7 percentage points above the minimum requested target of 20 %. Results from the plans monitoring reported, reveal an already achieved 23% overall reduction in emissions (Bertoldi, 2018).

In turn, the SUMP Guidelines prioritise accessibility and quality of life. Environmental quality is mentioned in the guidelines as one of several sub-goals (Rupprecht Consulting, 2019). Further, the SUMP Guidelines do not mention that the EU 2030 and 2050 climate targets are (or will soon be) legally binding for all Member States, requiring urban GHG emission reductions. Carbon emission reduction is discussed alongside other objectives of sustainable urban mobility planning, such as visioning, targets, and measure appraisal (steps 5-7 of the SUMP cycle). The lack of climate goals has been identified as one of three gaps, alongside framework conditions and enabling actions for long-term implementation and guidance on short-term measures (Smeds & Jones, 2020).

However, the planning tools mentioned above are just some of a few available to cities. They have the freedom to choose how to plan according to their ways.

In this context, we can ask ourselves:

- What are the main standards in city climate planning in European cities?
- Is transport planning considered a main topic in city climate planning?
- What are the prioritized transport actions in European cities within the context of their climate plans?

In section 2 I present the Climate Plans and Transport Actions database and explain the methodology to answer the research questions. In section 3 I present the analysis of the database and in section 4 I discuss the main findings as well as provide policy recommendations for the integration of climate and transport planning.

2. Methods

The Climate Plans and Transport Actions database is a set of Excel spreadsheets that contains information from 50 European cities' action plans. It is based on the Carbon Disclosure Project 2021 Cities Mitigation Plans database (CDP, 2022).

The CDP database has more than 1300 entries. The database was simplified by using the following criteria:

- Geographical scope: CDP region Europe
- Time scope: year of adoption of the plan: from 2020 onwards (included)
- Duplicate entries were excluded, for example iterations of plans
- Regional-level plans were excluded: to the best of our understanding only city-level (or unitary) plans were selected. Metropolitan level accounts as city level.
- Faulty entries: entries with no links or faulty links were excluded. Four exceptions to this rule were added to the database: Athens, Sofia, Ljubljana and Izmir. These entries didn't have links, however as they represented countries that were not included in the database until that moment, it was decided to look for the links and include them to enlarge the sample (14 countries and 1 city state).

The Climate Plan and Transport Actions database is a set of spreadsheets that contains data on 50 European Climate Plans approved after the EU net-zero targets. The user can search for transport actions and identify which cities are planning to apply them. Once the city/cities are identified, the user can use the third sheet to get a link to the Climate Plan, with further information about that action. The goal of the database is to help cities to identify suitable transport actions to include in their climate planning strategies.

The database is made of 3 sheets:

1. Grouped actions: this spreadsheet includes the list of aggregated transport actions from 50 European climate plans. Categories were created to aggregate similar actions from different cities. Actions are categorized using the Avoid-Shift-Improve approach. This sheet can be used to search for categories/actions and identify which city is planning to implement them.
2. Individual actions: this spreadsheet includes the full list of actions from 50 European cities' action plans without being aggregated.
3. Cities Climate Plans: this spreadsheet is based on a CDP database (CDP, 2024). The spreadsheet was completed by reviewing all Climate Plans. It includes a weblink for each plan. User cities can assess whether the actions and cities are closer to their local environment or landscape by using a city with a similar population, similar strategic planning background, level of autonomy index, etc.

The Cities Climate Plans includes columns where the assessment was done:

- LOAI: level of autonomy index: is based on a study by Heinelt (Heinelt, 2017) and the study of the University of Agder (Baldersheim, et al., 2019).The index has 11 variables: institutional depth, policy scope, effective political discretions, fiscal autonomy, financial transfer system and self-reliance, borrowing autonomy, organizational autonomy, legal protection, administrative supervision and central or regional access.
- Strong strategic planning background: (yes/no) based on mention of previous plans related to mitigation, energy, and environment.

- Socioeconomic environmental analysis: based on data on considerations and/or the impact of climate change on humans, the economy, and the environment.
- Quantify the impact of change: (yes/no) depending on whether the plan has some level of quantification of how climate change will imply a change in the city or the change is exemplified.
- Includes M&E or KPIs: (yes/no) whether it includes a monitoring and evaluation framework, even if general or if it includes specific KPIs to measure the plan.
- Target date: the date by which the city is expected to achieve carbon neutrality. Not all plans have the level of detail on projects or measures to get to net zero (non-demonstrable that the city will achieve the target).
- Mention of Sustainable Urban Mobility Plans or Transport Plan (yes/no).

3. Analysis

There is a good representation of cities of varying sizes that have produced a Climate Plan and disclosed it, according to the analysis of the Database (table 2). When we take a look at the geographical representation, we can see that the cities in the United Kingdom are at the forefront of climate planning in the two years after the year 2020 (table 1). These cities account for 32 percent of the entries.

Many of the cities have some level of experience in the planning process. Only 12% of cities listed no prior experience in their plans (figure 1). There appears to be no relationship between previous experience and level of autonomy. Surprisingly, most of those cities with no previous climate planning were from the UK, which also have a low level of autonomy. When it comes to planning, the degree of autonomy that a city has can be connected to the authority that it possesses to carry out the plan. Climate plans from UK cities frequently distinguish what is a local, regional, or national responsibility, or highlight actions that rely on other bodies such as electricity, water, and waste companies.

Table 1 Geographical distribution of climate plans

Country	**Count**
United Kingdom	16
Denmark	8
Italy, Sweden	5
Norway, Portugal, Spain, Switzerland	2
Bulgaria, Finland, Gibraltar, Greece, Iceland, Netherlands, Slovenia, Turkey	1

Figure 1 Experience in climate strategic planning

Table 2 City size distribution

Size	Count
Very small (less than 50,000)	6
Small (50,000-100,000)	4

Medium (100,000-250,000)	13
Large (250,000 – 500,000)	11
X-Large (500,00 – 1,000,000)	8
XX-Large (1,000,000 – 5,000,000)	8

The main methodologies used for the plans can be grouped into three, those who use SECAPs, those who use the Tyndall Centre methodology (Tyndall Centre, 2024) ,and a third larger group who uses an ad hoc methodology. Thirty out of 50 plans include a comprehensive social, economic and environmental assessment, and 12 plans have at least some assessment (either economic, social or environmental) (figure 2). About 80% of the cities have quantified the impact of climate change at some level, however when we look at the actions within the plans, we see there is no clear indication as on how much those actions will help get to the targets proposed. This means that cities understand the impacts but don't have a clear idea of how the actions in their plans will be enough to get to their goal. This is demonstrated as 36% of plans don't have monitoring and evaluation frameworks nor strong key performance indicators. With uncommitted actions, not linked to reduction targets or an estimation of reductions from those actions, some plans could be deemed as a narrative with a menu option with low certainty it can be implemented. The challenge around implementation and evaluation is not new. Prior studies on climate plans have identified that there is a lack of importance placed on this stage of the planning process (Aboagye & Sharifi, 2023).

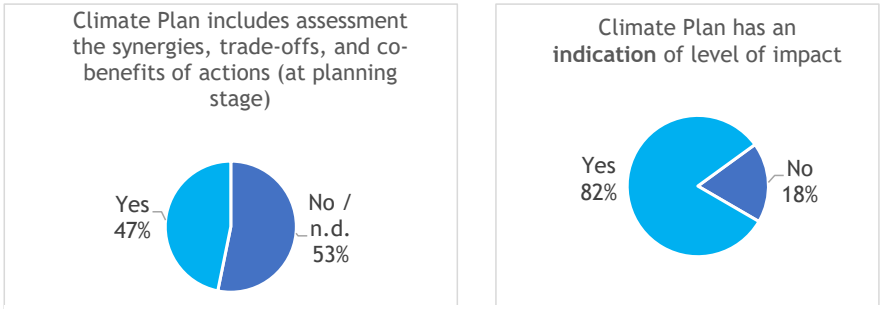

Figure 2 Climate plans availability of assessments (left) and indication of impact (right).

From the analysis of the Climate Plans included in the database, several baselines assessments have been identified as good practice for the development of such plans.

Crucial to the development of a sound transition pathway, climate action plan or strategy, is to understand the local context, gather information and determine what methodologies (or questions) will be guiding the discussions that stakeholders will have in order to prioritise strategies and policies.

The following assessments could be considered secondary processes done by the technical staff and feed into a bigger narrative of a climate plan. However, the technical baselines can also inform about the applicability and feasibility of the implementation of specific actions.

A. Emission assessment

▪ How high are the consumption-related emissions of the city? Are these distributed among the various consumption areas?
▪ What are the most influencing variables for greenhouse gas intensity of the individual consumption areas (e.g. electricity mix in the producing countries,trends in agricultural production, technology development, etc.)? What other important aspects have an influence here (e.g. proportion of animal products in the demanded diet)?
▪ What developments can be expected for the exogenous context factors and the other aspects realistically expected by 2050 (for example, investment in electrification)?
▪ Which opportunities and risks or synergies and conflicting goals with regard to ecological, social and economic aspects must be taken into account?
▪ Which administrative level owns the power to influence emission sources?

Emissions reporting is becoming a standard practice and most cities will have their methodology. Organisations such as international banks or third sector parties would have also developed methodologies (Greenhouse Gas Protocol, 2024). Alignment between them could streamline finance flows and improve accountability of climate projects financed by multilateral organisations.

B. Climate impact assessment

There is an assessment of all significant climate risks in terms of frequency and severity as well as the extent of the consequences up to 2030, as well as an obligation to assess up to 2050. This assessment includes:

- Risk scenarios are, where possible, based on local standard methods or on typical discharge scenarios (eg the IPCC's representative concentration course culminating at 4.5° C in 2100). For a general risk assessment cities could use the IPCC regional map (IPCC, 2024).
- A qualitative assessment of the impact on the city's systems, sectors and vulnerable social groups is prepared based on the climate risk assessment.
- Consequences for the city's inhabitants and necessary infrastructure (e.g. utility companies, hospitals) are seen in relation to how exposed they are and their ability to adapt.

C. Socio economic assessment.

This assessment is used to understand critical points and groups that are relatively more vulnerable to climate change impacts. It includes:

- Description of the existing administrative and physical geography, which is relevant to climate change (coastal proximity, flooding areas, topography, elevation)
- Social analysis to identify demographic changes and resilience (focus on disadvantaged groups likely to be impacted by climate change)
- Analysis of the economic mix of the city, including major economic activities, economic strengths related to climate supply chains (technical schools that could support upskilling for green jobs, manufacturer of sustainable materials, availability of entrepreneur and innovation environments, etc).

D. Technology assessment

Technology is considered a key factor in every climate plan, however it is mostly considered as the availability of certain technology without a long term consideration of its impacts or its regulatory needs.

- Which technology trends may have the greatest impact on emissions from transport, for example batteries, sensors, big data, drones? In the short, medium and long term
- What do we know today with a certain degree of certainty about technological changes in the transport sector (2030-2050)
- Will new technology require the development of new regulations, and what kind of regulation if any?
- What kind of new infrastructure must be developed to adopt new transport technology?
- What can the city do to facilitate the use of key technology?
- What kind of competence and capacity does the municipality need more towards 2030 to facilitate technological change in the transport sector?
- Are there any areas that the city can focus on in particular, which will be valuable in the global environment perspective?

E. Institutional and policy assessment

This entails a two stage assessment. The first stage should be done before the visioning step (SUMP-PLUS, 2021, Halpern, et al., 2022). This stage includes:

- Identification of relevant national and regional obligations: includes the overview of goals and initiatives that are shared with or owned by other bodies and actors
- The municipality's structure and scope of the plan
- The municipality's powers and capacity: An assessment is prepared of the powers that the municipality has with regards to other relevant sectors, assets and functions or measures, which also determines where it is necessary to further cooperate to accelerate the implementation of climate action
- Review of the integration of the plan into existing regulations, plans, statutes, policies and local institutions necessary to accelerate implementation and involved in the development of the plan

A second stage of institutional assessment can be used after high level strategies and actions have been selected to determine gaps in policy and linkages between vulnerable groups, emission reducing, strategies and economic opportunities.

The second stage should is designed to match the local authority institutional capacity at the baseline with the institutional capacity needed to deliver on the high level strategies that are selected. To do this, the Strategies selected need to be reviewed and assessed in light of the local environment. This second stage is closely related to the assessment of weaknesses, strengths and barriers that were researched in the previous assessments and the concept of enabling actions.

Following their technology and institutional assessments, Oslo considered Data to be of upmost importance to achieve its transition (City of Oslo, 2024). The city is working to identify its own role with regard to the ownership and operation of data. It will also be useful to go through the data sources that the municipality actually already owns, and assess how this data can be used to develop services and tools that contribute to reduced emissions. The development of the

platform itself for sharing data is probably something that should be located somewhere other than at the Climate Agency, but the agency can represent a good case for the utilization of current data with its clear goals of reducing emissions from the transport sector. Smart use of data can make a major contribution to streamlining the transport business and form the basis for the development of good services and products.

Citizen support and public participation

Climate plans surfaced as a consequence of a varied of causes, mainly the real impacts of climate change but also because of the perception of the citizenship and the policy push by the EU. The 2021 barometer shows that the most serious problem facing the world is climate change above poverty, hunger and the spread of infectious diseases. The same survey saw an increase in allocating responsibility for tackling climate change for all political strata. National governments, businesses and the European Union are seen as the main responsible. However, local governments have seen the bigger increase in perception of responsibility going from 33% to 43% in 2 years (European Union, 2022).

Climate plans can be seen as a policy response in the sense that they have yet a short trajectory. These type of plans are not statutory as it are National Determined Contributions or SUMPs or Local Transport Plans in the transport sector (for cities above a threshold). Even SECAPs which have a longer trajectory are not subject to a regulatory obligation. This brings shadow on the role of the citizenship role. About half of the plans in the database do not include public consultation, which represents a gap between one of the main driving force of plans and the planning in itself.

About 8% of plans have some type of public participation as they include a bigger range of stakeholders including universities, faith groups and industry professionals (figure 3). Some cities have developed digital tools to support the development of the plan like Stockholm. Developing such tools can be help bridge the gap mentioned before. Other public participation tools mentioned are calls for evidence (pre plan participation), regular engagement through communication channels, climate talks, and ad hoc events such as Climathon's or People's Assemblies.

An avenue for future research could be to link public participation methods, the efficacy of the plans and the legitimacy of the planning system.

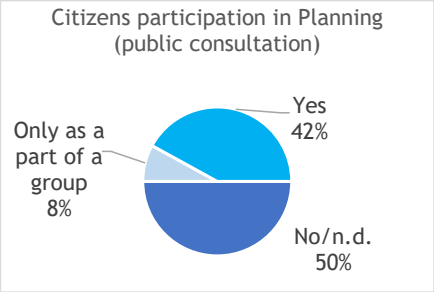

Figure 3 City plans and public consultation

Priority transport actions

It was previously mentioned that the link between climate and transport planning is not always clear at least at the strategic level. The analysis of the database shows that while all plans have at least some transport actions included, only 60% mention SUMPs and LTPs. 373 transport actions were identified and classified in 148 groups. Actions were also classified on whether they belong to any of the A-S-I categories. Two additional categories were created: avoid/improve (for example alignment of land use planning for sustainable mobility) and shift/improve(for example low emission zones). The majority of actions correspond to shift and improve actions (figure 4). Even when shift actions represents the majority of actions, the top 5 actions include improve cycling and walking infrastructure (S), E-charging infrastructure, hydrogen and EV public transport, the electrification or decarbonisation of public fleets (I), Improve accessibility and frequency of public transport (S) and car sharing (S). This result validates previous research looking at the candidate cities for the EU programme Climate Neutral and Smart Cities (Christidis, et al., 2024).

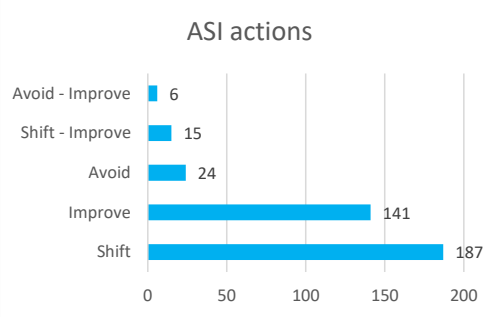

Figure 4 Transport actions A-S-I distribution

The level of detail of the actions is uneven. For example, within cycling we find the development of cycling strategies, monetary incentives for cycling uptake, road redistribution for active mobility, improvement of cycling infrastructure and promotion of cycling operations. On the freight side we find options such as the use of drones for freight, promotion of sustainable freight, electrification for urban boat freight, incentives for green freight, a roadmap for freight decarbonisation and “last mile and freight”. As shown actions can be very specific or high level according to each plan.

Considering prioritised actions according to level of autonomy, we see that active mobility improvements, electrification and infrastructure and improved public transport are the main actions considered (figure 5). We can see more collaborative actions prioritised in the low level of autonomy group with the inclusion of park and rides with other municipalities and car sharing schemes. For the high level of autonomy group we can highlight operational improvements for public transport (while in the low level of autonomy group we find infrastructure improvements) and hydrogen or EV public transport.

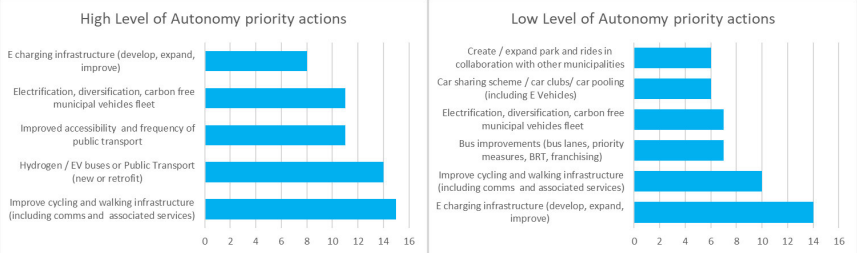

Figure 5 High (left) and Low (right) level of autonomy prioritised actions

4. Discussion

Despite the novelty of city climate plans, local authorities possess some prior knowledge and expertise in this particular planning methodology. Considering the methodologies employed, this does not appear to be related to the quality of the plans. While 88% of cities have some experience, the majority do not use a systematic approach that includes an assessment of synergies, trade-offs, and co-benefits among various urban systems. There is an opportunity to provide additional training to the employees of the local government in order to enhance their ability to make policies based on scientific evidence and to use methods that consider the impact of climate change and systemic factors.

Also, baseline assessments range from simple narratives to doing very in-depth analyses and numbers-based calculations of effects. Regarding the transport section of the plans, it would be interesting to connect the technical work required to establish baselines to the overall narratives of climate plans.

Recent endeavours have been made to establish a connection between these two aspects and address the obstacles identified in implementing plans and managing the transition (Geels, 2011, Sovacool, et al., 2020). The European Union has released new guidelines that can enhance the relationship between climate and transport planning by focusing on the bottom-up approach, specifically from transport to climate (Polis & Rupprecht Consult, 2021, EIB/Jaspers, 2022) . From climate to transportation, specific strategic links should be included in climate plans. Stakeholders should also be told to think of urban systems as being linked, such as water, biodiversity in cities, and transportation and urban planning. Still, the fact that some cities are making their plans public is a good start, and it could be seen as a response to the public's growing awareness of climate risks.

As a main takeaway from this research, it is important to evaluate the institutional capacity and level of autonomy in terms of the actions that need to be done first. Additional research that establishes a connection between climate plans and their actual effectiveness in reducing emissions presents a valuable opportunity to enhance monitoring and evaluation frameworks. Enhancing public engagement through conventional or innovative approaches could also enhance the credibility of plans.

Regarding prioritised actions, electrification, public transport, and active mobility appear to be the highest-ranked items on the list.

Avoid actions that are overlooked in favour of shifting and improving policies. Reducing the demand for trips and tackling trip generation by collaborating with sectors that produce the demand for trips can be a good approach (OECD, 2022).

Generally, climate plans are well-received and indicate progress in planning capabilities, although they have not yet attained the level of being legally enforceable and methodologically rigorous. Local authorities play a crucial role in addressing climate change due to their citizenship, which entails the responsibility to both mitigate and adapt to its effects. Granting cities enhanced authority and financial resources to address the issue could lead to improvements, alongside fostering partnerships with research institutions to oversee the process and integrate evidence-based approaches and objectives into practical measures.

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Chlorophyll City: Regenerative and Restorative Urban Planning for a Sustainable Future through Extensive and Branching Reforestation Initiatives

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Abstract
The problems arising from the expansion of cities are global challenges that require innovative and sustainable solutions. This paper explores the beneficial potential of urban forestation with regenerative and restorative urban planning. Focusing on the reuse of marginal, empty and abandoned areas, it proposes to transform them into smart parks to mend the green spots of cities and to reconnect the empty and degraded urban tissues, but would also offer tangible services and benefits to the local community. All connected through eco-human networks to make urban spaces relatable and give species the opportunity to move freely in uncontrolled cities. This integrated approach to urban planning could play a crucial role in shaping chlorophyll cities, sustainable for the future.

Keywords: Urban environmental sustainability, Restorative and Regeneration, Natural Based Solution, Cultural Based Solution, Eco-Human corridors.

1.1 Introduction

A great contemporary challenge and a problem now in extreme territorial growth is urban pollution, a cause of environmental and natural degradation, that pushes our cities, sources of a good part of these deprecated pollution and environmental disasters, to urgently reorganize given the speed of these changes, designating a turning point. Citing Richard Rogers (1998) *"The future of cities will be determined by its cities and cities"*.
Urban areas are vibrant and complex entities, comprising a heterogeneous blend of built environments, plants, animals, and habitats modified for human use.
A new planning and management of cities would report the creation of preventive and sustainable balances. The goal is to develop plans defined in advance and compatible with the environment itself, adopting a global vision that focuses on sustainable development and conservation of the territory. Spatial planning emerges as a key tool to address this challenge, offering the opportunity to study, design and achieve a harmonious balance between human pressures and available resources. This implies the need to balance human activities with the skills and needs of the territory, finding solutions that guarantee a basis for an ecological and social balance.
Unfortunately, over the last few years, many cities have experienced poor planning and management of the urban environment, compromising both the natural environment (water, atmosphere, green) and the socio-cultural part (urban landscape, cultural heritage, social cohesion)bringing increasingly pressing environmental and social challenges, including daily stress and lack of green spaces.
A large part of air pollutants is attributable to heating and urban traffic, while many of the water and soil pollution comes from solid and liquid waste in the city, because of an imbalance of settlements and an ineffective distribution of functions on the territory. At the moment global warming, the catastrophic consequence of these climate changes, is following an exponential trend whereby cities, for a matter of survival, must transform, change in values

and behavior to resist these variations. In the context just outlined, it is natural to consider technology as a possible response to this crisis. However, it is important to stress that it should not be seen as the only solution or as the only actor capable of solving environmental problems. Rather, technology can act as a support and complementary tool, intervening where resources require support to grow and become essential to the success of policies to promote a regenerative city. For example, innovative technology solutions could be used to monitor and manage water and energy resources, reducing waste and optimisting the use of available resources more efficiently. In addition, technology can play a key role in promoting more efficient and environmentally friendly public transport, thus helping to reduce air pollution and improve air quality in cities. However, it is important to remember that technology alone cannot solve environmental problems. It is necessary to adopt a holistic and multidisciplinary approach, involving a wide range of actors and interests, including governments, businesses, local communities and individuals.

1.2 Theoretical framework

Urbanization has been defined as the movement of population from rural areas where agriculture is the predominant economic activity to urban areas dominated by industry and services.[1]

With the demographic increase and urbanization that we are witnessing today, the number of people living in cities will continue to grow rapidly, predicting that by 2050, (70%) of the world's population will live in urban areas, putting increasing pressure on resources and the environment[2].

The continuous growth of urban population inevitably leads to the disorderly expansion of cities, which have long-standing habits of resource consumption and waste disposal. Consequently, a series of complex issues have emerged, such as environmental degradation, biodiversity loss, social dysfunction, scarcity of natural resources, and the increasing anthropogenic climate change[3]. As our societies become more complex and the urban environment deteriorates, the built environment upon which we rely will become increasingly unsustainable.

Despite occupying only (1.6%) of the earth's surface, cities produce a disproportionate amount of waste and harmful emissions. This tiny fraction of territory could be compared to a stone on the Praia do Cassino Beach in Brazil, one of the longest beaches in the world. This comparison helps us to visualize the enormity of environmental challenges: despite the limited extent of cities, which, although occupying only a tiny portion of the planet, have become places of environmental aggression, with devastating consequences for biodiversity and the quality of human life. This parallel "urban stone" generates a disproportionate amount of waste, carbon dioxide and harmful emissions, about the (80%) of the total environmental load, making the most of the resources available on our planet. The final price of this overproduction should be defined by a rebalancing of resources: everything that is taken away from the Earth, should be returned, a sort of virtuous cycle that maintains the natural balance. Reflecting on this comparison, one can realize that life on Earth is concentrated in a thin layer, just 20 kilometers high, known as the biosphere, extending 10 kilometers below sea level and 10 kilometers above. Of all this living, only the (0.3%) represents animal life, the total weight on the whole planet, of which only the (0.01%) belongs to human beings. And the remaining (89.7%) to whom does it belong? About (1.2%) it belongs to fungi and microorganisms, but

[1] He, Reith, (2022)
[2] (CORDIS, 2019)
[3] He, Reith, (2022)

the remaining (87%) of the biomass weight is made up of plants[4]. This percentage may surprise, as it indicates that the predominant weight of life on Earth is represented precisely by plants. However, the question arises as to how it is possible that, despite the domination of plant-related biomass, our planet is facing unprecedented rapid climate change.

In the course of 2020, a surprising fact was recorded: the material produced by man exceeded the weight of life itself on Earth. This comparison becomes even more significant if we relate it to the situation of just a hundred years ago: in 1900, the anthropogenic mass was almost negligible. It is incredible how in a century things have changed so radically, highlighting a devastating impact of human activity on the environment and a concomitant reduction in life as a whole.

In 2021, for example, China produced the same amount of cement that the United States used over a century. This extraordinary volume was consumed in just twelve months.

Speaking of cities, we talk about urban metabolism, which is like exploring the meanders of a living organism, a sort of pulsating entity that swallows and transforms the resources it receives. It is an intriguing concept, which drives us to consider cities not only as agglomerates of cement and asphalt, but as complex organisms able to interact with the surrounding environment in surprising ways. This analogy leads us to reflect on the similarities between the functioning of a city and that of a biological organism. At the heart of this notion is the concept of the circular economy, a principle that recalls the life cycle of nature itself. Imagine a constant flow of resources entering a city, like the blood flowing into the veins of an organism. But what really makes urban metabolism fascinating is its ability to transform these resources into something new, regenerated, just like the cells of the human body that transform food into vital energy. However, this change is not always as efficient as it should be. Unlike plants that exploit photosynthesis to maximize resource utilization, cities often operate with dysfunctional metabolism. Many resources enter, but too often excess waste is produced, generating an ecological footprint disproportionate to the size of the city itself.

The ecological footprint, in this context, reminds us that every human action has an impact on the surrounding environment. Measure the area of land needed to support a specific lifestyle and dispose of the waste produced. It is a powerful indicator that drives us to reflect on our habits and how we interact with the world around us.

One of the main problems facing European cities today is urban organisation, which manifests itself in the conflict between two objectives, both crucial for urban policy. On the one hand, the need to ensure high access to high-level urban services that define the very essence of a modern city, an aspect that no citizen is willing to give up, on the other hand, the challenge of preventing the concentration of such services from leading to an overload that threatens environmental and social sustainability, making the city unlivable.

Reflecting on this dynamic, it emerges clearly that large cities are in a situation of overcrowding compared to the available territorial resources and the degree of concentration. This uncontrolled expansion, which also extends beyond the historic center, has serious consequences: the loss of human sociality (sociality), the decrease in the sense of belonging and identity (identity), and the compromise of environmental sustainability (sustainability)[5].

The fundamental question is therefore: how to decentralise urban functions to reduce congestion and relieve the pressure on the historic centre, without compromising the quality of life?

This tendency for citizens to concentrate in or near urban areas is fueled by the search for advanced urban services. However, it seemed that the advent of modern telematic

[4] (Stefano Mancuso, 2023)
[5] (Franco Archibugi, 2002)

technologies had offered a solution to this phenomenon, reducing the need for spatial concentration: with access to the same services without the constraint of physical presence, The city could no longer be conceived as a collection of physical distances, but as a network of abstract communications. Unfortunately, the intrinsic attractiveness of cities cannot be completely replaced by the convenience of digital technologies as cities continue to offer a variety of social opportunities, cultural and economic that attract people not only for the services available, but also for the energy and diversity that characterize urban life. The vision of a clean and ecological city, regenerative, is what should be investigated, where technology acts as a stimulating and educational element for a better quality of life and a sustainable urban environment. But how can we keep the soul of cities alive in a digital age? How can we ensure that everyone has access to the opportunities that cities offer, regardless of their physical location? In this new world, the very concept of the city is constantly evolving, so we must have the ability to adapt to these sudden changes that will determine our urban destiny. We must recognise that we face a great challenge, not only in terms of adapting and mitigating climate change, but also in terms of restoring the balance between man and the natural environment. And this challenge begins right in our cities.

1.3 Research methodology

Looking at cities, we see that urban forestation plays a crucial role in rethinking and redesigning our urban landscape. It is necessary to go beyond aesthetics, considering urban forestation and its methodologies as a fundamental strategy to address environmental challenges and improve the quality of urban life, to restore the lost balance, especially in urban suburbs and in those urban places of environmental and social degradation.
We need to broaden our concept of the urban landscape, considering it not only as a collection of buildings and streets, but as a living organism. This means recognizing the interconnectedness between the natural and artificial elements of our urban environment and adopting a holistic approach to city design and management.
The concept of urban forestation has its roots in the United States, thanks to Frederick Law Olmsted, who adopted an interdisciplinary approach, combining the natural sciences, humanities and landscape design, to develop a new vision of the relationship between man and environment.
The development of effective urban forestry plans requires a collective commitment and an integrated vision, taking into account the environmental, social and economic needs of urban communities.
A significant example is the *"five-finger"* plan of Copenhagen, a 1947 urban plan that included an urban forestation strategy along the *"fingers"* of urban design. The "fingers" represented the backbone of the metropolitan urban railway network, while the interstitial spaces between them were left as green areas, including urban forests, wetlands and agricultural areas. These ecological corridors, in addition to their function of preserving biodiversity, also had to promote creativity and interaction among the inhabitants of the city. In this way, urban forestry is not just a matter of green belts, but a complex system of ecological connections that define and enrich the urban environment.
Recently, there was talk of *"Greening Green Belt"*, an approach that aims to strengthen the existing green belts. This is particularly important in view of the increasingly serious and evident effects of climate change, providing a unique opportunity to redevelop degraded urban areas, including derelict industrial areas and abandoned sites, contributing to urban regeneration and the creation of green spaces vital to the community.
A fascinating example is the landscape plan developed by Ian McHarg, who in the 1960s was commissioned to conduct a study for the city of Philadelphia, which at the time faced serious

pollution problems, especially in the city centre. McHarg, in his book "Design with Nature", highlighted the need to reduce pollution sources to solve the problem and through investigations, McHarg developed indicators based on wind direction and thermal inversion, which revealed how during the winter months, with poor air circulation, the pollutants remained trapped in the atmosphere. Using this data, McHarg identified the so-called *"wind pools"*, or areas crossed by prevailing winds, and established that along these corridors should not be built industrial polluting complexes, but suggested to strengthen urban forestry to improve air quality. These concepts demonstrate the ability to recognize the importance of nature and its integration in urban planning and it is surprising to note that these principles are still current and relevant, also in Italy, where we have only recently begun to consider in more depth the importance of urban forestation and landscape planning to address environmental challenges.

In 2020, in the capitals of the Italian region, the average annual temperature showed an anomaly of (+1.2)°C against thirty years 1971-2000. At the same time, there was a fall in rainfall of (-91) mm on average[6]. Cities have become places of increasing vulnerability to climate change, called hot spots, due to the high population concentration and density of infrastructure. At the same time, however, they present great opportunities for climate adaptation/mitigation actions. 2020 is the least rainy year of the last ten, together with 2011, with a total annual precipitation of 661 mm, reporting, as in 2020, in the capitals of the region, a quantity of water that could meet the needs of about 10 million people was lost daily. The greatest difficulties have been found in the southern regions: in more than one capital out of three there have been total losses percentages above (45%)[7]. In Southern Italy, it was even necessary to take rationing measures in the distribution of water to end users, through the reduction or suspension of the supply.

Due to the concentration of paved and built surfaces, interspersed with a few green spaces, as well as the presence of diffuse thermal sources, such as vehicular traffic, heating or cooling systems, large cities suffer the effect "Urban Heat Island" (UHI).

The term indicates the presence of a warmer microclimate in the city areas than in the surrounding peripheral areas, with average annual temperatures of 1-3°C higher than in the surroundings.

A possible solution to this problem, which is recognized as a valid tool, both of mitigation and adaptation by scientists of the IPCC and is provided for in European (Green Deal) and national (PNRR) plans, is precisely urban and periurban forestation. The vegetation is able to refresh the urbanized areas thanks to the shading and the evotranspiration process.

In addition, the urban greenery performs climate mitigation actions, capturing the CO2 present in the air and absorbs and reduces some air pollutants, making the soil more permeable, thus containing the impact of violent rains, and last but not least, makes our cities more pleasant, liveable and welcoming.

"The protection and promotion of urban greenery is a natural solution that, by increasing the resilience of cities, can play an important role in climate change strategies and, more generally, in improving the sustainability of urban systems and the quality of life of citizens" (Elisa Terenghi, 2022).

An excellent news is given precisely with regard to the urban green area where the total area of urban green areas is constantly increasing: in the last decade there has been an increase of green (15%) thanks to urban and suburban forestry works[8]. The distribution of these green lungs is far from uniform in the Italian peninsula, with maximum availability in the capitals of

[6] (Elisa Terenghi, 2022)
[7] (Terenghi, 2022)
[8] (Terenghi, 2022)

the Northeast and minimal in those of the South. This should give us an awareness of how urban forestry is an excellent path to pursue in spatial planning.

1.4 Case study

The challenges of demographic, energy and climate change need to be tackled rigorously, innovatively and in research, pluri- and inter-to formulate design responses that will promote sustainable development in the years to come. To re-establish a more direct and lasting relationship with the soil while waiting for a reinterpretation and a wise re-functionalization, in relation to the territorial urban location. There is no more space available to build something new, but we must work in the intermediate bands of different densities, on the brittle margins, on the edges of scattered and weak spaces that require care and maintenance[9]. Therefore a project fot the recovery and regeneration of what remains is urgent: degraded and forgotten enclosed spaces, the post-industrial decommissioning, the areas flattened by the heat islands, the cutouts between the motorway junctions, the illegal construction of buildings, the fallow countryside, all those residues of margin, surrounded by buildings mostly "disinterested" and consisting of spaces without relations and resonances, still free, available for transformation.
How can the architectural and urban project intervene for the requalification of degraded contexts? Is it possible that through waste, you create urbanity and quality landscape, able to regenerate the city and the contemporary territory?
We need a practice of defense, recovery and redevelopment of the interstice, which can become a park, open space, landscape, path and place of exchange to restore a balance between man and nature. Nature and culture can resume a dialogue, trying to relate the signs of the landscape (often anthropic and ideally wild and natural) and even dense artificial presences (built, infrastructure, etc.).
The concept and practice of sustainability are progressively evolving towards a design approach that not only seeks to avoid further damage to the status quo but rather aims to remedy the harm caused by previous practices through a reparative and regenerative approach. The term 'regenerative' denotes a process that repairs, recreates, or revitalizes energy sources, air, water, or other resources. Furthermore, regenerative urban design is seen as a process to replace the current linear system with a cyclical one, aspiring to regenerate life itself and thus offering prospects of hope for the future[10]. Similarly, restoration implies correcting damages resulting from human activities and returning the environment to its original state through deliberate development. The intermediate areas, marginal, of environmental and social degradation, would become compensations that go to rebalance what has torn, injured, saturated and polluted our cities and their surroundings out of control. Spaces that are designed for the community, starting from considerations on the nature of their limits and the most degraded portions, putting them in reciprocal dialogue with the external context, from the scale of the city to the territory itself, in a vital osmotic exchange.
Gilles Clément, landscape gardener, in his Manifesto of the Third Landscape said that the waste is a constituent material of the Third Landscape, a scenario located on the urban edges, uncertain and changeable, place of abandonment and neglect that defines and gathers the whole of abandoned spaces, pockets of acceptance of diversity. The Third Landscape includes all the territory left free, rural and urban, degraded or excellent: the edges of roads and plots of land, the margins of industrial areas, nature reserves.

[9] (Anna Arioli, 2012)
[10] He, Reith, (2022)

"It is the space of indecision and the living beings who occupy it act in freedom. Consider in the third landscape a biological need, which affects the future of living beings, changes the reading of the territory and enhances places usually neglected" (Gilles Clément, 2015). The project is called into question for an integrated and multi-scale intervention with particular attention to the naturalistic dimension and the design of the connections (paths, accesses).

Considering urban forestry plans and supporting the related ideologies, such as the creation of green belts and ecological networks, is a method of rebalancing the urban ecosystem. This implies the integration of green areas with spaces dedicated to services and cultural, physical, work, social, connected by a minor network, light and slow, of discontinuity in full, but also of continuity within areas that are polluted, fragmented and isolated. The landscape enters the city, the open space designed and recomposed, no longer residual, discarded, becomes a place of propulsion of relationships and energies[11].

Indicators related to space and infrastructure are crucial in sustainability-oriented urban design. While some findings regarding infrastructure suggest a return to human-centric design, physical proximity does not always imply a significant connection between spaces[12]. Hence, it is essential to create a "network of places" to foster deeper connectivity and better integration among urban areas. Regenerative urban design tackles urban challenges from an integrated perspective of economy, society, and environment, not only seeking to increase conventional indicators such as employment and biodiversity but also restoring and establishing adaptive capacity. Additionally, reparative urban design not only restores polluted and damaged ecosystems to a healthy state but also integrates nature into daily life through appropriate design models, while promoting interaction and contact with nature to enhance the physical and mental well-being of inhabitants. Regenerative urban design goes beyond conventional indicators to include those emphasizing nature as a form of self-regeneration, such as solid waste reuse, renewable energy, and the development of a sense of place. Physical connectivity does not erase boundaries between various spaces, as people tend to mentally separate these elements[13]. However, the geometric relationship between places influences the type of feeling a place conveys to individuals. Here is how eco-human paths, where species can wander without the constraints of suspension, sudden or gradual, which can occur in an urban or non-urban setting, represent new strategies for eliminating boundaries. Chlorophyll connections provide the possibility of a continuum, a transition from one space to another, immersed in the well-being gifted by greenery. A design that we can define as "biophilic urban planning" that aims to mend the dynamics of marginal landscapes, degradation, abandonment, and the city with its anthropic behaviors, rendered polluted and uncontrolled in its social and geographical growth.

Eco-human paths in which species can walk without conditions of suspension, sudden or gradual, that can occur in an urban or non-urban path, chlorophyll connections that give the possibility of a continuum, a transition from one space to another, immersed in the wellness given by the green. New strategies that go to mend the dynamics of the landscape of margin, of degradation, of abandonment and the city with its anthropogenic behavior, made polluted and uncontrolled in its social and geographical growth.

Through the vegetation it’s possible, not only to absorb carbon dioxide and release oxygen, helping to reduce the greenhouse effect and alleviate the negative effects of air pollution, such as reducing urban temperature, mitigate the effects of heat islands, but these realities also offer a regenerating space for citizens, promoting well-being and reducing stress, helping to create a more comfortable climate in the cities. These urban forestry initiatives and the creation of green rings transform the forgotten areas of the city into more sustainable and

[11] (Anna Arioli, 2012)
[12] He, Reith, (2022)
[13] He, Reith, (2022)

welcoming places for their inhabitants, re-educating and transmitting all those environmental and social benefits that are now lacking in the territories of dispersion of the saturated city and its very margins, building new centralities open to the landscape, to put into system redeveloped complex spaces, disoriented inhabitants, energies and structuring dynamics. Making those forgotten, empty places become protagonists and material of composition to give a new structure to those fragments of a degraded city. The residues, the free portions of space, emptied but almost never empty, constitute the weak and yet fertile framework on which to fix new reference points[14].

Imagine a city where nature and urbanization are not in conflict but harmoniously integrate to create a healthier, more sustainable, and welcoming urban environment for all its inhabitants. This is the vision of a reparative city, one that utilizes afforestation and ecology to regenerate its abandoned spaces into oases of life and well-being. Urban afforestation is not merely an aesthetic concern; it is an intelligent strategy to address multiple urban challenges. However, this process is not without its challenges. We must carefully consider crucial issues such as accessibility, safety, sustainability, and social inclusion. How to address the practical challenges related to transforming abandoned urban spaces into green areas, such as accessibility and safety? In the context of urban repair, one of the fundamental questions is how to design and plan a safe city through forestation and the creation of intelligent urban parks. The presence of trees and green spaces is essential to improve urban life quality and promote citizen well-being, but it also presents practical and safety challenges that must be carefully addressed. One critical aspect, for instance, concerns the access of emergency vehicles to various points in the city, including fire trucks, ambulances, and law enforcement, to operate effectively. However, the presence of obstacles such as trees and dense vegetation along streets and in parks could compromise their proper positioning and swift access in case of emergencies. This challenge raises significant urban planning and design issues, particularly concerning public space planning and the arrangement of green elements in cities. It is essential to provide dedicated areas for emergency vehicle transit and ensure the presence of escape routes with alternative access in case of emergencies. To address this challenge more broadly, it is important to consider the safety of the cities from various aspects, such as crime prevention, traffic management, protection from extreme weather events, and more. Solutions could include the integration of surveillance and lighting systems in urban green areas, the design of safe roads and sidewalks for pedestrians, and the implementation of traffic management policies that promote safe and sustainable mobility. Addressing the issue of safety in cities in urbanized contexts with a strong presence of trees and vegetation requires an integrated and collaborative approach that takes into account safety needs, environmental sustainability, and community involvement.

In the context of the urgent need to address contemporary urban challenges related to climate change and quality of life, the innovative perspective of using artificial intelligence (AI) emerges and advanced technologies to drive urban regeneration through forestation.

Within these parks, a network of biological sensors would be installed to monitor the health of urban ecosystems in real time, to detect changes in air, soil, water and biodiversity, providing detailed and predictive environmental health data.

In parallel, the system could include a community engagement component, through the implementation of digital platforms and mobile apps that allow residents to actively participate in the planning and management of urban forests. This platform could facilitate communication and collaboration between residents, local organizations and public authorities for the management and animation of green spaces. Users could share ideas, projects, and initiatives to enhance and enrich the city's green spaces, thus promoting greater

[14] (Arioli, 2012)

community involvement, aware of which aspects of their cultural heritage need to be protected and preserved. All of this can lead to educating and raising awareness within the community about the importance of urban green spaces for health, well-being, and the environment. The shared information becomes educational resources and success stories to inspire greater appreciation and use of green spaces. An innovative way to promote environmental sustainability, improve urban quality of life, and encourage greater community involvement in the management of urban green spaces.
In the digital age in which we live, we must rethink art as a tool and support to improve urban quality, no longer confined to the walls of galleries or museums, but spread among urban contexts, interacting with our daily environment in innovative and exciting ways. The installation of digital art and immersive arts in eco-human paths is a powerful tool to raise awareness of environmental and climate issues that we face today.
These works of art not only decorate public spaces, but also serve as a vehicle to convey important messages about the environmental crisis we are experiencing. Using advanced digital technologies, such as lights, colors and projections, artists can represent in a tangible way the climate changes and environmental pollution that directly affect our lives and our habitat. A tangible example of this approach is the integration of sensory elements into digital artworks, which allow environmental data such as air pollution or temperature to be detected and displayed in real time. In this way, citizens who go through these eco-human paths can immediately understand the impact of their actions on the surrounding environment.
In addition, 3D installations representing models of facilities and services in the area add an additional layer of interactivity and information. These representations can be enriched with additional data, such as statistics on energy consumption or emissions produced, to educate the public on sustainable practices and innovative solutions available. In summary, the use of digital technologies in urban art not only enriches the aesthetic experience of citizens, but also promotes awareness and action towards the preservation of our planet. This form of artistic expression is thus an essential bridge between human creativity and the global challenge of environmental sustainability. It becomes crucial to consider the crucial role of education and awareness in promoting sustainable practices and encouraging the adoption of eco-responsible behaviour. Educational programmes and awareness-raising initiatives in the form of digital art would help actively involve citizens in the care and enhancement of urban green spaces, transforming them into places of learning and personal growth. Through environmental education and the promotion of sustainable lifestyles, we can create a more conscious and committed urban culture in protecting our environment and future generations.

1.5 Conclusion

This approach aims to create sustainable and resilient cities that grow together and with green photosynthesis, can address the environmental and social challenges of the 21st century in an effective and collaborative way. New urban parks, "Intelligent Urban Ecosystems" (IUE), inserted in those marginal realities of degradation and pollution, restoring a new identity, reversing the approach, so as to redevelop the city itself that tried to destroy them, making them empty spaces. These places will not become static green parks, but real dynamic ecosystems and interconnected by eco-human networks, managed through the use of artificial intelligence and emerging technology: a regenerative break and synthetic photo for the entire city and its territory. Within these reforested spaces or parks, we could find functions and services suitable for the city, where citizens can identify their activities.
Any buildings and infrastructure within these parks would be designed with an *"intelligent green"* approach, including plant facades integrated with irrigation and self-powering systems, green roofs equipped with photovoltaic technology and rain water collection facilities. Roads

and pavements made of permeable materials that allow water to infiltrate the ground, reducing the risk of flooding and recovering water that would otherwise be discarded.
Design with a focus on resilience to climate change, integrating infrastructure and adaptation practices that protect the city from the effects of extreme events, such as floods, drought and heat waves. An urban planning project that addresses the environmental, social and economic challenges faced by modern cities, integrating innovative and sustainable solutions to create more prosperous and resilient urban environments.
The landscapes of the peri-urban countryside connote memories and call for redevelopment to bring benefits and values to the city, which has grown away from the countryside, placing it on the margins of an increasingly rampant expansion. Today, urban agriculture is gaining popularity: from hydroponic crops on roofs to vertical gardens on the walls of buildings, becoming real centers of local food production. These initiatives not only provide fresh and healthy food to urban residents, but also reduce dependence on long-distance transport and promote environmental sustainability. Urban gardens are not only places of food production, but also community meeting points. People come together to cultivate, share knowledge, and socialize, creating stronger bonds between residents and fostering a sense of community. These spaces foster cultural exchange and social cohesion, helping to create more livable and resilient cities. Traditional coworking spaces are evolving to include elements of biophilic design in green design, with a focus on the psycho-physical well-being of individuals[15]. The goal is to (re)create a powerful connection between urban spaces and nature, making our habitat greener through osmosis between design, architecture, and natural elements, symbolizing vitality par excellence. Plants, in fact, not only improve air quality and reduce stress but also create a more stimulating and creative work environment.These hybrid spaces integrate digital connectivity with the sensory experience of nature, offering a green haven for urban professionals.
We must also imagine the cities of chlorophyll as a hub for the circular economy and sustainability: catalysts for a more sustainable approach to the use of natural and renewable resources, collected within the parks, such as solar energy through photovoltaic panels and rainwater collection through drainage and filtering systems, exploited to feed local production processes. In this context, innovative solutions for waste management, such as organic composting and the production of biogas from food waste, could be implemented to create a virtuous cycle of recycling and reuse of resources within the urban community. The adoption of circular economy practices would reduce the consumption of finite resources and the environmental impact associated with the production and disposal of materials, while promoting greater resilience and local self-sufficiency.
In some chlorophyll parks space will be given to living laboratories for the research and development of innovative technologies and business models oriented towards sustainability. Through collaboration between public authorities, research institutes, businesses and local communities, initiatives are promoted to stimulate innovation and the adoption of sustainable solutions in key sectors such as energy, mobility, construction and urban agriculture. These projects promote social inclusion, offering spaces for meeting and public use for people of all ages and socio-cultural backgrounds, becoming a reality to improve the physical environment of cities and a driver of growth and social cohesion.
Ultimately, these smart parks and eco-human networks would represent not only an opportunity to strengthen the connection between man and nature in regenerative cities, but also an engine of transformation towards a more sustainable and resilient future.

[15] Braga, (2020)

In chlorophyll networks, space is given to intelligent mobility, addressing current challenges related to pollution and traffic congestion, promoting a more balanced and harmonious urban environment.
Integrating eco-human corridors and linear parks along transport infrastructure such as cycle paths, sidewalks and roads can create ecological corridors that allow plants and animals to move freely within the urban environment. These infrastructures not only improve the air quality and aesthetic appearance of the city, but also promote biodiversity by offering natural habitats and corridors for urban wildlife.
The integration of electric vehicles with sharing systems would reduce the total number of vehicles in circulation, freeing space for the creation of green zones to preserve the urban landscape. Parks, public gardens and green corridors provide vital habitats for plants and animals, increasing the quality of life for urban dwellers and promoting nature conservation even in urban areas.
Urban regeneration through forestation and the creation of eco-human corridors offers an innovative solution to environmental and social challenges. With smart urban parks equipped with biological sensors and green networks that aggregate services to the community, we create intelligent and resilient ecosystems, actively involving the community, trying to reduce the growing crowding in the cities and bringing people back to live even in peri-urban areas, dark and forgotten. These parks not only improve air quality and biodiversity, but also become vital centers, with a cutting-edge approach to a more sustainable city, connecting through more ecological culture, art and services, a city that grows thanks to chlorophyll and its photosynthesis.
To conclude, urban regeneration through forestation and the creation of intelligent urban parks offers an innovative and vital solution to the environmental and social challenges of our time. This approach not only improves air quality and promotes biodiversity, but also transforms urban spaces into vital hubs of connection and resilience. By actively involving the community in this process, these parks, reachable and connected through eco-human corridors, become places of encounter, learning and collaboration, creating a more sustainable and supportive urban fabric. Through chlorophyll and its photosynthesis, we guide the growth and the journey towards a city that embraces nature and culture as fundamental pillars of its development. It is smart urban parks, equipped with biological sensors and integrated green networks, that offer us a brighter future, where connectivity, ecology and community well-being are at the heart of urban design. In this context, the city is not only a place of residence, but becomes a dynamic and interconnected ecosystem, able to adapt and thrive in the face of the challenges of climate change and urban growth.
Reparative and regenerative urban design is closely related to the goals of sustainable development, mitigating and minimizing the negative impacts of design and development on natural systems, while also using the built environment to promote a closer relationship between humans and nature. Urban development must go beyond simply maintaining sustainability; urban design thinking must transcend the dialectic of coexistence between humans and nature, pursuing the logic of coevolution between humans and nature.
Chlorophyll thus becomes our ally, guiding us towards a greener, regenerative city in harmony with our planet.

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Comparative analysis of net land take in Portugal's Metropolitan Areas

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Rita Nicolau is a principal researcher at DGT (Directorate-General for Territory) and a research collaborator of CiTUA (Center for Innovation in Territory, Urbanism, and Architecture of Lisbon University). Her background is in environmental engineering (undergraduate in 1996 and PhD in 2002, by New University of Lisbon) and operational research and systems engineering (Master by Lisbon University in 1994). She is a GIS specialist accredited by the Portuguese Engineers Order.
Until 2002, she worked at the National Centre for Geographic Information in the National Spatial Data Infrastructure (SNIG) implementation.
During 2003-2006, she lectured courses on GIS, standards for geographic data, land use planning and cadastre, and statistics at the University of Coimbra.
From 2006 to 2010, she researched at the National Institute of Health Doutor Ricardo Jorge (INSA), participating in projects concerned with the spatial analysis of mortality and morbidity and their determinants, and assessment of the impact of atmospheric pollution on human health.
Since 2011, at DGT, she has participated in research projects that have entailed the analysis of urban systems, the identification and delineation of settlements and built-up structures, the delimitation of rural-urban interfaces, land use change assessment, and the creation of indicators for monitoring sustainable urban development and spatial planning in general. Her current research relates to land consumption for urban development (land take, soil sealing, developed land recycling and re-naturalisation).

Beatriz Condessa is assistant professor at IST. She obtained a degree in Environmental Engineering – Specialization in Spatial Planning (1986, New University of Lisbon, Portugal) and a PhD in Geography (1999, Barcelona University, Spain).
She has carried out research activities since 1992. Firstly, in CNIG (National Centre for Geographic Information), mainly in developing databases using GIS tools to facilitate urban management and promote public access to information. Between 1998 and 2004, she coordinated the CNIG research team on Spatial Planning.
Since 2004, in IST, she has taught and researched urban management, focused on integrating urban planning, law and urban economics. More recently, she was PI of PERCOM project (Equity and efficiency in the urbanization process: a land readjustment execution model), of LANDYN (Land use cover change in continental Portugal: characterization, driving forces and future scenarios) and RIPROCITY (Rivers in Cities: potential for urban sustainability).
During 2014-2015 she coordinated the master programme in Urban Studies and Territorial Management at IST. She is a GIS specialist accredited by the Portuguese Engineers Order and a member of the Portuguese Urbanists Association and the International Academic Association on Planning, Law, and Property Rights (PLPR).

Abstract

The "No Net Land Take by 2050" target, set by the EU, has been reshaping European urban development. The main goal of this research is to compare the processes related to net land take and soil sealing in the Portuguese metropolitan regions (AML and AMP) and to assess their situation regarding the 2050 target.
During 2007-2018, the artificial land area increased by 4.9 percent in AMP and 4.6 percent in AML. Net land taken averaged 0.6 ha/day in the AMP and 0.7 ha/day in the AML. Reuse of artificial land was rarely practised, at 0.02 ha/day in the AMP and 0.03 ha/day in the AML. Given that the share of sealed artificial land in both regions was already close to 60% in 2018, thereby jeopardising urban biodiversity, to reduce net land take it is recommended that future infrastructure and housing needs be met by reusing already sealed artificial areas.

Keywords: Urbanisation; Reuse of developed land; Re-naturalisation of developed land; Urban land use efficiency

1. Introduction

Urban development in Europe is being shaped by the "No Net Land Take by 2050" target, set by the 2011 Roadmap to a Resource Efficient Europe (EC, 2011a) and reinforced by the EU Soil Strategy for 2030 (EC, 2021). In pursuit of sustainable use of soil, this strategy recommends that Member States set, by 2023, their targets aimed at net land take reduction by 2030 and report on their progress by making measurable contributions towards the 2050 target. The first draft of the Soil Monitoring Law (SML) was launched in July 2023 (EC, 2023) to ensure healthy soils across the EU by 2050. It establishes a regulatory framework for sustainable soil management, which mandates Member States to monitor land take and soil sealing.
Land take conveys the 'loss of undeveloped land to human-developed land' (EC, 2016, p.4) over a given period. In practice, it represents 'the surface of agricultural, forest, semi-natural and natural areas, wetlands and water bodies artificialized in a given period' (Nicolau and Condessa, 2024, p.1). Net land take accounts for the difference between land take and re-naturalisation of developed land, which is the reverse process of land take. A reduction in net land take is only attainable through the reuse of developed land (i.e. artificial or urban areas) or by increasing re-naturalisation, a rarely practised land use transformation (Nicolau and Condessa, 2022).
Soil sealing is considered the most intense form of land take, as it causes a total and irreversible loss of ecosystem services and functions provided by soil (Scalenghe and Marsan, 2009; EC, 2011b; Tobias et al., 2018). To prevent cities' biodiversity from declining, some experts (Decoville and Feltgen, 2023) advocate keeping soil sealing levels within urban areas below 40 percent, a threshold supported by a study on urban plant diversity loss caused by soil sealing in a rapidly urbanising Chinese city (Yan et al., 2019). Nonetheless, research applied to the Paris Metropolitan Area (Tardieu et al., 2021) showed that the level of soil sealing is insufficient to predict a large part of the variations in ecosystem services at the landscape level. Therefore, their authors argue that planning decisions affecting ecological functions on which the well-being of urban citizens depends should be based on regular assessments of these services.
To limit land take and soil sealing, the Soil Strategy (EC, 2021) also proposes the adoption of a hierarchy in land use planning that prioritises the reuse of developed land. Whenever land take cannot be avoided, measures should be implemented to compensate for the loss of ecosystem services (e.g. re-naturalisation of artificial areas, development of green infrastructure).
This research aims to compare the processes related to net land take and land take driving forces between Portuguese metropolitan regions (Área Metropolitana de Lisboa - AML and Área

Metropolitana do Porto - AMP) to assess their progress towards meeting the 2050 target. In addition to sensitising decision-makers and public authorities to the European goal, the research also intends to support the setting of regional and local land take targets, which do not exist to date, and the definition of reduction strategies for land take. Although the Portuguese National Spatial Planning Policy Programme recognises the need to protect the soil as a natural capital asset and to control land artificialisation, these objectives have not yet been translated into quantitative targets (national, regional and local) that can contribute to the successful implementation of a "no net land take" policy.

2. Materials and Methods

2.1. Methods and Data

The study assessed land use changes between 2007 and 2018 and the degree of soil sealing in 2018, based on Portuguese land use/cover maps known as COS (Costa et al., 2023), municipal boundaries maps for 2018 (both produced by the Directorate-General of Territory - DGT), and the Imperviousness Density (IMD) layer produced by Copernicus Land Monitoring System (CLMS, 2023). Annual population estimates launched by Statistics Portugal were employed to analyse population dynamics. COS are vector maps with a minimum mapping unit of one hectare and the IMD 2018 is a raster product with a spatial resolution of 10 metres.

The research assumed that the COS classes relating to artificial surfaces represent developed or urban land, including both sealed and unsealed areas, and that the remaining COS classes represent undeveloped or non-urban land.

The sealing level of each spatial unit and its artificial land was assessed in three stages. First, pixels covering the spatial unit and its artificial land were identified; Next, the product of the IMD value by the surface area of each pixel was totalled for all pixels of interest; Finally, the percentage of the area of interest that was sealed was calculated.

The processes described by the study regard surface areas per spatial unit over a specific period. Due to the unequal sizes of spatial units, the study reports them in $m^2/year \cdot km^2$, which allows comparison of the same process across different spatial units, or in ha/day, which only enables comparing processes relating to the same spatial unit between different periods.

2.2. Study Area

The study examines two NUTS III regions of mainland Portugal (Figure1) during 2007-2018 and at the end of this period: the Lisbon Metropolitan Area (AML) and the Porto Metropolitan Area (AMP). The AML is the most populous area in the country, with almost 2,9 million inhabitants (2021). It is subdivided into 18 municipalities, one of which (Lisboa) is the largest city in Portugal. The AMP covers 17 municipalities and is the second most populous region in the country (nearly 1,8 million inhabitants in 2021). In 2018, almost half (47 %) of the mainland's population was concentrated in the AML and the AMP, justifying these regions having the highest proportions of their surface area covered by artificial land (25.1 % in AMP and 21.7 % in AML). Although the AML has over a million more inhabitants than the AMP, in 2018 the artificial land per capita was higher in the AMP (297 m^2/inhabitant) than in the AML (230 m^2/inhabitant), which shows that the latter region is denser than the AMP. According to the Municipal Plans in force in 2018 and the population estimates for that year, the availability per inhabitant of parks, gardens and forests in areas classified as urban in the AML (39 m^2/inhabitant) was much lower than in the AMP (83 m^2/inhabitant).

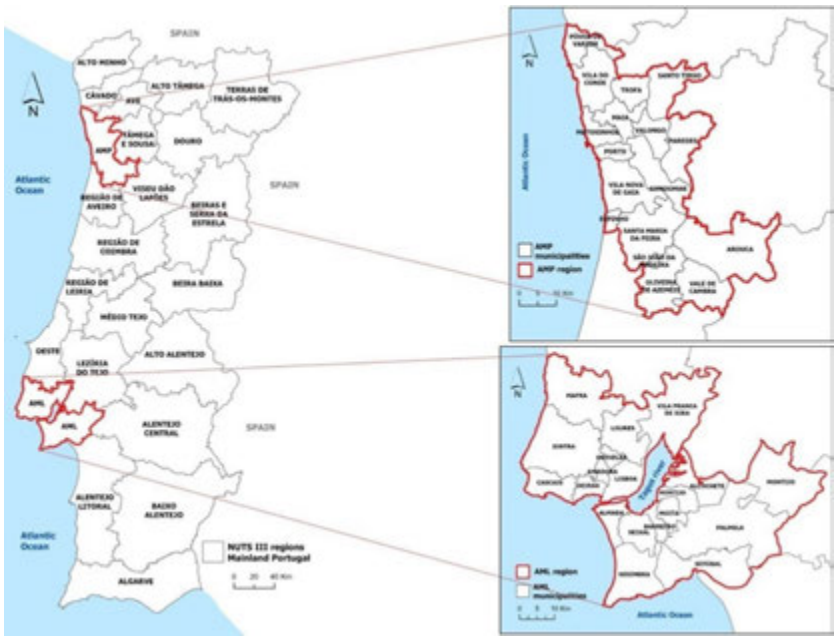

Figure 1 – Study area

3. Results

3.1. Land Take, Land Re-naturalisation and Net Land Take

During 2007-2018, the AMP land take rate (1153 m^2/year·km^2) was the highest among the NUTS III regions of mainland Portugal (Nicolau and Condessa, 2022), while that of the AML was the second highest (1021 m^2/year·km^2). These rates corresponded to an average consumption of undeveloped land of 0.6 ha/day in the AMP and 0.8 ha/day in the AML.
The main drivers of land take in AML were the development of new industrial and commercial sites (27 %), construction sites (26 %), transport networks (13 %), dispersed residential areas (12 %) and mining and quarrying areas (7 %). In the AMP, the four main driving forces of land take were similar, but their relative importance changed: transport networks (31 %), industrial and commercial units (27 %), construction sites (21 %) and dispersed residential areas (10 %). The low population densities that characterise much of the AMP territory with linear settlements mostly made up of detached houses interspersed with economic activities (AMP, 2014), and the high frequency of commuting by private vehicles (INE, 2018), explain the importance of strengthening transport networks in this region, where public transport is less used than in the AML (INE, 2018).

Table 1- Land take drivers in the AMP and AML, 2007-2018 (Percentage of non-artificial land consumption)

Drivers of Land take (2007-2018)	**AMP**	**AML**
Transport networks	31%	13%
Industrial and commercial units	27%	27%
Construction sites	21%	26%
Urban diffused residential	10%	12%
Urban green areas	3%	6%
Mining and quarrying areas	1%	7%

Re-naturalisation of artificial land rates were 93 m^2/year.km^2 (0.05 ha/day) in the AMP and 158 m^2/year.km^2 (0.13 ha/day) in the AML, evidencing the shortage of their practices. Figure 2 compares these rates between both regions municipalities, showing that Amadora, in the northern AML, made the most use of re-naturalisation (1054 m^2/year.km^2) in the period under review. The land use transformations most commonly associated with re-naturalisation in both regions were converting mineral extraction areas and construction sites into bushland. These changes result from land abandonment and increase the risk of forest fires, so they are the least desirable re-naturalisation type.

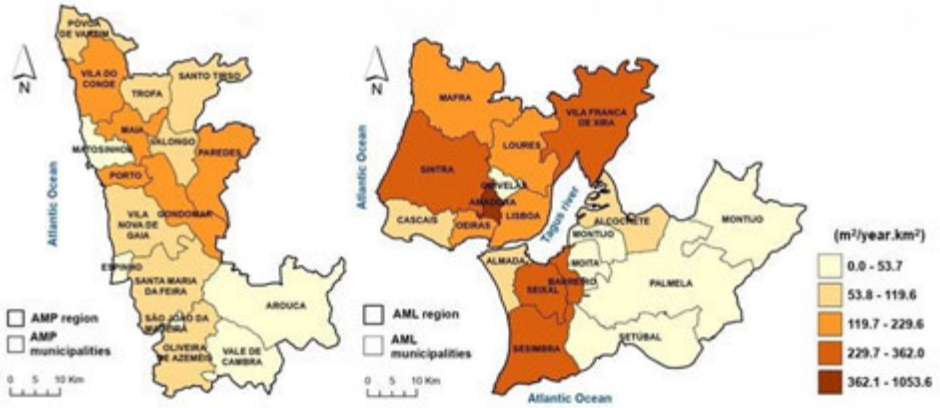

Figure 2 – Land re-naturalisation rate by AMP and AML municipalities, 2007-2018 (m^2/year.km^2)

The net land take rate in the AMP was also the highest among mainland Portugal regions (1060 m^2/year.km^2), immediately followed by that of AML (863 m^2/year.km^2). These rates represent net daily consumption of undeveloped land of 0.6 ha and 0.7 ha respectively, which still needs to decrease to meet the 2050 target.

The highest net land take figures within both regions (Figure 3) stood out in the municipalities bordering the most densely populated cities (Lisboa and Porto) and the municipality of Seixal (in the AML South), which recorded the highest rate (3133 m^2/year.km^2).

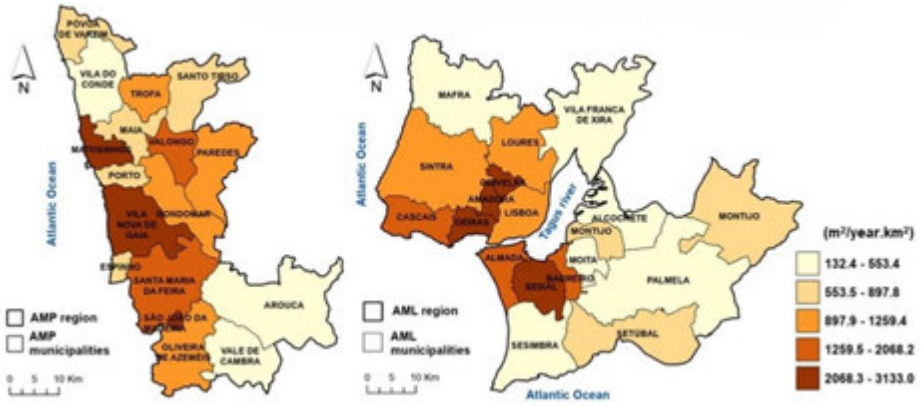

Figure 3 – Net land take rate by AMP and AML municipalities, 2007-2018 (m^2/year.km^2)

3.2. Reuse of Artificial Land

The reuse of artificial land was also little practised in both regions during 2007-2018, averaging 0.02 ha/day in AMP and 0.03 ha/day in AML (i.e. 28 m^2/year.km^2 and 38 m^2/year.km^2, respectively).

Despite this trend and the fact that three municipalities did not apply this process (Vale de Cambra and Arouca in the AMP, and Moita in the southern AML), two AML municipalities (Amadora and Lisboa) stood out for having the highest rates of land reuse (289 m^2/year.km^2 and 267 m^2/year.km^2, respectively) (Figure 4).

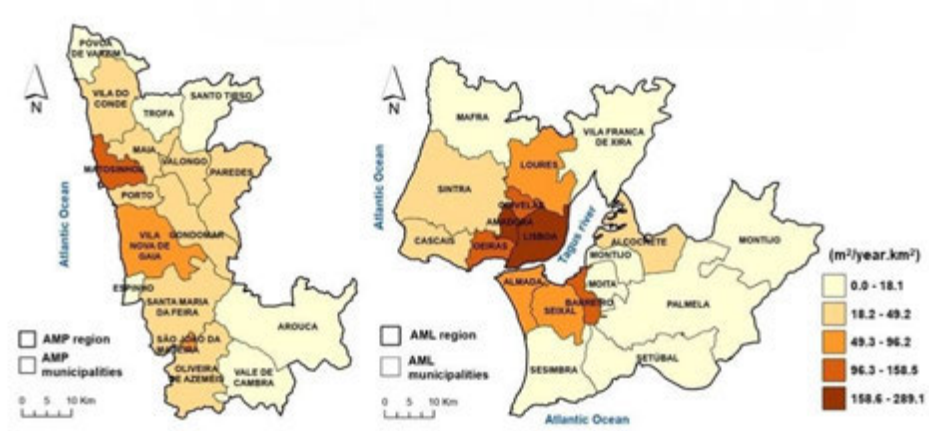

Figure 4 – Artificial land reuse rate by AMP and AML municipalities, 2007-2018 (m^2/year.km^2)

3.3. Urban Soil Sealing

In 2018, the degree of imperviousness of the artificial land was 56 percent in the AMP and 58 percent in the AML. At the municipal level (Figure 5), it ranged from 28 to 69 percent in both regions. Only two municipalities in the AMP (Arouca and Vale de Cambra) had levels of urban

soil sealing below 40 percent, which is recommended by some experts (Decoville and Feltgen, 2023) to prevent cities' biodiversity from declining. In the same year, the availability of unsealed artificial land per capita was 132 m^2/inhabitant in AMP and 97 m^2/inhabitant in AML.

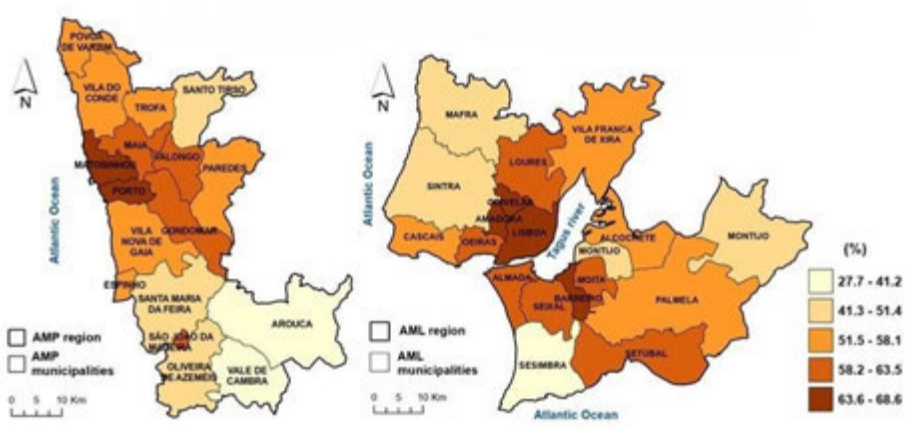

Figure 5 – Soil sealing level within the artificial land by AMP and AML municipalities, 2018 (%)

3.4. Artificial Land and Population Dynamics

During 2007-2018, the artificial land area expanded by 4.9 percent in the AMP and 4.6 percent in the AML (Figure 6), while the resident population of the AMP decreased by 2.4 percent, that of the AML increased by 2.5 percent. The expansion of artificial land was coupled with a population loss in most of the municipalities in the AMP and a group of five in the AML (Lisboa, Almada, Barreiro, Moita and Setúbal).

Population growth was only faster than that of artificial land in Maia (in the AMP) and eight AML municipalities (Cascais, Mafra, Vila Franca de Xira, Odivelas, Alcochete, Montijo, Palmela and Sesimbra), which experienced a decrease in artificial land per capita that is considered desirable to achieve the European target (EC, 2016).

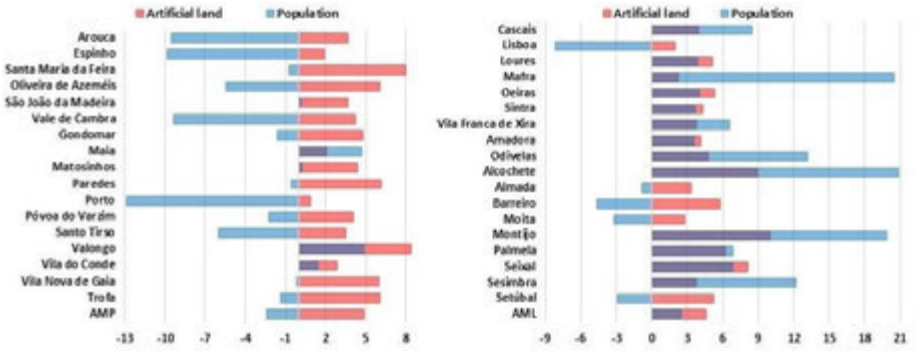

Figure 6 – Growth in resident population and artificial land by region and municipalities of AMP (left) and AML (right), 2007-2018 (%)

4. Discussion and Conclusions

During 2007-2018, the expansion of the artificial surface area in Portuguese metropolitan regions was mainly intended for infrastructure (expansion of transport networks, industrial and commercial sites and areas under construction). This increase (4.9 % in the AMP and 4.6 % in the AML) was in absolute terms almost double that of the resident population (-2.4 % in the AMP and 2.5 % in the AML). Although the AMP has seen a population loss in this period, the 2021 Census indicates that its inhabitants and those of the AML continue to grow, which leads to an increase in demand for housing.

To meet the European target by 2050, the net land take rates during this period (0.7 ha/day in the AMP and 0.6 ha/day in the AML) have to drop. To this end, in addition to publicising the European target among regional and local decision-makers, stricter control mechanisms must be implemented to reduce the consumption of non-artificial land and increase the reuse of artificial land, which has been under-implemented (0.03 ha/day in AML and 0.02 ha/day in AMP).

As the share of sealed artificial land in both regions was already close to 60 percent in 2018, a level that according to some experts compromises urban biodiversity (Yan et al., 2019; Decoville and Feltgen, 2023), to obtain net land take reductions, it is recommended that future infrastructure and housing needs must be met by reusing already sealed artificial areas. However, intensifying land use in these areas can reduce urban resilience and must be compensated for by increasing the surface covered by green spaces and other nature-based solutions (EC, 2012).

In line with the recommendations of the EU Soil Strategy (EC, 2021), the authorities of both AMP and AML should also define quantitative targets (regional and local) for net land take reduction by 2030 and monitor its progress.

Meeting the 2050 target requires intra-urban densification without neglecting the unique features of each city (Nicolau and Condessa, 2024), such as its availability of brownfields, vacant lots and underused areas (Schiller et al., 2021) and ecosystem services (Tardieu et al., 2021), as well as legal, economic, environmental, and social aspects, which have not been addressed in this study. Given that a single strategy that can be applied universally to achieve this target does not exist (Decoville and Feltgen, 2023), defining a policy for its fulfilment demands a more in-depth analysis encompassing those aspects and the specificities of each city.

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How Urban Morphology Affects Wind-Heat Environment: An Example in Beijing from Ancient Cities to Modern Cities

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Abstract
The urban wind-heat environment is a critical component affecting residents' health. This research investigates the impact of urban morphology on the heat and wind environment, focusing on three distinct residential blocks in Beijing's Nanluoguxiang Historic District. The three neighborhoods represent ancient, modern, and a mix of historical and modern urban forms. The ENVI-met was utilized to simulate wind speeds and temperatures for ancient times (1880) and modern times (2023). The results reveal that traditional urban forms with compact buildings and courtyards create more moderate wind and heat conditions. Modern urban forms with high-rise buildings and open spaces result in higher wind speeds and temperatures. The findings highlight the importance of preserving traditional urban layouts for comfortable microclimates.

Keywords: Urban microclimate, Urban design, Historic district, Numerical simulation, China

1 Introduction

Climate change has stood as one of the most formidable global challenges, with far-reaching implications for the environment and human societies. This challenge pertains to urban areas, where most of the world's population resides. The urban wind-heat environment, an integral component of the urban climate system, profoundly influences city residents' health and well-being. The morphology of modern cities often plays a crucial role in the urban wind-heat environment. Research has shown that urban morphology, including building layout and street design, can either facilitate or obstruct natural ventilation, with implications for heat dissipation and air quality management (Yuan *et al.*, 2014; Tsichritzis and Nikolopoulou, 2019; Palusci *et al.*, 2022). The concept of urban morphology has also been extensively studied in the context of the heat environment. The increase in global average temperatures has intensified the urban heat island effect, resulting in significantly higher temperatures in city centers than in suburban areas (Zhao *et al.*, 2011; Zhang *et al.*, 2022; Wu *et al.*, 2022). Numerous studies have delved into the role of building height, street orientation, and density in modifying urban temperatures (Johansson, 2006; Apreda *et al.*, 2020). This elevates the risk of residents experiencing heat stress and heat-related illnesses such as heatstroke, dehydration, and cardiac arrest. Therefore, improving the urban wind-heat environment is increasingly receiving attention from scholars and city administrators. However, most of these studies have been conducted within the context of modern cities. The research of microclimates in ancient cities or historical urban areas can assist in urban construction in two key respects. Firstly, it

aids in enhancing the understanding of the microclimate within traditional urban form districts in modern cities, thereby safeguarding the health of residents. Secondly, it offers references and support for the climate adaptability design of future cities.

The harmonious coexistence of ancient cities with the natural environment contrasts sharply with the modern approach of reshaping the natural environment through planning, reflecting different philosophies and methods of human adaptation to and transformation of the environment (Shi and Zhao, 2022). The study of ancient urban forms provides traditional architecture, and planning often includes elements that enhance natural cooling and ventilation (Yang *et al.*, 2022). Indraganti's (2010) research on Indian settlements also emphasized the strategic use of layout, street design, and materials for climate adaptation, noting the effectiveness of centralized, narrow streets in xerothermic conditions. Dili *et al*. (2010) analyze the passive environment control systems inherent in Kerala's vernacular architecture, demonstrating how traditional design principles effectively address the region's warm-humid climate. Arrar *et al*. (2022) investigated the outdoor thermal comfort levels in the historical urban fabric of Algiers Casbah, which informs urban design strategies to mitigate heat stress in traditional city settings. These findings suggest critical insights into sustainable design principles, particularly in their adaptive response to climate. The research of these ancient urban forms can inform modern urban planning and design practices, particularly in the context of climate change adaptation. The design of traditional Chinese cities often reflects a profound understanding of the local climate. Research on the renovation of traditional blocks guided by wind-heat environment simulations is also gradually emerging in China (Liu et al., 2022; Xiong et al., 2023; Zheng and Wang, 2019). However, given the vast territory of China and the complexity of various traditional blocks, fundamental research on the microclimate of different urban blocks is still relatively weak.

Historical blocks, characterized by a concentration of cultural relics and landmarks, or those broadly reflecting the traditional style and ethnic local features of a particular historical period, are integral to the urban fabric. In northern China, the morphology of historical blocks often evolves from the traditional Chinese courtyard, with building heights typically ranging from one to three stories. These structures generally incorporate construction techniques tailored to address the local climate conditions (Jin *et al.*, 2018). These areas, designed in response to the social context and climate of their time, offer urban residents natural, safe, comfortable, and pleasant spatial environments, thereby contributing significantly to urban construction, the preservation and enhancement of urban history and culture, and the quality of life for city dwellers. Therefore, this study selects the Nanluoguxiang Historic District in Beijing, China, which includes an area representative of ancient cities, a modern urban area, and an area that integrates ancient and modern elements, each representing different periods of urban development, and aims to address these gaps by examining the relationship between urban morphology and the wind-heat environment across different temporal scales, from ancient to modern cities. Through a series of simulations by ENVI-met under various climatic conditions, the research aims to analyze the differences and advantages and disadvantages of the three urban form types in terms of the wind-heat environment, providing insights and

inspiration for the construction of climate-adaptive cities and the preservation and development of historic districts.

2 Methodology

2.1 Study Sites

China's urban construction boasts a long history, extensive distribution, and a multitude of cities, making it an excellent subject for studying ancient human settlements. The forms of ancient Chinese cities evolved under various historical, geographical, cultural, and economic conditions, reflecting the ways and characteristics of how ancient Chinese people organized and utilized urban space, as well as the extent and manner in which they met the needs of social life. With its long history, Beijing is among the first batch of China's national historical and cultural cities and holds immense research value. Beijing Old City (39°28′ ~41°50′ N, 96,115°25′ ~117°30′ E), located in the center of Beijing. It has been developed for 3000 years and has been the capital city for 800 years. The Old City represents the unique scenery of traditional Beijing, featuring Siheyuans (courtyards with buildings on four sides) and Hutongs (lanes between Siheyuans). Beijing is rich in research materials, with a wealth of historical maps, documentary records, and numerous cultural heritages and historical blocks, making it feasible for research.

The Nanluoguxiang Historic District, the focus of this study, is situated in the northeastern part of the Beijing Old City, covering an area of 0.84 km^2. It was established during the same period as the Yuan Dadu(the name of Beijing in the Yuan Dynasty) and has a history of over 740 years. During the Ming and Qing dynasties, it was an upscale residential area for officials and gentry, and in modern times, it became a cluster of former residences of notable figures. In 1990, it was designated as one of Beijing's first historical and cultural protection areas. It is the only area that has preserved the Yuan Dynasty's "Li Fang System" of alleys and is the largest, most prestigious, and most resource-rich traditional residential area within the Yuan Dadu site (Fig.1). In 2016, the Design Guide for the Preservation and Renewal of Nanluoguxiang Historic and Cultural District was implemented, and the residential function began to be restored.

For this study, three sites within the Nanluoguxiang Historic District were selected as experimental sites. All three sites are located in the core area of the Historic District, on Mao'er Hutong, and are predominantly residential in function (Fig.1, 2). Site A is the courtyard at No. 5 Mao'er Hutong and the surrounding area of Ke Garden, representative of ancient cities. They are critical national and Beijing's cultural relics, preserving many historical features. Site B is the "Old Residence" and its surrounding area, which includes cultural relics, general traditional buildings, and many modern buildings constructed later that are in harmony with the traditional style. It represents the basic situation of a larger area of the Nanluoguxiang Historic District and is also the essential condition of many historical blocks in China. Site C is the courtyard at No. 45 Mao'er Hutong, located on the westernmost side of the Historic District. This group of residential buildings, constructed after the 1980s and

approximately six stories high, is consistent with the large-scale commodity housing communities built in China in the last century, representing a modern urban area.

Fig.1 Experimental sites selection

a. Site A b. Site B c. Site C

Fig.2 Computational models

2.2 Numerical Simulation

Beijing experiences a monsoon-influenced humid continental climate, marked by hot and humid summers and generally cold, windy, and dry winters. As the capital city for both the Ming and Qing dynasties, Beijing has an extensive record of climate observations. From the first year (1875) to the fifth year (1880) of the Guangxu period, the Russian Church, located at the northeast corner of Beijing city, used meteorological instruments calibrated by the Central Observatory of St. Petersburg to measure meteorological data, resulting in the average monthly meteorological data for Beijing during the first to fifth years of the Guangxu era (Zhu, 1936). This data is consistent with the recent collection and organization of historical documentary records of warm and cold temperatures, which indicate that since the Yuan Dynasty, the eastern region of China has essentially been in a cold period, with a temperature

difference of approximately 1-2°C compared to the present (Fig.3) (Ge *et al*., 2002). Intensive urbanization during recent decades has dramatically modified the urban heat environment (Yan *et al*., 2010).

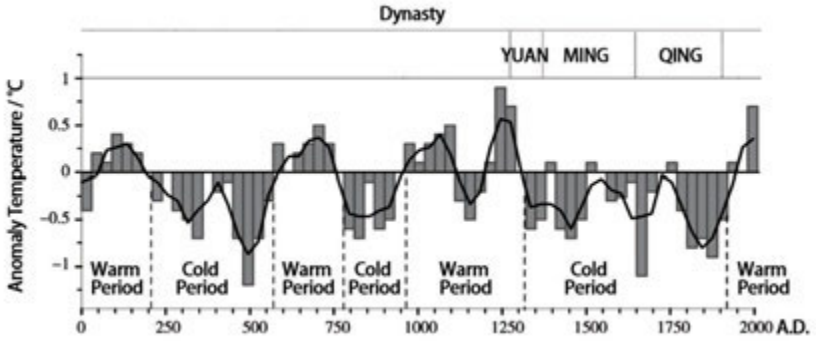


Fig.3 The sequence of average temperature changes in the winter half-year over the past 2000 years in the eastern region of China (Ge *et al*., 2002)

The simulation analysis software adopts the ENVI-met. It can simulate the energy, momentum, and material exchange processes between buildings, the ground, vegetation, and the atmosphere in small-scale urban spaces with the function of calculating the wind field, turbulence, radiation, air temperature, and humidity, which is based on the related theories of fluid mechanics, thermodynamics, and urban meteorology. ENVI-met has been widely used in urban microclimate research in different regions of the world (Andreou and Axarli, 2012; Ng *et al.*, 2012).

The ENVI-met numerical simulation encompasses two fundamental steps: constructing the computational model and setting parameters. The computational domain for Sites A and B is 100m×200m, while for Site C is 200m×200m, with a grid resolution of 4m. The computational model for the study area is constructed based on the building outlines within the modeling range (data sourced from Baidu Maps Open Platform at https://lbsyun.baidu.com), delineating elements such as buildings, underlying surfaces, and vegetation (Fig.4). The parameter settings for the data are primarily derived from the measurement data during the Guangxu period (1880). The observational data from the meteorological station (2023) (Tab.1). Site A, representative of ancient cities, underwent simulation for the year 1880. Site C, representative of modern cities, was simulated for 2023. Meanwhile, Site B was subjected to simulations under both meteorological conditions.

Tab.1 Wind-heat environment parameter settings

	Parameter setting 1880	Parameter setting 2023
Wind speed (m/s)	1.20	1.94
Average Air Temperature (℃)	26.9	28.5
Air Temperature at 14:00 (℃)	33.2	35

Humidity (%)	72	60

3.3 Data Analysis

The study simulated the variations in the wind-heat environment throughout the hottest day of the year in Beijing, July 30th, focusing on the pedestrian-level (1.4m above ground) wind speed, temperature, and relative humidity at different time points of a typical meteorological day. For this paper, the numerical simulation maps of the wind-heat environment at the peak heat of the day, 14:00, were selected for detailed analysis. The simulation results were analyzed to compare the wind and heat conditions across the three study sites.

4 Results

4.1 Wind Environment

Representing the ancient cityscape, Site A's simulation for the year 1880 reveals an average wind speed of 0.57 m/s, which is a significant deviation from the parameter wind speed of 1.20 m/s, indicating a -52.83% difference (Tab.2). The maximum wind speed recorded was 1.12 m/s, which also saw a decrease, dropping by 0.08 m/s. That is to say, the wind speed in all areas of Site A was less than the ambient wind speed.

Site B, which includes both cultural relics and modern buildings, was simulated under two different sets of meteorological conditions, allowing for a temporal comparison. In 1880, the average wind speed was 0.56 m/s, with a deviation of -53.75% from the parameter. By 2023, the average wind speed slightly increased to 0.82 m/s, a deviation of -58.00%. The comparison between the two time periods suggests that the overall impact on pedestrian-level wind conditions remains moderate. Among them, the simulation for the year 1880 showed no particularly significant difference compared to Site A. However, the simulation for the year 2023 exhibited the greatest proportionate decrease in wind speed among the four simulations.

As a representative of a modern urban area, Site C's simulation for the year 2023 shows the highest average wind speed among the three sites at 1.01 m/s, which is the greatest of all simulations. Among the four simulations, Site C's wind speed deviation from the parameter is the smallest, at only -15.83%. At the same time, the maximum wind speed was recorded at 3.37 m/s, which is significantly higher than the ambient wind speed and also the highest among all simulations. Compared to Site B's simulation for the year 2023, Site C's average, maximum, and median wind speeds are all considerably higher.

Tab.2 Simulation results of the wind environment

	Site A (1880)	Site B (1880)	Site B (2023)	Site C (2023)
Wind Speed Parameter(m/s)	1.20	1.20	1.94	1.94
Average	0.57	0.56	0.82	1.01

Wind speed (m/s)				
Deviation from the Parameter (m/s)	-0.63	-0.65	-1.13	-0.19
Deviation from the Parameter (%)	-52.83	-53.75	-58.00	-15.83
Maximum (m/s)	1.12	1.40	2.15	3.37
Minimum (m/s)	0.00	0.00	0.00	0.00
Median (m/s)	0.64	0.59	0.84	1.11

4.2 Heat Environment

The simulation results for Site A in the year 1880 indicate an average air temperature of 32.22°C, which is slightly below the parameter setting of 33.2°C, showing a deviation of -0.99°C or -2.97% (Tab.3). This change represents the only instance of a temperature decrease among all simulations. The maximum temperature recorded was 35.58°C, the minimum was 30.74°C, and the median temperature was 32.18°C.

For Site B, the comparison between the simulations of 1880 and 2023 reveals a gradual increase in the average air temperature. In 1880, the average temperature was 33.26°C, with a deviation of 0.06°C or 0.19% from the parameter. By 2023, the average temperature rose to 35.10°C, a deviation of 0.10°C or 0.28%. The difference between the simulations of the two meteorological conditions is not significant. Among them, the simulation for the year 1880 showed a distinct difference compared to Site A. The average value increased by 1.04°C, and the difference from the ambient temperature changed from negative to positive. Site B's highest temperature was 35.71°C, 0.13°C higher than Site C. Meanwhile, Site B's lowest temperature was 32.10°C, 1.36°C higher than Site C's. Regarding the median, Site B was 1.07°C higher than Site C.

Representing the modern urban context, Site C's simulation for 2023 shows the highest average air temperature among the sites at 35.33°C, with a deviation of 0.33°C or 0.94% from the parameter. This site represents the most significant increment among the three simulations with increasing temperatures. The maximum temperature reached 38.79°C, a 3.79°C increase from the ambient temperature. The median was 35.21°C, a 0.21°C increase from the ambient temperature, indicating that most of the area's temperatures are above the ambient temperature. Compared to Site B's simulation for the year 2023, Site C's average, maximum, and median temperatures are all significantly higher. However, Site C's minimum temperature, which was 33.41°C, is lower than the minimum value of Site B's 2023 simulation, which was 33.91°C.

Tab.3 Simulation results of the heat environment

	Site A (1880)	Site B (1880)	Site B (2023)	Site C (2023)
Air Temperature Parameter at 14:00(m/s)	33.20	33.20	35.00	35.00
Average	32.22	33.26	35.10	35.33

Air Temperature (℃)				
Deviation from the Parameter (℃)	-0.99	0.06	0.10	0.33
Deviation from the Parameter (%)	-2.97	0.19	0.28	0.94
Maximum (℃)	35.58	35.71	37.43	38.79
Minimum(℃)	30.74	32.10	33.91	33.41
Median(℃)	32.18	33.25	35.08	35.21

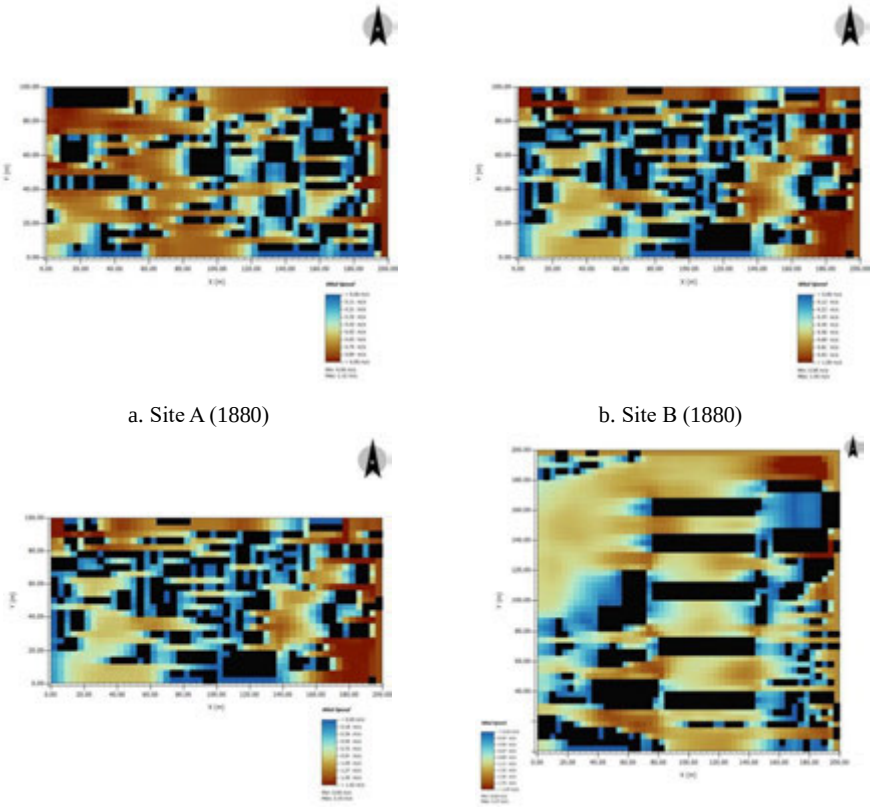
4.3 Comparison of Urban Morphologies

Site A represents the ancient city form, characterized by traditional courtyards (Siheyuans) and narrow lanes (Hutongs). This area is rich in cultural relics and historical features, providing a unique landscape preserved over time. The simulation results for Site A in 1880 indicate that the wind environment is influenced by the compact arrangement of buildings and the narrow streets (Fig.4a). The maximum wind speed is observed in the open courtyard areas, where the flow is less obstructed. Conversely, the minimum wind speed occurs in the confined spaces between buildings, where the flow is restricted and turbulence increases. The heat environment of Site A is moderated by a dense network of courtyards and Hutongs (Fig.5a). The extensive greenery within the courtyards played a significant role, providing shade and promoting natural ventilation. The lowest temperatures are observed in the shaded areas under the plants within the courtyards. The highest temperatures occur in the courtyards without plants that are directly exposed to sunlight. There is no significant difference between the south and north of the buildings.

Site B encompasses a mix of cultural relics, traditional structures, and modern constructions harmoniously integrated with the traditional style. This site represents the evolution of urban form over time, reflecting both historical preservation and modern development (Fig.4b, c). Similar to Site A, Site B shows a wind environment influenced by the traditional urban layout. The maximum wind speed is recorded in the open areas, while the minimum is found in the narrow passages between buildings. Similarly, Site B's air temperature is akin to Site A. Courtyards filled with vegetation offer better cooling effects. In contrast, enclosed courtyards without plants experience the highest temperatures (Fig.5b, c).

Site C represents the modern urban form, characterized by high-rise residential buildings and large-scale housing communities. This area resembles the urban development patterns seen in many contemporary Chinese cities. The simulation for Site C in 2023 shows that the wind environment is significantly different from the traditional forms (Fig.4d). The taller and more widely spaced buildings result in larger open areas with higher wind speeds. The wind speed at the edges of high-rise buildings is higher than the lowest at the edges of buildings, as in Sites A and B. The minimum wind speed for Site C is found within the central open spaces where the flow is more turbulent than elsewhere. The highest temperature at Site C occurs on the south side of the high-rise buildings, even though some plants are present (Fig.5d). The temperature on the north side of the buildings is comparatively lower. The lowest temperature

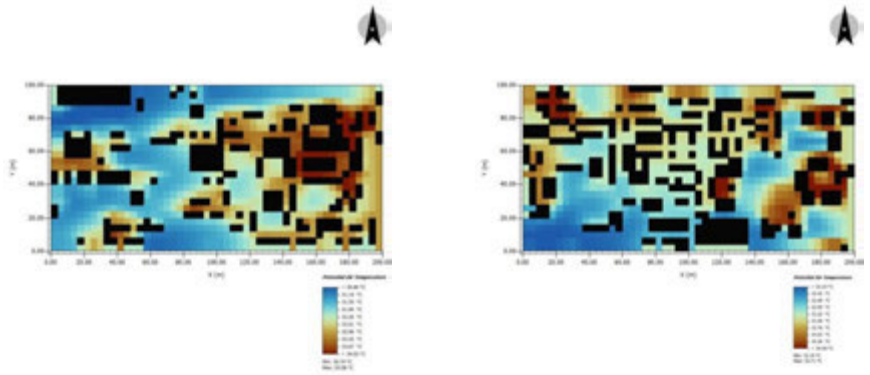
is found in the courtyard enclosed by several buildings at the northeast corner. This courtyard is surrounded by three buildings, with some plants in the middle.



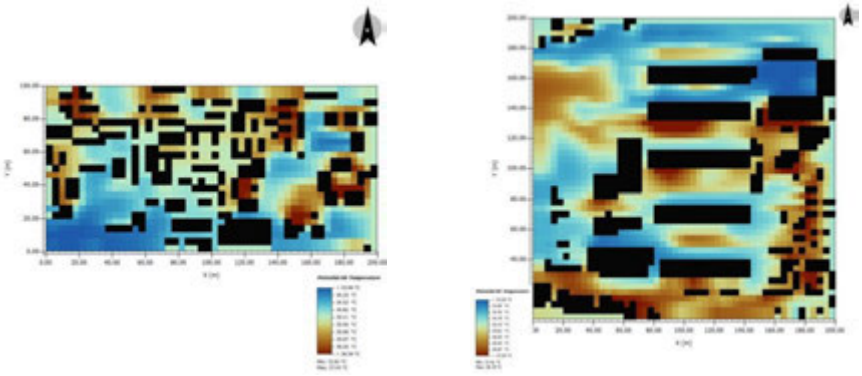
a. Site A (1880) b. Site B (1880)

c. Site B (2023) d. Site C (2023)

Fig.4 Diagrams of simulation results of the wind environment



a. Site A (1880) b. Site B (1880)



c. Site B (2023) d. Site C (2023)

Fig.5 Diagram of simulation results of the heat environment

5 Discussion

5.1 Urban Morphology and Wind Environment

Urban morphology profoundly influences the wind environment at the pedestrian level. The study's findings from the three sites in Beijing reveal that traditional urban forms, characterized by low-rise buildings and narrow streets, tend to create a more sheltered microclimate with reduced wind speeds. This is particularly evident in Site A, which represents the ancient city form, where the compact arrangement of buildings and the presence of courtyards and narrow lanes act as a buffer against the wind, resulting in a more moderate wind environment.

However, the modern urban form, exemplified by Site C, presents a different scenario. The taller and more widely spaced buildings in the modern urban area create larger open areas prone to higher wind speeds. While increased wind speeds can enhance natural ventilation and dissipate heat, they can also lead to discomfort and potential safety hazards, such as the risk of blown debris or difficulties walking against strong winds.

The transition from the traditional to the modern urban form, as seen in the evolution of Site B from 1880 to 2023, highlights the impact of urban development on the wind environment. The modernization process, marked by the construction of taller buildings and wider streets, has increased wind speeds at the pedestrian level (Kubota *et al*., 2008). This shift underscores the need for urban planners to consider the wind environment implications when designing modern cityscapes, ensuring that the benefits of increased ventilation are balanced against the potential discomfort and safety concerns associated with higher wind speeds (Yang *et al.*, 2013).

5.2 Urban Morphology and Heat Environment

The heat environment analysis in this study offers a perspective on how urban morphology can shape the thermal conditions experienced by city residents. In the traditional urban form, such as that represented by Site A, the compact building arrangement and the presence of courtyards and narrow streets contribute to a cooler microclimate (Nasrollahi *et al.*, 2017). The courtyards, often filled with vegetation, provide shade and promote natural ventilation, which can help to reduce the urban heat island effect (Su *et al.*, 2022). The dense network of courtyards and Hutongs in Site A creates shaded areas cooler than the surrounding environment, providing thermal comfort during the hot summer months. From 1880 to 2023, the rise in temperature at Site B was mainly due to the increase in ambient temperature. This change reminds us to pay attention to the new requirements for urban form design posed by global warming (Tringa and Tolika, 2023).

As seen in Site C, the modern urban form presents a different set of challenges. Taller buildings require greater distances between them, leading to larger open spaces and a more distant relationship between the buildings and the vegetation. These morphological characteristics can exacerbate the urban heat island effect. The simulation results for Site C indicate the highest average air temperature among the sites, highlighting the potential for increased heat stress on residents and the need for effective strategies to mitigate this impact.

5.3 Limitations and Future Research

While the study offers valuable contributions to the field, it has limitations. The simulations, though based on detailed urban models and climate data, represent a controlled environment and may only partially capture the dynamic nature of real-world urban spaces. Future research could enhance the accuracy of these findings by incorporating real-time meteorological data and conducting field measurements to validate the simulation results. Additionally, the vegetation modeling in this simulation is not sufficiently detailed, and there may be considerable variations in the plants over time, which is also a limitation.

Additionally, the study focused on a limited number of urban districts in Beijing, which may only represent some urban environments. Expanding the scope to include a diverse range of cities worldwide and climates would provide a more comprehensive understanding of the relationship between urban morphology and the wind-heat environment. In particular, there should be more exploration of the relationship between ancient urban forms and meteorological conditions. Urban form can not only be based on existing historical districts with characteristic features but also modeled according to records from historical maps to further investigate the interplay between urban form and other environmental factors of the microclimate, such as air quality and noise pollution.

6 Conclusion

Understanding the relationship between urban morphology and the wind-heat environment is crucial for creating urban spaces that are comfortable and sustainable. This study's comparative analysis of urban morphologies within Beijing's Nanluoguxiang Historic District reveals that traditional forms, characterized by compact buildings and courtyards, foster more moderate wind and heat environments. In contrast, the modern urban form exhibits higher wind speeds and temperatures, potentially intensifying the urban heat island effect. The comparison of urban morphologies across the three sites reveals the complex interplay between architectural form, urban layout, and microclimatic conditions. It emphasizes the need for a balanced approach to urban planning that respects historical contexts while addressing contemporary environmental challenges. The findings underscore the importance of preserving traditional urban layouts for comfortable microclimates and suggest that urban planning must adapt to mitigate the impacts of modernization and global warming on urban thermal comfort.

A balanced approach to urban form design is essential, one that respects historical contexts while addressing contemporary environmental challenges. On one hand, attention should be paid to the adaptability of historical blocks to the contemporary climate. The current protection of historical blocks often needs more consideration of the microclimate environment, with related regulations and standards having broad indicators. It is necessary to refine these standards to protect historical blocks from extreme climate damage and provide residents with a climate-appropriate place. On the other hand, the climate adaptability design of new buildings should be emphasized. The experiences and lessons from ancient cities' architectural styles and planning principles can be utilized to adapt the urban form to climatic conditions effectively. For instance, controlling the building heights in residential areas and enhancing the integration of architecture with vegetation can be adopted.

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Regenerative Public Space as game-changing option for Thriving Communities

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Abstract
There is currently growing evidence of many conflicts and intolerance at both macro and micro levels in the world. These trends question the future of public space as a peaceful and inclusive commons. This paper focusses on regenerative public space in South Africa and its potential to contribute to thriving communities. By exploring the paradigm, process, and product, the discussion shares critical challenges facing public space development in the Global South while offering pathways for regenerative development and design applicable everywhere globally. The paper argues that regenerative public space can become a game-changer for peace construction and inclusion in diverse societies and contribute to healthy and thriving communities in global South and North cities.

Keywords: Regenerative public space; potential, process, peace, SDG 11.7, South Africa

Introduction

The world is witnessing many volatile situations. Wars are raging, populations are fighting for political justice, and in cities and towns, people are facing desperate conditions in a struggle for survival while the fear of crime creates growing intolerance. These events give rise to growing insecurity and the re-negotiation of territoriality at many scales. Re-territorialisation concerns more than just countries and regions but also spaces within cities. Public spaces are often reconsidered or re-negotiated through appropriation, either by those without space for survival or those who want to reserve the space for a select few through fortification. Hence, public space has become a place of selection based on the various needs contained within the survival or fortified city, and more often than not, creating a maze of juxtaposed entities varying between these two opposites. These trends raise many questions for the future of public space as a common collector and facilitator of inclusion, or as places of peace and prosperity.

Public space is considered to be spaces owned by the state and accessible to the public (Madanipour, 2003). They are very important as the glue in the city that ties together all the private spaces and allow people to move between them. Public spaces are also important as gathering spaces where people can interact and exchange ideas or goods in a peaceful manner. This is critical to allow social relationships to grow, flourish and thrive. Public spaces, such as streets, sidewalks, plazas and parks, also offer access to nature, through trees alongside roads, formal vegetation in plazas and a celebration of the nature in parks. However, exclusion and violence threaten access to public spaces and peaceful co-habitation in these spaces. “One of the important qualities of Positive Peace is that it creates societies that are more resilient. In

other words, better capable of adapting to their changing environments." (Killelea, 2024). This calls for resilient and regenerative public spaces.

Regenerative development and design extend the work of sustainability and resilience. The emphasis is shifted from existence to potential and recognises the interdependent web of multileveled structures of complex living systems. Regeneration acknowledges the unrealised potential inherent in a given system and its broader system. Its exploration enables the residing systems to evolve by expressing their latent potential (Hes & Du Plessis, 2015; Mang et al., 2016; Du Plessis, 2022). Finding the potential paves the way for a trajectory of responsible design, moving from conventional and green practices to restorative and reconciliatory practices toward regenerative development and design (Reed, 2007). Such an approach is relevant to address the challenges facing public space and urban transformation (Landman, 2019).

This paper focuses on regenerative public space in South Africa and its ability to contribute to thriving communities. Drawing from four case studies in the City of Tshwane (the municipality that includes Pretoria), South Africa, it unpacks an alternative paradigm for public space, proposes a different process for (re)development and design and offers examples of a few regenerating public spaces. These case studies were carried out as part of a National Research Foundation (NRF) funded Project (Grant: 137981) focussing on Regenerative Public Space. The NRF project focusses on the manifestation of regenerative public space and set out to develop a methodology to facilitate this in practice and ensure ongoing collaboration through an online digital platform.

By exploring the paradigm, process, and product, the paper shares critical challenges facing public space development in the Global South while offering pathways for regenerative development and design applicable everywhere globally. The paper argues that regenerative public space can become a game-changer for peace construction and inclusion in diverse societies and contribute to healthy and thriving communities.

Changing paradigm and the call for regenerative sustainability

Sustainable development has become an important concept worldwide to guide development practices to alleviate the harmful impact of urban development in the past century, adapt urban practices to be less dependent on finite resources, mitigate the impact on climate change, and transform cities and urban spaces to regenerative places. In essence, sustainable development is concerned with reducing the use of scarce resources to ensure prosperity for all, while minimising the impact on the planet and people. The United Nations developed the eight Millennium Development Goals to establish a joint base to guide interventions. These were replaced in 2015 by the 17 Sustainable Development Goals (SDGs) set out in the Agenda 2030. The SDGs are a collection of goals developed to serve as a "shared blueprint for peace and prosperity for people and the planet, now and into the future". The New Urban Agenda, highlights public space as a critical lever to transform urban areas through "multifunctional areas for social interaction and inclusion, human health and well-being, economic exchange and cultural expression" (2016:13). Goal 11.7 of the SDGs explicitly promotes "universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities explicitly".

This goal, therefore, highlights the need for safe and inclusive public space to enable peace and prosperity.

However, to be sustainable, people and places need to adapt to changing needs and environments. Resilience is related to the ability of a particular geographic area, settlement, group of people or person to deal with a specific shock or disturbance in the system. In other words, resilience refers to the adaptive capacity of a particular place or people to respond to a crisis or changing conditions through particular responses in the socio-ecological system. However, change is not linear and emerges from complex relationships between multiple actors and environments (Walker & Salt 2006, Nel et al 2018). Resilience thinking offers a mechanism to work with change to adapt to disturbances in the system and transform those that are not conducive to the reorganisation of the system to bring forth new life, forms and functions (Du Plessis 2022). Urban resilience, dealing with ability of the urban system to adapt and transform, does not only depend on local authorities and their ability to develop resilience policies and plans to deal with natural hazards and disasters. Involving the skills of academics, practitioners and communities is far more likely to produce more robust strategies while enabling some level of flexibility to respond to the actual disturbance through increased awareness and knowledge (Walker & Salt 2006; Nel et al 2018; Orsetti et al. 2022)

Nevertheless, change should not just respond to a crisis or attempt to recreate the same places again. Regeneration is about improvement - not just maintenance – to create healthier and thriving people and places. More recent definitions highlight the importance of regenerative sustainability that goes beyond an attempt to maintain the status quo, and create opportunities for the environment and people to flourish in a harmonious and symbiotic relationship. Regenerative sustainability aims to "cultivate relationships that sustain the ability of the global social-ecological system to provide not just life-supporting, but also life-enhancing conditions for the global community of life" (Hes & du Plessis, 2015:39).

Regenerative development and design incorporate but goes beyond resilience thinking and are concerned with the co-evolution of humans and nature. All living systems survive by adapting in evolving environments (Mang et. al. 2016). This means that people do not need to be afraid of change, but use the opportunities to create different places that relate to the local place and the people living there. The aim is to ensure that both humans and nature can work together to create increased well-being.

> "*Thriving is possible for life on earth because of regeneration. All organisms including humans, live and breathe and continue to exist because they regenerate ... Thriving is a natural process*" (Visser, 2020:3).

Drawing from several authors who pointed out various issues related to regenerative development and design (Reed, 2007, Mang & Reed 2012, Du Plessis, 2012, 2022, Hess & Du Plessis 2015, Benne & Mang 2015, Mang et. al. 2016, Gibbons 2020, Landman et. al. 2019, Landman, 2024) and looking at various initiatives in South Africa, it is possible to highlight a number of principles of regenerative public space. These principles are a) the essence of place, b) evolutionary protentional, c) value-adding role, d) leverage points and e) control the hard lines.

Essence of place

Interventions should be based on an understanding of the essence of place, ensuring that they are specific and fit in the environment to allow co-evolution to occur. The essence of place emerges from the entire network of ecological and cultural systems within a specific geographic area. Revealing the essence of place shows the relation to broader environment and the history of the place to open up the potential of the place. Many stakeholders need to collaborate for this to emerge.

Evolutionary potential
The evolutionary potential seeks to uncover the unmanifested latent energy inherent in unused resources or locked up capital in rigid systems. It is the seed that enables the system's evolution to flourish and thrive. An awareness of the notion of evolutionary potential, together with a substantial effort to look for it in and around public spaces, can enable planners and urban designers to respond to change and transform if necessary, e.g. through spatial transformation.

Value-adding role
Livings systems continuously regenerate and depends on many subsystems to do this. The health of the whole-system depends on each member fulfilling its role to benefit each other. Public space, as a subsystem of the larger socio-ecological system in the city, need to add value and contribute to the whole-system's evolution. Examples may include public space's role in contributing to the ecological regeneration of a river system and the socio-economic uplifting of a marginalised community through improvement opportunities linked to the transformation of a space and its broader environment.

Leverage points
Energy or opportunity is created through opportunities for exchange, for example trading goods, sharing ideas and relaxing in nature. These activities happen in various nodes across many scales. Nodes are leverage points for transformation through interaction and exchange. Public spaces have the potential to act as key leverage points to initiate transformational exchanges through, for example, approaches such as urban acupuncture and tactical urbanism. Identifying leverage points implies considering which types of public spaces should be developed in which locations and how many, which links back to the necessity of considering the whole system.

Control the hard lines
Controlling the hard lines means only doing what is essential to meet, support or detract from the objective. It refers to the development of preconditions to enable the system to emerge, thus enabling rather than controlling actions by identifying absolute no-go areas and upper/lower limits. It deals with the 'operating rules' that determine behaviour and what is possible, bearing in mind the characteristics of a healthy system, such as emergence, self-organisation, complexity and open-endedness.

Regenerative sustainability offers a pathway to not only change mindsets to facilitate co-evolution, but also to guide built environment practitioners and other stakeholders to facilitate the process in practice.

Transforming process and the need for regenerative practices

Applying the concept and principles of regenerative development and design in practice is very context-specific and generally centred on three phases. Mang and Reed (2012) describe these

phases as 1) understanding of the place – as a way for people to unify nature and humans in a concrete way; 2) aligning place and people through the harmonisation of buildings and infrastructure with the patterns of the land and the cultural systems and 3) co-evolving mutualism to ensure continuous improvement through beneficial stakeholder relationships.

Broadly guided by this process and the local dynamics and conditions of the four case study areas (see the next section), the NRF project team - representing multi-disciplines - worked with four diverse communities from different parts of the City of Tshwane Municipality to develop a process that would contribute to regenerative public space in South Africa. This process involves three ongoing phases.

1. Reconnect through co-conceptualisation and collaboration

The first part of the process revolves around the potential value and evolutionary potential of the specific public space. This is usually centred upon questions that could involve the following. Why are we doing this? What is it that we want to change? Who is doing it? Who needs this? What do we care about? The value of a specific public space is often hidden in the characteristics of the space, the skills of the people, its distinctive patterns and relationships and the value to the broader environment. For example, linking back to the principles, the role of a public space to contribute to a larger ecological system or boost an existing social system.

The first part of the process requires all the relevant stakeholders to meet on site and think through a variety of issues. Delving deeper into the story of place, could involve the following questions:

1. What is distinctive about the place? (e.g. special places, structures, trees, vegetation, etc.)
2. What is distinctive about the people? (e.g. history, memories, skills, knowledge, etc.)
3. What is the value-adding role of the public space in the broader environment (precinct, neighborhood and city)?
4. What is the higher potential of the public space for all the people involved?

This part of the process can involve storytelling, interactive mapping, dashboards, surveys, etc. The main goal is to assist with the determination of the role of the space for the everyday users and the broader community or environment. Given this, it is important that people identify and discuss special places, share precious photos and memories and tell stories about historical and current day people and events.

The aim of phase 1 is, therefore, to reconnect the people to each other and the specific space through co-conceptualisation and collaboration to develop a common story and a vision to go forward. Working with specific communities in particular places allows for a common sense of purpose to develop. This in turn creates opportunities to bring different stakeholders together to foster the seeds for inclusion and peace, not only related to the exterior landscape, but also towards inner healing.

> *Social-ecological systems are far more than coupled human-nature systems in which humans rely on ecosystem services. Instead, social-ecological systems represent the combination of the 'exterior', as created by biogeochemical processes and activities (in which humans and their technologies have come to play a disproportionate part), and*

> *the 'interior', as created by, and experienced through, processes of thought and shared cultural phenomena* (Hes & du Plessis 2015:27).

Therefore, considering cities as socio-ecological systems and public spaces as a critical value-adding component of this systems, requires a focus on both the exterior landscape and the interior spaces of people to enable peaceful and inclusive transformation.

2. Revitalisation through co-creation and participation

The second phase of the process is concerned with the concrete manifestation of the vision in practice. It relates to interventions in a public space to revise or revitalise the existing landscape through the addition or modification of existing buildings and infrastructure to enable the public space to reflect the land patterns and the ecological and cultural systems towards the improvement of the broader socio-ecological system, the city. Initial questions could include the following: Who is the core team? Who can assist to manifest the vision? What do we need to start? Who can provide this?

This phase requires the relevant stakeholders to make decisions around the physical transformation of the public space and key actions that is needed to realise this. While architects, urban designers and planners can play an important role, they should be careful of dominating the process. Critical questions to facilitate the process, may include:

1. What can be or has been done to enable the space to realise its higher potential for the broader environment?
2. How have / can different interventions work with and connect different socio-ecological systems in and around the public space?

During this part of the process, stakeholders can co-design interventions utilising maps, models and on-site demonstrations during small community workshops. The aim of phase two is therefore to revise or revitalise the state of the public space through co-creation and participation to plan and design an accommodating and liveable space. Working with the specific community to develop and design the specific space, enables the seeds of inclusion and peaceful co-habitation to grow and flourish in an open and vibrant manner. This part of the process holds within it the potential to allow for the restoration of the balance between humans and between humans and nature. Healing is concerned with the reconciliation of different agendas and aspirations, working together to rebuild a specific space and allow it thrive in the broader socio-ecological system through the restoration of the flows of life.

> *Every development, no matter how small, enters and unspoken contract with the world that it inhabits from the moment that it is commissioned until it is torn down. It can be a burden on resources and disrupt life-sustaining processes, or it can contribute positively to the commons, the network of spaces and flows* (Kishnani, 2017:22).

In this way, public spaces can act as key leverage points to initiate transformational exchanges where small conscious and conscientious interventions in the right place can create beneficial, system-wide effects.

c) Reinvigorate through co-mutualism and cooperation

The third phase of the process is concerned with the ongoing care of the public space and its continuous evolution to ensure that it keeps on flourishing. Useful questions could include the

following. What do we need to do to ensure continuous care? How do we engage the larger community of care in the neighbourhood and city? How can the space allow possibilities for others to grow and thrive? How do we allow for evolution?

This phase involves the core team and wider stakeholder network to ensure the ongoing management, maintenance and care of the public space to allow it to spread its ripples of positive benefit outward into the larger environment. Key to consider is:

1. Who has or will ensure that there is ongoing care in the future? (partnerships, community groups, etc.)
2. What resources are necessary to manage and maintain the space?

This part of the process can utilise online platforms such as community websites, WhatsApp groups, and other Applications to build communities of care and spread the value of the public space to a wider audience. The development of a digital platform assists to facilitate an ongoing process of co-evolution through 1) access to data and information to highlight potential within the four communities and allow others to learn from it, 2) taking research activities outside the university to accommodate co-production of knowledge and facilitate participation, and 3) building ongoing cooperation between communities, academia and professionals from private practice towards greater knowledge sharing and integration (Landman & Guest, forthcoming). The purpose of these actions would be to maintain the momentum created by the interventions and ensuring ongoing care of the space in the future. In addition, it can enable the creation of wider networks of communities to allow for the evolution of multiple public spaces over time. This would allow for the reinvigoration of the public spaces and others in the larger environment through co-mutualism and cooperation.

> *The potential of a neighbourhood park lies in the health and well-being of the human and natural communities that it may benefit and the social bonds that it fosters. As the neighbourhood evolves, a well-designed park evolves with it. This implies that a park is more than its physical elements (playgrounds, benches, trees, fountains). From a living systems perspective, it also includes the process by which it is used, maintained, improved and celebrated over the years* (Mang et. al. 2016:118).

Regenerative Development and Design should therefore focus on co-evolution, requiring whole-systems re-orientation that connects human activities with the evolution of natural systems (Mang et al 2016). This is an ongoing process that involves continuous evolution, similar to the creation and maintenance of peace. There have been many misconceptions of peace and how it can be attained. It often implies that once the guns fall silent, peace has been achieved (Kallelea, 2024). This closes opportunities for everyday renewal and reinvigoration of peace through inclusivity in specific urban spaces (Figure 1).

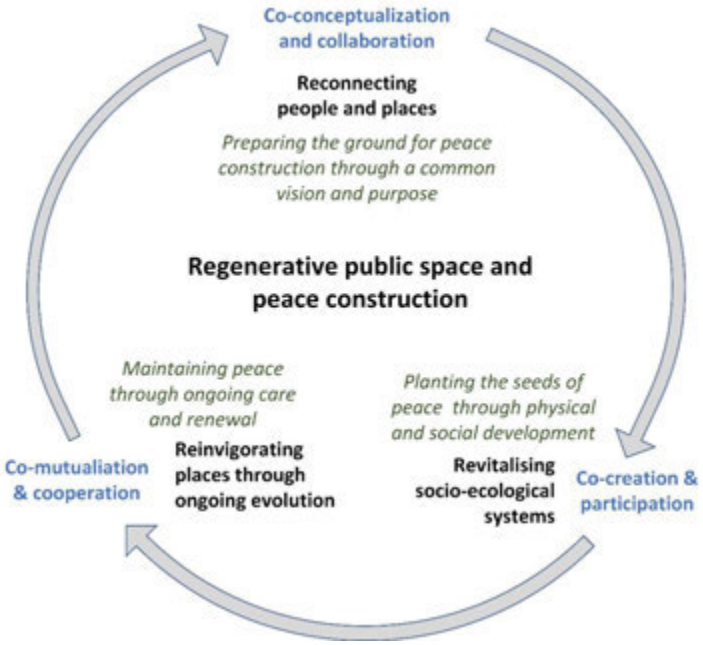

Figure 1: Regenerative public space and peace construction

Peace construction in public spaces should therefore also be concerned with finding new approaches to peacebuilding and development that extend beyond security to restructure societies and their relationship to nature so that they have the capacity to adapt and modify constantly changing environments. This could offer a pathway for continuous reinvigoration to create more resilient peace and other social characteristics, including stronger economic outcomes, better measures of well-being and more sustainable environmental performance (Kallelea, 2024). However, constant reinvigoration through co-mutualism and cooperation also implies that it may be necessary from time to time to revisit the vision of the space and restore the balance; hence the need for a continuous process of transformation and regeneration as indicated in Figure 1.

Transitioning spaces and requirement for ongoing care

As mentioned, applying the concept and principles of regenerative development and design in practice is very context-specific. Consequently, the process could vary in different contexts and conditions. Similarly, the outcome or product may be quite different. This is illustrated through the four case study areas located in the City of Tshwane, a large municipal area located in the Gauteng Province in north of South Africa. The municipal area (Figure 2) includes Pretoria, and covers an extensive area of 6,345 km². In 2017, the population was 3.31 million, as the municipal area housed 6% of the national and 25% of the provincial population. The principal economic activities included government and community services (30%), finance (25%) and manufacturing (13%). In 2017 Tshwane contributed to 28.4% of Gauteng's GDP and 10% of national GDP. However, despite the concentration of economic and research activities, unemployment was estimated to be around 24% in 2017. In addition, there are a growing

number of informal settlements with an estimated 19% of the population in 2017, residing in informal dwellings (City of Tshwane 2020/2021 IDP). The economic conditions have since deteriorated due to the Covid-19 pandemic, contributing to rising levels of inequality, poverty and unemployment and challenges related to service delivery and urban management and maintenance.

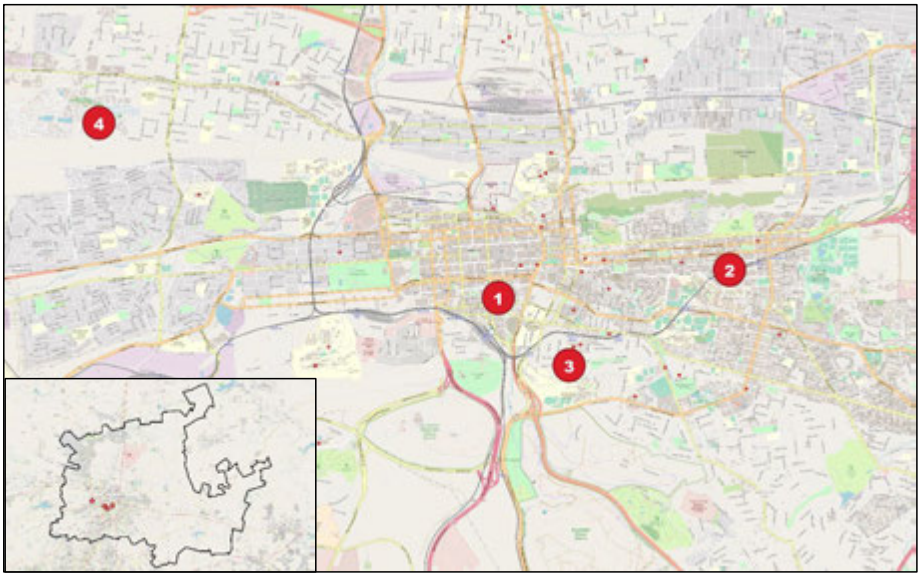

Figure 2: Location of four public spaces in the City of Tshwane (insert). They include 1: Burgers Park; 2: Moja Gabedi; 3: Muckleneuk Commons; 4: MYDO & Melusi Clinic (Source: Landman & Guest, forthcoming).

The NRF project focussed on four public spaces located in different parts of the municipal area (Figure 2). The four spaces were selected based on their ability to show various phases or notions of regenerative development and design in different socio-economic and physical conditions. The team worked closely with the core stakeholders to find out what happened in spaces, why and what they are planning for the future. The main intention was to find out what the regenerative development and design of public space could entail in South Africa. Each public space embodied a specific reality and transition story.

a) Burgers Park

The park is one of the oldest parks in the inner city of Pretoria, serving a very diverse population in a high density and mixed-use area (Figures 3 & 4). The Victorian Garden of 47,678 m^2 was completed in 1874. One of the key stakeholder groups involved in the regeneration of the park is *Friends of the Park*. They focus on mobilising resources, engaging stakeholders and ensuring security in and around the park through collaboration with local and private law enforcement entities. The Community-Based Organisation (CBO) also work with entities and institutions surrounding the park, including schools, churches and businesses, as well as those affected by it. Additionally, they try to foster a sense of ownership within the community and advocate the community's goals, needs and ideas to the city of Tshwane. The primary organisation overseeing several social programmes is the *Tshwane Leadership Foundation* (TLF), which manages and

repurposes buildings in the area to address social needs, including housing for women, young girls, homeless individuals, and those with chronic illnesses. They are assisted by Urban Studio, a partnership between the representatives, the Centre for Faith and Community, and the University of Pretoria. The Urban Studio focuses on providing social housing for homeless community members and women escaping from Gender-Based Violence situations.

Figure 3: Location and form of Burgers Park.

Figure 4: Nature of Burgers Park with high density buildings in the background.

The nature and use of the park changed several times over the years. Being located in the inner-city it caters for a diverse group of people form the surrounding higher-density housing in need to relax, recreate, connect to nature and meet other people. Despite challenges related to management, maintenance and security, the park is extensively used by people from all ages. However, over the years, the park struggled with ownership. Although formally under the care of the local authority, they have often failed to maintain the park, leaving it to the local NGOs and CBOs to care for the park. In spite of these challenges, ongoing initiatives, such as the annual Feast of the Clowns ensure that the importance of the park is re-emphasized. The Feast of the Clowns is an inner-city festival in Pretoria centered in and around Burgers Park. It was created and is still hosted by the TLF as a festival celebrating the city, building community and creating awareness of social justice issues. It is an annual proclamation of the city as a good place, lamenting actions that seek to rob the city of its soul and its people of access, dignity and justice (De Beer, 2020:234). The TLF, and the Centre for Faith and Community is working with many other stakeholders, including business owners, academics and other community organizations to find new ways to reconnect, revise and re-invigorate the park. These efforts are not only focusing on ways to address the lack of maintenance, but also finding ways for peaceful interaction of people from diverse backgrounds and socio-economic conditions sharing the park.

b) Moja Gabedi

This public space is located on an open space situated in a dense and rapidly growing area of Tshwane, namely Hatfield. The neighbourhood is one of the most dominant nodes in the City of Tshwane and is not only home to the University of Pretoria, but also includes prominent schools, large corporations and office blocks, and higher-density, mixed use housing developments. The representatives from Moja Gabedi and Reliable House, an institution focusing on homeless people, recognised the urgent need for addressing the negative space in the community. The strong influence of churches and religions in the area played a significant role in mobilising the community. Churches organised prayer sessions, providing food to participating community members. Reliable House offers homeless individuals access to food,

prayer and accommodation, while Moja Gabedi, a garden in the city, provides working opportunities for recovering drug addicts from Reliable House. In addition, it is an open space that any member of the public can use. Over a period of five years the space was transformed from a neglected and vacant open space to a vibrant, luscious garden with flowers, vegetables and fruits.

Figure 5: Location and form of Moja Gabedi

Figure 6: Nature of Moja Gabedi indicating a space to sit and relax with housing in the background.

The park is a result of people who cared about others and the waste in the city and who dreamed to heal a wound in the urban fabric. Building on the vision of a healing space and working with people who are trying to find their place in society alongside students doing community service, the space created new purposes for derelict land. Together, the Faith Based Organization, the University of Pretoria and the local City Improvement District continue to care for the thriving food garden, recreation space and small coffee shop. Students can also hire small allotments to plant food for themselves and the broader community. Working together, does not only foster inclusion, but also peacebuilding between different age and socio-economic groups in Hatfield and the larger city.

c) Muckleneuk Commons

Muckleneuk is an older, upmarket suburban neighbourhood close to the inner city of Pretoria. The community members shared a passion for nature and desire to revitalise a former neglected and unsafe space. To improve and connect the community, they formed a neighbourhood association and developed an urban design framework to identify areas to promote safe and community-friendly public spaces. However, they faced a backlash from some community members who were concerned about attracting drug-users, loud music and alcohol abuse in the public space. The representatives and residents were responsible for drafting the design, and physical elements were added in different phases as needed. The Cool Capital Festival in the Pretoria offered the impetus for the transformation of the space. Resources were obtained through donations, connections and community contributions. Telkom (a large telecommunications organisation), located next to the commons, donated a significant amount and provides electricity and water. Maintenance and combating challenges like vandalism and misuse requires constant involvement and active maintenance efforts.

Figure 7: Location and form of Muckleneuk Commons

Figure 8: Nature of the small park with rapidly growing vegetation.

The park is used by community members and people who pass by on a daily basis. The community also organizes regular events to raise funds for the ongoing maintenance and community-building. These events include movie-nights under the stars, informative talks on nature and self-development and Sunday food markets. These events that have also been able to extend the impact beyond the local neighbourhood and attract people from further away. While the land is owned by the municipality, the park is maintained by a few community members. The action of the core group shows how an idea to heal a scar in the urban environment can bring about a thriving space for both locals and visitors. Places of peace and inclusivity therefore does not have to be big spaces with large budgets, but could be the result of a small tactical intervention to unite people and place.

d) Melusi community spaces

Melusi is a predominantly informal settlement with a very high density including approximately 30,000 residents and 900 households located in the west of the City of Tshwane. The area includes inadequate service provision and many of the housing units are informal. The Melusi Youth Development Organisation (MYDO) was created to assist the youth with their schoolwork, providing food and extracurricular activities focused on sports and art programmes. MYDO coordinated with community health workers and stakeholders to provide resources and health services to the youth in a community that faced many challenges related to service delivery and maintenance of services. The MYDO centre developed into a prominent public space and community centre, with infrastructure sponsored by large donors such as Coca-Cola, other businesses and NGOs. The MYDO Project has become the heart of the community, and the organisation is registering as an NGO to facilitate involvement from sponsors and stakeholders. They assist around 200-300 students and aftercare learners per day. They have also partnered with the Faculty of Health Sciences at the University of Pretoria, located opposite the Community Centre to offer health services. Next to the clinic (Figure 9) is an abandoned municipal nursery. MYDO is investigating the possibility to work with the municipality to revitalise the space a green open space and sportsgrounds for the Melusi community.

Figure 9: Location and six of the MYDO center (top) and clinic (bottom). The municipal open space is located just south of the clinic.

Figure 10: MYDO community center and open space.

The MYDO center is a space of healing that allows the youth to develop and thrive through access to study rooms, computers, tutors and spaces for relaxation. It is a place of inclusivity that creates a peaceful environment where young people can study in a safe environment under the protection of capable guardians. It is an example where this public space has become a point of exchange to facilitate the flows of information and goods to assist the development of marginalized youth. The public space is a pulsing point that ripples through the community and vibrates its energy to build the larger system. MYDO is constantly evolving and searching for new ways to assist the youth and the broader community, for example through their efforts to repurpose the green open space next to the clinic for sportsgrounds and a park.

These four public spaces indicate that there are many challenges facing communities and institutions towards regenerative public space, especially in the Global South. The challenges in the City of Tshwane are related to a lack of funds for development, management and maintenance, as well as issues related to safety and security. This is especially true in public spaces that have to accommodate a diverse population from different ethnic groups and socio-economic backgrounds. However, despite the challenges, these cases have indicated that there are examples of regenerative public spaces, albeit at different phases, that offers hope for the establishment of peaceful and inclusive public space. Given this, regenerative development and design offers a pathway for peace construction in public space.

Conclusion: public space as game-changer for peace construction and inclusion

Drawing from four case studies in the City of Tshwane in South Africa, the paper explored an alternative paradigm for public space, proposed a different process for (re)development and design and offered examples of four regenerative public spaces to highlight the value of regenerative development and design as a game-changer for peace construction and inclusion.

Regenerative sustainability, as alternative paradigm, extends the work of traditional and contemporary sustainability (including resilience thinking) to focus on the improvement and regeneration of living systems to enable the co-evolution of humans and nature interacting in cities. This evolving paradigm emphasises the need to work with change and transformation of socio-ecological systems to enable both external (biophysical space) and internal (mental and social space) space. This process of transformation could be guided by five over-arching principles, namely a) the essence of place, b) evolutionary protentional, c) value-adding role, d) leverage points and e) control the hard lines.

The process to enable regenerative practices involves three phases. The first phase is concerned with reconnection of people and places through co-conceptualisation and collaboration of multiple stakeholders in a specific public space to develop a common story and vision. This creates the opportunity to identify the potential and the value-adding role of the space and foster the seeds of inclusion and peace through acknowledgement and inner healing. The second phase involves revitalisation through co-creation and participation to work with the socio-ecological systems to enable the vision to manifest. This part of the process facilitates the co-design of various initiatives to restore the balance between humans and between humans and nature to encourage healing and the development of thriving communities and places through inclusion and peaceful participation and co-habitation. The third phase relates to reinvigoration through co-mutualism and cooperation. It requires ongoing communication, support and involvement to ensure the continuous care of the public spaces and the people using them. Thus, allowing for evolution opens opportunities for everyday renewal to foster peace and inclusivity over a longer period of time.

Although the implementation of the process varies in different public spaces and contexts, the four case studies (products of various elements of regenerative development and design) illustrated the potential to assist with peace-making and peace-building in an inclusive and evolutionary manner. The discussion therefore highlights the value of regenerative development and design as a game-changer for peace construction and inclusion in diverse societies in the Global North and South contributing to healthy and thriving communities.

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„Potential of Hydrogen Production by Wastewater Treatment Plants (WWTPs) - Technologies, Benefits, Challenges and Limitations using the Example of the Wastewater Treatment Plant Straubing“

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Abstract

Due to an ever-increasing change towards a circular economy and energy self-sufficiency, the energy production and the use of it must be redefined. This does not stop at the water- and wastewater industry, which is responsible for a large amount of a municipality's energy consumption. However, WWTPs can also make a significant contribution to the energy transition and circular economy. Sustainable hydrogen, produced decentrally, regionally and for regional consumers, will play a important role in the future energy supply. The aim of this study is to identify possible potentials and technologies for local hydrogen production, conceivable alternative uses, research programmes, funding opportunities, but also challenges and limits with regard to the possibilities of hydrogen production at the approximately 10,000 municipal WWTPs in Germany.

Key words

Hydrogen production, regionality, wastewater management, circular economy, sustainability

1. Hydrogen demand and production options

In order to reach climate goals and achieve deep decarbonisation of the society, transformation of our entire industrial landscape towards a circular economy, sustainable production, and renewable energies is needed. Of course, the wastewater sector must also be considered and contribute to the energy transition. Some sectors already have obligations to save energy, recycle raw materials by comitted recovery rates or using a certain proportion of recyclates. In Germany and Switzerland, for example, phosphorus will have to be recovered from sewage sludge in the future. In other areas of wastewater treatment further research and development are being carried out so that wastewater management contribute further towards sustainable industries, including nutrient recovery (Nitrogen) excess energy usage (Heat or hydrodynamic) (Qadir, M. et al., 2020; Nagpal, H. et al., 2021).

Here, the revision of the Urban Wastewater Directive (in German - Kommunale Abwasserrichtlinie) will bring about a lot of positive changes across Europe in terms of circular economy, Electricity consumption, reuse, recycle and the production of green energy to cover self-consumption. However, this will also lead to major challenges for wastewater treatment plant (WWTP) operators. Many innovations are to apply to WWTP with a size of 10,000 PE (Population equivalents; in German - Einwohnergleichwerte/EWG) or more. Financially, in terms of personnel and organization, all of this must be managed.

The availability of sustainable hydrogen as an energy carrier and as an indispensable raw material is an important key technology. For example, the German National Hydrogen Strategy focuses on green hydrogen (Schuberth, J., 2023) and its production potential. By 2030, instead of 5.000 MW (5 GW), 10.000 MW (10 GW) of Electrolyser capacity must be created (Federal Ministry of Education and Research – BMBF et al., 2023). There are various ways to produce hydrogen in wastewater treatment. Several ways and possible synergies, but also their disadvantages, will be shown.

Apart from providing suffient amounts of hydrogen by centralized or decentralized production sites, the hydrogen distribution is also a very demanding task. The transition of natural gas pipelines to be “hydrogen-ready” will cost 45 billion Euros (DVGW, 2021). For the transition period, short and long term storage options and conversion methods für hydrogen will play an important role.

For this purpose, biomethanation is an interesting area of application, in which hydrogen and carbon dioxide are converted into methane. We would also like to take a closer look at this in this study.

Green hydrogen can be produced at WWTP and thus synergies, such as the use of the resulting oxygen or wastewater as a raw material, can be used.

In addition to green hydrogen as a possible energy carrier, the oxygen also obtained during water electrolysis can be used in the biology of the WWTP or as a starting material for a so-called fourth purification stage in order to remove further pollutants from the wastewater stream. The resulting wastewater is purified in the sewage treatment plant and thus serves as an additional raw material. The electrolyser waste heat can also be used in the wastewater treatment plant. Nitrogen-rich side streams in the WWTPs have great potential to produce hydrogen from them. This also applies to the biogas produced y digestion of raw and/or excess sludge. Furthermore, wastewater or sewage sludge can also be used as sources of supply for extraction via biological or thermal processes. The potential hydrogen production and therefore the optimal production technology is heavily depending on the situation of the WWTP, like influent, sludge composition, biogas production, or synergies on site.

In addition, using synergies with nearby industries, cycles can be closed in the sense of the circular economy. WWTPs are given great potential (Jentsch, M. F. et al., 2019). Regional electricity surpluses can also be used, and CO_2 emissions and energy dependencies are reduced.

The mentioned technologies are presented in more detail in the study and their feasibility in municipal WWTPs is evaluated. The findings can also be used as a basis for industrial wastewater treatment plants.

At the end of the introduction, however, a distinction should now also be made as to what type of hydrogen is involved. The most common term is grey hydrogen. The grey hydrogen is produced from fossil fuels. Blue hydrogen, on the other hand, is when the carbon dioxide produced during hydrogen production from fossil fuels is used and not simply released into the environment. Green hydrogen means that no additional carbon dioxide is produced during its production process (Federal Ministry for Economic Affairs and Climate Action – BMWK et al., 2023).

Current estimates assume that up to 800 TWh of hydrogen will be needed in Germany alone by 2050 (German Bundestag et al., 2022), whereby green or at least blue hydrogen in particular should be purchased and used in order to achieve the climate targets.
Germany was produced and consumed around 55 to 60 TWh of hydrogen in 2020, but this is mainly grey hydrogen from natural gas and only about 5% green hydrogen (Noack, C. et al., 2015; Merten, A. et al., 2020).
In 2019, German WWTPs produced around 1.515 GWh or 1.5 TWh of electricity (Federal Statistical Office – Destatis et al., 2020).
To calculate the amount of hydrogen that can be produced with 1.5 TWh of electricity, we assume an efficiency of 75%. Depending on the type of electrolysis, the efficiency is around 70% to 80%.

$$Amount\ of\ hydrogen = Electricity\ in\ TWh\ x\ Efficiency$$

$$Amount\ of\ hydrogen = 1{,}5\ TWh\ x\ 0{,}75$$

$$Amount\ of\ hydrogen = 1{,}125\ TWh$$

This would allow the WWTPs to cover around 0.14% of the hydrogen demand forecast for 2050. As a rule, however, the WWTPs use the self-generated electricity themselves, which would make the proportion for hydrogen even lower.
The following text shows the various technologies, research projects, funding opportunities, corresponding laws and obstacles.

2. Presentation and explanation of the different technologies

a. Electrolysis of water

Various processes and technologies can be used to produce hydrogen. This study explains how electrolysis of freshwater, treated wastewater, desalinated seawater, or direct electrolysis of saltwater works. Alkaline water electrolysis (AEL) is very widespread. It is the most established technology among the proven electrolysis processes. However, it has the most problems in intermittent operation associated with renewable energy. Polyelectrolyte membrane electrolysis (PEM), also known as proton exchange membrane electrolysis, is therefore becoming increasingly important. Very large research efforts are being made in the field of anion exchange membrane electrolysis (AEM) and high-temperature electrolysis (HTEL). The efficiency, the lifetime of the electrodes and the operating costs of the electrolysers vary greatly depending on the technology used. In addition, the operating costs are influenced by the purity of the water, which material is used for the electrodes (Aluminum, Copper, Iron, Nickel, Zinc), whether the waste heat from the electrolyser can be used and how high the electricity demand is.

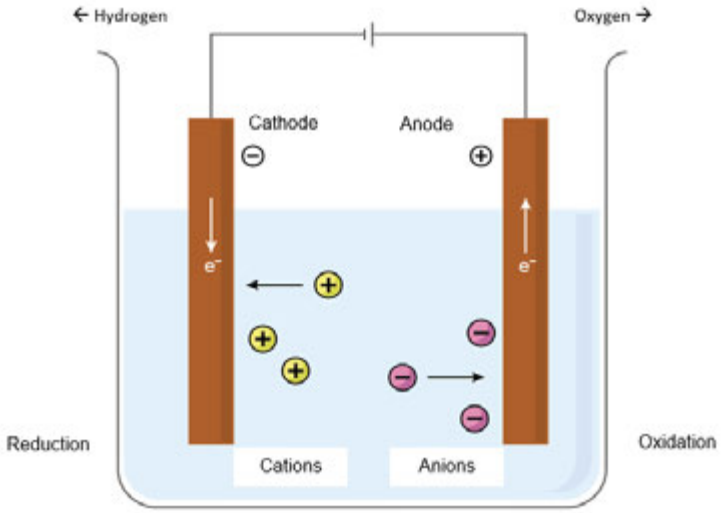

Figure 1: Basic design for water electrolysis (Vögtil, Dr. A., 2024), with own modifications

Electrolysis is the process of using electrical energy in the form of electric current to break down water into hydrogen and oxygen, as you see in figure 1. Electrolysis can take place in an acidic, alkaline and neutral solution. Figure 2 shows the three different electrolytes.

In acidic solution:

Cathode: $4\,H_3O^+ + 4\,e^- \longrightarrow 2\,H_2 + 4\,H_2O$

Anode: $6\,H_2O \longrightarrow O_2 + 4\,H_3O^+ + 4\,e^-$

Overall reaction: $2\,H_2O \longrightarrow 2\,H_2 + O_2$

In alkaline solution:

Cathode: $4\,H_2O + 4\,e^- \longrightarrow 2\,H_2 + 4\,OH^-$

Anode: $4\,OH^- \longrightarrow O_2 + 2\,H_2O + 4\,e^-$

Overall reaction: $2\,H_2O \longrightarrow 2\,H_2 + O_2$

In neutral sodium sulphate solution:

Cathode: $4\,H_2O + 4\,e^- \longrightarrow 2\,H_2 + 4\,OH^-$

Anode: $6\,H_2O \longrightarrow O_2 + 4\,H_3O^+ + 4\,e^-$

Overall reaction: $10\,H_2O \longrightarrow 2\,H_2 + O_2 + 4\,H_3O^+ + 4\,OH^-$

By neutralization: $10\,H_2O \longrightarrow 2\,H_2 + O_2 + 8\,H_2O$

After shortening: $2\,H_2O \longrightarrow 2\,H_2 + O_2$

Figure 2: Representation of different electrolytes (Kurzweil, P. et at., 2022), with own modifications

To produce one kilogram of hydrogen, you need about 9 to 10 liters of water. In addition, you need about 53 kWh of electricity. The degree of utilization is about 60 - 85% (GASAG et al., 2022).

Probably the best known and most widespread electrolysis application is the electrolysis of fresh water (drinking water or well water).
Before that, however, the drinking water must be purified of disturbing minerals, i.e. salts. Only ultrapure water can be used to prevent salt deposits on electrodes or the membranes. As a result, the service life can be shortened and the service life of the system components can be increased (Jabs, F., 2021).
Important in terms of utilization: The calculated efficiency depends on how the energy content of the hydrogen is calculated. You can use the HHV (Higher Heating Value) or the (significantly lower) LHV (Lower Heating Value). In relation to the HHV (Higher Heating Value), this results in correspondingly higher values.

b. Electrolysis of treated wastewater

Due to the ever-increasing shortage of freshwater, attempts are being made to utilize treated wastewater instead of freshwater in electrolysis. However, it should be noted that due to the substances still contained in the treated wastewater, such as organic compounds, bacteria and salts, a great deal of effort must be made in the purification of the wastewater. Tests at the Straubing sewage treatment plant have shown that the wastewater from a partial flow of the sewage treatment plant after the normal purification cycle and an additional ultrafiltration overloaded the test downstream test activated carbon filter within a very short time, making it no longer possible to regenerate the activated carbon. Thus, ultrafiltration with an activated carbon filter is unsuitable for providing water for desalination and further for the supply of an electrolyser, at least in WWTPs with trickling filters. Alternative pretreatment technologies of wastewater are nanofiltration or reverse osmosis before the water can be fed to the desalination plant and an electrolyser. This not only increases the energy requirement, but also the amount of water, because, for example, process-related water losses have to be compensated for during reverse osmosis. Electrolysis would then take place in the same way as freshwater electrolysis.

c. Electrolysis of desalinated seawater

Here, too, the salt water must be specially pre-treated. There are, especially in the Arab world, many seawater desalination plants that desalinate the seawater to supply of potable water and also for the supply of electrolysers. However, a lot of energy is needed for desalination and hydrogen production, which is mostly obtained from fossil fuels. Therefore, it is mainly grey hydrogen that is generated here. In addition, the degree of utilization is even lower, as the purification of the salt water is time-consuming. Certainly, many more countries and regions will be dependent on saltwater desalination plants in the future due to global warming and the lack of precipitation. Therefore, this would be a way to combine both, i.e. the provision of drinking water and ultrapure water for electrolysis.

d. Direct electrolysis of salt water

Recent research and experiments have shown that direct electrolysis of salt water is quite possible, at least on a smaller scale. For this purpose, Tianjin University in China operates a pilot plant that produces about 40 liters of hydrogen per hour from salt water (Klatt, R., 2023). The main challenges in seawater electrolysis are that the chlorine (Cl-) contained in seawater has an extremely corrosive effect on the electrodes. In addition, there are many other components that attack the electrodes and membranes. These include calcium and magnesium, which are deposited as hydroxide precipitates on the cathode and anode, thus

reducing performance and service life. Tianjin University has protected the electrodes from these influences with a special nickel coating.

WWTPs are usually the largest energy consumer in a municipality. In 2021, 31.6 kWh were needed to treat approx. 82 m³ of wastewater per PE (Population equivalents; in German - Einwohnergleichwerte/EWG) per year. The share of self-generated electricity generated by the WWTPs participating in the performance comparison is less than 40% (DWA Working Group BIZ-1.1 "Wastewater Treatment Plant Neighborhoods" et al., 2022). If, in the future, electrolysers are also to be established at WWTPs for the production of hydrogen, the demand for electricity will increase significantly. If the supply of green electricity cannot be secured, hydrogen production will not produce green hydrogen and should therefore be viewed critically. In addition, WWTPs will have to supply themselves with green energy in the future in order to achieve their own energy self-sufficiency. As a result, there may be a certain amount of competition between the company's own energy supply and the production of hydrogen. The investments must be covered by subsidies, or at least largely covered, to minimise negative effects on wastewater charges for the inhabitant of a municipality or city. Of course, it would also be conceivable to install hydrogen-capable CHP (Combined Heat and Power) units on the wastewater treatment plant, which would then convert the hydrogen produced in-house into electricity and heat. However, the usefulness, cost-effectiveness and operational safety of all concepts must be carefully examined. Likewise, the safety of handling hydrogen, the effort required for certifications and the need for qualified specialists must not be ignored.

e. Hydrogen production from nitrogen-rich material flows

i. Wastewater Plasmalysis

By means of the so-called wastewater plasmalysis, hydrogen can be obtained from effluent from sewage sludge dewatering, slurry or vapours from sewage sludge drying. These media contain high nitrogen-rich loads, mostly ammonia, which are ideal for the process. Graforce has developed, patented and implemented an established process in various plant sizes.

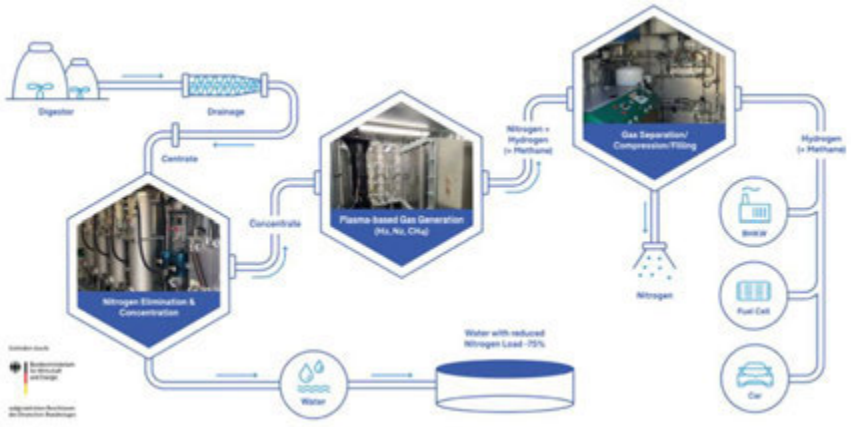

Figure 3: Production of green hydrogen from ammonium-containing wastewater (Cronenberg, A. 2020)

In this process, which is shown in detail in figure 3, a plasma is generated from (green) electricity. In this high-frequency plasma field, the nitrogen and carbon compounds in the water are split. In fact, the reverse reaction of the Haber-Bosch process occurs in the case of nitrogen compounds:

$$2\ NH_3\ (g) \xrightarrow{Plasmalysis} N_2(g) + 3\ H_2\ (g)$$

The energy requirement of this process is significantly lower than that of conventional electrolysis. Such a process reduces the Nitrogen chargeback from sludge treatment and facilitates the subsequent treatment of this effluent and produces green hydrogen. Prerequisite is obtaining chemically pure and concentrated soluten of ammonia, impurities can produce unwanted by-products and hamper the hydrogen production. A corresponding plant is operated in Berlin Waßmannsdorf as a demonstration plant for the treatment of the centrate of sewage sludge dewatering.

ii. Plasmalysis of biogas

Here, too, there is great potential to produce hydrogen and also to establish a solid carbon dioxide sink. The so-called carbon black can be obtained as carbon in solid form for other branches of industry, e.g. for asphalt or tire manufacturers. The company Graforce has also developed a corresponding process here.
Clearly explained in figure 4, in this process, a plasma is also generated from (green) electricity. In this high-frequency plasma field, methane, which is contained in biogas (or

natural gas), is split into its two molecular components, hydrogen and carbon. Thus, 4 kilograms of methane and an additional 10 kWh of electricity produce 1 kilogram of hydrogen and 3 kilograms of elemental carbon. The hydrogen produced in this way is also known as turquoise hydrogen. Such a system is operated on the roof of the MOA Hotel in Berlin. Here, natural gas is split into carbon and hydrogen by means of plasmalysis, the hydrogen fires a heating boiler, and the carbon is collected and reused for further processes.
The application for biogas is more efficient, if the methane content is high. WWTPs can raise the methane yield by adding high caloric wastes like fat float to the biogas digester.

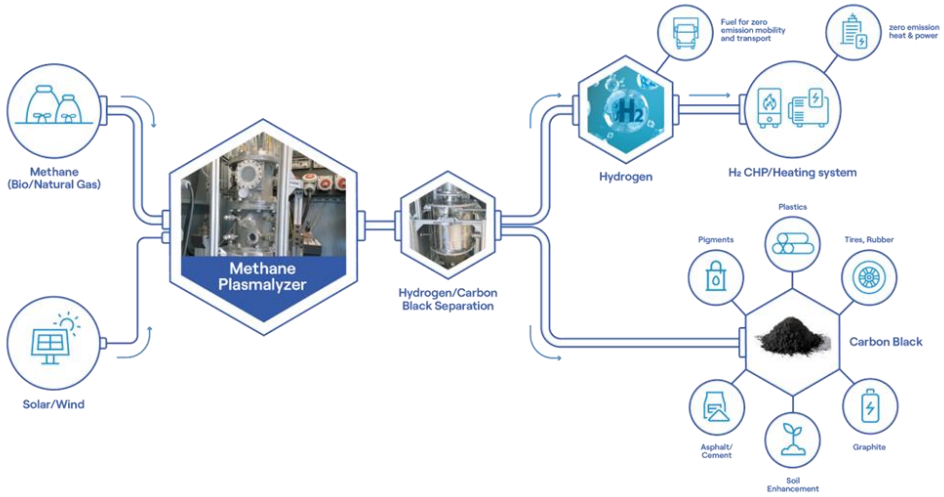

Figure 4: Production of green hydrogen from methane plasmalysis (Graforce GmbH, 2020)

f. Thermal sewage sludge treatment

Sewage sludge contains large amounts of organic compounds. Non-stabilized sewage sludge contains up to 75%, anaerobically stabilized sewage sludge contains 50 – 55% organic compounds. These can be converted into hydrogen, carbon monoxide, carbon dioxide and methane by substoichiometric combustion or gasification. Water vapour is a suitable oxidizing agent here, a large part of the hydrogen produced also results from the water, not from the organic compounds. Air is also possible, but not favored due to the dilution of the product gas with nitrogen and nitrous oxides.
Gasification takes place optimally at temperatures higher than 850°C and in a fluidized bed reactor, analogous to thermal combustion. Ideally, this also makes it possible to recover phosphorus from sewage sludge ash, as required by the Sewage Sludge Ordinance (in German - Klärschlammverordnung - AbfKlärV), which was amended in 2017, for sewage treatment plants > 100,000 PE or > 50,000 PE from 2029 or 2032. The necessary heat can be provided by simultaneous incineration of part of the sewage sludge in the combustion chamber or by separate incineration of sewage sludge or other energy sources and the subsequent transport of the heat by means of heat pipes or heat exchangers.
In addition to the gaseous compounds, the flue gas also contains tar compounds, which must be condensed. The gas must then be purified, and the hydrogen yield can be increased by means of water gas shift. The hydrogen must then be removed from the gas mixture. Possible

methods for this are pressure swing absorption or organometallic frameworks. The lean gas must be treated, for example by off gas burning, in order to prevent the emission of harmful gases.

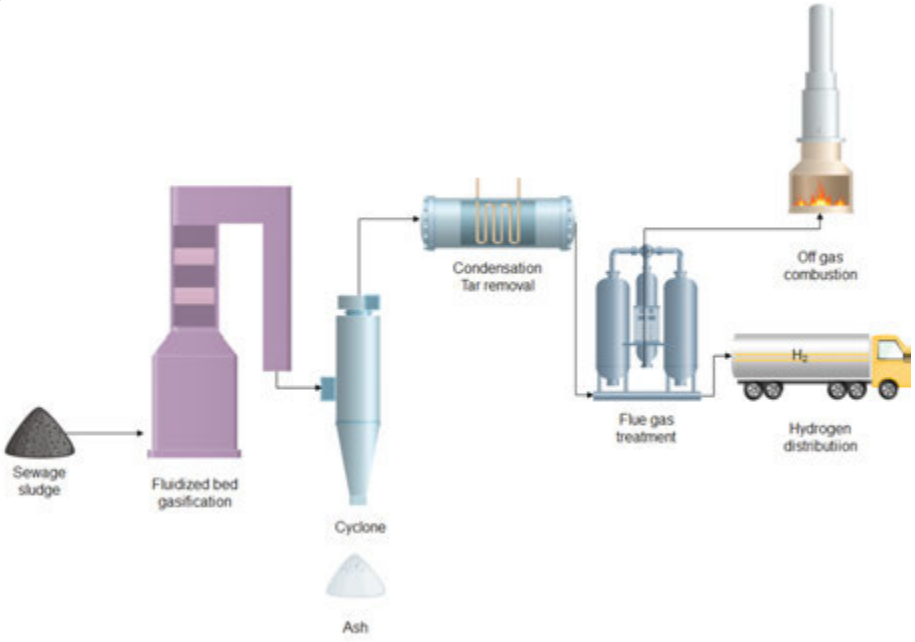

Figure 5: Schematic structure of sewage sludge gasification, own scheme by Jürgen Pettrak

As can be seen from the figure 5 above, many process steps are required to produce renewable hydrogen from sewage sludge. The advantages are that raw materials such as phosphorus can be recovered and the production of hydrogen can contribute to the energy transition. However, studies currently suggest that economical operation for gasification is only possible in very large plants (Lumley, N. P. G., 2013), with hydrogen separation being added as an additional treatment step. The gas quality depends strongly on the composition of the sewage sludge and therefore has a very strong influence on economic efficiency. Depending on the process technology, up to 50% hydrogen can be achieved in the gas mixture.
For this purpose, suitable locations must be sought and found, as is currently often planned with mono-incineration plants for sewage sludge, in which sufficiently large quantities of sewage sludge are available and there are customers for the hydrogen produced. To comply with german or swiss legal regulations, phosphorus recovery must be possible, in order to be able to carry this out economically, sewage sludge with high phosphorus contents is necessary, and in addition, little or no bed material may be discharged so as not to further dilute the phosphorus content. Economic feasable operation of such plants either require centralized sites or close proximity to WWTPs.
There are some pilot plants in operation, such as Green Hydrogen Technology in Leoben, but there are currently no large-scale plants planned.

g. Biological processes

Sewage sludge or wastewater can also be used to produce hydrogen via biological processes.

The principle in a nutshell:
Microorganisms break down organic compounds and produce hydrogen under anaerobic conditions. These microorganisms can represent pure cultures, i.e. a selected strain, co-cultures, i.e. several selected strains, or a mixed flora. Hydrogen is already produced in the digester during normal operation of a biogas plant and is needed to convert CO2 into methane. By acidifying the fermentation substrate to pH 5-6, methane formation can be inhibited and only CO2 and hydrogen are produced (Cai, M. et al., 2004).
There is a variety of hydrogen-producing microorganisms, from mesophilic (25 - 40°C) clostridia to hyperthermophilic (65 - 90°C) thermotogales (Kengen et al., 2009). The greater the load of organic matter in the water, measured by the chemical oxygen demand (COD), the higher the theoretical yield, but bioavailability, which can be determined by the biological oxygen demand (BOD), also plays an important role here.
The hydrogen yield from sewage sludge decreases rapidly with the degree of sewage sludge stabilization (Kim, S., 2004). This is not surprising, since the easily degradable organic load has already been metabolized in both aerobic and anaerobic sewage sludge stabilization, making the residue difficult to degrade.
For both sewage sludge and raw wastewater, pre-treatment of the substrate is therefore necessary to increase gas yields (Mohan, S. V. et al., 2008). The most efficient pre-treatment depends on the type and composition of the substrate. For example, larger aggregates are broken down into smaller, more easily accessible flakes by physico-chemical processes such as thermal pressure hydrolysis or acid treatment. Longer, difficult-to-degrade molecules can, for example, be broken down into shorter molecules by acidification, which are then more bioavailable.
For biological hydrogen production, it is also promising not to focus on municipal WWTPs, but rather to use wastewater streams rich in organics, such as wastewater from breweries, milk processing industries, oil mills, or similar industries that produce oil, protein and/or sugar-rich material streams, which can then be used for hydrogen production by means of selected cultures. Often, an increase in efficiency can be expected through pre-treatment, but the gas yields are much higher than with wastewater or sewage sludge (Preethi et al., 2019).

i. Biomethanation

Biomethanation uses the methane-forming microorganisms of the Archeen type. They can withstand extreme living conditions, such as high temperatures and pressures (Bär, K. et al., 2015). However, the process usually takes place between 30–70 °C in the technical reactor and a distinction is made between the in-situ and the ex-situ process:
In the in-situ process, the hydrogen produced from electrolysis is introduced directly into the digester (Bär, K. et al., 2015). This has the advantage that existing fermenters can be used for power-to-gas concepts without additional reactors. However, since other steps take place in anaerobic fermentation in parallel to methanation, the conditions in the fermenter are not specifically tailored to the archaea. This results in lower methane formation rates. In addition, large quantities of hydrogen are needed immediately, as the volumes of the fermenters are very large.
External reactors (ex-situ methods) are quite efficient (Bär, K. et al., 2015). This has the advantage that the microorganisms can obtain the perfect framework conditions and the use of hydrogen can be better regulated. In addition, the required carbon can also be used from external sources. The most relevant reactor concepts for process engineering are stirred tank, trickle bed and bubble column reactors (Manig, R. et al., 2023).
Another advantage of biomethanation is the elimination of hydrogen storage facilities, which are not available in Germany in the required quantity and size. Either disused salt caverns,

exhausted oil or gas fields are used, or containers built above ground that first have to be produced and erected. Among other things, lengthy planning procedures are necessary for both, and the metabolism of hydrogen by microorganisms in the exhausted oil and gas production fields is another problem. There is an urgent need for further research efforts with regard to underground storage options, as many safety questions and which chemical reactions take place, among other things, remain unclear (Heinemann, N. et al., 2021). In addition, the biomethane obtained can be used directly as fuel for agricultural vehicles, for city buses or the waste collection fleet of cities or companies.

3. Hydrogen Research projects at wastewater treatment plants

As the use of hydrogen as a clean energy carrier becomes increasingly important worldwide and efforts to combat climate change and reduce dependence on fossil fuels are intensified, WWTPs are of course also increasingly becoming the focus of research and technology companies in this context. They are trying to optimize the purification of wastewater and also to harness the potential for the production and use of hydrogen.
Research projects on hydrogen production at WWTPs are the focus of this chapter. These projects aim to optimise wastewater treatment processes by using innovative technologies to produce hydrogen from biological waste streams. Not only are environmentally friendly alternatives to conventional energy generation being explored, but synergies between wastewater treatment and the renewable energy industry are also being created.
Table 1 takes a closer look at the various research projects on hydrogen production in WWTPs.

Project Name	Project Partners	Goal	Technology	Performance	Synergies	Project Status	Reference
ARRIVED	Wirtschaftsbetrieb Mainz, TU-Kaiserslautern	Oxygen, hydrogen as a by-product	Water electrolysis and extension of the 4th purification step for the elimination of trace substances from ozonation and a filter stage with granulated activated carbon	ca. 1,25 MW	Oxygen for ozonation, waste heat, hydrogen for blending into the natural gas grid	Electrolysis is an out-of-budget tender	(Environmental Innovation Program et al., 2024)
SeWAGE PLANT H	Stadtentwässerung Hannover, Siedlungswasserwirtschaft und Abfalltechnik (ISAH), Institut für Elektrische Energiesysteme (IfES)	Hydrogen, oxygen as a by-product	Water electrolysis	1st. Stage: 2,5 MW; 2nd. Stage: 17 MW	Oxygen for ozonation, waste heat for the district heating network, hydrogen for the natural gas grid	In implementation	(Leibniz Universität Hannover et al., 2024)
WaStraK	Emscher-genossenschaft, Forschungsinstitut für Wasserwirtschaft und Klimazukunft an der RWTH Aachen e. V (FIW), TUTTAHS & MEYER Ingenieurgesellschaft mbH, Ingenieurbüro Redlich und	Methanoal, synthesis gas, hydrogen as a necessary substance for the process	Steam reforming, water electrolysis, methanol synthesis reactor	This is not clear from the literature	Waste heat	Pilotphase finished	(EGLV et al., 2024)

	Partner GmbH						

Table 1: Overview of different projects - own illustration

Projects in this direction are also being driven forward in other countries such as Japan, the UK and the USA.
As an example, Thames Water, the UK's largest water treatment company, is working to design a pilot plant that produces hydrogen from wastewater. This plant uses electrolysis to use excess renewable energy from solar panels and produce hydrogen.
In the USA, the Mazzei Injector Company, in collaboration with a wastewater treatment plant in California, has launched a project to produce hydrogen from biogas using high-performance nozzles. This hydrogen can then be used as a fuel or to generate electricity.

4. Funding systems

Subsidies play a crucial role in hydrogen projects for several reasons.
Research and development are to be promoted. Hydrogen technologies are still at a relatively early stage of development, and funding can help drive innovation and improve the efficiency and economics of hydrogen projects. This includes research into new production and storage technologies as well as the development of applications for hydrogen in various sectors such as transport, industry and energy.
The market launch can and must also be supported. Hydrogen is not yet economically competitive on a large scale with conventional energy sources such as natural gas or gasoline. Subsidies can help accelerate the market introduction of hydrogen technologies by supporting investments in infrastructure projects such as hydrogen refueling stations, electrolysis plants and fuel cell vehicles. Subsidies can also be used to incentivize to increase demand for clean hydrogen solutions in various industries.
Subsidies can also lead to cost reductions and economies of scale. Subsidies can reduce the initial costs of building hydrogen infrastructure and producing hydrogen. This can help to achieve economies of scale and reduce the cost of hydrogen technologies in the long term by increasing production and realizing efficiency gains.
Of course, support programs also have a positive impact on environmental and climate protection. Hydrogen is considered a promising clean energy carrier that can help reduce greenhouse gas emissions, especially when produced from renewable energy sources. Funding can help accelerate the transition to a low-carbon hydrogen economy and achieve climate and environmental goals.
Overall, grants play an important role in supporting hydrogen projects by promoting the development, market uptake and scaling of hydrogen technologies and accelerating the transition to a sustainable and low-carbon energy future. Table 2 briefly summarizes some funding opportunities.

Funding Institute	Institute	Amount	Recipient	Reference
Germany for inland and for international cooperation	BMWK, KfW	project budgets range from several thousand euros to several of millions of euros per project	Municipality, company, association, university, research institution, etc.	(BMWK et al., 2024)
Germany for inland and for international cooperation	BMWK, KfW	project budgets range from several thousand euros to several of millions of euros per project	Municipality, company, association, university, research institution, etc.	(DIHK et al., 2022)
European Union	European Commission, Connecting Europe Facility for Energy (CEF-E),	project budgets range from several million euros to several	Municipality, company, association, university, research institution, etc.	(Hydrogen Public Funding Compass et al., 2024)

	Connecting Europe Facility for Transport (CEF-T), European Regional Development Fund (ERDF) and the Cohesion Fund (CF), etc.	hundreds of millions of euros per project		
European Union	European Commission, Horizon Europe 2021-2027	project budgets range from several million euros to several hundreds of millions of euros per project	Municipality, company, association, university, research institution, etc.	(HORIZONT EUROPA et al., 2024)
European Union	European Commission	project budgets range from several million euros to several hundreds of millions of euros per project	Municipality, company, association, university, research institution, etc.	(IPCEI Hydrogen et al., 2024)

Table 2: Overview of different fundings - own illustration

5. Overview of the Urban Wastewater Directive, Regulations and Legislation

a. Urban Wastewater Directive

The Urban Wastewater Directive (Kommunale Abwasserrichtlinie - KARL), also known as Council Directive 91/271/EEC from 21st of May 1991 on urban wastewater treatment, is a legal instrument of the European Union that deals with the treatment and protection of urban wastewater. It lays down minimum requirements for the collection, transport and treatment of wastewater in the Member States in order to protect the environment and ensure human health.

The main objectives of the Municipal Wastewater Directive are:

- To ensure the protection of waters from pollution by wastewater, in particular by reducing the discharge of pollutants such as nitrogen, phosphorus and organic matter.
- To promote sustainable wastewater treatment by setting minimum treatment quality requirements and compliance with emission limits for WWTPs.
- Ensuring adequate collection and treatment of wastewater in urban areas in order to minimise the burden on the environment and reduce the risk to human health.

The Directive requires Member States to draw up wastewater management plans to ensure that the objectives are met and specifies that WWTPs should be operated in accordance with the best available techniques. It also establishes monitoring and reporting obligations to verify implementation and ensure that requirements are met.

The Urban Wastewater Directive has made a significant contribution to the protection of European waters and has driven the development of modern wastewater infrastructure in the Member States. It is an important tool in the EU's water policy and helps to improve the quality of the environment and ensure citizens' right to clean water.

At the beginning of April 2024, the revision of this directive was approved by the EU. Important innovations are listed here:

- Polluter pays principle: The Directive implements the polluter pays principle by imposing requirements on Member States to better protect the environment and human health.
- Fourth purification stage: The European Commission wants to make the fourth purification stage mandatory for all sewage treatment plants with a size of 100.000 population equivalents (PE) or more by 31.12.2035. For settlement areas between 10.000 and 100.000 inhabitants, this level is to be introduced by 31.12.2040 if higher concentrations of micropollutants pose a risk to human health or the environment.
- Extended producer responsibility: To finance these measures, the Commission proposal provides for the implementation of the polluter-pays principle through the introduction of

extended producer responsibility. Manufacturers are to be obliged to make individual contributions based on the quantity and toxicity of the substances they put into circulation.

- Energy neutrality: The draft provides for energy audits for WWTPs with a population of 100.000 or more by the end of 2025 and for WWTPs with a population of 10.000 or more by the end of 2030. In addition, the total amount of energy produced annually from renewable energies generated by WWTPs (≥ 10,000 PE) is to cover 50% of the energy demand of these WWTPs by the end of 2030. By the end of 2040, this share is expected to increase to 100% (Wasser 3.0 gGmbH et al., 2024).

b. Regulations and Legislation

Laws and regulations are important for the hydrogen economy for several reasons. They are intended to ensure safety and health protection. Hydrogen is a highly flammable gas and therefore requires strict safety standards for production, transport, storage and use. Laws and regulations set these standards to prevent accidents and ensure the safety of employees, the public, and the environment.
Quality standards are also required for the various applications of hydrogen to ensure that the hydrogen meets the respective requirements. For example, hydrogen fuels must have certain levels of purity to ensure efficient combustion and proper operation of fuel cells. Laws and regulations can set these standards and monitor their compliance.
The development of a hydrogen economy requires appropriate infrastructure, including production facilities, transport networks, refueling stations and storage. Conditionality can support the development of this infrastructure, for example by incentivising investment, providing access to public land and facilitating planning and permitting procedures to promote the production and use of green hydrogen and accelerate the transition to a low-carbon economy.
Clear and uniform rules prevent a patchwork quilt, which can become more complicated and even less transparent depending on the federal state.
Legal certainty can strengthen economic development and create a positive investment climate for the hydrogen economy. Facilitating market access and ensuring a level playing field can help to increase private and public investment and enable job creation and economic growth.
Overall, laws and regulations are crucial for the development and successful operation of a hydrogen economy by ensuring safety, quality, infrastructure, environmental protection and economic development. Otherwise, there is a risk of a patchwork quilt (DIHK et al., 2023).

6. Discussion, Challenges and Outlook

For water management, there are a variety of technologies that open up the possibility of contributing to the coverage of hydrogen demand. These are not universally applicable. There is a need for an evaluation of the potential of the technology on the ground.
In addition to the production of hydrogen, electrolysis also offers the strong synergy that the oxygen produced can be used for biological processes in the wastewater treatment plant or for the ozone production of the 4th purification stage. However, green electrolysis hydrogen is characterized above all by the fact that the operation of these plants is intermittent. This also means that there is no continuous supply of pure oxygen. As a result, a high level of control for wastewater treatment must be expected. In the worst case, the biological processes in wastewater treatment can be negatively influenced. Electrolysis would therefore only be an option for WWTPs that generate green surplus electricity. This is the case for very few WWTPs in Germany.

The treatment of nitrogen-rich fractions, for example by plasmalysis, is more promising. The higher the nitrogen content of the material flow, as is the case with co-fermentation, for example, the more economically this process can be operated.
Plasmalysis of biogas offers the possibility of producing blue hydrogen, but reduces the degree of self-generation of WWTPs and therefore only makes sense for surplus plants.
In central sewage sludge utilization plants, there is great potential for the production of hydrogen by means of gasification, but the process needs to be further developed and implementation by 2029 or 2032 is rather critical.
The production of hydrogen from wastewater streams, which have a high organic content, is exciting and independent of WWTPs. Here, hydrogen can be produced by degrading the organic matter and at the same time pre-purification of the wastewater can be achieved. In this way, the energy demand of wastewater treatment can be reduced and there is a double contribution to achieving climate targets.
Challenges are, depending on the federal state and the responsible licensing authority, requirements and regulations. It is important to involve the public, associations, nature conservation organizations or the surrounding residents in the process at an early stage in order to minimize fears, resistance, misinformation or lawsuits. Of course, the process must be cost-effective and be able to compete with established, mostly fossil technologies. Industry partners or suitable (IPCEI) funding opportunities are also of great importance.
The transport and marketing of hydrogen must also be organized and ensured. Network operators or suppliers must work hand in hand with WWTPs, authorities and other key stakeholders and define solutions on an equal footing. Therefore, local production and consumption is very important.
In order for all this to succeed, funding opportunities must be expanded, awareness raised and any hurdles for the application process lowered.

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Assessing regional potentials for green hydrogen infrastructure planning in Germany

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Abstract
Green hydrogen offers significant advantages in terms of sector coupling and electrification of energy systems. To ensure a reliable hydrogen supply chain in regions, there is a growing need for hydrogen infrastructure planning. Strategies need to take into account spatial characteristics of supply and demand as well as existing regional potentials. The aim of this study is to develop a holistic approach to assess regional potentials in the context of green hydrogen infrastructure planning by considering both technical and socio-economic factors. A principal component analysis was carried out in NUTS-3 regions throughout Germany. We identified four indices representing regional hydrogen and location potential. A cluster analysis was used to identify region-specific needs and requirements. This will benefit the planning process for developing regional hydrogen strategies.

Keywords
Green Hydrogen; Regional Planning; Planning Methods; Energy Infrastructure; Assessment Concept

1. Introduction

In the process of global sustainable energy transition, green hydrogen is often referred to as a game changing technology. As a carbon-free energy carrier, green hydrogen provides options for storing and delivering volatile renewable energy and is an integral part of sector coupling. However, the role of green hydrogen in future energy systems remains controversial, due to uncertainties about supply, demand and cost of system integration during the rollout phase (Ren et al., 2023). This poses major challenges to the development of hydrogen infrastructure, which relies on a stable and long-term framework for initial investments.

In recent years, the European Union and several European countries have published strategies to increase green hydrogen production capacities. For example, the European hydrogen strategy for a climate-neutral Europe (EHS) increases their target for green hydrogen production capacity significantly to 40 gigawatts by the year 2030 (European Commission, 2020). With the expected increase in green hydrogen production and imports, a need for a reliable infrastructure to transport hydrogen from areas with high renewable potential to demand centres and hydrogen storages is emerging (Baufumé et al., 2013).

In this context, different planning approaches for the development of green hydrogen infrastructure can be observed in hydrogen strategies of the European Union and Germany. The development and implementation of the suitable strategic approach for hydrogen infrastructure planning is highly dependent on the spatial context (Mai et al. 2023). In this way, the assessment of regional location potentials is seen as an essential component. While the EHS refers to a wider range of location potentials such as spatial connectivity and socio-economic factors, the current focus of assessments is still on technical potentials such as green hydrogen supply and demand. However, as a basis for planning and decision-making, it is important to examine and assess all relevant potentials in detail.

This raises the question of how to develop an assessment of regional potentials for green hydrogen infrastructure planning in order to derive context-specific planning strategies. The

study aims to develop a holistic concept for the assessment of regional potentials related to the planning of green hydrogen infrastructure. During the study we examine regional hydrogen supply and demand potential, as well as a selected range of location potentials. Using spatial clustering methods, we explore region-specific requirements in the process of green hydrogen infrastructure planning.

The concept is intended to support the planning and decision-making process by exploring suitable strategies for hydrogen infrastructure planning. By saving valuable time and resources, the concept accelerates the planning and decision-making process at the regional level. In particular, regional planners benefit from the systematic assessment in order to adapt hydrogen strategies with location-specific actions and measures.

2. Theoretical Framework

The deployment of green hydrogen depends mainly on future supply, demand and cost developments that accumulate along the hydrogen supply chain (HSC). The HSC refers to the entire process from the production of hydrogen gas to its use by the final consumer. It includes hydrogen infrastructure for production, transportation, storage and utilisation (Changjong et al., 2022). However, the process of green hydrogen infrastructure planning is challenged by uncertainties such achieving competitive costs and mass market acceptance (Mai et al. 2023). In this section, we focus on green infrastructure elements across the HSC and on planning strategies to implement these infrastructures. The EHS will be considered in this context, as well as the role of assessing regional potentials for green hydrogen infrastructure planning.

2.1 Green hydrogen infrastructure

Hydrogen can be produced through various pathways using fossil fuels, nuclear energy or renewable energy. For the generation of carbon-free or green hydrogen, only renewable energy sources (RES) are utilised to dissociate water into hydrogen and oxygen (Xu et al. 2023). This process, called water electrolysis, is widespread and uses volatile RES such as wind, solar or bioenergy. Global electrolysis capacity is expected to increase from 0.5 million tonnes in 2022 to over 21 million tonnes in 2028 (Al-Douri and Groth, 2024, p.777).

The cost of producing hydrogen from electrolytic water (between $5.78 and $23.27/kg) is currently significantly higher than the cost of producing hydrogen from gas ($2.08/kg) (Nikolaidis and Poulikkas 2023, p.621). Although costs for electrolysers are expected to halve by 2030, another challenge in this regard is meeting the increasing demand for electricity from RES. A study by Kakoulaki et al. (2020, p.9) predicts that major hydrogen production regions, especially densely populated regions, will not have enough green electricity to cover both current electricity consumption and electrolytic hydrogen production. However, given the overall surplus of electricity from RES across the European Union, this challenge could be met by interregional electricity transmission.

Hydrogen is supplied to the final consumer at hydrogen refuelling stations. Currently, hydrogen is used as a chemical feedstock and as a raw material in heavy industrial processes such as oil refining or fertiliser production. In general, these sectors are particularly difficult to decarbonise, which underlines the crucial role of hydrogen (Abdalla et al. 2023). Typically, the amount of hydrogen used in these industries is produced on-site or near the location of its use, in quantities that meet the needs of these industries (Steen, 2016).

By focusing on future decarbonisation scenarios and considering the use of power-to-gas or power-to-X technologies, the potential for hydrogen applications in other sectors is expected to increase further (Kakoulaki et al 2020). There are application potentials in the transportation sector and in the building sector as a fuel in combined heat and power systems. But hydrogen demand in the building sector is highly dependent on regional conditions such as renovation rates and the mix of heating technologies used (Wang 2021; Ge et al., 2024). The future global market for hydrogen is expected to grow significantly to between 115 and 130 million tonnes by 2030 (Dou et al., 2023; Al-Douri and Groth, 2024, p.775).

As noted by Baufumé et al. (2013) hydrogen transport and storage infrastructure should be designed to suit spatial and temporal distribution of demand and supply. If hydrogen production plants are located far from energy consumption sites, storage and transportation methods are necessary. Hydrogen can be stored in either gaseous or liquid state depending on its use in low-, medium- and high-pressure storage tanks (Mai et al., 2023). Whereas subsurface hydrogen storage in salt caverns or abandoned mines is a suitable option for large-scale and long-term storage uses (Ge et al., 2024). To connect relevant areas of supply and demand, a ubiquitous hydrogen transportation and distribution infrastructure is essential.

Hydrogen can be transported via trailors or pipelines. The former is used to transport gaseous and liquid hydrogen, while the latter is used to transport gaseous hydrogen only (Abdalla et al. 2023). The choice of transport mode depends on the delivery costs, which are influenced by the quantities transported, the delivery distances and local circumstances (Hugo et al., 2005; Ball and Weeda, 2015). Because fixed costs for initial construction of pipelines are relatively high (around 80,000 USD per 100m), this investment is only economical when transporting large quantities over longer distances (Changjong et al., 2022, p.1706). Therefore, transportation through pipelines is considered as the most cost-effective option for distances up to 3,000 kilometres, when there is high demand for hydrogen (Abdalla et al. 2023; Lipiäinen et al., 2023). For longer distances, sea transport by ship is an option.

Using the existing gas network by blending hydrogen into natural gas pipelines is expected to achieve significant savings (Jens et al. 2021, Moultak, et al. 2023). The European Union and several of its Member States are in the process of developing hydrogen transport projects, some of which are even planned to carry exclusively hydrogen (Lipiäinen et al., 2023). To reduce costs and improve infrastructure design and operation, coordinated support and strategic planning across the HSC is essential.

2.2 Strategic hydrogen infrastructure planning

According to Luise et al. (2023), the selection of an appropriate strategic concept is essential for the planning of hydrogen infrastructures across the HSC. Different planning concepts are distinguished according to their degree of centralisation and decentralisation with regard to production, storage and transport infrastructures. The EHS published in 2020 pursues both concepts simultaneously. While long-term initiatives such as the European Hydrogen Backbone (EHB) take a centralised approach in planning large interconnected transport networks, the focus lies also on the development of local hydrogen clusters.

The EHS aims to establish a hydrogen ecosystem by 2050 in close cooperation with the European Member States. The target for 2030 is to increase electrolyser capacity by 40 gigawatts by 2030 (European Commission, 2020). To achieve this, key actions are described, such as the establishment of an investment agenda for the European Union or the expansion of hydrogen supply and demand across the HSC. In this context, a suitable hydrogen infrastructure will be developed in stages, from a decentralised to an increasingly centralised system.

In the initial phase, local hydrogen valleys with on site production, closely located to consumption and distribution network systems will be developed. Afterwards, the strategy intends on progressively connecting emerging hydrogen valleys, import terminals, large-scale storage facilities and industrial clusters to an initial backbone transmission infrastructure. In this regard, eleven transmission system operators presented plans in 2021 for an integrated European hydrogen network largely based on repurposed and existing natural gas infrastructure (Jens et al., 2021). Since then, the vision of the EHB initiative has grown fast into a pan-European pipeline network of almost 53,000 kilometres to be established in 2040 (Moultak et al., 2023).

As noted by the EHS, to ensure the implementation of infrastructures across the HSC, further research and innovation efforts are required. This refers to the development of hydrogen technologies such as large scale, efficient and cost-effective electrolysers, large scale end-use applications and infrastructure to distribute, store and dispense large quantities of hydrogen (European Commission, 2020). To address these challenges, the EHS aims to coordinate and financially support European projects for research, development and demonstration of hydrogen technologies. Changjong et al. (2022) state that providing demonstration projects is a central part of the European roll-out strategy for developing hydrogen infrastructure.

Several European countries have published their own national hydrogen strategies to support the deployment of green hydrogen. It has been criticised, that these strategies often focus on policy making rather than concrete actions and local measures (World Energy Council 2020; BMWK, 2023). However, as noted by Mai et al. (2023), the development and implementation of strategic concepts or planned projects is highly dependent on the spatial context. In this regard, analysing the availability of RES or the expected demand for hydrogen is already considered as an essential part for the implementation of hydrogen strategies.

While hydrogen demand and supply potentials are assessed comprehensively at the national scale, e.g. for the planning of the EHB, the regional perspective is rarely taken into account (Moultak et al., 2023). Nevertheless, regional assessments offer a higher spatial resolution and are therefore able to detect regional impacts at a smaller scale, an advantage that has already been recognised and applied in the field of national grid planning for volatile renewable energy sources across Europe (Ebner et al. 2019).

Although several studies focus on the assessment of regional potentials, they usually solely consider the technical potentials for green hydrogen production such as RES potential, electricity demand or current hydrogen production (Kakoulaki et al., 2022; Okunlola et al., 2022). While Okunlola explores the impact of spatial distance to gas pipelines and population clusters for green hydrogen production, neither study considers socio-economic factors to contribute to the implementation of the EHS.

3. Methodology

In order to provide a reliable basis for the planning of green hydrogen infrastructure we developed a holistic concept for assessing regional potentials across the HSC. In addition to the consideration of demand and supply potential, this concept has been extended to include other location factors relevant to the implementation of the EHS. In this regard, we focused on socio-economic location factors related to research and development and energy infrastructure.

3.1 The case of Germany

In this study, we use Germany as a test case to assess regional hydrogen and location potentials for green hydrogen infrastructure planning. In the context of the EHS, the German national hydrogen strategy was released in 2020. The target for domestic electrolysis capacity in 2030 will be doubled from five gigawatts to at least ten gigawatts (BMWK, 2023, p.1). Efforts are currently focused on implementing power-to-gas technology and model regions with hydrogen-related concepts across the country (Changjong et al. 2022; BMWK, 2023).

The German industrial sector has a great need for decarbonisation, especially in high-temperature applications such as the primary steel production and in the chemical industry. The forecast for hydrogen demand in the German industry is between 290 and 440 terawatt hours by 2045. (BMWK, 2023, p.20). Although the share of RES in the electricity sector is increasing, the potential for domestic production of green hydrogen is limited. Therefore, in the long term, most of the demand will have to be met by imports (BMWK, 2023; UBA 2024).

At first, import of hydrogen and its derivatives is planned to be largely ship-based, with the possibility of pipeline expansion to European countries. As Lipiäinen et al., (2023, p.31322) note, Denmark is already planning a pipeline of 350 to 450 kilometres to export green hydrogen to Germany. Germany has ambitious plans to build a hydrogen network that consists of repurposed and newly constructed hydrogen pipelines. An initial core network of hydrogen transmission pipelines with more than 9,700 kilometres is expected to be completed by 2032 (FNB 2023). In addition, two hydrogen pipeline networks are currently in operation located in the Rhine-Ruhr area (220 km) and at the outskirts of Leuna and Bitterfeld (100 km) in eastern Germany (Baufumé et al., 2013).

3.2 Data and methods

Following the Nomenclature of Territorial Units for Statistics (NUTS) level three[1], a total of 400 cities and counties were considered as research units. NUTS is a geocode standard for referencing spatial units for statistical purposes. We used a variety of official and open databases to collect measurable indicators for the empirical examination. Relevant geospatial data was pre-processed using GIS software. Through a theory-based analysis of relevant aspects of the HSC, the EHS and the German hydrogen strategy, we compiled a dataset from an initial set of 65 variables, selecting proxy variables related to the socio-economic situation, municipal finance, public funding, renewable energy production and the hydrogen production chain. Table 1 provides an overview of the dataset used in the further research process, including 20 relevant indicators and their data sources.

[1] With the exception of the city of Eisenach, which was merged with Wartburg County in 2021. To ensure data consistency, only Wartburg County was included in the analysis.

Table 1. Used dataset

Source	Indicator / Variable	Year
Global Wind Atlas	Average wind power density at 150m height (in W/m^2)	2023
Leibniz Institute of Ecological Urban and Regional Development	Area % of windfarms out of total area	2021
Federal Ministry of Transport and Digital Service	Minimal distance to seaports (in km)	2022
Federal Office of Cartography and Geodesy	Area % of 2km-corridores around electricity transmission lines out of total area	2022
Federal Institute for Research on Building, Urban Affairs and Spatial Development	Average age of population (in years)	2022
	% of employees at professional level	2022
	Students in vocational schools (per 1,000 inhab.)	2019
	Students at universities (per 1,000 inhab.)	2021
	% of graduates with higher education level	2022
	Expenditure on direct project funding (in € per inhab.)	2021
	Federal expenditure on university funding (in € per inhab.)	2021
	Tax revenue (in € per inhab.)	2021
	% of households with min. bandwidth of 1,000 Mbit/s	2022
	% of residential buildings with renewable energy sources	2022
	Travel time to intermodal terminals (in min)	2021
	% of employees working in the industrial sector	2021
	% of employees working in the secondary sector	2021
	% of gross value added in the secondary sector	2021
	Passenger car density (per 1,000 inhab.)	2022
Association of supra-regional gas transmission companies Germany	Minimal distance to planned hydrogen core network pipelines (in km)	2023

To create indices for assessing regional potentials we used an exploratory principal component analysis (PCA) (Jolliffe, 2002). After testing for suitability using Kaiser-Meyer-Olkin test and Bartlett's test of sphericity, we conducted three separate PCAs to identity relevant indicators for constructing representative indices of location factors and hydrogen potential from the above dataset. Following Mayer (2018), we first computed PCA based on eigenvalues to determine the number of relevant components in an iterative process by analysing the respective screeplots. The resulting components were then interpreted in terms of their factor loadings in the component matrices (using varimax rotation if applicable). Each index variable was normalised using z-score transformation.

Finally, the compiled indices were used to perform a cluster analysis in order to detect and classify regions with similar potentials. Based on the analysis of these cluster specific potentials it is possible to draw conclusions about cluster specific needs and requirements for hydrogen infrastructure planning. Following Backhaus et al. (2017) and Kimes et al. (2021), we conducted a hierarchical cluster analysis using the Ward method with a subsequent cluster centre analysis. For the cluster centre analysis, we use k-means clustering to extract eight clusters in the process.

4. Results

This section describes the results of the exploratory principal component analysis and the subsequent cluster analysis. Following our research objective, we first constructed indices from different regional location potentials in order to analyse their prevalence and spatial distribution in the following. Finally, we derived context-specific planning strategies based on the results of the cluster analysis.

4.1 Measuring of regional potentials

In total, four indices were created. According to the research concept, two indices describe the regional hydrogen demand and supply potential while the other two represent regional location potentials. We named each index variable according to their most influential indicators[2].

First, the index, *Knowledge and Innovation Potential* (RIP), was created in a separate PCA. It explained 49 per cent of the total variance between variables used (Table 2). Table 2 shows that the RIP index is predominantly characterised by educational indicators such as the number of students at universities or the level of expenditure on university funding. While the RIP index shows positive factor loadings for indicators that measure education, it is also compromised by negative factor loadings. In this respect, the percentage of employees at the professional level and the average age of the population indicate a possible shortage of skilled workers and a younger population at the same time. We use the RIP index as representative to assess regional location potential for the development of hydrogen research and innovation centres.

Table 2. Factor loadings of the Research and Innovation Potential (RIP) index

	Research and Innovation Potential (RIP)
Average age of population (in years)	**-0.720**
% of employees at professional level	**-0.812**
Students in vocational schools (per 1,000 inhab.)	0.630
Students at universities (per 1,000 inhab.)	**0.777**
% of graduates with higher education level	0.625
Expenditure on direct project funding (in € per inhab.)	0.636
Federal expenditure on university funding (in € per inhab.)	**0.736**
Tax revenue (in € per inhab.)	0.652
% of households with min. bandwidth of 1,000 Mbit/s	0.707
% of variance explained by the factor	49.4

Second, the indices, *Infrastructure and Connectivity Potential* (ICP) and *Hydrogen Supply Potential* (HSP) were created in a combined PCA. The HSP index, as the first principal component, explained 41 per cent of the total variance (Table 3). As Table 3 shows, the HSP index is characterised by indicators of RES such as average wind power density and the area share of wind farms. There are negative factor loadings for the minimum distance to seaports, indicating close access to import opportunities from overseas. We use this factor to assess regional hydrogen supply potential.

[2] To facilitate labelling the indices, the dominant indicators (factor loadings >0.75) are marked bold in the tables.

The second principal component, the ICP index, explained 26 per cent of the variance (Table 3). It is mainly characterised by positive factor loadings for travel time to intermodal terminals and negative loadings for the area share of corridors of electricity transmission lines. The factor loads were reversed for this index with higher loadings representing lower potential. In order to ensure consistency with the other indices, we inverted its score values so that positive scores represent higher potential. This third index is likely to represent regional location potential for the availability of energy infrastructure and spatial connectivity in the assessment.

Table 3. Factor loadings of the Infrastructure and Connection Potential (ICP) index and the Hydrogen Supply Potential (HSP) index

	Indices	
	1 – Hydrogen Supply Potential (HSP)	2 – Infrastructure and Connectivity Potential (ICP)
Minimal distance to seaports (in km)	**-0.884**	0.118
Average wind power density at 150m height (in W/m^2)	**0.929**	0.055
Area % of windfarms out of total area	**0.778**	0.132
Travel time to intermodal terminals (in min)	0.005	**0.832**
Area % of 2km-corridores around electricity transmission lines out of total area	-0.177	**-0.758**
Minimal distance to planned hydrogen transmission pipelines (in km)	-0.427	0.518
% of variance explained by the factor	41.1	26.2

Finally, the fourth index *Hydrogen Demand Potential* (HDP) was created in another separate PCA and explained 63 per cent of the total variance (Table 4). For this index table 4 indicates high factor loadings for the share of employees working in the secondary and the industrial sector as well as for the share of gross value added in the secondary sector. Since the HDP index is highly influenced by indicators of industrial density, we use this index as a representative to assess regional hydrogen demand potential.

Table 4. Factor loadings of the Hydrogen Demand Potential (HDP) index

	Hydrogen Demand Potential (HDP)
% of residential buildings with renewable energy sources	0.625
% of employees working in the industrial sector	**0.808**
% of employees working in the secondary sector	**0.936**
% of gross value added in the secondary sector	**0.878**
Passenger car density (per 1,000 inhab.)	0.673
% of variance explained by the factor	62.8

The scores of each index and its spatial distribution are presented in Figure 1 to 4 for administrative units at NUTS-3 level in Germany. In all cases, higher value scores represent a higher regional potential and vice versa.

For both the RIP and the ICP index, there is a spatial concentration of high scores in high density urban areas. We assume that this is due to the amount of educational and technical infrastructure such as universities or electricity hubs provided in cities. The HSP index shows an increasing

gradation of higher values towards the northern regions. As data of the Global Wind Atlas (2023) indicates, this is closely related to the wind power density and in coastal regions. This pattern is further reinforced by including seaports. The HDP index shows higher values in rural regions with an increasing gradation towards the south.

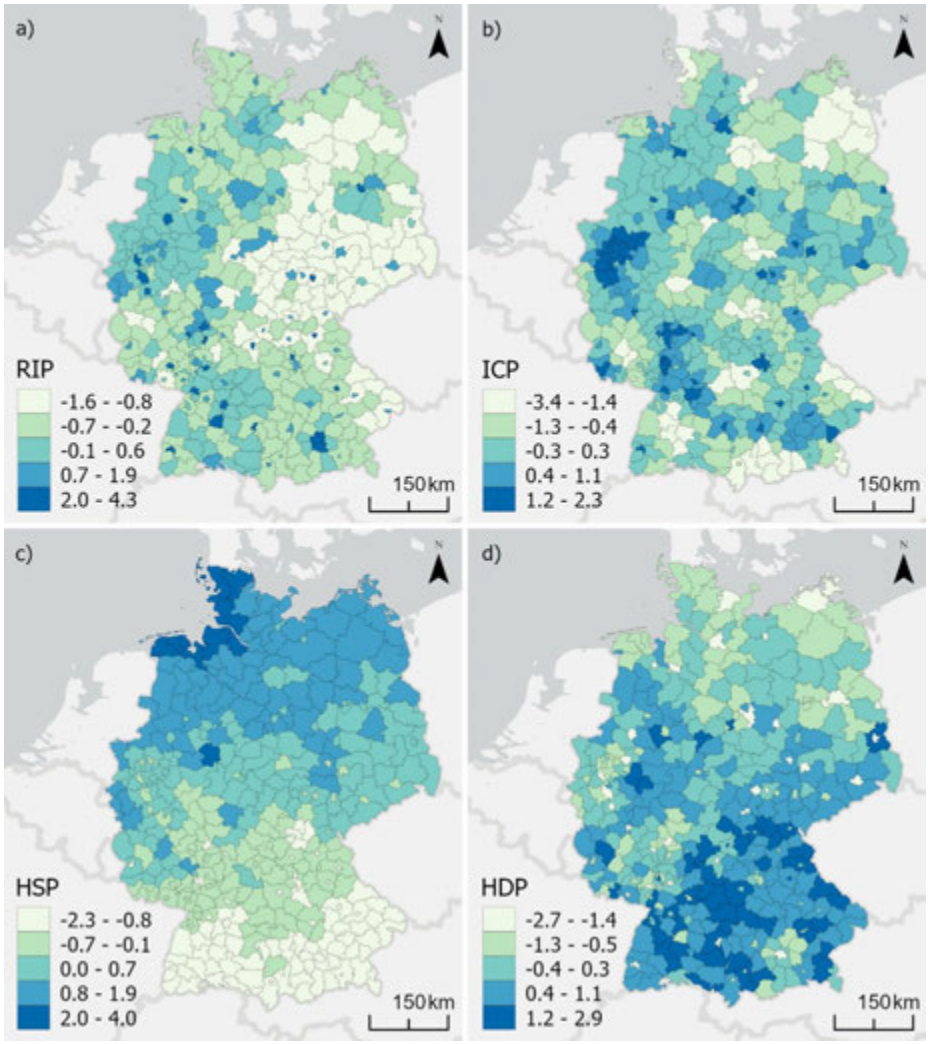

Figure 1-4. Spatial distribution of indices: RIP (a), ICP (b), HSP (c) and HDP (d) at NUTS-3 level in Germany

4.2 Clustering of regional potentials

Following the holistic approach all indices were considered equally in the analysis. As Table 5 indicates, we identified and extracted eight distinctive clusters in the research process. The average cluster distance indicates the heterogeneity that occurs within a formed cluster and allows the identification of cluster representative regions.

Table 5. Results of cluster analysis: Average cluster distance and average scores of indices

Cluster	**Average cluster distance**	**Average score values**			
		RIP	ICP	HSP	HDP
1 – Supply region with needs for infrastructure	0.97	-0.68	**-1.27**	**1.02**	-0.46
2 – Demand region with needs for infrastructure	1.03	-0.56	**-1.33**	-0.89	**0.98**
3 – R&D region with needs for infrastructure	1.24	0.66	-0.44	-0.80	-0.76
4 – Supply region with connectivity potential	1.04	-0.13	0.08	**1.54**	-0.25
5 – Activatable supply and demand region	0.77	-0.81	-0.11	0.23	0.34
6 – Infrastructure hub regions	1.05	0.54	**1.36**	-0.19	-0.78
7 – R&D centres with connectivity potential	1.38	**2.45**	0.95	-0.23	**-1.49**
8 – Demand region with connectivity potential	0.90	-0.16	0.26	-0.69	**1.03**

Each cluster is associated with corresponding mean value scores, representing the standard deviation from mean, of the compiled indices. We use these values for the characterisation and interpretation of the respective clusters[3]. The spatial distribution of the compiled clusters is shown in Figure 5 for administrative units at NUTS-3 level in Germany. Additionally respective cluster representatives are labelled on the map.

Cluster 1 (n = 29) is characterised by *supply regions with needs for infrastructure*. It contains a below average score on the ICP index and an above average score on the HSP index. These regions are suitable to supply hydrogen with renewable energy production and import possibilities. However, location potentials are indicating regions with low connectivity and a need for infrastructure development. A representative region in this cluster is Ostprignitz-Ruppin, a region with rural character in northern Germany.

Cluster 2 (n = 52) contains regions described as *demand regions with needs for infrastructure.* The value scores on the HDP index are above average and the ICP index is expressed below average. These regions are suited to apply hydrogen with a predominance of the secondary sector and energy intensive industries. On the other hand, location potentials confirm these regions a low connectivity and a need for infrastructure development. Calw, a region with rural character in southern Germany, is the representative region in this cluster.

Cluster 3 (n = 33) represents *research and development regions with needs for infrastructure.* The cluster contains below average score values on all indices except for the RIP index. These regions are considered unsuited to supply or apply hydrogen in the near future and have a need for infrastructure development. However, the RIP index suggests locational potentials for research and development in these regions. The cluster is represented by Chemnitz, a region with an average urban character and a medium-sized university. The high degree of heterogeneity in this cluster suggests that there are deviations between the regions in this cluster.

Cluster 4 (n = 57) represents *supply regions with connectivity potential* and contains the highest average score values of the HSP index. All other indices contain score values in the average range. Regions in this cluster are highly suitable for hydrogen supply. Additionally, locational

[3] To facilitate characterising different clusters, the dominant values (average score value >1.0) are marked bold in the tables.

factors are indicating average connectivity potential to existing networks of energy infrastructure. A representative region in this cluster is Steinfurt, a region with rural character in north-west Germany.

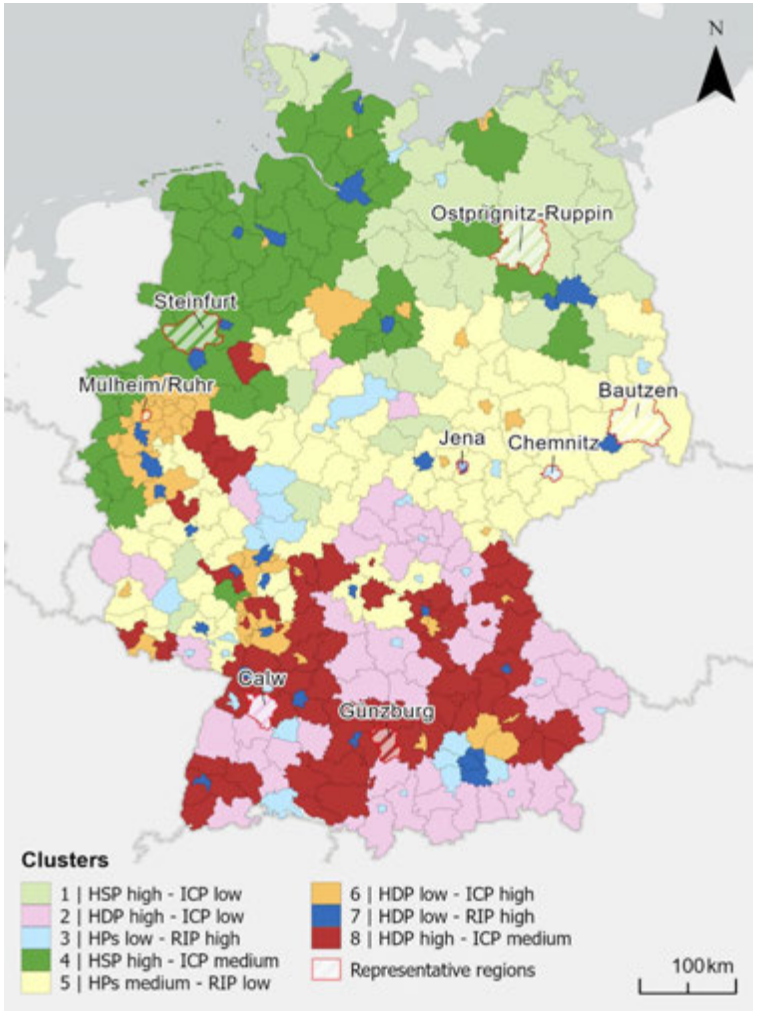

Fig 5. Spatial cluster distribution and related cluster representatives at NUTS3-level in Germany

Cluster 5 (n = 76) is labelled as *activatable supply and demand regions*. These regions contain a slightly above average score on the HSP and the HDP index indicating a general suitability for regional hydrogen potenials. Whereas, the average score on the RIP is below average, which points to a lack of regional locational potential in terms of expertise. Bautzen, a rural region in eastern Germany is considered as a representative region within this cluster. Heterogeneity is least pronounced in this cluster, suggesting a homogeneous composition within the cluster.

Cluster 6 (n= 57) focuses on regions described as *infrastructure hub regions*. It contains the highest average score value of the ICP and HSP and HDP values below average. These regions are unsuited to supply or apply hydrogen within their region, but contain a high regional potential to be connected to existing networks of energy infrastructure. A representative region for this cluster is Mülheim an der Ruhr, a region with urban character in western Germany.

Cluster 7 (n = 31) consists of *research and development centres*. It contains the highest average score values of the RIP index. While the ICP index scores above average both HSP and HDP index contain below average scores. Although these regions are considered unsuitable for hydrogen supplying and applying hydrogen, location factors indicate a high potential for research and development centres. A representative region in this cluster is Jena, a region with urban character and a large university in eastern Germany. There is a high degree of heterogeneity within this cluster.

Cluster 8 (n = 65) is composed by *demand regions with connectivity potential* and contains the highest average score values on the HDP index. This implies a high suitability for hydrogen demand due to the industrial character of the region. Additionally, these regions contain an above average score value on the ICP index, indicating a potential to connect these industrial regions to existing energy infrastructures. A representative region in this cluster is Günzburg, a region with an average urban character in southern Germany.

Our results indicate increased needs for action in cluster regions one, two, four, five and eight. In particular, clusters one and two show high potentials for hydrogen production and consumption while being poorly connected to the existing energy infrastructure. Due to the potentially large amount of green hydrogen produced or consumed in these regions, they should be given priority when connecting to infrastructure networks such as the hydrogen core pipeline network. Regions in clusters four and eight, with exceptionally high production and consumption capacities, should also focus on connecting to a centralised green hydrogen infrastructure network in the near future.

Concerning cluster five, there are average potentials for producing and consuming hydrogen with relatively low regional location potentials. Because these areas are classic remote and rural regions, the focus should be on decentralised strategies for hydrogen infrastructure planning. This means focusing on local on-site production, appropriate storage facilities and transportation via trailers. With the development of initial projects and model regions new expertise in the field of hydrogen infrastructure planning can be acquired.

In cluster three and seven there are high location potentials for research and development. Especially cluster seven contains potentials in becoming centres for hydrogen related research and development when granted appropriate support and funding. The conditions for connecting to existing infrastructure networks are also relatively high in cluster seven. Regions of cluster six are considered to be future infrastructure hubs that can be connected to central infrastructure networks in the process of expanding the hydrogen core pipeline network.

Discussion and Conclusion

Strategies for green hydrogen infrastructure planning need to consider spatial characteristics of demand and supply (Baufumé et al., 2013) as well as existing regional potentials (Mai et al.,

2023). Selecting suitable concepts in alignment with the respective regional context is essential when planning green hydrogen infrastructure (Luise et al., 2023). In accordance to the literature, we developed a holistic concept for the detailed assessment of relevant regional potentials for green hydrogen infrastructure planning.

Our results determined four main regional potentials of importance, which were derived from a selected dataset of 20 indicators: research and development, infrastructure connectivity, hydrogen demand and hydrogen supply. After assessing these potentials, we were able to characterise eight clusters. By applying these clusters to the regional dataset, we identified different type regions with context-specific suitabilities, opportunities and needs for action and planning throughout the case of Germany. This will provide the basis for developing strategic approaches to green hydrogen infrastructure planning. In conclusion, by combining technical with socio-economic location factors at a regional scale, we developed a holistic concept for assessing regional potentials for green hydrogen infrastructure planning.

Nevertheless, it should be noted that the conducted assessment is not a true reflection of the reality and that a detailed analysis of the specific region is still required. As the statistical analysis only shows indicator-based suitability, the selection process of variables has a strong influence on the results. In the course of the analysis, seemingly relevant factors were excluded from the data set due to statistical insignificance. In the case of the HSP index, photovoltaic production was excluded, which should be viewed critically in terms of its interpretative value. Also, large-scale storage facilities and existing hydrogen projects were not included in the analysis due to low data availability and missing or inconsistent values.

Furthermore, the reduction of information density during the PCA should be viewed critically. The data set used is not considered exhaustive for all relevant regional potentials for hydrogen infrastructure planning. Whether or not the predictive power of the indices holds true in reality needs to be verified in a detailed analysis. However, for an initial assessment and exploration of possible actions and strategies, this method can support and accelerate the planning process.

The application of the developed concept is generally possible, but highly dependent on the availability of data at regional level. Significant differences in factor loadings are highly likely not only depending on the spatial but also on the temporal relation of the used data (Jolliffe 2002).

Finally, a critical look at hydrogen as an energy carrier is in order. Although currently the use of hydrogen energy technologies seems promising, there is still great debate on it. (Dou et al., 2023). The true potential of this climate-friendly technology will be revealed in this decade as the hydrogen infrastructure develops. In addition to green hydrogen, other production pathways and technologies may need to be applied.

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Removing cultural barriers to climate change adaptation in Tuscany

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Abstract
The paper investigates the role of cultural factors in hindering climate change mitigation and adaptation policies. The importance of historical landscape in Tuscany makes it difficult to accept transformations necessary to adapt to the new climate. After reviewing available data on climate transformations in Italy and taking stock of the status of mitigation and adaptation planning, some projects of renewable energy production facilities are analysed. The media debate and the legal and bureaucratic oppositions to them are discussed. The idea of landscape emerging from the debate is related to the musealised conception of the same that has been established in Italy. The concluding section discusses the policy implications of the present work.

Keywords: urban landscape; climate change adaptation; cultural barriers; Tuscany; Italy.

1. Introduction

We live in an increasingly urban and hot world. According to United Nations projections in 2050 68% of the world's population will live in cities (United Nations, 2019). Over the same period, the planet's average temperature is expected to rise between 1.5 and 2 degrees (IPCC, 2023). These two simple figures place at the forefront the need to rethink urban landscapes in order to adapt the living environment of the majority of the world population to exceptionally rapid change. This rapidity is at odds with the long time frames in which cities undergo change and transformation. Planning can only play a central role in such processes (Norman, 2022, IPCC, 2021). The long timescales of urban change partially depend on the symbolic and psychological meanings cities hold for their inhabitants (Lingiardi, 2017, Ulrich, 1979). This raises the issue of cultural barriers to climate change adaptation, a topic that is particularly relevant in Italy, as demonstrated by the numerous cases of nimbyism and 'administrative resistance' to mitigation and adaptation projects (Fanetti, 2012, Fraioli, 2022). This paper aims to investigate this issue, with specific reference to the cultural, political and administrative situation in Italy, and to put forward some working hypotheses aimed at identifying procedures and tools to promote socially sustainable climate change adaptation measures. The first section summarizes available data and research on climate change that has occurred so far in Italy and Tuscany. The second section reviews planning aimed at climate change mitigation and adaptation in the same area, showing its inadequacy to achieve zero CO_2 emissions by 2050 and to make the territory resilient to the changing climate. The third section presents some cases in which climate change mitigation and adaptation plans and projects face procedural and administrative difficulties that can be attributed to cultural barriers arising from a static and immutable conception of the landscape. The conclusive section draws policy implications from the present research.

2. Materials and Methods

The first part of the essay introduces the topic of climate change and of the relationship between planning and climate. After some general considerations on global trends, climate transformations in recent decades in Italy and Tuscany are examined, with an in-depth look at the city of Prato. These transformations are derived from statistical elaborations on

temperature and precipitation and from research conducted by research institutes specifically dedicated to the study of climate change and environmental protection in Italy, including the Euro-Mediterranean Centre on Climate Change and the Istituto Superiore per la Protezione e la Ricerca Ambientale (Ispra). The set of systematic studies on climate change in Italy conducted so far, albeit based on pre-2012 data, shows a considerable increase in the risks of extreme weather events and poses the urgent need for climate change adaptation and mitigation planning. The numerous disasters due to extreme rainfall, extreme heat and prolonged droughts that have occurred in recent years confirm the urgency and seriousness of the situation.

The second section reviews climate change mitigation and adaptation planning in Italy and in Tuscany. Planning at the national level was reviewed through existing literature on the subject. Data obtained from literature were checked and updated by consulting web portals of institutions and administrations responsible for climate change mitigation/adaptation planning. The analysis regarding the Tuscan area was conducted by consulting plans and policy documents prepared by local governments and by the Tuscany Region through their web portals. For reasons of time and research opportunities, we only focused on provincial capital cities. The choice was motivated by the fact that these accommodate most of the regional population, are the major greenhouse gas polluters, have a higher degree of vulnerability compared to the rest of the region, and have a political-institutional environment that is relatively committed to climate change mitigation and adaptation.

The third section analyzes the role that historical and cultural factors play in hindering climate change mitigation and adaptation processes in Tuscany and more generally in Italy. Firstly, we describe some cases of conflict over mitigation and/or adaptation projects. The cases were selected using journalistic sources and by talking to local technicians and administrators. The journalistic sources were identified using the search engine news.google.com and setting different keyword strings in order to intercept articles from national and local newspapers that dealt with different types of mitigation and adaptation interventions in the period between 01/01/2023 and 30/09/2023. Secondly, we analyze the role that historical and cultural factors play in these conflicts. The discussion of cases is made using the concept of sostalgia developed by Glen Albrecth (2005) and relating the idea of landscape that implicitly emerges from the debate with the static and musealised conception of the same that has been established in Italy through the protection laws enacted since the 1930s. The concluding section of the essay discusses the policy implications of the present work.

3. Results

3.1. Climate change in Tuscany and Italy and future urban scenarios.

As is well known, there is now almost unanimous consensus among scientists that the change in the Earth’s temperature observed in recent decades can be attributed predominantly to anthropogenic climate-altering emissions (NOAA National Centers for Environmental Information, 2023, Lynas, Houlton and Perry, 2021, Myers et al., 2021, Powell, 2019). The increase in the earth's temperature and the aggravation of the often disastrous impacts due to it have seen a significant acceleration in recent years (Portner et al., 2022). This determines the need for rapid adjustment of urban landscapes in order to ensure that inhabitants have an adequate living environment even in the new climatic conditions.

Building systems and urban layout are largely determined, especially in the historic city, by climatic conditions. It is a well-known fact that the historic Islamic city had various spatial and construction devices aimed at ensuring environmental well-being in very hot climates: narrow streets and tall buildings to increase shading, domed buildings to minimise the surface area exposed to the sun, extensive use of arcades to provide shaded open spaces, and the use

of materials such as unfired earth mixed with straw to improve insulation performance in masonry (Sahebzadeh et al., 2017). The correlation between variation in climate and in building systems has also been studied in typological analyses of traditional rural constructions, whose building features were adapted to the negative thermal gradient associated with altitude in various ways: reducing the size of openings, optimizing their exposure so as to maximise sunshine, increasing the slope of roof pitches, making the most of the heat produced by animals by positioning stables so as to heat the rooms above, etc. (Biasutti 1938).

The increase in Earth's global temperature, while still relatively small to date compared to the various change scenarios projected from now even to 2050 (IPCC, 2023, Vince, 2022, Smith, 2010), is already driving a shift in Earth's climate belts toward the poles (Jones, 2023, Fin, 2022). This is of course a simplification, and the reality is far more complex: for example, the arid part of the tropical belt is expanding both toward the equator and toward the poles; the Sahara Desert, whose area is roughly the same as the entire United States, is extending further both northward and southward; the eastern arid zone of the United States is moving eastward, at the expense of the wetter, more fertile zone (Jones, 2023). At the level of biological systems, this is evident from the migration of some species that are more free to move, particularly those belonging to the insect class, with sometimes disastrous consequences on the ecosystems that receive them, or even from the increase in their reproductive cycles due to rising temperatures. The situation is particularly alarming in Trentino-South Tyrol, where the multiplication of the bark beetle's reproductive cycles due to the excessively mild temperature has resulted in a spruce-fir ecatomy (Fin, 2022). This insect has also spread to the boreal forest of Finland producing similar problems (Zimmer, 2023). One of the main difficulties ecosystems face in adapting to the rapid rate at which the climate changes stems from the varying difficulty of their component species to move. Different living species could be classified according to their respective time required to move through space so as to follow the shift in climate zones brought about by the increase in Earth's temperature. Such a classification, in fact, could also be made in relation to different variables in urban landscapes that exhibit greater or lesser inertia to change-more specifically to the changes that would be required to align and adapt our cities to the new climate framework.

It should be pointed out that rising temperatures do not simply imply a shift in latitude and altitude of climate zones, but a broader and more general upheaval of the climate. Currently [May 2024] the level of CO_2 in the atmosphere is about 426 ppm, up from 316 ppm in 1959 (Pro Oxygen, 2024). The level of 500 ppm today corresponds to the most ambitious and optimistic scenario for limiting future emissions and is roughly the same as it must have been during the Miocene, when the temperature was about 4°C higher, sea levels were about 40 meters higher than today, and lush forests grew in Antarctica and the Arctic (Vince, 2022). Therefore, it is evident, as indeed we are continually told by climatologists, that we are venturing, or rather have already ventured, into unknown territory, in which it is not possible to speak simplistically about a shift in Earth's climate zones, nor to apply any more of the knowledge and experience accumulated in relation to them. That said, it is all too obvious and evident, that we are witnessing an unmistakable as well as rapid trend of increasing intensity of four categories of phenomena, which immediately need structural adaptations of urban landscapes: heat waves, floods, fires and drought. In her book The Nomadic Century, Gaia Vince (2022) calls these phenomena "the four horsemen of anthropocene."

Table 1, prepared by the City of Prato, shows the change in average and maximum temperatures, rainy days, and total mm of water rained annually between 1990 and 2022. These data show a very significant increase in temperature and an equally pronounced transformation in rainfall data, from which it appears that while the amount of water falling each year has remained essentially unchanged, the number of rainy days has decreased

significantly, which explains the increasingly frequent phenomenon of so-called 'water bombs.' It is clear that we are witnessing an alternation of periods of drought, often associated with heat waves and fires, and very heavy rainfall, which in turn is associated with increasing frequency with landslides and floods. This trend has seen an impressive acceleration in recent years and it is reasonable to assume that it will continue to grow in frequency and intensity in the coming years.

Table 1. Temperature and precipitation in Prato from 1990 to 2022.*

	Temperatures (°C)				Rain	
Year	Absolute		Mean			
	max.	min.	Max.	min.	mm	days of rain
1990	34,4	-4,5	19,8	11,4	899,5	119
1991	33,5	-7,4	18,7	10,4	1.199,0	111
1992	37,0	-3,6	19,4	11,2	1.153,4	122
1993	36,0	-5,9	19,3	10,1	911,6	115
1994	36,8	-2,7	20,0	11,1	881,4	94
1995	34,6	-3,7	18,7	9,8	908,4	116
1996	33,5	-6,8	18,6	9,9	1.080,4	121
1997	35,2	-1,1	20,5	10,1	951,2	118
1998	38,1	-5,0	19,5	10,1	902,0	113
1999	34,6	-4,1	19,6	10,5	1.000,2	125
2000	36,0	-5,7	20,0	10,9	1.004,8	115
2001	38,0	-5,7	20,0	10,2	921,6	132
2002	36,0	-5,9	19,9	10,5	971,4	139
2003	40,4	-3,8	21,2	10,6	809,0	106
2004	35,2	-3,3	19,2	9,9	928,0	140
2005	37,5	-5,2	18,6	9,3	951,8	128
2006	35,7	-4,4	19,9	10,1	810,4	133
2007	36,4	-3,2	19,9	10,2	770,0	113
2008	35,0	-3,4	19,5	10,3	908,4	147
2009	39,0	-6,0	21,1	11,6	815,8	78
2010	37,0	-5,7	19,3	10,8	1.255,2	108
2011	40,2	-2,6	21,3	11,5	694,6	59
2012	39,5	-3,7	21,0	11,5	763,4	83
2013	38,1	-1,6	20,1	11,5	1.076,0	109
2014	36,4	-0,5	21,2	12,5	1.410,8	110
2015	38,5	-0,1	21,3	12,2	723,6	71
2016	36,0	-1,8	21,1	12,1	1.035,2	99
2017	40,8	-3,1	21,6	11,5	808,4	72
2018	38,0	-5,1	21,4	12,4	927,0	100
2019	39,9	-3,5	21,6	12,2	1.017,2	95
2020	37,9	0,3	21,4	12,0	934,4	94
2021	39,9	-2,5	21,1	11,7	884,8	82
2022	40,0	-0,3	22,5	12,8	734,0	65

* The table is available in the 'climatology' section of the portal of the Prato Municipality's statistics office: https://www.comune.prato.it/it/statistica/aree-tematiche/climatologia/pagina2298.html (accessed on 08 May 2024).

The above data are in line with the more general picture regarding climate change in Italy. The Euro-Mediterranean Centre on Climate Change report finds, for the period 1961-2012, changes of 1° C every 10 years in the annual maximum and minimum temperature values, an increase in warm nights by about 14 days in 10 years and in warm days by about 21 days in 10 years (Spano et al., 2020). Alongside this generalised warming of the climate there is evidence of a statistically significant increase in the intensity of precipitation events in both the North and the South of Italy. These data are in line with reports prepared by other research and land-government institutions, including the Italian Atlas of Climate and Climate Change

(Esposito et al. 2015), the ISPRA report on variations and trends in temperature and precipitation extremes in Italy (Fioravanti et al., 2013). All of them highlight significant increases in the risks of extreme weather events such as exceptionally intense and spatially concentrated rainfalls, heat waves, ruinous forest fires, and periods of prolonged drought. More recently, the annual report on climate change already occurring in Italy provided by Legambiente confirms the picture outlined above (Nanni, Minutolo, eds., 2022). These changes immediately require decisive action through urban planning aimed at mitigating, as far as possible, the effects on human health, the built and environmental heritage, food security and the economy as a whole. In the following section we will analyze the state of planning for climate change mitigation and adaptation in Italy, with a special focus on Tuscany.

3.2. Climate change mitigation and adaptation planning in Tuscany and Italy

The Paris Agreement on Climate Change, adopted at COP21 in December 2015, set the goal of limiting global warming to below 2°C and also committed subscribers to continue efforts to contain it to 1.5°C. The agreement also commits governments to increase their capacity to adapt to the effects of change that have already occurred and that, albeit to varying degrees depending on the ability to cut future emissions, will continue to occur in the decades to come (UNFCCC art. 2b, 2020). Since the conclusion of the agreement, the situation has further worsened. Extreme weather events occurred during 2023, are in some cases in the upper range contemplated by models and have caused concern and even astonishment among many scholars. It is possible that our fragility to extreme weather events has been underestimated, which is why some scholars argue that Paris agreements are inadequate to avoid the most severe consequences and that it is absolutely necessary to contain global warming well below 1.5°C (Carrington et al., 2023).

Italy is highly vulnerable to the climate crisis and to extreme weather events (European Environment Agency, 2019). There are several reasons for such vulnerability: geological instability of much of its territory; high population density; coastal extension and high urbanization of it; location in the centre of the Mediterranean, a hotspot of climate change, and astride the North African and North European climate zones, the clash of which often results in extreme weather phenomena. According to a study by the Euro-Mediterranean Centre on Climate Change, the risk from extreme weather events increased for the entire country by 9 percent during 1999-2018 compared to the previous 20 years (Spano et al., 2020). Urbanised areas are the most vulnerable, especially in relation to heat waves and heavy rainfall.

On the institutional level, the growing awareness about the impacts of climate change is attested by the number of Italian local governments (114, corresponding to 47.6 percent of the population, by May 10, 2024) that signed the Climate Emergency Declaration (Climate Emergency Declaration, 2024). In any case, although Italy is one of the signatory countries of the Paris Agreement and despite the growing awareness of the high vulnerability of the Italian territory, legislation and planning for mitigation and adaptation to climate change are still very incomplete. Planning activity in Italy is based on four territorial levels: national, regional, provincial and municipal. Following the constitutional reform of 2001, regions have acquired important competencies in the field of energy and environmental policies (De Gregorio Hurtado et al., 2015), as well as in the field of planning, whose tools and procedures are now highly differentiated at the regional level (Mazzeo et al., 2021). In essence, state and regions have competing competencies in climate change mitigation and adaptation and are in charge of providing the regulatory framework to be followed by local authorities.

In 2019, the national government submitted the National Energy and Climate Plan (NECP) to the European Commission (Ministero dello Sviluppo Economico, 2019). The plan sets

national targets and measures by 2030 on energy efficiency, renewables and CO2 emissions cuts, as well as goals on energy security and connectivity, competitiveness and unification of energy markets, and sustainable mobility. The NECP is in fact the main national tool for mitigation policies. Adaptation policies, on the other hand, are based on the National Strategy for Adaptation to Climate Change (NSACC), approved in June 2015 by the Ministry of Environment and Land and Sea Protection (Ministero dell'Ambiente e della Tutela del Territorio e del Mare, 2014). This provides for the adoption of a National Climate Change Adaptation Plan (NCCAP), which has begun to be developed based on a participatory process, but has not yet been approved. Thus to date there is no regulatory and legislative framework for climate change adaptation, so municipalities, provinces and the regions themselves are basically acting on a voluntary basis (De Gregorio Hurtado, 2015).

At the regional level, by November 2019 plans aimed at climate change mitigation and/or adaptation had been adopted only by eight regions (Pietrapertosa et al., 2021): the Mitigation Plan by the autonomous province of Bolzano (which has similar competencies to regions); the Integrated Mitigation and Adaptation Strategy by the Emilia-Romagna Region; the Regional Adaptation Strategy by the Sardinia and Lombardy Regions; and the Environmental Energy Plans (EEPs) by the Valle D'Aosta, Liguria, and Friuli Venezia Giulia Regions and by the Autonomous Province of Trento, that although not specifically dedicated to climate change mitigation/adaptation, contains binding targets aimed at cutting CO2 emissions. Provinces were not very active in planning for climate change mitigation and adaptation, only four (corresponding to 6 percent of the population) having developed a plan.

Municipalities undoubtedly were (and are) the most active and dynamic institutional level, mainly due to their numerous adherence to the Covenants of Mayors, the network of cities promoted by the European Commission to fight climate change. Joining this network is an important step, as it commits the adhering municipality to draw up a Sustainable Energy Action Plan (SEAP) within two years and assume emission reduction obligations based on a baseline emission inventory, as well as to monitor progress in biennial reports. Until 2015, the greenhouse gas reduction target was 20 percent by 2020. Since then plans were renamed Sustainable Energy and Climate Action Plans, the reduction target was increased to 40 percent by 2040, and adaptation targets were also introduced.

3.3. Local and institutional opposition to climate change adaptation and mitigation

The state of CC mitigation/adaptation planning demonstrates a progressive awareness among the main local governments in Tuscany of the climate emergency in which we find ourselves and of the need to drastically reduce greenhouse gas emissions and to adapt cities and territories to the new climate situation. However, while a number of mitigation and renewable energy production projects have been promoted, mostly by private operators, adaptation policies are still more or less stuck on declarations of intent. However, in Tuscany, and more generally in Italy, almost all interventions aimed at renewable energy production (wind farms, photovoltaic plants, and biomass production plants) encounter significant obstacles and opposition, at the bureaucratic level and in local communities. I argue that these obstacles are due to a misconception of the idea of landscape.

This emerges, for example, in the case of wind farms, on which we will dwell here. According to Terna's data, the total energy generated in Tuscany in 2020 by all existing wind power plants was 250.2 GWh, corresponding to about 1.5 percent of total energy production from both fossil and renewable sources (Terna, no date). According to the inventory of wind farms built in Tuscany, as of the beginning of September 2023, there were ten wind power plants in the region, four of which were located in the province of Pisa, two in the province of Arezzo, and one in each of the provinces of Florence, Livorno, Massa, and Grosseto, with a total combined power of 140.3 MV (Wikipedia, 2024a). According to the same inventory as

of the same date, seven more plants with a total capacity of 66MV had been authorised and an additional ten plants with a total capacity of 426.6 MVh were in the planning stage. The implementation of the set of wind farms both authorised and in the planning stage would expand the total wind power capacity in Tuscany by 3.5 times and would significantly contribute to the goals of climate neutrality and energy security. However, as mentioned above, renewable energy plants face a lot of opposition, both at the bureaucratic level and from local communities and interest groups.

It is interesting to look at the media debate that has developed around these projects. We will focus in particular on two interventions: that of Monte Giogo di Villore, in the Tuscan Apennines-the mountain ridge that crosses the northern part of the region in a northwest/south-east direction-and that of Montauto, a place in southern Tuscany that is popular among elite tourists. Both projects were met with strong opposition and were widely debated in national and local newspapers. In the case of the Monte Giogo di Villore wind farm, counter initiatives were led by Leonardo Rombai, a professor emeritus of historical geography well known for his research on the Tuscan territory and president of the Tuscan section of the 'Italia Nostra' association. In an interview with a national newspaper, Rombai associated this project with the "business eagerness of major works," pointing out that it would "irreversibly alter what remains of pristine land and biodiversity." The Apennines, Rombai says, cannot be regarded as "a resource for industrial development." Among the grounds for the appeal to the administrative court filed by Italia Nostra are: geomorphologic, ecological, forestry and aesthetic changes to ridge, failure to fit into the landscape, visual impact on listed cultural heritage, and impact on tourist trails. (Rombai, 2023).

The media debate concerning the Montauto wind farm was even more heated, this area being known for its beauty and wilderness and encountering the attentions (and reactions) of numerous VIPs, including Vittorio Sgarbi, undersecretary for culture in the Meloni government, a renowned art historian and television journalist. In an interview with a newspaper Sgarbi called the wind farm "a criminal project, an abominable thing," whose implementation was the result of madness and would have disastrous impacts on Italian tourism (Mugnaini, 2023). Again, the local branch of Italia Nostra appealed to the administrative court. This same association was simultaneously engaged in several other legal and media battles against interventions aimed at renewable energy production and at climate change adaptation, including forest fire prevention cuts in the coastal pine forest of Tombolo and the construction of a photovoltaic plant in the province of Grosseto. Interestingly, Italia Nostra, throughout its nearly seventy-year history, has gathered around its ranks the elite of Italian culture and aristocracy. Although some of its environmental 'battles' had considerable relevance during the years of economic boom and of housing speculation, it, unlike other associations, has a strongly elitist character. Many of its media campaigns and legal battles are the result of an ideological view of the landscape, on which I will elaborate later. In the case of Montauto's intervention, for example, Legambiente, another major Italian environmental association, expressed its disagreement with Italia Nostra. In the words of one of its members, Angelo Gentili, given during a newspaper interview, "Cutting fossil fuels is fundamental and necessary. [...] Legambiente is not against renewable forms of energy and says yes to wind power and yes to photovoltaic. A shovel does not constitute a monstrosity." (La Nazione, 2023).

Beyond the positions expressed by different interest groups on individual interventions, the fact remains that cultural and bureaucratic obstacles to the implementation of climate change mitigation and adaptation projects in Italy remain huge. Although the business community is dynamic and has submitted many permit applications for renewable energy plants-potentially capable of making Italy carbon-neutral in a few years-most of these applications remain frozen for years and only a very small number are finally approved (Fraioli, 2022).

We could dwell on a great many other cases, including the total ban on photovoltaic roofs in much of the municipality of Florence and the regular aversion that solar farm projects encounter in the media and the courts. The debate that emerges in all these cases highlights the role played by cultural and affective factors that certainly bind us to the existing urban and rural landscape inhibiting an already difficult and problematic, but all the more urgent and necessary, adaptation to new conditions.

4. Discussion: removing cultural barriers to climate change mitigation and adaptation

From the debate on climate change mitigation and adaptation projects emerges an idea of landscape understood as fixed and unchanging--a kind of landscape-museum--and not as a flexible and adaptable living environment, to be continually transformed according to changing social, economic, environmental and climatic conditions.

In the absence of an awareness of the urgent need to adapt our living environment to the new climate, the market will take care of it, through the choices of millions of small property owners and buyers, but even more so through the choices of insurance companies and real estate operators, who will inevitably try to minimise the risks associated with climate change. As of the end of May 2023, the leading U.S. insurance company, has decided not to insure properties in the entire state of California against fire risk in order not to jeopardise its financial stability (Oladipo, 2023, Hao and Said, 2023). This resounding but at the same time entirely rational decision has, if nothing else, the advantage of providing the Golden State's political, economic and social system with a huge incentive to take all possible steps to counteract through planning and land management the phenomenon of forest fires, which has been out of control for a few years now.

In a state like Italy, and even more so in a region like Tuscany, the problem of cultural and affective barriers to the adaptation of the urban and rural landscape to the new and as far as possible future climatic conditions is particularly strong and evident. In fact, in this political decision-making context, resistance and friction to change are also determined by the fact that the cultural, pictorial and literary history of the urban and agricultural landscape have a very special weight and significance. There is an element of rationality in this attitude to preservation, both economically (for example, for the purpose of tourist exploitation of heritage) and psychologically. Studies in environmental psychology teach us that the landscape in which one is born and raised and with which one has a prolonged and lasting familiarity is an essential component of our psychological well-being (Lingiardi, 2017). Substantial alteration of it can be highly traumatic for each of us.

Philosopher Glen Albrecht coined the term solastalgia to describe the existential and emotional stress brought about by an environmental change that leads to profoundly altering the connotations of the landscape in which one lives (Albrecht 2005, 2007). This is described as "the homesickness you have when you are still at home." One could easily apply the term solastalgia to literary and musical works that described the alteration of the environment brought about by the 'building boom' in post-war Italy. Among these, Italo Calvino's *La speculazione edilizia* [The Building Speculation] (1963) and Adriano Celentano's song *Il ragazzo della via Gluck* [Gluck Street's Boy] (Wikipedia, 2024b) come to mind. However, while climate change mitigation and adaptation interventions may be perceived as worsening the aesthetic qualities of the environment in which they are implemented, it should be noted that solastalgia has been recognised by the medical journal *The Lancet* as a useful concept in understanding the impact of climate change itself on human health and well-being. It has also been used in various empirical research measuring the psychological consequences of environmental crisis situations (fires, floods, heat waves, droughts) attributable to climate change (Watts et al., 2015). So, on the one hand there is certainly a rational and 'self-protective' component (in that it is aimed at the preservation of one's psychological well-

being) in a certain amount of conservatism in urban and rural landscape management; on the other hand, it can produce inaction and immobility that could even prove disastrous in the current climate context.

Studies in environmental psychology are helpful in understanding some of the psychological dynamics that are potentially present in these attitudes. Alongside the 'healthy' tendency to preserve our living environment, we have in fact a much more dangerous and harmful propensity to fictitiously 'adjust' in our imagination an undesirable or even frightening reality, removing it and thus avoiding having to deal with the anxieties and psychic 'pain' that would result. According to several psychologically based researches, climate change would fall into this case (Hoggett, 2021, Hamilton, 2013, Norgaard, 2011, Stoll-Kleemann, O'Riordan and Jaeger, 2001). This is justified by the frankly very worrisome scenarios foreshadowed by studies and models on climate evolution in the not-too-distant future, such as 2050 or 2100, such as to heavily impact our future and even more so that of our children and grandchildren.

So the protection of the landscape 'as it is' to which we are affectively attached should be mediated with the adaptation of this same landscape to the new climate, in order to avoid in the near future even greater disruptions of our living environment. Instead, in the Italian and even more so in the Tuscan bureaucratic and administrative system, 'the instinct' for the integral protection of a landscape conceived as a museum prevails. Let us then try to imagine some mitigation and adaptation interventions that we might have to resort to in order to make our settlements more resilient. As known, in the literature on the subject, a distinction is made between mitigation and adaptation interventions. The former serve to make the effects of climate transformation less severe by reducing greenhouse gas emissions or enhancing the storage of climate-altering gases. The latter aim to contain the damage done by adapting cities and land to the new climate and weather situation. These two types of actions are equally urgent and necessary and cross different scales: from wide-area land-use planning, to urban and neighbourhood planning, to architectural design. Both mitigation and adaptation actions strongly require cross-sector and interdisciplinary approaches.

Transformations aimed at climate change mitigation mainly aim to contain emissions by improving the energy performance of the building stock, or to produce energy from renewable sources by building new energy production facilities. While the former generally have a limited landscape impact, the latter are at the centre of the nimbyism phenomena highlighted above, which, more generally, characterise much of the public and private interventions of urban and building transformation (Stoll-Kleemann et al. 2001, Bianchi, 2023). The words expressed by Undersecretary for Culture Vittorio Sgarbi against the installation of new wind farms, and the actions taken by him to prevent their implementation, are emblematic and demonstrate the inherently cultural and ideological roots of the problem.

In the urban context, adaptation will be mainly aimed at managing the water cycle and at contrasting heat waves. The metaphor of the sponge city summarises the urban planning approach needed to mitigate the effects of the increasing meteorological polarization consisting of alternating phases of prolonged drought and phases of intense and potentially devastating rain. A general multiplication of hydraulic risk will also necessitate typological transformations aimed at clearing the floors of buildings subject to flooding in high-risk areas, as well as the abandonment of those parts of the city that are excessively exposed. Problems arising from heat waves, where well managed, will result in a significant transformation of the urban landscape through the adoption of more reflective materials than traditional ones and the widespread creation of shading systems on facades, roofs and urban public spaces. It is also likely that the plant species we are accustomed to in our cities will have to be replaced with others more apt to the new climate. Once again there are numerous cases of cultural and administrative resistance to these types of landscape transformations.

All of this once again brings to light the cultural roots of bureaucratic inertia that makes permitting processes for renewable energy plants and for climate change adaptation projects particularly lengthy and cumbersome. In fact, underlying the administrative behaviour of the public administration is a static conception of the urban and rural landscape, which is implicitly believed to have attained a virtually perfect and final arrangement in its configuration immediately prior to the great demographic and urban port-WWII development. This approach has its roots in the landmark landscape and historical heritage protection laws enacted in Italy in 1939, during the Fascist regime. It is significant in this regard that Article 1 of Law 1497 of 1939 uses expressions such as "natural beauties considered as natural pictures," "viewpoints or belvederes, accessible to the public, from which the spectacle of those beauties is enjoyed," "complexes of properties that make up a characteristic view having aesthetic and traditional value". This idea of a definitive landscape, to be admired comfortably from the benches of the belvedere, is transmitted in the daily administrative practice of municipal landscape commissions and Superintendencies for cultural heritage, whose supervisory activities have resulted in the production of purified landscapes that are in fact 'made perfect.'

The purification of the landscape carried out, especially in Tuscany, since the Second World War, has resulted in the removal of all those elements that were in conflict with this static, abstract, idealised and ahistorical -or rather referred to imaginary historical situations and depending on the case vaguely and generically medieval, Renaissance, pre-industrial- idea of landscape. One can borrow the term 'fantasy restoration,' used to describe the nineteenth-century interventions promoted by Viollet le Duc and aimed at restoring medieval monuments according to canons that were as abstract and perfect as they were distant from their historical and material reality, and apply it to the administrative behaviour of landscape protection agencies. The 'fantasy landscape' realised in Tuscany is in fact a perfected and purified one, quite distant from the historical and material reality of the landscape prior to its purification (Giovannoni, 2017). It is quite evident how this landscape, because of its rigidity, is completely incompatible with the need to adapt our living environment to the rapid transformation of climate.

5. Conclusions and policy implications

Climate change poses unprecedented challenges to the adaptation of urban and territorial systems because of the rapidity with which it is taking place and the intensity of the transformations already detectable at the level of the water cycle, heat waves, and fire risk. Our cities are the spatial synthesis of ways of inhabiting space that are often rooted in cultures and traditions thousands of years old and have long transformation times that tend to be incompatible with new scenarios. This paper has shown that in Italy, more than in other countries, there are cultural and psychological barriers that strongly hinder the necessary process of adaptation. The operational and policy implications of the analysis conducted so far are twofold: first, we should combat, especially on a cultural and communication level, the museification of the landscape, emphasizing and stressing its dynamic and adaptive character; second, it is necessary to conceive procedural and regulatory innovations aimed at simplifying climate change mitigation and adaptation planning and at realigning, as far as possible, urban and regional policies to the current operational context so that they can provide a timely response to current climate challenges.

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The increasing entry of the energy subject in spatial planning policies: new visions for energy landscapes

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Abstract

The energy topic is of great concern to our society, because of the increasing tensions of fossil resources supply and emission of greenhouse's gas to the atmosphere resulting in climate change. The landscapes we live in are transforming and becoming increasingly complex in their relationship to energy and we can observe an evolution of the European and national directives and laws progressively increasing the place of energy in spatial planning policies as well as the subject of the ordinary landscape. The spatial planning documents are participating in changes and the evolution of landscapes and they are developing new visions for future energy landscapes. The research explores and compares the spatial planning system in France and the Netherlands, enabling to follow the evolution of two different planning cultures, as they incorporate new relationships between energy and landscape.

Key words: France, Netherlands, renewable energy production, energy sufficiency

1. Energy Transition and Changing Landscapes

From an energy point of view, each territory is an open thermodynamic system with inputs and outputs of energy (Stremke, van den Dobbelsteen and Koh, 2011). In every territory, whether urban or rural, energy is more or less intensely consumed and potentially produced; these actions are closely dependent on local characteristics, both natural (such as topography) and human (technical, economic, etc.) (Mérenne-Schoumaker, 2007). However, over the centuries, we have witnessed a progressive disconnection between society, its territory, and its resources (Magnaghi, 2010), and consequently its landscape. Gradually, due to the exponential use of fossil resources, the link between consumption and production sites has been broken. This rupture has led to the forgetting of the 'localization' of energy resources and has been accompanied by the decline in knowledge and know-how in energy management, which, for example, used to guide the construction of houses according to the correct orientation to benefit from maximum solar gains. Suddenly, all of this was no longer necessary: the power of energy seemed to solve all problems thanks to technological development.
Today, the ecological awareness of the depletion of fossil resources and the environmental destruction associated with their exploitation changes the game. With climate change as a contributing factor, we are witnessing attempts to reverse this trend, and the stakes for a transition towards a low-carbon and efficient energy system are becoming increasingly important in national and international discourse. The current energy transition requires space, with all the implications this entails for the landscape in a nearby 'here' instead of the indefinite 'elsewhere' of fossil resources. On the stage of the energy debate, localization thus brings with it the question of the landscape, where are combined functions related to energy production

from renewable sources, reduction of energy consumption as well as the optimization of energy flows (Stremke, Oudes and Picchi, 2022).

Landscape is here addressed according to the European Landscape Convention (2000) as perceived and conceived by the people and whose character is the result of the action and interaction of natural and/or human factors. So this convention puts a dynamic approach towards landscape and in the Recommendations on the guidelines for its implementation is stated at point E to 'Integrate the landscape dimension in territorial policies' that 'The landscape dimension should be included in the preparation of all spatial management policies, both general and sectoral, in order to lead to higher-quality protection, management or planning proposals' (CM/Rec(2008)3, 1-E). So ELC encourages including landscape concerns in the national planning systems and after the ratification of the convention by the different nations these systems are progressively including landscape, potentially going beyond the preservation of exceptional landscape and in the direction of a more operational and extended concept of ordinary landscape.

Moreover in Europe, after several directives (e.g. energy package 20-20-20 of 2009, REpowerEU 2022) and national laws (e.g. LTECV in France) the energy topic has entered the spatial planning system in national contexts (Lopez, Pellegrino and Coutard, 2019), due to the need to give a regulatory framework, for examples of the choice of sites for renewable energy technologies in territories but also to improve the energy sufficiency in the built environment.

Therefore, potentially planning instruments could combine the landscape and energy topics and address them together. The understanding of this connection could be useful because it is recognized that the planning instruments participate in changes and the evolution of ordinary landscapes (Labat and Donadieu, 2013), so their analysis leads to an understanding if landscape is consciously addressed in these documents and if these landscapes 'changes' are intentionally thought out. Otherwise landscape, conceived as our living environment, could be an unplanned consequence, resulting from the superposition of different planning strategies and actions for energy management.

The research establishes an international comparison between France and the Netherlands, two nations that have integrated strategies for transitioning from fossil fuels to renewable and decarbonized energy sources into their political agendas, as confirmed by the latest documents: 'Klimaatakkoord' 2019, 'Loi Climat et Résilience' 2021. However, there are differences in the timing of their commitment as well as in the public policies and planning instruments linking space and energy that allow to put the results into perspective. Moreover the Netherlands is a nation with a surface area of 1/13 of the French one with a population density about four times higher than the French one, differences that could lead to differences in the way to approach spatial planning.

In the following section we explore the French and Dutch planning instruments to study if, and to what extent landscape and energy are treated together. The guiding questions are: in planning documents when addressing the energy transition process is landscape considered mainly in its visual and esthetical component as something to be preserved? Or is landscape addressed as an evolving and dynamic entity to be planned and designed?

2. The Potential relation between energy and landscape in the planning system in France and the Netherlands

This section is not an exhaustive vision of all the documents and ways in which energy is addressed in the planning system, but the goal is to give a general overview illustrating the type of documents existing in the two nations and their possible link with the energy and landscape topic.

In France we assist to a progressive inclusion of the energy topic in the spatial planning documents, in particular with the two Laws 'Grennelle de l'Environnment' (2009-20010), which emphasised the trend for a territorialization of climate and energy policy in France (Nadai et al. 2015) and which introduced a new planning documents the 'Plan climat énergie territorial' [Territorial climate energy plan] (PCET) compulsory for municipalities or inter-municipalities with more than 50.000 inhabitants. Subsequently with the law 'Loi transition énergétique pour la croissance verte' [Law energy transition for the green growth] (LTECV) the PCET become the 'Plan climat aire énergie territorial' [Territorial climate air energy plan] (PCAET), becoming compulsory for all municipalities and inter-municipalities counting 20.000 inhabitants, therefore greatly expanding the number of local communities that need to develop this plan, compared to the PCET.

In France, the energy topic seems to be more prominent in the planning system when compared to the Dutch one, because there are compulsory and specific documents which have to treat the energy subject at all the territorial levels, such as the 'Schéma régional d'aménagement de développement durable et d'égalité des territoires' [Regional scheme for spatial planning, sustainable development and territorial equality] (SRADDET) setting energy ambitions for the region and the PCAET a document that focuses on climate, air and energy to establish goals for a territory (inter-municipality) on short and long terms and to define actions, to implement them. Moreover there are other planning documents that address several subjects including energy. One is the 'schémas de cohérence territoriale' [Territorial Coherence Scheme] (SCoT) a planning instrument that guarantees the implementation of strategic inter-municipal planning and it ensures the reference framework and coherence with different sectoral policies such as infrastructure, mobility, energy and climate, etc. Another document is the 'plan local d'urbanisme intercommunal' [Local urban inter-municipal Plan] (PLUi), a planning instrument at inter-municipal scale, that determines a global project for spatial and urban planning and which determines the conditions for land use and its development. This document could integrate several energy topics, such as the development of wind parks, photovoltaic parks, heat networks and energy sufficiency. For example, the PLUi could impose on new construction a minimum amount of renewable energy production and insulation.

In the Netherlands, the planning system, fixed by the 'Wet Ruimtelijke Ordening' [Spatial planning act] (WRO) of 2008, is more flexible and seems to favour integrated planning instruments (Janssen-Jansen and Woltjer, 2010). Compulsory energy focused planning documents that all provinces or municipalities have to elaborate do not exist. However the importance of introducing energy in planning instruments is recognized and it is compulsory to deal with energy, both from a renewable energy production than energy sufficiency perspective, in the *structuurvisie* [structural vision] which defines the strategic point of view for spatial development, and set actions for the provinces and for the municipalities. Every tier could

develop several *structuurvisie* that could be centered on a specific topic (e.g. agriculture) or that could be cross-sectoral. Moreover in the zoning plan (*bestemmingsplan*), which establishes the land uses, their development and regulations at municipal level, energy topics could be included for example defining the areas for renewable energy production and the rules on how to implement them.
A particular approach is reserved, however, for the wind turbine planning policy, following the Energy Agreement for Sustainable Growth (2013), which settles the national objective of 6000 MW of electricity production from onshore wind turbines. The national government required provinces and municipalities to integrate it in their planning instruments, defining suitable areas on national territory for its implementation, in a very top-down perspective. The only national *structuurevisie* that is energy focused deals with wind energy development (Structuurvisie Windenergie op land, 2014). This planning system is now in progress of changing due to the Environment and Planning Act [Omgevingswet] that came into effect in 2024.
Concerning the connection between landscape and energy in several French and Dutch planning instruments there is the possibility to establish a connection, but this is left to the discretion of local institutions in both countries. This means that in the Netherlands in the *structuurevisie* of provinces and municipalities or in the municipal *bestemmingsplan* these topics could be adressed together, although there is no obligation to do so. France seems to be potentially well equipped to enhance this integrated vision through the PLUi and SCoT, that operate at an inter-municipal level and deal with both energy and landscape concerns, and therefore could create synergies between the two subjects.
In particular now, the relationship between landscape and energy is specifically mentioned for the elaboration of the SCoT. It can be read in the orientation and objective document in Article L. 141-4 3° of the Urban Planning Code that the SCoT relies, among other things, on 'the preservation and enhancement of landscapes, with the objective of integrating and enhancing the landscape quality of various human activities, notably renewable energy production and transportation installations.' On the other hand, the French PCAET which is the energy and climate focused, do not have to address any link with landscape, and often even a spatial approach is not addressed.

3. The Path towards Energy Transition of three Territories

In order to give insight on how these energy landscape topic is treated specifically in planning documents, at different scales, three territories are analysed: two 'Territoires à énergie positive' [Energy positive territories] (TEPOS) in France, the Community of Communes (CC) des Monts du Lyonnais and the CC du Thouarsais, and one in the Netherlands, the municipality of Goeree-Overflakkee (Province of Zuid-Holland/South Holland). All three territories have set ambitious energy goals both from renewable energy production and energy sufficiency at the horizon 2030-2050, with an affirmed intention to integrate them with landscape considerations. Although they could not be defined as representative for other territories, the reason to choose them was: to inquire about possible 'best practices' of what is feasible to accomplish. The results, however, draw attention to several limits on how landscape and energy transition are

included in these documents. These territories, comparable in dimension and are rural, but also include urban areas, and are they are characterised by 'ordinary' landscape, meaning that they are not the object of particular degree of safeguards for heritage or natural characteristics (e.g. UNESCO).
The case studies were explored through an analysis of the different planning documents, from the regional to the inter-municipal and municipal scale and completed by semi-structured interviews with the technical services in charge of the development of the planning documents as well as elected representatives.

3.1 *Communauté de communes* Monts du Lyonnais

The idea of commitment to the energy transition process of the CC of Monts du Lyonnais started in connection with the building sector in 2006. According to the interviews developed with the energy transition technical service and an elected representative, the starting point of the gradual commitment to the transition process was the creation and development of the 'Parc Eco Habitat' a resource and information centre about retrofitting techniques and environmentally friendly construction.
Subsequently the local institutions of the CC Monts du Lyonnais were awarded the call for 'expressions of interest' (AMI) launched by ADEME and the Rhone-Alpes region in 2012, to encourage territories to commit and achieve TEPOS objectives for 2050. So in 2013, territorial local institutions engaged in a volunteer PCET thanks to the economic support of the AMI-TEPOS award call. Subsequently and according to the news rules settled by the law LTECV of 2015 the CC Monts du Lyonnais developed a compulsory PCAET.
The landscape perspective was introduced in 2013 through the development of a landscape plan financed by the ministry of environment and finalised in 2017, in order to be included in the SCoT that was in the process of revision and update. In the commission of the landscape plan the energy issue was not explicit in the initial request, but it emerged as a priority during a public workshop with local stakeholders such as elected officials, technicians, and residents, organised by the landscape architect responsible for developing the landscape plan. Several topics were displayed based on the landscape analysis, and the present stakeholders had to choose among the priority objectives, with energy being highlighted. However, according to the interviews the landscape plan, even if it was centred about energy, it was not really used to support the elaboration of the PCAET which started in 2016.

3.2 *Communauté de communes* Thouarsais

The local institutions have since long addressed the energy subject in the territory of CC Thouarsais, through the development of renewable energy projects, where in 1984 a swimming pool heated with solar panels was constructed. Since then several projects followed, one of the bigger was the 'Technologies Innovantes pour la Production d'Énergies Renouvelables' [Innovative technologies for renewable energy production] (TIPER); with the objectives of high rates of renewable energy production from several different technologies: photovoltaic, wind energy, biogas, in an area with polluted ground soil. This interest and commitment towards the

energy subject, that also allowed economic implication, brought the CC Thouarsais to be one of the founder territories of TEPOS network in 2010.
In this context the elaboration of the landscape plan of the CC Thouarsais has been conceived from the beginning by local institutions with a primary focus on achieving energy objectives to become TEPOS. The landscape plan comes in 2017-2018 at a time when the CC was developing a PCAET in which the development of additional wind turbines, photovoltaic and biogas projects were addressed. The landscape plan was seen as a tool capable of informing a renewable energy development more grounded and integrated in the landscape. Moreover the landscape plan fed into the PLUi, which was being developed during the same period, and particularly the territorial institutions decided to elaborate an 'Orientation d'aménagement et de programmation' [Planning and Programming Orientation'] (OAP), a part of PLUi, on the theme of 'Energy and Landscape' focused on wind energy development to establish a framework and a support tool for deploying new parks well integrated into the landscape. It is interesting to note that this OAP is binding for local institutions, whereas a landscape plan is not, stressing the importance for the CC to develop defined orientation for the development of wind parks on the territory, which were starting to raise some opposition.

3.3 The municipality of Goeree-Overflakkee

In Goeree-Overflakkee the starting point to engage in energy spatial planning has been the Energy Agreement for Sustainable Growth (2013), which sets goals at national scale for energy sufficiency of 100 PJ and a production of 6,000 MW of onshore wind energy by 2020. The local institution of Goeree-Overflakkee in 2013 commissioned a landscape architecture firm to create a document linking landscape and energy: 'Goeree-Overflakkee, Sustainable Energy in the Landscape.' This document was developed following the definition of national goals, distributed top-down among the different provinces, where the municipality, given its low population density, was identified for the production of 300 MW of onshore wind turbines.
The aim of this landscape study was to analyse the current state and develop different scenarios for analysing local resources and the location of renewable energy production facilities in the landscape going beyond just wind energy. This study served as a tool for understanding and supporting negotiations with the Province of Zuid-Holland for a reduction to a wind production of 225 MW, filling the gap with an energy mix from photovoltaic panels and biogas production, considering the agricultural and breeding activities of the territory.
Moreover the document contributed to developing the provincial-level planning *Structuurvisie Ruimte en Mobilitiet* (2014) [Structural Vision for Space and Mobility] and at the municipal-level the urban documents like *Structuurvisie Goeree-Overflakkee windenergie* (2014) and *bestemmingplan* [zoning plan]. This landscape document was particularly used for defining wind development zones and criteria on how to implement them.
Recently, following the 'Nationaal Klimaatakkoord' [National Climate Agreement] in 2019, a new national program called 'Regionale Energie Strategieën' [Regional Energy Strategies] (RES) has been introduced in the Netherlands. This program, led and coordinated from national to municipal level, mandates the development of territorial energy strategies for the 30 identified territories covering the entirety of the Netherlands. Each territory must outline in its RES how and to what extent it will contribute to the production of renewable electricity, the

transition of the heating system in the built environment, as well as energy storage and infrastructure. The national objective is to produce at least 35 TWh of electricity from renewable sources and reduce CO2 emissions by 49% by 2030. It is explained that the different territories have 'to make the *Regionale Energie Strategieën* (qualitative and quantitative) spatially possible' (Climate agreement., p. 223). The local institutions of Goeree-Overflakkee were among the first to commission a consortium of architects, landscape architects, urban planners, and engineers to conduct a study on three spatial and landscape energy scenarios for the development of Regional Energy Strategy: 'Energy Production in Goeree-Overflakkee. Scenarios for Sustainable Energy Supply by 2030' (2017). The three scenarios address renewable energy production through a technologies mix, as well as consumption reduction and optimization of flows, also addressing building renovation and transport infrastructure systems. These documents are the basis for developing and implementing the new Environment and Planning Act [Omgevingswet], which is in progress, and changing the content and process of the previous planning system.

4. A Crossed Perspective of the Planning Documents of the French and Dutch Territories

4.1 Connection between Landscape and Energy in the Planning Documents

Table 1 sums up the results found in the analysed documents between energy transition, operational principles and their connection or not to the word landscape. I inquired about energy principles which are defined both as operational principles which implementation could impact landscape changes (e.g. development of wind turbine and photovoltaic panels), but also as spatial/landscape design principles which, if implemented, could improve energy management (e.g. building orientation to maximise solar gains). In the table renewable energy production and energy sufficiency measures are addressed separately, because they are each energy transition pillars for which distinctions appear in planning documents.

Table 1, Sum up the energy transition highlighted actions appearing in planning documents in the three analysed territories, highlighting their connection with landscape. The landscape plan and the Dutch landscape focused report. Green background colour corresponds to the explicit connection of the energy action with the word 'landscape' word. The white background colour means that the action detailed could lead to landscape repercussion but the connection is not established in the document.

	Renewable energy production	**Energy sufficiency**
CC MONTS DU LYONNAIS (FR)		

SRADDET- Schéma régional d'aménagement de développement durable et d'égalité des territoires - 2019	Wind turbine implementation: landscape preservation	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
SRCAE - Schéma régional du climat, de l'air et de l'énergie - 2014	Wind turbines and on ground PV implementation: landscape integration	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
	Hydroelectric, wood energy, biogas technologies implementation	
SRE - Schéma regional éolien - 2012	Integrating wind turbines in landscape from the site choice to their implementation phase: landscape design principles	/
PCET - Plan climat énergie territorial - 2015	Wind turbine implementation: landscape preservation	Compact settlements form, building retrofitting, slow mobility, etc.: spatial designing principles for low energy consumption
	Biogas, photovoltaic panels, hydroelectric technologies implementation	
PCAET - Plan climat aire énergie territorial – 2019	- Wind turbine implementation: landscape preservation -Wood-energy sector: exploitation and preservation of the forest as a strong element in the landscape	Compact settlements form, building retrofitting, slow mobility etc.: spatial designing principles for low energy consumption
	Biogas, photovoltaic, hydroelectricity facilities implementation	
SCoT - Schéma de cohérence territorial - 2016	- To develop a mix of RE technologies projects: landscape integration - PV implementation: landscape integration	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
Plan de paysage - 2016	PV panels implementation and wood energy sector development: landscape design principles	Energy building retrofitting: landscape design principles
CC THOUARSAIS (FR)		
SRCAE - Schéma régional du climat, de l'air et de l'énergie – 2013	Development of trees and hedges for wood energy: landscape as a basis for the development	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
	Wind turbines, photovoltaic panels, solar heating, biogas power plant,	

	agrofuel, geothermal technologies implementation	
SRE - Schéma regional éolien - 2012	Wind turbines, landscape design integration principles and site plans	/
SRADDET - Schéma régional d'aménagement de développement durable et d'égalité des territoires - 2020	- Implementation for wind turbines and PV parks: landscape preservation	Compact settlements form, building retrofitting, slow mobility, etc.: spatial design principles for low energy consumption
PCAET - Plan climat aire énergie territorial - 2018	- Implementation for wind turbines and PV parks: landscape preservation - *Bocage* landscape suitable for the development of wood energy sector	Energy building retrofitting, raising inhabitant awareness of territory inhabitants: spatial design principles for low energy consumption
	Biogas, solar heating, geothermal technologies implementation	
SCoT- Schéma de coherence territorial - 2018	RE technologies implementation to be reconciled with landscape issues	Building retrofitting, new high energy performance buildings, slow mobility, etc.: spatial design principles for low energy consumption
PLUi - Plan locale d'urbanisme intercommunal- 2018	RE development in agricultural land holdings: landscape integration	Compact settlements form, building retrofitting, new high energy performance buildings, slow mobility, etc.: spatial design principles for low energy consumption
	- Possible rules derogation for RE technologies implementation in buildings -Specific principles for PV integration in buildings.	
Orientation d'aménagement et de programmation (OAP), landscape & energy – 2018	- Landscape design principles for wind turbine site plans - design principles for landscape integration	/
Plan de paysage – 2018	- Energy transition landscape analysis - Wind turbines, photovoltaic panels, wood energy, biogas technologies implementation: listing of landscape design principles (there is no a detailed action plans)	Energy building retrofitting, slow mobility, local food production systems, raise awareness about sustainable behavior: listing landscape design principles (there is no a detailed action plans)

GOEREE-OVERFLAKKEE (NL)		
Structureevisie windenergie – 2014	Wind turbine site choice for implementation. Landscape design principles	/
Structureevisie Goeree-Overflekkee – 2011	Implementation of a RE technologies from a mix of sources (wind, sun, tidal, geothermal): possible landscape compensations	Energy building retrofitting, building by good solar orientation: spatial design principles for low energy consumption
Bestemmingsplan (zoning plan)	- Principles/rules for wind turbines and photovoltaic panel facilities implementation. - Site choice for wind turbines and on ground photovoltaic parks.	Rules for energy-saving measures in building, to avoid sprawled settlement: spatial design principles for low energy consumption
Landscape report: 'Goeree-Overflakkee. Sustainable energy in the landscape' – 2012	Landscape design principles for RE technologies implementation	/
Landscape report: 'Energy producing Goeree-Overflakkee. Scenarios for making the energy supply more sustainable until 2030' - 2017	Several scenarios for RE technologies (wind turbine, photovoltaic panels, tidal, geothermal) implementation: landscape design principles.	Several scenarios for energy building retrofitting, high-performance new buildings, slow mobility: landscape design principles for low energy consumption
Province Zuid-Holland Structureevisie Ruimte & Mobilitet. Visie - 2014	- Wind turbine implementation: landscape integration - Photovoltaic parks: landscape impact Geothermal implementation	Energy cascading from industrial, to residential, energy building retrofitting, high energy performance buildings, slow mobility, etc.: spatial design principles for low energy consumption
Province Zuid-Holland Structureevisie Ruimte & Mobilitet. *Programma ruimte* (spatial program) - 2014	- Wind turbine implementation: landscape integration - Photovoltaic parks: landscape impact Geothermal implementation	Energy-efficient buildings, heat networks, etc.: spatial design principles for low energy consumption
Province Zuid-Holland Structureevisie Ruimte & Mobilitet. Verordening ruimte (spatial regulations) - 2014	Wind turbines implementation	/

The first visible result is that landscape direct concern both in France and in the Netherlands is associated with wind parks. The landscape impact of renewable energy technologies implementation remains the most debated landscape issue towards energy transition in France as in the Netherlands. Wind turbine implementation principles are directly related to their landscape impact most of the time. Here is where landscape is mostly addressed by a preservation point of view. This is followed by the landscape concerns around PV parks on the ground, connected to the visual impact and also about preserving agricultural land.

The preservation of landscape aesthetics is a point of view broadly addressed everywhere and to which is recognized much attention especially for the development of renewable energy technologies in order to 'preserve scenic values' (e.g. Apostol *et al.*, 2016) even if aesthetics and sentiment of beauty is recognized to be something variable through time and space.

However the majority of documents address several types of renewable energies technologies implementation, such as biogas power plants, but there is no direct connection with landscape characteristics in these cases. We find this primary focus on wind turbines also because there are several specific planning instruments devoted to wind turbines, for instance, the obligatory 'Scheme regional eolienne' [regional wind turbine scheme] (SRE) at regional level in France, or the wind energy and landscape OAP voluntarily developed in the CC Thouarsais, or in Goeree-Overflakkee the *structuurvisie windenergie*. There are no other documents specifically developed about other renewable energy technologies such as photovoltaic parks. However, in France, the law LTECV introduced a new document the 'schéma régional biomasse' [regional biomass scheme] with the goal to estimate biomass potential and its accessibility in the region in order to facilitate the development of renewable energy production. This shows an enlargement, compared to the sole wind turbine SRE focus, but in the territories under analysis these documents were still under elaboration with no possibility to examine them. In the Netherlands it is possible to develop several *structureevisie* about different topics estimated to be of relevance for the territory. In Goeree-Overflakkee, regarding energy transition, only the one wind-energy exists, showing that, as compared to other sources, their site plans and implementation remain the main concern. Indeed, the binding regulations of the Province Zuid-Holland in its *structuurvisie Ruimet & Mobilitat*, relating energy transition concerns, addresses only wind turbines.

Another point that the Dutch and French planning documents have in common is that energy transition and landscape are developed in separate chapters (e.g. SCoT Monts du Lyonnais, *structureevisie GoereeOverflakkee*), complicating the articulation between the two and showing how they are not easily associated.

Another result identified is that none of the French and nor Dutch planning instruments have landscape associated with energy sufficiency measures, except for the French landscape plans and the second landscape report of 2017 of Goeree-Overflekkee, but these documents are not regulatory and binding. Compulsory planning instruments highlight principles that, from a spatial/landscape planning and design perspective, could encourage reducing energy consumption. However their potential landscape effects are not addressed at all, even if the changes required in urban areas could be extensive (e.g. external isolation, compact urban form).

Moreover, for the French case, the PCAET document being energy-climate-air centred is a very relevant document for territory analysis and fixing energy goals. Nevertheless, it lacks explicit

insight into spatial/landscape dimensions that could be a significant and valuable support in establishing energy goals (e.g. exploration of available surface area and sites for photovoltaic or wind turbines) as well as the way to achieve them (e.g. establishing synergies among functions). An interesting tool could be the introduction of energy potential maps (e.g. Oudes and Stremke, 2018) representing solar or wind but also biomass potentials as well as heat cold storage sites that could be further exploited through a cascading process. Indeed this kind of representation requires reliable data at a local level, that are in many cases not available and needs to be crossed references with the other characteristics and resources of the territory (e.g. topography, etc.).
In the Netherlands there is not a specific energy planning instrument even if *structuurvisie* could be dedicated to energy topic. However, a new instrument has been recently introduced through the Dutch *Nationaal Klimaatakkoord* (2019): the *Regionale Energie Strategieën*, that, as explained above, aims to define energy targets while considering its spatial component, for all Dutch territories covering all the Netherlands. Unfortunately, the translation of this instrument in the new planning system introduced by the environmental act is still ongoing and no further exploration could be done during the research period. However, this shows how, in the Netherlands as in France, energy transition development is left less to the discretion of local institutions and strongly encouraged.

4.2. The need for quantitative high resolution energy data for spatial planning

Another point of discussion is the accessibility of spatial data for energy. The difficulties to access statistical disaggregated data on energy could be defined as an impediment for further insight about the spatial components of energy within territories. Indeed, it is needed in order to develop more spatial conscious and efficient projects that connect energy supply and demand. We acknowledge that for now, in France as well in the Netherlands, the electricity produced is injected in the main power grid, so the energy produced somewhere in a photovoltaic park could be used at a distance far away, and the grid handles fluctuations that are intrinsic to renewable energy production. Nevertheless, the idea to have a better comprehension of the local consumption and production from a spatial perspective is valuable in order to better answer the needs of the territory and to establish synergies among functions.
Several critical points could be stressed, in particular a difficult access to statistical data about energy at local scale. Not all territories have stats available on general energy production or consumption nor by sector for each municipality. For example, for CC Thouarsais, data about energy for the development of the PCAET is only at the *communauté de communs* (grouping many municipalities) scale, and lacks precise information about locations. The CC Monts du Lyonnais benefits from the more complete open statistical data provided by the region, 'Observatoire Régional de l'Energie et des Gaz à Effet de serre' (OREGES), which provides energy data at municipal level as well as from a historic perspective. But the data remains incomplete and figures about industries are almost totally absent. The CC are using them to develop the PCAET. In the Netherlands for the province of Zuid-Holland, data are at the territorial (group of municipalities) level, and in some cases at the municipal level. However

this topic has been directly addressed in connection with the development of the *Regionale Energie Strategieën* for all the Dutch territories and the construction of a database is in progress. In order to better understand the topic I led a parallel investigation in order to find the energy data used for the planning documents, and see if other more local high resolution data were accessible. I contacted the offices that backed the technical services departments of the territory under analysis and other accessible databases, such as the regional office. One of the main problems is that for privacy issues the data on energy consumption for the industrial sector are not made public. This absence is, for example, mentioned in the PCET of CC Monts du Lyonnais that underlines this approximation ('PCET SIMOLY'2015, 26). This difference in data disaggregated is found in the lack for example of maps in the PCAET of CC Thouarsais, resulting in no illustrations of spatially local potential and consumption.
The need for high resolution data on energy and their difficult access aligns with the results from other research that explored this gap, showing how the connection between local data on energy and territorial characteristics (e.g. building age) could actively support the definition of a strategy for energy consumption reduction (Pincetl *et al.*, 2016). Some research also emphasises the need to access spatio-temporal dimension and how this data could be useful for environmental designers and urban planners to implement tailor-made energy strategies (Voskamp *et al.*, 2016).

4.3 Sectors including energy goals and a landscape perspective in planning documents

Throughout the studied planning documents, energy transition is addressed across sectors, housing, transport, agriculture, and industry. However, the connections between these sectors and landscape are few and not clearly established in the documents.
I noticed that all the actions regarding energy sufficiency such as the implementation of external insulation in buildings or the implementation of paths and streets for low mobility are not directly associated with landscape.
The same could be said for the agricultural sector that, especially considering the rural character of the analysed cases, could play a major role toward achieving energy goals, through biogas production, biofuel production, wood energy, etc. For this sector, again connection with landscape is under-evoked. Yet all these actions could induce major landscape changes through possible changes in agriculture: the type of crop cultivated, new trees and hedges plantations, etc., beyond the installation of the biogas power plant itself. We found some association made to landscape in the CC Thouarsais's PCAET relating to the implementation of a hedge system for wood-energy sector development. However, the connection is absent in the regional planning instrument (SRCAE). Landscape is mentioned in connection to agriculture when these documents explain how the implementation of PV parks should respect and preserve food production.
Beyond the landscape impact, some research has shown how a better analysis of biomass production for energy from a spatial perspective could lead to better choices in scale for implementation and improving positive social impact (van der Horst and Vermeylen 2011). Moreover it is explored how landscape viewpoint could sustain conscious choices on more suitable areas for biomass development (Howard et al. 2013).

Another sector for which landscape is not entered in the discussion is the industrial sector. Even if the industrial sector is stressed in the French document, such as the PCAET, and in the Dutch ones there is no clear connection with spatial perspectives. The industrial sector is primarily connected to improvements for energy efficiency where machines are used to reduce energy demands, an aspect hardly connected with landscape. However, in the planning document some focus exists on identifying waste energy/heat to be re-used in other nearby manufacturing facilities, companies, etc. For this energy cascade a spatial analysis of proximity among industries and areas could back the process.
However, in the Dutch case, it is mentioned the idea of heat energy cascade from Rotterdam's industrial harbour to the residential areas in the landscape report of 2017. This gives prominence to the idea that these two topics are starting to be linked.

5. Are Planning Documents Moving towards Integration between Energy Transition and Landscape?

Planning instruments carry a project framework to shape the future of territories. In this paper I explored the way they address energy transition and landscape together and what role is given to landscape design and planning from an institutional perspective in the energy transition process.
Generally speaking, from the French planning documents emerge a preservation, aesthetic vision of landscape, connected to heritage and natural beauty, which persists in connection with the energy transition issues and renewable energy technologies in particular. The same attitude was found in some Dutch documents as well, however it is accompanied by a more explicit landscape design attitude. In Goeree-Overflakkee, every time that local institutions settled energy goals a landscape document was commissioned to inform the decision-making, and integrate the planning system. This difference could have its roots in the traditional attitude towards landscape, which varies between the two nations. In France, landscape has long been associated with nature and heritage in legislation (Donadieu, 2012). In the Netherlands, this attitude coexists with a strong planning and project perspective (e.g. de Jonge, 2009), in a land that is mainly considered as man-made.
It would be interesting for the years to come to follow this inquire questioning the 'Zone d'accélération de la production d'énergies renouvelables' [Renewable energy production acceleration zone] introduced by the law accelerating the production of renewable energies (APER) in 2023, and see if an evolution in the relations with landscape will occur. The same could be said for the Netherlands where the enter into force of the Environment and Planning Act [Omgevingswet], at the beginning of 2024 introducing a new planning system will lead to changing in the relations between landscape and energy.
Moreover another path to further explore is that, the actual results show an understanding that spatial organisation could affect energy sufficiency but it is not directly connected to the idea that it could lead to landscape impact or change. And vice versa, the landscape viewpoint is not considered to be useful as leverage to improve energy sufficiency. Nevertheless, in the Dutch context, with the progressive entry into force of the Environmental act [Omgevingswet], a connection could be observed between reduction of energy consumption and landscape. Indeed

even if renewable energy technologies are visible in landscape energy sufficiency measures remains one of the major challenges for the years to come, requiring a profound restructuring on how to plan, design and inhabit our territories, cities and their landscapes.

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Re-definition(s) of the role of Central Business Districts under the effect of extreme heat conditions and Climate Change: Evidence from the Mediterranean context.

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Abstract
Central Business Districts have always been the loci of major transformation, redevelopment and constant re-definition(s) regarding their role within large urban territories. Climate Change combined with Urban Heat Island, could render CBDs particularly vulnerable to extreme heat conditions and persistent heatwaves, affecting their key functions and quality of life. This work investigates the above issue through a case study in Athens, a densely populated Mediterranean urban agglomeration. Methodology involves identification of key aspects of the CBD structure that increase its vulnerability to extreme heat waves and related hazards and pressures. Our conclusions state that Climate Change could eventually lead to changes in urban structure, affecting existing CBDs and possibly favoring relocation of activities towards other city zones, where climatic conditions will be more favourable.

Keywords: Central Business District, Climate Change, Heatwaves, Urban Structure, Urban Planning, Athens

1. Introduction

In the summer of 2023 an extreme heatwave stretching from Miami and Texas to Arizona and California has led to unprecedented record-breaking temperatures, most notably in Phoenix with a 31-straight-days with over 43.3 °C record. During the same period, in the Mediterranean air temperatures hit 46°C in Rome and Madrid, with major cities suspending certain functions, temporarily banning outdoor working and outdoor events, and taking precautionary measures to protect human population from extreme heat conditions and consecutive heatwaves. Generally, the persistent heatwaves of July 2023 have largely affected several Mediterranean capital cities including Madrid, Rome, Athens and Lefkosia (Figure 1). More cases worldwide have been reported where extreme heatwaves due of unprecedented nature are linked to partial lockdowns in urban metropolitan areas, putting urban life on pause[1].

The common driver and accelerator behind such conditions is Climate Change. Since the last quarter of the 20th Century, Planet Earth has entered an accelerating global warming phase, with the mean surface air temperature on land reaching about 15°C (14.98°C in 2023), i.e. a +1.09 in 2011–2020 period in respect to the pre-industrial levels and the 1850–1900 average (IPCC, 2022). This increase practically means that winters are expected to be less cold, while summers will be warmer and with more heat extremes. Globally, the last ten years have been the warmest on record, while the summer of 2023 has official been declared as the hottest summer on record (https://climate.copernicus.eu/summer-2023-hottest-record).

[1] https://www.bloomberg.com/news/articles/2023-08-02/heat-lockdowns-are-the-new-covid-lockdowns,

https://www.telegraph.co.uk/global-health/climate-and-people/sudans-heatwave-school-closures-children-lockdown-africa/

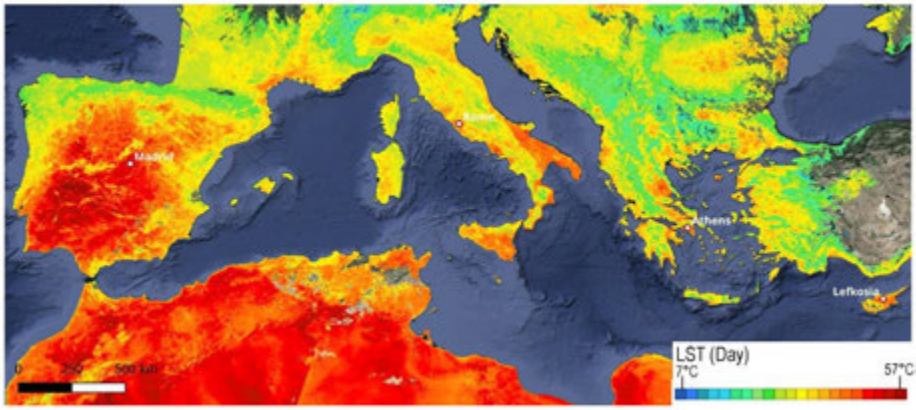

Figure 1. Land surface temperature (day time) across South Europe and parts of northern Africa during the heatwave of 10 July 2023 (source: Google Earth Engine, 'MODIS/061/MOD11A1').

While significant uncertainty remains regarding the exact future climatic conditions and related hydrological phenomena at the regional level, one thing is certain: Global warming will result into longer and more frequent extreme heatwaves in many regions, directly affecting current standards of living, and causing an increase of human thermal discomfort. This can be translated into significant problems predominantly in urban areas of high exposure to such climatic conditions, where the concentration of people and infrastructure in maximized. According to the Intergovernmental Panel on Climate change (IPCC, 2022), in urban areas climate change has caused adverse impacts on human health, livelihoods and key infrastructure including transportation, water, sanitation and energy systems, with resulting economic losses, disruptions of services and negative impacts to well-being. Moreover, compound hazards are expected to occur more often as heatwaves could possibly be accompanied by droughts, wildfires, flash-floods and other weather extremes, that could expose the fragility of urban infrastructures and resources.

A major parameter of climate change in urban areas is that heatwave impacts are multiplied by the Urban Heat Island (UHI) effect. UHI is a phenomenon where urban centers experience higher ambient air temperatures than surrounding suburban and rural areas, that are less urbanized (Sánchez-Guevara et al., 2017). UHI is often quantified through air temperature differences or surface temperature differences (Peng et al., 2012). UHI is most notable during the evening and night hours, as impervious surfaces and buildings release the heat absorbed by solar radiation during the daytime. The relationship between Urban Heat Island and urban form is a complex one, with street canyon effects, wind speed, blue and green urban infrastructure, along with traffic conditions, and energy functioning of buildings playing a crucial role (Xu et al., 2019; Luo et al, 2020). Generally, the spatial distribution of heatwaves within urban areas is influenced by building density and impervious surfaces (do Nascimento, 2022), land use structure, and intra-urban microclimatic variation (e.g. due to the effect of a coastal zone) (Luo et al., 2020). Researchers are also exploring the linkage between urban heat island and urban pollution island, as heatwaves are associated with higher concentrations of pollutants (Ulpiani, 2021). Heatwaves in urban areas result into positive heat loops at a local scale: a heatwave is followed by a rise in energy use for cooling, and the associated discharge of anthropogenic waste heat from the buildings to the environment increases (Luo et al, 2020).

The above remarks are particularly relevant when considering the South European/Mediterranean context. At a general level, Europe is considered to be a Climate Change hotspot, warming more rapidly than the rest of the planet (EEA, 2023). Heatwaves in Europe are responsible for more deaths than other natural hazards and disasters, including floods, hurricanes and earthquakes, with the highest heat-related mortality rates reported in Italy, Greece, Spain and Portugal (Ballester, et al., 2023). While in Central and North EU cities like London, Paris, and Warsaw, heatwaves last for just a few days and are mostly perceived as "Climate Change evidence", in EU-South capitals like Madrid, Athens, and Rome, record-breaking temperatures and heatwaves are largely undermining the citizens' quality of life lasting for several weeks or even months. Mediterranean ranks among the top five regions globally demonstrating significant increasing trends in the intensity, maximum duration, frequency, and cumulative heat of heatwaves (Perkins-Kirkpatrick & Lewis, 2020). In such cases, heatwaves could pose particular stress on energy systems, have drastic consequences on food production, discourage tourism traffic, while everyday functioning is also severely affected.

In this research I focus on how central city areas widely known as the Central Business District (CBD) are be affected by extreme heat conditions and persistent heatwaves as Climate Change unfolds. CBD areas have long been the nuclei of economic and social life within metropolitan areas, while being particularly dynamic, undergoing major changes through different urbanization cycles, including suburbanization, de-urbanization and re-urbanization processes. Climate Change could impose a new process of urban restructuring, particularly affecting CBD areas in certain metropolitan regions where extreme heat risk is maximized. Our main hypothesis is that the "vibrant" character of such central districts could be largely undermined for considerable periods of time, possibly resulting into a redefinition of their role and imposing changes in the city form and structure in the long term.

To examine this hypothesis, I first delve deeper into the historical role of CBDs, also examining recent transformations taking place in terms of urban form and structure. At a next section I present the major challenges posed by extreme heat conditions on CBD areas, through a case study in Athens, i.e. a typical large metropolis of the Mediterranean region. Methodology is based on the identification and examination of the key dimensions of the urban spatial structure of the city center, and the assessment of their vulnerability to the increased exposure on heatwaves. The conclusions provide links to urban planning and spatial adaptation issues, while considering the possibility of new climatic conditions favoring more decentralized spatial arrangements.

2. Central Business Districts: Conceptualizations and dynamics

Cities are usually conceived as the spatial outcome of economic processes, with contemporary city growth being driven by agglomeration economies. Since the early scientific conceptualizations of city-structure by scholars of the Chicago School of Anthropology, the crucial role of Central Business District has been underlined. Ernest Burgess in his concentric rings model identifies CBD as the focus of commercial, social, civic life district, and also the headquarters of economic, social civic and political life. According to Murphy and Vance (1954), CBD is the heart of the city where the greatest concentration of offices and retail stores is found, reflected in the cities highest land values and tallest buildings, while it is also the focus of pedestrian and automobile traffic. According to Drozdz & Appert (2010) a CBD is a "unique area of massive concentration of activities and focus for the polarisation of capital, economic and financial activities in cities". Key geographical attributes of CBD are: a) prime

accessibility/centrality in transportation terms (Murphy, 1979) and b) concentration/density of key urban activities and land uses McColl, 2005).

Based on a concentric rings' approach (Park & Burgess, 1925), CBD zones are usually coinciding with the oldest and more central city parts with large-scale redevelopments and high-rise office and administrative buildings pushing housing further out. CBD monofunctionally in US cities can be explained by economic rand rent processes: As a city grew in size, competition for land at the center resulted in land values so high that only business could afford. It is certain though that CBDs also present considerable internal variation, even within the same city. According to Murphy (2007), there is a tendency toward regionalization of specific functions (financial areas, hotels sections, theater grouping, night clubs and other specialized localities).

A relatively different context regarding CBD structure is observed in the EU-Mediterranean model of urbanization, where central city areas have traditionally been the place of residence of the upper class, while the labor class has settled in the periphery. This is what Leontidou (1990) has defined as an inverse-Burgess model. CBD areas in the Mediterranean, usually coincide with historical city centers and have been characterized by high population densities. Urban layout can be more organic, especially in the oldest parts of the city where streets are narrow and built-up coverage is very high. Land uses are highly mixed and differentiated vertically, with commercial shops occupying the ground-floor and apartments occupying the rest floors. Unlike American-style cities where a sudden collapse of built-up density and building heights is observed as one moves out from the CBD, in Mediterranean cities density gradients are "smoother", following a pyramid-like structure of building heights from the core to the outer rings. Particularities of urban form and structure of the Mediterranean core-city zones are important parameters related to the distribution of public spaces and green urban areas, also affecting microclimatic conditions and energy behavior at the urban scale (Tsirigoti & Bikas, 2017).

It is important to note that CBDs are not static but rather dynamic elements within the city structure, usually undergoing major changes. Conceptualized in functional terms and not as spatially fixed high-rise structures around central metro stations, CBD zones could expand their boundaries, spread into new areas or withdraw from others. Deteriorating housing conditions and social deprivation has been a well-documented process of urban decay of city-core areas (Broadway, 1989; Hall & Barrett, 2012). Dynamics are also particularly important at the metropolitan/regional scale. According to Soja (2000), in the postmodern metropolis the periphery is gaining more importance with the emergence of a polycentric or even totally dispersed urban form. Under such de-urbanization processes, downtown areas can lose their significance. Recently, however, processes of re-urbanization are being observed at least in the European territory (Salvati et al., 2019). Large-scale urban regeneration projects, real-estate driven gentrification of central city areas, and expansion of the tourism sector, are key factors currently affecting CBDs in Europe. In the Mediterranean context such processes are particularly intense with gentrification of inner-city areas affecting major cities like Madrid (Sequera & Janoschka, 2015), Barcelona (Arbaci & Tapada-Berteli, 2012) and Athens (Balampanidis et al., 2021).

Based on this understanding of CBDs as dynamic city element, it becomes particularly important to delve deeper into the effects of Climate Change. The ongoing climate crisis has already heavily impacted urban areas, that become particularly vulnerable to compound risks including extreme heatwaves, sea level rise and floods, wildfires. In the following case study, I intend to sketch such vulnerabilities by identifying key urban functions and how they can be

affected by extreme heat conditions in the Mediterranean context. Adopting an urban planning perspective when addressing such problems is crucial and it could lead into new insights on how cities could adapt or be transformed by unfolding environmental challenges.

3. Athens case study

3.1 Heatwave impacts and compound risks in Athens metropolitan area.

Athens is located at 37°58' N (Latitude), 23°42' E (Longitude) with a population of 3,81 million at the level of urban agglomeration (Attika Region, census of 2021). The metropolitan area is located in the Attika peninsula. The compactly built-up part of the city (Lekanopedio of Athens) is bounded by large mountains to the North, West and East, while towards the south the city is stretching along the coastal zone. Along this coastal metropolitan axis between Piraeus Port and municipality of Vouliagmeni, the new development project of the Ellinikon is currently taking place (Figure 2). An extended periurban zone surrounds the city from the east (Mesogeia Plain) where the international airport is located, from the west (Triasio Plain) where industrial activities mostly concentrate and from the north where residential suburbs and commercial activities surround the national highway connecting Athens to Central and Northern Greece.

The climate is characterized as subtropical Mediterranean with mild winters and warm summers (Georgakis & Santamouris, 2017). Athens, like other big cities of the eastern Mediterranean, belongs to the top-ranked European capitals with respect to heatwave severity and urban thermal risk (Smid et al., 2019). According to a recent study by Kartalis (Kartalis, 2024), heatwaves have significantly increased in the period 2001-2020 in respect to 1971-1990, both in terms of frequency and duration. According to climate scenarios adopted by the Regional Climate Change Adaptation Plan of Attika Region (https://www.patt.gov.gr/category/koinonia/perivallon/pespka/), the increase of mean annual days of very high temperatures (>35 °C) in the near future (2030-2060 period) will reach 15-19 days (RCP 4.5 and RCP 8.5, respectively), and 22-55 days (RCP 4.5 and RCP 8.5, respectively) up to 2100. Tropical nights (>20 °C) will also increase by 27-33 (RCP 4.5, RCP 8.5 respectively) per year. Table 1 summarizes expected changes in Heat Extremes, Humidex index, Mean Moisture and air pollution (PMs) under RCP8.5 scenario in central Athens zone, based on the Greek Ministry of Environment & Energy data.

Figure 2. Case study area, with demarcation of CBD area, Piraeus Port, International Airport and the new Ellinikon Project site on the coastal zone.

Table 1. Projections for period 2031-2060 in central Athens (change in comparison to baseline time period 1971-2000, under RCP8.5 (source: https://mapsportal.ypen.gr/maps, own elaboration).

Very Hot days (>35) baseline	Change in Very Hot days (>35 °C)	Days with Humidex (>40 °C) baseline	Change in days with Humidex (>40 °C)	Mean Moisture (RH) change
14.4	19.9	15.1	30.6	-2.1
PM2.5 (Mean annual) baseline	PM10 (Mean annual) baseline	Change in Mean Annual Highest temp (°C)	Tropical nights (>20 °C) baseline	Change in Tropical nights (>20 °C)
43.6	47.1	2.1	44.8	39.0

Due to the rapid and largely unplanned urbanization process mostly occurring through the 20th century, the city of Athens is characterized by a considerable lack of green and blue areas that could possibly improve microclimatic conditions. The unsustainable paradigm adopted during Athens urbanization process can be clearly demonstrated by the artificialization of the main river (Kifisos) spanning west of the central zone, where most part of the river's route has been transformed into a major highway, and also to the considerable absence of parks and public spaces within the urban fabric.

High density of development and high levels of impervious surfaces in Athens, are parameters linked to a considerable UHI effect (Papamanolis, 2015), with UHI intensity estimated at 5–6 °C between central urban parts and the surrounding periurban areas (Roukounakis et al, 2023). According to a study by Giannopoulou et al. (2011) mean air temperature is maximized in the area north-west of the CBD. Difference can reach 2-3 °C in comparison to the south coast zone and as one moves to the east-west-north suburbs. Generally, the center of Athens and the western part are found to present a similar temperature regime due to the lack of green, the densely built areas and the increased traffic (Giannopoulou et al., 2011). In a similar way

Roukounakis et al. (2023) state that under heatwave conditions and in the absence of strong air circulation, areas of intense daytime UHI effect are observed in central as well as western parts of the urban complex. This is partly confirmed by examination of Land Surface Temperature (LST) distribution during the most recent heatwave (Fig.3). Based on the corresponding maps, it becomes evident that the heat island effect is more intense in the central and west zone, while the southern coastal metropolitan zone benefits from relatively lower temperatures. It is also notable that LST is maximized during the daytime in agricultural and bare ground areas of the periurban zone.

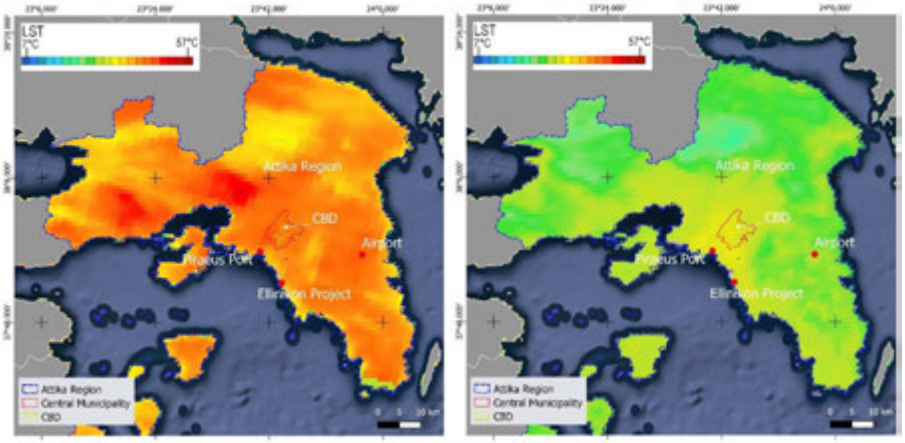

Figure 3. Land Surface Temperature for daytime (left) and nighttime (right) during the heatwave of 15 July 2023 (source: Google Earth Engine, 'MODIS/061/MOD11A1')

Recent evidence shows that Climate Change is already affecting key functions of the city. On 15 July 2023 during the heatwave ‘Kleon’, the archaeological space of Acropolis suspended its functioning for several hours, while the same happened a few day later. During the same heatwave, the Train Administration (TrainOSE) had to adjust several train schedules and speed limits for security reasons. Also, precautionary measures have been taken by public administration, with several municipality services and tax offices switching to remote work, flexible working schedule and special work permits. Private sector was also affected, as there have been orders to stop open-ground work at least during the afternoon hours (12:00 -17:00). Partial lockdowns of schools have also been reported during similar heatwave conditions during the past years, this issue being related to insufficient air-conditioning systems.

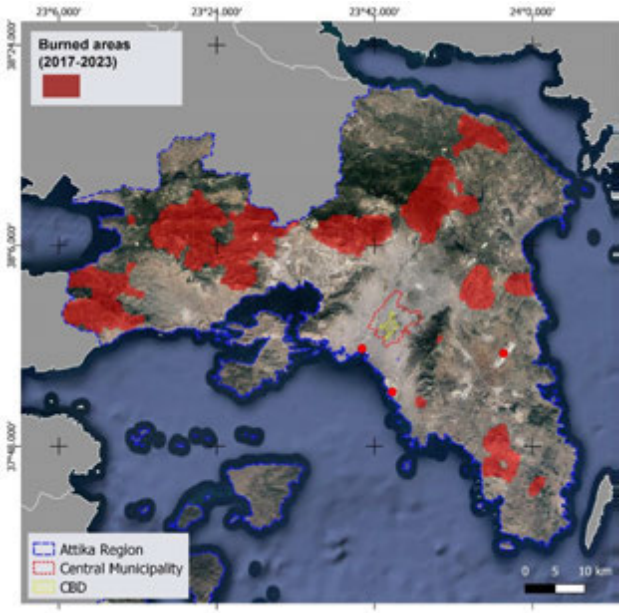

Figure 4. Burned areas during the period 2017-2023 in Athens Metropolitan area (source: Google Earth Engine, MCD64A1.061 MODIS Burned Area Monthly Global 500m).

Compound risks of heatwaves in Athens are related to air pollution and wildfires. Heatwaves in central Athens are usually combined by high levels of particulate matter (PM) concentrations, that are also maximized in the city core (Moustris, 2017). Vulnerability of Athens metropolitan area to fire risk is also a major problem, with most recent fires resulting into significant loss of periurban vegetation and forest land. Extreme fire risk is highly dependent on a combination of windy conditions and extreme heat. Forest fires in the Attika area are increasing during the past years, as shown in figure 4 where burned areas are mapped per time period; this being partly attributed to climate change. During the heatwave of 2021 with temperatures reaching up to 46 °C, a wildfire in the area of Varypompi near Parnitha Mountain, resulted into smoke covering the Athenian sky and rendering respiration very difficult for millions of people. As part of the emergency measures taken, access to major city parks has been occasionally suspended (including the central park of Pedion Areos and all big metropolitan parks) due to anticipated extreme fire risk. Closing down of parks is usually combined by cancellation of cultural activities that have been programmed within their infrastructures. The reasoning, as explained by the Prefectural Administration of Attika during heatwave 'Kleon', was one of "*precautionary reasons, reducing heath risk and malicious actions*". Closing down of public parks for several days has raised protests from citizen groups defending their right to public access into green urban spaces.

3.2 Central Business District in Athens: Key dimensions and vulnerability

The central municipality of Athens counts 643,4 thousand with a population density of 17.102,9 people/km^2, recorded as one of the highest urban densities in Europe. Building blocks are compactly built, with narrow streets at the neighborhood level and considerable lack of green infrastructure and lack of public spaces. Notable open space in the central part is related to the

presence of large archaeological spaces, and there are several areas with significant tree coverage around Acropolis, in Lykabetous hill, in the National Garden and in the large park of Pedion Areos (Fig.5). Microclimatic conditions around such green areas are considerably improved, however their influence is mostly local, limited to the surrounding building blocks. A considerable increase in tree coverage is notified in the eastern and northeast axis, just outside of the central municipality and towards the high-class municipalities of Papagou, Psychiko and Neo Psychiko, and Imyttos mountain (Fig.5).

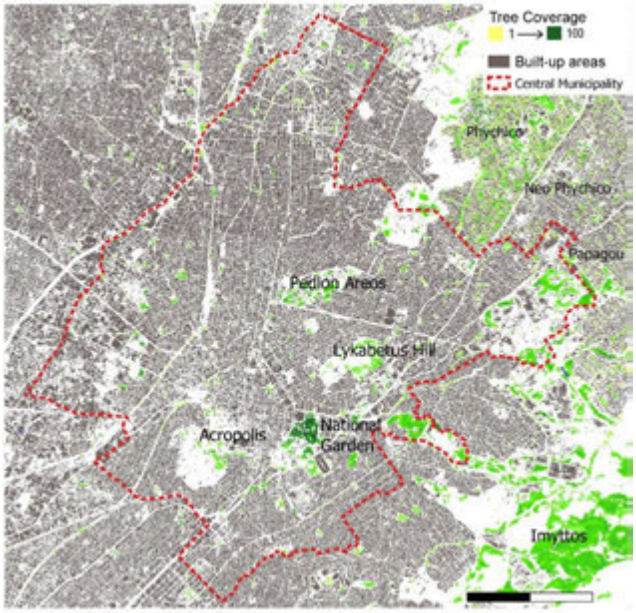

Figure 5. Built-up areas and Tree Coverage in the central zone of Athens (source: own elaboration on data obtained from Copernicus Land Monitoring Service).

To identify the Central Business District within the central municipality of Athens, the combined concentration of several activities has been examined. More specifically, libraries, banks, bars/pubs, cinemas, courthouses, restaurants, malls, museums, clubs, theaters, hotels, department stores and public buildings, have been considered, and to identify the distribution of those activities within the urban fabric, data were obtained from Open Street Map (https://download.geofabrik.de/). A Kernel Density estimation was applied resulting into the spatial pattern of Figure 6. Results show that the highest concentration is identified in the triangle between Acropolis, Lykabetus Hill and Pedion Areos, also expanding towards Piraeus Str. (south-west), Sygrou highway (south) and Patision Str. (north). This area can be perceived as the CBD of Athens, coinciding with the highest concentration of business and recreation activities.

To further support this delineation, I have also consulted the Google maps 'commercial corridors' data, where zones with high concentration of people are identified and marked as 'busy areas' during the daytime and nighttime. Such data are reported in the graphs of Figure 7 for characteristic central locations mapped by numbers (C1-C7) in Figure 6. Based on data retrieved from Google maps on a normal-temperature day of April, peak hour is observed at

noon (12:00-15:00), though the temporal patterns can vary between the different central-city spots.

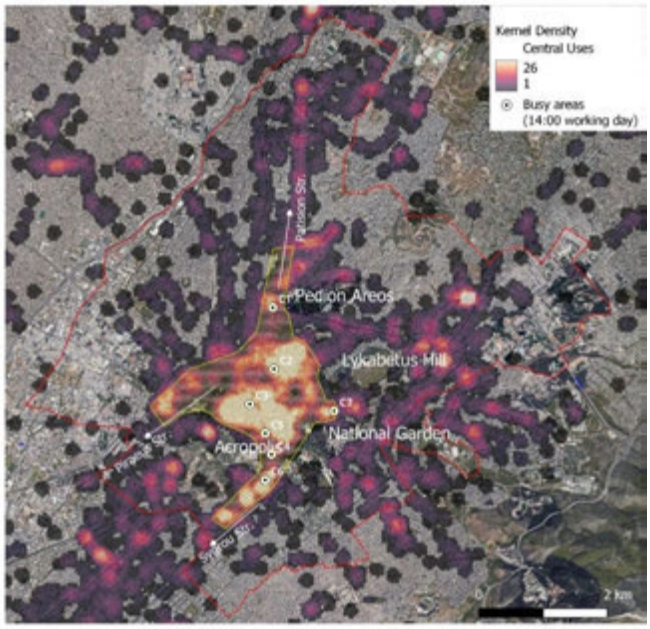

Figure 6. Kernel Density maps (50m pixel, 150 radius, method: quartic) with concentration of land uses and activities linked to CBD functioning.

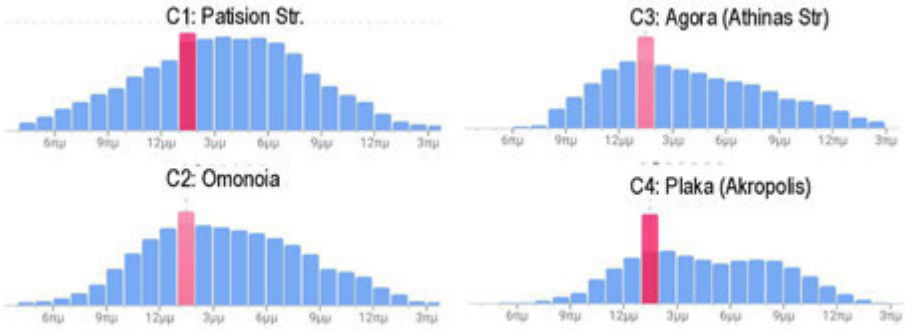

Figure 7. People concentration in characteristic central-city spots on a normal-temperature day of April. Blue bars represent average values, while purple bars represent actual concentration of people at 14:00 on a working day of April (source: Google maps/Busy areas).

Tourism activity is another important dimension of the central zone in Athens. To analyze tourism patterns within this zone I have applied Airbnb data as obtained from InsideAirbnb platform (https://insideairbnb.com/). Airbnb is an activity free to locate anywhere in Athens, overruling existing land use regulations. Generally, it tends to concentrate in areas with high accessibility to tourism-related activities especially museums, archaeological spaces and recreation. As shown in Figure 8, Airbnb concentration is largely spotted inside the CBD zone,

with a major focus on a semicircle around Acropolis (Psyri-Plaka-Koukaki neighborhoods) and an expansion towards Kolonaki and Exarcheia neighborhoods on the northeast, and Metaxourgeio and Thiseio on the west.

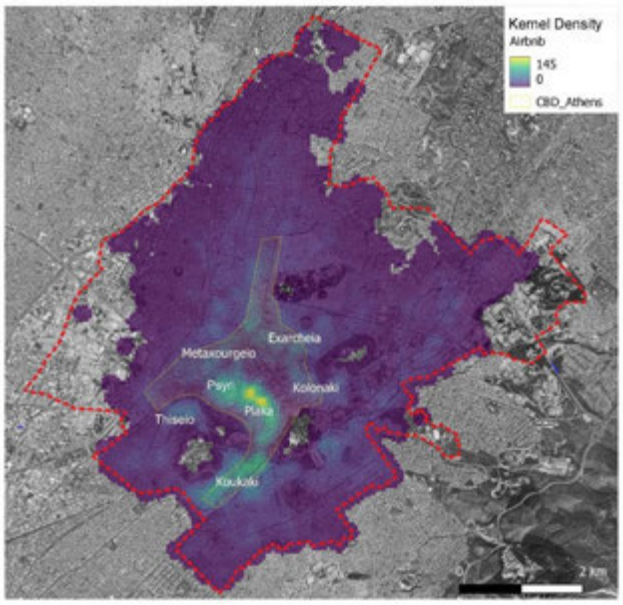

Figure 8. Tourism activity concentration (kernel density, 50m pixel, 150 radius, method: quartic).

Both of the above key dimensions of CBD functioning in Athens (i.e. business/recreation and tourism), are highly dependent on outdoor activities and pedestrian mobility, including street shopping, archaeological space exploration and sightseeing, visiting cafeterias and restaurants etc. These activities can be rendered particularly vulnerable in the case of heatwaves as people become unwilling to move, or even the authorities might decide to pose restrictions to protect public health (see Section 3.1).

A third dimension of CBD Athens is what I define as "housing/population". Generally, housing within a CBD zone remains a key parameter in order to preserve a sustainable mixed-use zone. Historically, the center of Athens has been a densely populated area, with a major concentration of people within the boundaries of the current CBD and its surrounding neighborhoods. However, since the 90's, an important suburbanization process has resulted into a loss of 22.5 percent (186,000 people) of the central municipality's population. The suburbanization process was largely driven by the deterioration of quality of life in the center due to traffic congestion, air pollution, lack of public spaces and overbuilding. As middle-class and high-class residents were moving out, immigrants and refugees were moving in, based on the well-known invation-succesion processes (Lee, 2015). Loss of population combined with the economic crisis of 2009-2019 period, left the central area in a degraded condition, with thousands of empty shops and apartments, further deteriorating the conditions of the housing stock and public spaces especially in the north central sector where social deprivation, unemployment and poverty are more intense (Arapoglou et al., 2021). Such processes have largely affected CBD functioning as many office buildings were practically abandoned (Cheirchanteri, 2023), and economic activity was considerably reduced.

In the most recent period (2011-2021) population loss is practically stabilized, with a marginal 3.1 percent decrease. Figure 9 shows a dot density distribution of population in the central municipality, with respect the current CBD boundary. Data are obtained at the level of Urban Analysis Units (EKKE-ELSTAT, 2015), using Hellenic Statistical Authority (ELSTAT) population census data for 2011. The map shows that significant population still resides within the CBD boundary, especially in the neighborhoods of Koukaki, Exarcheia, Kolonaki, and Metaxourgeio, where large scale gentrification processes are currently taking place. Conversion of apartments to Airbnb accommodation along with a major trend of replacing neighborhood-level shops with tourism-oriented stores and recreation facilities, are pushing land values up, this ultimately resulting into a major relocation of permanent residents out of the CBD nuclei.

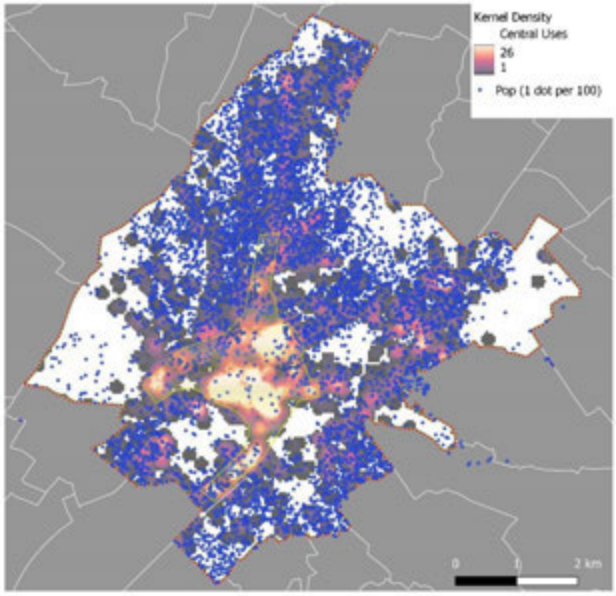

Figure 9. Population distribution (2011) in comparison to CBD boundaries and commercial/recreation activities concentration (Population data obtained from EKKE-ELSTAT, 2015)

Overall, it can be stated that despite considerable population relocation towards the suburbs during the 1991-2011 period, Athens CBD still acts as a key market area for over half a million residents mostly located in the adjacent neighborhoods. However, poor environmental conditions and Climate Change are imposing stress to this population, while considerable vulnerabilities in respect to the housing/population dimension are identified. Data show that the majority of population (75,8%) resides in old apartments constructed before the ‘80s, usually with very low energy standards and without thermal insulation. At the same time, population is considerably aging. About 19 percent (19%) of the population in several central municipality is above 65 years old, this fact rendering a significant proportion of residents particularly vulnerable to the impacts of persistent heatwaves. Based on the spatial distribution presented in the corresponding map (Figure 10) these two major vulnerabilities in respect to heatwaves (old housing stock and aged population) are maximized within the CBD, this fact raising important concerns regarding quality of life conditions and public health, and also regarding future energy demands for cooling. Another important social issue to be considered is the high poverty rate in Athens municipality, estimated to be around 24 percent (Petraki, 2013), and

geographically concentrated in poverty pockets close to the center (Kypseli, Kato Patisia), or even within the CBD (Omonoia square, Victoria square, Metaxourgeio etc).

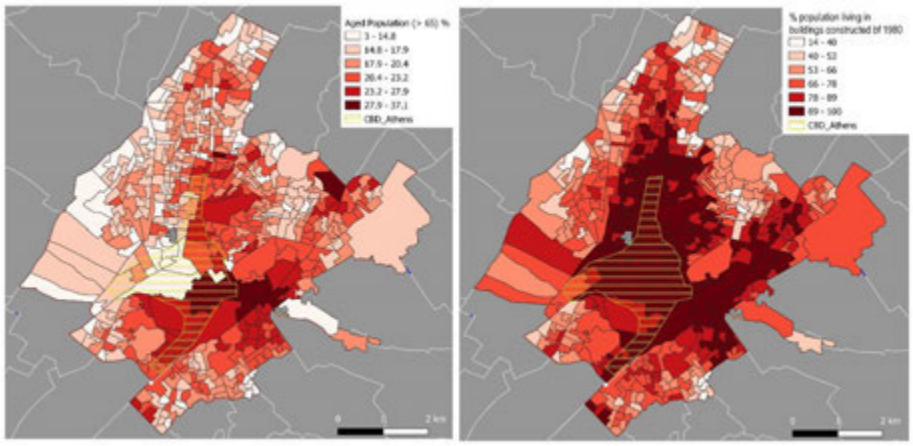

Figure 10. Aged population and old housing stock in Central Municipality of Athens (source: own elaboration on EKKE-ELSTAT 2015 data).

3.3 Overall assessment and discussion

To assess the overall vulnerability of the CBD of Athens to heatwaves, the three key dimensions and related functions (i.e: Business & recreation, tourism, housing/population), and their respective vulnerabilities are combined to a single graph (Figure 11). Exposure to hazard and compound risks are also included; while increase of adaptation capacity remains to be investigated, with the role of urban planning being particularly crucial in order for the CBD to retain its attractiveness & functioning during future heatwaves. The major risks identified are related to the loss of vibrancy and decreased quality of life, followed by population moving out. Such processes might be accompanied by a possible decrease in tourist flows, especially during the summer period.

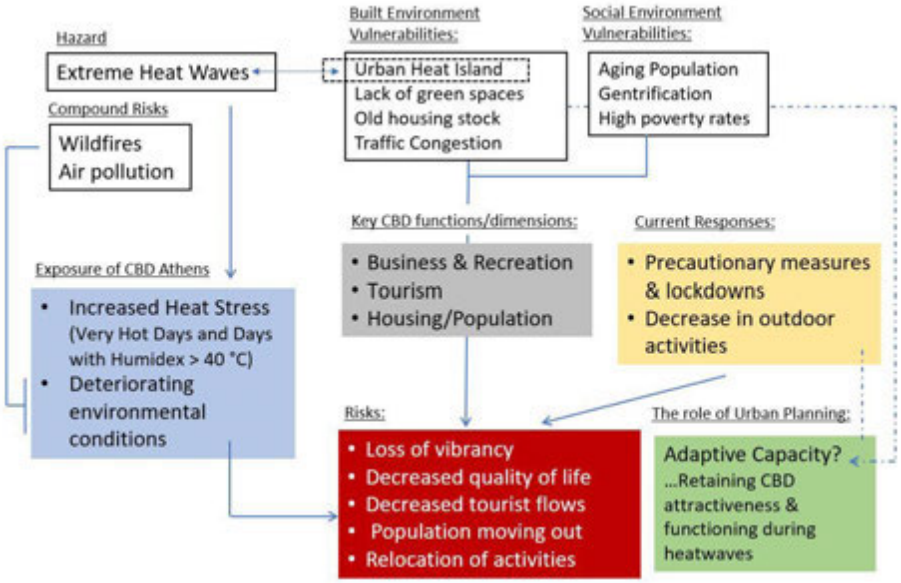

Figure 11. Connections between hazard, vulnerabilities and risks regarding extreme heatwaves in CBD of Athens.

From the preliminary research and data analysis presented, it becomes evident that the future role of the CBD of Athens will be largely dependent on urban planning strategies applied, with respect to land use policies, handling of the gentrification processes, and embracing a climate-resilient and sustainable agenda. As the CBD of Athens in its current state is particularly vulnerable to heatwaves, it is probable that it could face the consequences of certain activities relocating towards more favorable locations. A key example is the new mixed-use hub currently created on ex-brownfield land (the Ellinikon project, https://theellinikon.com.gr/), where large investments are taking place within a large coastal zone accompanied by skyrocketing land values. Consequently, favorable climatic conditions due to less intense Urban Heat island effect could render the coastal zone of Athens most attractive in the future -especially during the expanding summer period- possibly challenging the traditional role of the CBD.

4. Conclusions

Dependencies between Climate Change and urban structure should be at the core of current urban planning discourse and practice, opening up new fields of research exploration. CBD areas are persistent structural elements of a city with their historical role mainly based on a very high concentration of people and business facilities that are particularly dependent on face-to-face interactions, vibrant streets and outdoor activities. Regardless of the varying socio-spatial context in different geographical regions and the fact that they are going under considerable changes through time, CBDs are steadily perceived as key elements of the city structure, functioning as economic “hearts” of cities. Current evidence shows that as the Climate Crisis unfolds, such areas might be heavily affected, while climate-related risks could challenge existing urban structures and hierarchies. Evidence from this work sets the ground for more elaborated studies on this crucial topic, opening up the question of possible re-definition(s) of the role of Central Business Districts under the effect of Climate Change.

Results from the case study in Athens reveal three key dimensions supporting the current CBD role: Business & recreation, tourism, and housing/population. All three dimensions are particularly vulnerable to increasing heatwaves and compound risks like increasing air pollution, mainly due to parameters related to urban planning, including lack of green infrastructure and poor housing conditions, while social inequality and aging population add another important dimension to be considered. The cumulative impact of increased heatwaves could greatly affect CBD functioning and quality of life of citizens during the summer period, and have a direct impact on economic activity, tourism flows, and productivity levels. Moreover, it could pose important stress on critical infrastructure, including the heath system, while outdoor activities and outdoor work would be largely discouraged.

In the long term, such conditions could possibly result into a relocation of activities towards other city zones where climatic conditions will be more favorable. Based on current evidence, Athens is undergoing large-scale gentrification processes in the central zone, and also impacted by large-scale investments along the coastal zone. In this scenario, the center of Athens will be facing major challenges in the future and an integrated spatial adaptation plan would be needed in order to ensure quality of life and reduce the adverse impacts of Climate Change.

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Analysis and evaluation of the quality of open spaces and green zones in periurban landscapes, the greengates as strategic nodes of green infrastructures.

The case of the northern border area of the municipality of Fuenlabrada (Madrid, Spain) in its contact with the area called Bosque Sur and the case of the cities of the Dutch Randstad and their mediation or buffer zones.

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Abstract

The aim of this paper is, starting from the problem of peripheral landscapes produced by urban sprawl forms, to define a methodology for analysing the quality of peripheral public space in municipalities surrounded by natural spaces of environmental value, in order to evaluate their potential quality as environmental corridors, civic axes and natural gateways. To define the evaluation with proper indicators the investigation is based in the origin of the urban greenbelts and in the case study of the northern boundary of the municipality of Fuenlabrada (Madrid, Spain) with the Bosque Sur Periurban Forest Park and its comparison with Midden-Delfland, a buffer-zone belonging to the area known as Randstad Holland.

Keywords: greengates, periurban territories, green infrastructure

1. Introduction. Urban sprawl as a form of urban growth

Peri-urban territories have evolved since the mid-20th century towards a remarkable dispersion of their built space, with a large proliferation of industrial land infrastructures and operational landscapes (Brenner & Nikos, 2020) which have led to the fragmentation of originally natural areas.

The dynamics of urban growth resulting from the so-called Capitalocene (Moore, 2017) have caused a substantial reduction of the natural space which, originally, due to its size, was the container of the limited built space of the isolated municipalities and which has become a stressed "edge" space in which its natural and landscape qualities are strongly altered.

The European Union, through the European Environment Agency (Agency, 2016) has issued reports on the situation in such territories, warning about this complex problem and proposing measures to build detailed guidelines and support for national operational policies.

The report *Urban sprawl in Europe* highlights the environmental and socio-economic problems of these growth patterns. Even in areas where the expansion of built-up space has continued to take place despite a declining population (Haase, et al., 2014).

In addition to proposing parameters for measuring urban sprawl, the report proposes different methodologies for its analysis: those that insist on the need to work with as many variables as possible, others that propose integrating the different variables and the third, which opt for measures based on one or a few variables.

Spatial policy measures propose a review of spatial and urban planning, but also highlight the relevance of possible actions in favour of biodiversity recovery and enhancement and nature conservation.

Reflection on how to analyse and plan these complex territories, made up of overlapping layers like a palimpsest (Corboz, 1983). Built up over the years, it has developed in Europe from examples such as the Dutch Randstad, the Italian Veneto, the Flemish Diamond or the German Ruhrgebert.
The need for an integral conception of the territory from a strategic vision implies an architectural understanding of the territory, with a special sensitivity for the exploration of the structures and formal features of different natural and rural spaces and the effects of urban sprawl (Alonso Teixidor, 2024).

1.1 The empty territories of urban sprawl

In peri-urban landscapes shaped by the urban sprawl growth model it is essential to consider spaces not colonised by urbanisation, such as protected natural spaces, as vital nuclei of the territory, from which green infrastructures can cushion the effects of the urban continuum and provide natural continuity in already urbanised territories.
In addition to the areas protected for their natural and environmental value, it is necessary to point out the relevance of the areas bordering the municipalities, which are usually places with a higher level of biodiversity, as opposed to some large open spaces. The so-called *third landscape* (Clèment, 2020), the one that escapes from territorial exploitation practices, which does not belong to a protected natural environment and is not considered as a place to be designed, is an agglutinating space of great biodiversity with a great regenerative capacity in natural and environmental terms.
These hinge spaces, between the naturalised urban space, the third landscape, and the protected natural spaces, can be considered as greengates, gateways to nature from the city, and at the same time, as connecting focal points and carriers of biodiversity.
In this research we approach two areas: the model set by Midden-Delfland and the southern periphery of Madrid, with Bosque Sur, as a study of a complex peri-urban space. The work intends to emphasise the strategic spaces of connection between the urbanised space and the peri-urban green areas, based on a historical review of the origins of the recognition of the need for a link between city and nature, in order to promote a healthy habitat.

2. The origins of green belts. Boundary and landscape

The edges of growing cities are often areas of ambiguity, particularly unstable in their forms and uses. Many of the peripheries of post-industrial Europe's urban areas show considerable differences with those built along the growth of industrialisation: unstructured territories, made up of pieces of fragmented urbanisation in their forms and functions, physically connected -or segmented- by motorways, roads or railway lines. The underlying territorial processes have been overwhelmingly dominated by markets, often under conditions of high uncertainty, and with environmentally unsustainable outcomes (Teixidor, 2014).
The pressure exerted by residential and industrial growth and the growth of the operational landscapes serving the urban has led to the fragmentation and atomisation of undeveloped spaces, as well as to a formal lack of definition of the urban edges, which are configured as heterogeneous territories, not very permeable with their surroundings and disconnected from their territorial support.
However, they can be considered spaces of opportunity as growth buffer zones, as naturalisable territories, capable of hosting greater biodiversity and functioning as ecosystem services providing green and blue infrastructure to existing urbanised areas.

The integration of the city and nature was consolidated at the end of 19th century and beginning of the 20th century with Ebenezer Howard, intellectual father and promoter of the so-called English garden city, which can be seen -as Rasmussen (2010, p. 235) does in his work *Londres, ciudad única*- in continuity with the English tradition that proposes an alternative to the compact city that recovers an idealised vision of medieval England in which the city is situated in balanced harmony with the countryside and nature.

But the concept of preserving green zones as limits to growth in the city is also complementary to that of shaping and defining a peripheral landscape that is easily accessible to citizens. So green belts have a dual function: that of containing growth and that of providing healthy uses and natural landscapes.

One of the most important aspects of Howard's proposal is the awareness of the vertiginous increase in the size of a city like London and, therefore, his model of the city uses the idea of the limit as a fundamental instrument. A conception of the limit that is irremediably linked to the possibility of reaching it on foot, of being able to feel close and easily accessible the end of the urban environment and the beginning of another type of environment that is sometimes formalised as countryside and at other times as nature.

2.1 Ebenezer Howard and the notion of limit in the English Garden City

This idea of Howard (2018), which is an emancipating idea with respect to the confinement and overcrowding that the industrial city represented for most people, is linked to the image that English Romanticism had been creating since the 18th century, that of an inhabitant of the countryside -identified in Romantic imagery with a shepherd- who enjoys an ideal freedom that he uses to wander around the territory. This identification between walking and freedom is precisely what will make the proximity between the urban core and its surroundings so important in Howard's conception, introducing as a guarantee of this proximity the idea of a limit to urban growth as opposed to unlimited sprawl, an issue that in later developments of this same idea will also be taken up, both in Unwin's proposals and in the Green Belt of Abercrombie's Greater London Plan.

Howard's work abounds in references to walkable distances between its various parts (Howard, 2018) and it is a quality, its walkability, that determines so many of the characteristics of the proposed city: its dimensions, the proximity between its different elements and the construction of its clean and green atmosphere that makes walking a pleasant and liberating experience.

‘(…) so that from any part of the city perfectly fresh air and grass and sight of far horizon might be reachable in a few minutes' walk. This the final aim’ (Ruskin, 1865 in Howard, 2018, p. 53). This is part of the second of the three quotations with which Howard begins the first chapter of his work and with it he states that his urban proposal contains the idea of the proximity between the countryside and the city, that is, that the undeveloped outdoors should be within easy walking distance of the city (Fig. 1). It is not only that the city and the countryside merge -the city in the garden-, that the dwellings of its inhabitants are surrounded by trees or that these and the streets are part of the garden, but also that the countryside must always be close by. And close means on foot, i.e. walking a reasonable distance.

Figure 1. Diagram by Howard in which he tries to explain the relationship between the different garden cities. The commentary accompanying the diagram states 'open country ever near at hand'.
Source: Howard, 2018, p. 195

2.2 The proximity between the countryside and the city in Arturo Soria's Linear City

This idea, for example, was perfectly embraced by Arturo Soria. His linear city contains a city that can be infinite in one direction, along the line, but which always has the countryside nearby, at a walkable distance in the transversal direction (Fig. 2). Indeed, This is another urban model -contemporary to Howard's- which also raised this issue even in its formal conceptualisation. Here, its creator assumes the idea of proximity between the city and its surroundings and makes it more radical in formal terms: The linear city of Arturo Soria is urban –endlessly urban- in one direction -the longitudinal- but at the same time, if in Arturo Soria's time it had been crossed transversally, it would have been possible to be completely outside the urban environment in barely three minutes on foot. Its linear configuration imposes -from its very form- that proximity between the countryside and the city that is so important for the formalisation of the new urban model.
The city envisioned by Howard is not only a city in the garden but, above all, a city close to the garden, or rather, a city within walking distance of the garden. As the famous diagram of the magnets so aptly expresses it, Howard (2018, p. 47) does not despise the advantages of the city, but thinks it is possible to reconcile them (Howard, 2018, p. 50) with the benefits provided by the countryside. With those advantages that life in small communities had. Among others, with the advantage of proximity to the non-urban environment, i.e. the countryside and nature.

Figure 2. Oblique view of Arturo Soria's Linear City with the city in the foreground and the nearby rural landscape extending from its edges to the horizon.
Source: https://commons.wikimedia.org/wiki/File:Ciudad_Lineal-acuarela.jpg

2.3 Limits, nature and proximity in the Australian city of Adelaide

Howard (2018, p. 193) mentions in his work the case of the Australian city of Adelaide, designed by Colonel Light, which, according to Hall (1996, p. 99),, was instrumental in providing the idea that once a city had reached a set population limit, another settlement should be created, separated from the first by an undeveloped area. The proposal for Adelaide, a typical colonial grid, included a substantial land reserve surrounding both the original core and its subsequent growth to the north of it. Light's proposal included in this wide belt -originally nine hundred and thirty hectares- just a few amenities, but above all it was dominated by the course of the Torrens River -or Karrawirra Parri River, according to the aboriginal name- as the main natural element that articulated this space and the relationship between the two settlements. This prominent inclusion of the river -with its natural course highlighted- also brings Light's proposal (History Trust of South Australia , 2019) closer to the contemporary sensibility regarding the value of primal nature as opposed to that which has been modified by human intervention.
However, Light was at least sufficiently skilful and pioneering to formalise that reserve of land which guarantees immediate contact between either of these two Adelaide urban centres and a green belt dominated by the River Torrens (Fig. 3), while, for example, in Hampstead, the city built by Unwin and Parker following Howard's teachings, and in Arturo Soria's Linear City, where this immediacy with respect to the countryside was fundamental, the growth of their respective metropolises has ended up absorbing the garden city proposed in each case, completely erasing the countryside from its surroundings.

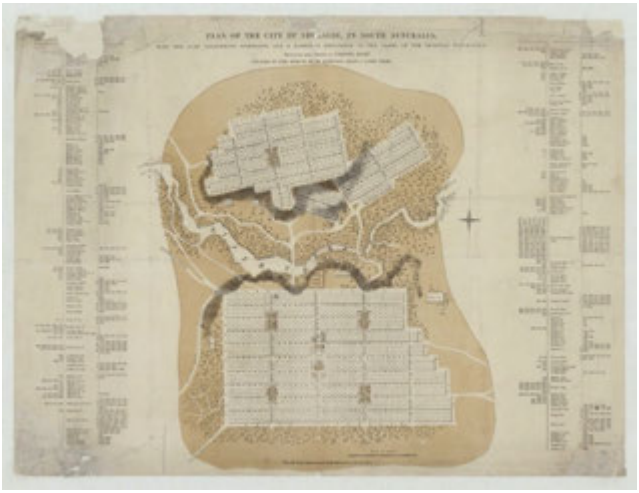

Figure 3. Plan of the proposal for Adelaide by Colonel William Light with the two cores and the space between them characterised by the presence of the river.
Source: https://adelaidia.history.sa.gov.au/panoramas/lights-plan-of-adelaide-1840

2.4 The challenge of the endless city

The city proposed by Howard was designed from the perspective of walking. It has behind it a tradition of rediscovering the landscape from the perspective of the walking human being as opposed to the acceleration proposed by the automobile. The image of medieval England as a country of villages that characterised the imagery of the Romantic period was also key to Howard's conceptualisation and is precisely illustrated in the idea of direct access to the environment. Even in medieval towns, their size was also adjusted to distances that allowed them to be easily traversed or exited in the direction of the surrounding countryside in a short time. In the collective memory of Ebeneezer Howard's contemporaries, the image of pre-industrial London portrayed, for example, by Daniel Defoe, is still vivid. Defoe's work (1986), *A Tour through the Whole Island of Great Britain,* is considered by scholars of British history as a fundamental text that allows to visualise -despite some inaccuracies and inventions- the image of Britain just before the emergence and consolidation of the Industrial Revolution (Rogers, 1986, pp. 10-11). In the case of London, especially, this transformation moves between the beginnings of suburban expansion -intensely speculative- after the Great Fire of 1666 and the definitive demographic explosion of industrialisation. And although Defoe himself is astonished at the size the city has recently acquired (Defoe, 1986, p. 286), in fact, it is still a contained and manageable city, especially from the perspective of the stroller, and he himself walks without difficulty from the centre of London to some of the first suburbs -Islington, Newington, Chelsea, London, Newington and Chelsea (Defoe, 1986, pp. 287-288) or Hackney, Newington, Tottenham, Edmonton (Defoe, 1986, p. 337)- which are now just parts of the immense city.
London at that time was of a contained size that allowed access on foot to its natural and rural perimeter. From what is probably the earliest description of London by Thomas Becket's twelfth century biographer -William Fitz-Stephen-, Ackroyd (2012, pp. 83-84) highlights the immediate countryside and nature surrounding the city: past the wall, to the west 'were gardens and vineyards among which were the mansions of the noble and powerful'; to the north, 'stretched meadows and pastures bordering on 'an immense forest', of which Hampstead and

Highgate are now its only remnants'; to the north-west 'there was a meadow now known as Smithfield, where every Friday horses were sold'; and in other meadows around 'pigs and oxen were slaughtered and sold'. Even in the 16th century, cities were still relatively small and, although part of the population might live outside the city walls in the emerging suburbs, these were far from being extensive. And so, what still distinguished medieval cities like Exeter, capital of a vast province, from the sprawling patches that would emerge after the Industrial Revolution, was that 'one could have walked around the entire circuit of the city walls in half an hour, or could have reached the open country form the centre of the city in any direction in fifteen minutes' or ' Even London, with its sixty or seventy thousand people, was soon left behind if one had in mind to see the green fields and natural heaths' (Hoskins, 1981, p. 147).

3. Urban Green Rings and Greenheart as contemporary territorial strategies

Indeed, several authors (Freestone, 2002) claim that the origin of the Green Rings lies in the proposals made by Ebenezer Howard at the end of the 19th century. The background described above pointed to a problem -that of the unrestricted growth of the metropolis and to the need for a new form of urban development-, but they also opened the way to address a response, indicating to planners the inescapable need to maintain or generate links between the intensely built space of the city and a contrasting rural or natural environment.
The consideration of this system of open spaces as a tool for urban planning has served, in the development of numerous European cities (London, Vienna, Frankfurt, etc.), not only to combat sprawl, but also to provide solutions of a social and environmental nature, promoting the protection of natural areas and the conservation of agricultural and livestock areas, providing leisure and recreational areas for citizens.
Green Rings are not instruments that have served to formalise similar peri-urban spaces, but they have become a tool to define new concepts such as urban green infrastructures, so recurrent in the design of new urban models aligned with the fight against climate change and environmental responsibility (Ahern, 2007).
The classic form of green belts is that of a ring of open spaces surrounding the city, although it can often take on irregular shapes depending on the geographical characteristics of the area. (Aguado, et al., 2017)

However, growth containment associated with green buffer spaces has historically been conceived primarily with three formal outcomes: Greenbelt, Greenheart and the Finger Plan (Vejre, et al., 2014). There are studies that assess the effectiveness of some versus others in terms of growth restriction (Kuhn, 2003). However, they all agree on the clear social benefit they provide as spaces for the use and enjoyment of citizens and for the definition of a habitable landscape connected to the urban environment.

4. Midden Delfland in Randstad Holland

With the double purpose of understanding Bosque Sur -the study area where the Green Arc of Madrid meets the northern edge of Fuenlabrada- and having a reference on this type of space, a comparison and contrast area has been chosen in the Netherlands: Midden-Delfland. This is a buffer zone between Rotterdam and The Hague, two of the largest cities in a country credited for its culture of spatial planning.

The meaning and role of Midden-Delfland, are better understood it in its context, within the Dutch multi-scale territorial system where landscape and planning intersect. A good approach to this system is provided by the short section on the Netherlands in Peter Hall's classic book

'Urban and Regional Planning' (Hall, 1992, pp. 197-202), which is complemented by the much more recent and extensive 'The Randstad: A Polycentric Metropolis', edited in 2021 by Vincent Nadin and Wil Zonneveld (Nadin & Zonneveld, 2021). The following text draws on both sources, as well as on unpublished academic work by Ignacio Bisbal, Marcos Delgado, Javier Malo de Molina and Emilio Ontiveros, which also drew on the sadly no longer available bulletins of the Netherlands Institute of Geography, IDG.

4.1 The Randstad, the denser urban structure of Western Europe

The west of the Netherlands lies at the centre of a metropolitan belt, with an axis between London and Milan, which concentrates a high proportion of Europe's economy and urban population. There, at the mouth of the Rhine, is one of the most important urban regions in Europe, with a population of around 7 million inhabitants. Almost 40% of the Dutch population is concentrated in just 5% of the country's surface area, reaching a higher degree of metropolitan concentration than in Great Britain or France.

4.1.1 A polynuclear model

Despite the high density, an observer's impression is not that of a large, saturated metropolis. What was once a medieval network of small towns, became an important enclave in the 19th century thanks to its industrial and commercial development. The transformation of the Rhine into a major artery in Western Europe made its mouth the prize for the Netherlands. Thus, as Germany became an industrial power, the Netherlands also developed as a trading power. In 1850, the cities in the west of the country were separate entities. By 1950, these cities had extended to almost touch each other, forming an urban perimeter. This territorial structure is called the Randstad (edge city or ring city), a term coined in 1938 by Albert Plesman, founder of the Dutch airline KLM, describing what the view from his aeroplane (Nadin & Zonneveld, 2021, p. 10)

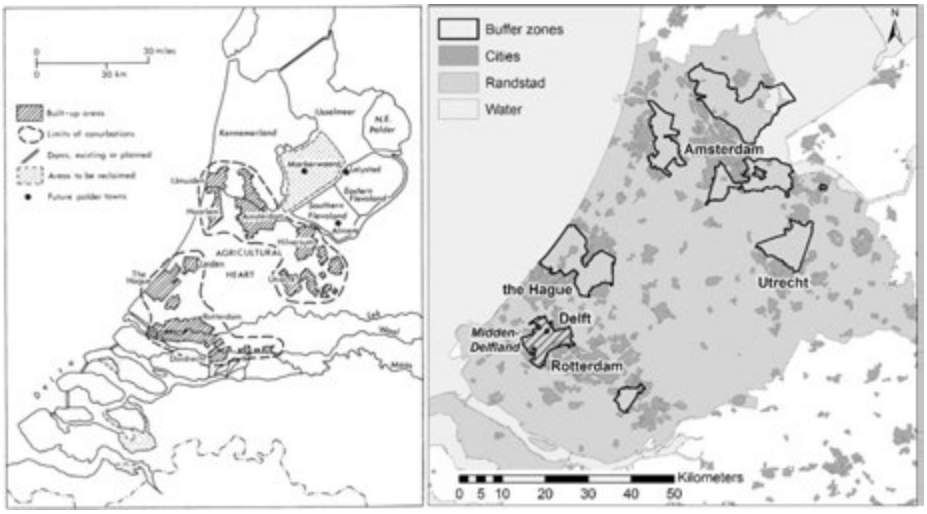

Figure 4. Left: Randstad Holland (Hall, 1992, p. 198)
Right: Midden-Delfland and other buffer zones in the Randstad (Koomen, 2008, p. 38)
Sources: Referred bibliography

4.1.2 Morphology and programme

The Randstad adopts the layout of a ring of cities physically separated along a 180 kilometre horseshoe-shaped line. The ensemble comprises the four most populous cities in the Netherlands: Amsterdam, Rotterdam, The Hague and Utrecht, as well as a number of intermediate cities such as Haarlem, Leiden, etc. Each city is separated from its neighbours by green zones and all of them overlook a large, less urbanised inner area, called Green Heart, which is protected by planning (Fig. 4). This polycentric territorial model is not limited to a physical aspect but is also operational. The larger cities in this structure adopt differentiated functions: the seat of government and international justice are in The Hague; the largest port and heavy industry in Rotterdam; the financial world, tourism and culture in Amsterdam; congresses and research and development venues take advantage of the railway node in Utrecht. This configuration avoids certain problems of large mono-nuclear cities, shortening commuting times and reducing traffic jams (Hall, 1992, p. 197).

4.2 The Randstad's metropolitan *Green Heart*

4.2.1 Evolution of the concept

Historically, the Green Hart had been a marshy area unsuitable for the development of cities, which sought dry and elevated sites. From the early Middle Ages onwards, thanks to windmills, this land was drained for agricultural use (Korthals Altes, 2018). The area remained as such until the development of settlements around its perimeter began to threaten it. In 1960, the 1st Dutch Spatial Planning Guideline highlights this area and decides to preserve it as an agricultural area free of urbanisation. The 2nd Guideline (1966) sought to control the growth of settlements within the Green Heart by designating a few suitable localities and thus maintaining the defensive sense of planning. It was not until the 3rd Guideline (1973) that other functions of the area, compatible with its agricultural status, were considered: recreational programmes and the development of ecosystems through planting. Until then, the Green Heart had an almost conceptual character, lacking clear boundaries. Although in theory residential growth and new roads were to be avoided within it, in practice its extension was reduced in areas close to large cities.

Figure 5. The Randstad's Green Heart. To the left, Midden-Delfland.
Source: Prepared by the authors of the paper

4.2.2 The role of the Green Heart in planning

In 1990, with the 4th Guideline, its boundaries were precisely delimited and in 1996 the Green Heart Administrative Platform was established. This platform, although it had no legislative powers, was the forum for discussion of Green Heart issues. This made it possible to gather precise statistical data on the Green Heart municipalities, their population, land use, etc. In terms of growth within the Green Heart, restrictions were set for businesses, offices and new communication infrastructures, and residential growth was limited to the six historic urban centres. Three landscape types associated with specific uses were delineated: a) the lake environment (for ecosystem conservation and recreational programmes); b) the marsh and grassland areas in the north and on both banks of the Lek River (subsistence agriculture and ecosystem conservation); c) grasslands in the west (agricultural farms, greenhouses, and forestry). In addition, it was decided to invest in creating new ecosystems, developing new networks of canals for recreational boats and cycle paths, and planning the transition areas between the large cities and the Green Heart.

4.2.3 Tensions over the Green Heart

A prevailing idea in successive planning guidelines in the Netherlands has been the fundamental need to keep the Green Heart of the Randstad undeveloped. However, demographic and economic pressures ignored this recommendation and resulted in the Green Heart being diminished: south of Amsterdam, at Schiphol airport, east of Utrecht, along the Rotterdam-Delft-The Hague-Leiden line, and on the periphery of inner towns.

4.3 ***Midden-Delfland: a buffer zone between Rotterdam and Delft***

4.3.1 Countering the Randstad' saturation

In a context of high population growth, buffer zones emerged as areas of containment of urbanisation in the 1st Guideline to preserve the historic cities of the urban ring as separate and distinct points. These zones were designated as spaces for parks, drainage areas and public bathing areas. The treatment of these areas has evolved in a similar way to that of the Green Heart, from an exclusively defensive origin to a key role in planning as agricultural and recreational areas. Although they were planned as open spaces between cities to promote the active perception of the territory, since their conception these territories have been associated with important infrastructures and, therefore, exposed to high noise and environmental pollution, as well as to continuous pressures to take away part of their surface. However, it was not until the 3rd Guideline that eight buffer zones were identified on the Randstad map and a specific plan was proposed for the one known as Midden-Delfland (Fig. 6). That buffer zone status saved the Midden-Delfland polder landscape from housing development and the expansion of glasshouse horticulture (Feddes/Olthof, 2017).

Figure 6. Midden Delfland. The buffer zone of southern Randstad.
Source: Prepared by the authors of the paper

4.3.2 Origin, evolution, extent and functional division since the Reconstruction Act

Midden-Delfland was an intermittently inhabited peatland landscape until the Middle Ages, when it was drained for exploitation, and sandy-bedded hillocks emerged as a unique landscape. After the Second World War, the growth of the surrounding towns gradually reduced its extent, leading to the passing of the Midden-Delfland Reconstruction Act in 1977, which remained in force until 2010. As a result, 'green belts' of recreational areas were placed between the peripheral towns and the agricultural core of Midden-Delfland. In 2004, Midden-Delfland became a municipality by merging the municipalities of Maasland and Schipluiden (Midden-Delfland, 2024) with Den Hoorn. The buffer zone maintains an area somewhat larger than that of the municipality itself, covering 6,700 hectares, of which 68% is used for agriculture, 28% for recreational purposes and the remaining 4% for natural areas. The area is divided into three main zones with 27 subdivisions to which one or two main functions are associated. Near the settlements, the recreational function is predominant (playgrounds and rest areas, facilities for windsurfing, sailing, rowing, sport fishing, campsites and leisure in forest areas). In the rest of

the areas the original agricultural function prevails, shared with recreational use (footpaths and cycle paths).

Figure 7. View of access from Delft to Midden-Delfland along Delftse Schie canal.
Source: Google Street View

4.3.3 The Midden-Delfland® Vision 2025

At the initiative of the municipality of Midden-Delfland, in 2005, the central government, the province, local municipalities and civil society organisations promote the Midden-Delfland® Vision 2025, which includes the report 'Midden-Delfland Gateways'. These gateways are conceived as strategic entry points connecting the city to the countryside, articulating various functions: enhancing the urban-rural relationship, making landscapes and their transitions accessible and legible, providing information and orientation, serving as parking, transfer and departure points for recreational, cultural and historical routes, etc (Fig. 7).

Understanding the sequence in which these gateways serve as a passageway to a buffer zone - Midden Delfland- which itself constitutes a major gateway to the Green Heart landscape, may help conceiving the possibility of a similar articulation in the relationship between Fuenlabrada and its surroundings.

5. Fuenlabrada, Madrid Sur and the Green Arc

5.1 Fuenlabrada and Madrid Sur

Fuenlabrada shares with the rest of the cities in the southern belt of the city of Madrid a similar origin and evolution: old rural settlements born next to crossroads in the territorial structure of the south of the region which, especially from the 1950s onwards, took in -precariously arranged as commuter towns- the population that emigrated from various rural areas of the country -mainly Andalusia and Extremadura- in search for employment in the capital, a movement that was accentuated in the 1970s (Cabrero Garrido, 2004, pp. 407-408) which promoted an indiscriminate and sprawling growth that will begin to be managed, by providing facilities and infrastructures, in the 1980s after the arrival of democracy in Spain and economically boosted by its entry into the European Community (now the European Union).
Fuenlabrada sits on a very flat territory on the border between the sub-basins of the Jarama and Guadarrama rivers. It is an area that has left behind the steep slopes of the north of Madrid and has entered the flat territory, with no significant elevations, of the area of the middle course of the Tagus River basin. However, it is also a scarcely consolidated space, with some valuable interventions that need to be reinforced, but which is exposed to the persistent pressure of urban

growth -from all the surrounding settlements- which, at the very least, compromises its identity and dilutes its potential and its value as a civically and ecologically valuable space, threatening its long-term survival. It is a territory that historically has been home to agricultural fields (Cabrero Garrido, 2004, p. 396) whose activity is still relevant and remains settled on an east-south-west arc around the city.

The northern fringe has long since abandoned its agricultural condition and, in fact, composes a metropolitan void that transcends the limits of the city itself and forms part of a wider structure that forms the backbone of a sort of incipient conurbation formed by the larger cities to the south of Madrid, known as Madrid Sur (Fig. 8). Fuenlabrada is thus, together with the cities of Móstoles, Alcorcón, Leganés and Getafe, part of a kind of archipelago of cities that make up the southern sector of the metropolitan ring of Madrid which together have a total population of 948,337 inhabitants (INE, 2023), a population that, if it were considered as a single municipality, would represent the third largest city in Spain, behind only Madrid and Barcelona, but ahead of Valencia.

Figure 8. Madrid Sur. The conurbation that forms the southern metropolitan fringe of Madrid and the open space between its five cities (Fuenlabrada, Móstoles, Alcorcón, Leganés and Getafe).
Source: Prepared by the authors of the paper

All these cities in the conurbation (Fuenlabrada, Móstoles, Alcorcón, Leganés and Getafe) are separated from each other by an open space that accommodates some recreational uses, but which, above all, serves as a base for the layout of major infrastructures such as the railway, an arc of the third major ring road around the municipality of Madrid (M-50) and some radial roads. It is a space with enormous potential as a buffer zone that can accommodate the large infrastructures mentioned above -especially the M-50-, act as a barrier to the sprawl that would eventually lead to the merging of all these cities into one urban continuum and provide citizens with an open space with facilities and leisure activities incorporated into an area that should take advantage of the natural and ecological conditions of the place, providing an habitat that is clearly differentiated from the urban environment. However, it is also a scarcely consolidated space, with some valuable interventions that need to be reinforced, but which is exposed to the persistent pressure of urban growth -from all the surrounding settlements- which, at the very least, compromises its identity and dilutes its potential and its value as a civically and ecologically valuable space, threatening its long-term survival.

5.2 Green Arc / Arco Verde

This space around which the cities of Fuenlabrada, Móstoles, Alcorcón, Leganés and Getafe orbit is also linked to a larger initiative, known as Green Arc (Arco Verde), that connects the three natural parks of the Madrid region (Cuenca Alta del Manzanares, Curso Medio del Río Guadarrama and Parque Regional del Sureste) and other natural areas of interest through the network of cattle trails and other paths and tracks, creating a great corridor of more than 200 kilometres that surrounds the city of Madrid and connects the municipalities of its metropolitan area (Fig. 9) (Comunidad de Madrid, 2024).

Figure 9. The Green Arc around Madrid.
Below left, the area of Madrid Sur where Fuenlabrada and Bosque Sur are located.
Source: Prepared by the authors of the paper

Therefore, the potentially valuable heart that articulates the southern conurbation of the metropolitan crown acquires a greater dimension by entering into synergy with the structure of the Green Arc, a ring that links the most valuable natural landscapes of the Madrid region. Thus, any resident of Fuenlabrada would have at his disposal -from the gateways that this research proposes (Fig. 10)- both the wide space that separates it from the bordering cities to be found in the south of the metropolitan crown, as well as access to a vast territory of enormous landscape and ecological value, a connection that allows a restoration of equilibrium between life in the intensely urban environment of the cities and the beneficial contrast offered by the contact with open spaces of diverse ecological value. Both projects -the heart of the southern conurbation and the Green Arc- represent an opportunity to reconsider and restore many ecosystems that have been degraded from their natural condition as a result of human activity. In the case of Fuenlabrada and the southern conurbation, the space that articulates it is a space historically linked to agricultural activity whose abandonment should be taken as the starting

point for a process of renaturalisation that counteracts the climatic urgency by investing in ecological improvement. Access to these territories must also contribute to their recognition by citizens. Recognition that should lead to their enhancement and, consequently, to the demand for their conservation, maintenance and protection. It is in this initiative that the present research is framed.

Figure 10. Map of Fuenlabrada (left) with red brackets as access points to Bosque Sur (right)
Source: Prepared by the authors of the paper

6. Evaluation of peri-urban greengates in quantitative and qualitative terms. Indicators and design criteria

Understanding the city as an ecosystem implies redefining our conception of the urban from a holistic approach to the dialogue between nature and the city. The return to nature, its recovery or reintroduction on the support of the consolidated city, situates our research in the contemporary framework of the renaturalisation of cities. Urban renaturalisation is a multiple challenge: economic, social and physical-spatial. Economic, because it involves reversing a development system linked to the urbanisation of grey infrastructure. Social, because of the need to transform the collective thinking that links progress with consumption and individual freedom towards a purpose of environmental commitment. And physical-spatial because all regeneration relies on existing support, image and formalisation of decision-making over decades that have not had the possibility to build with nature. The emergence of the concept of 'nature-based solutions' has meant the integration of multiple strategies with a multi-scalar multi-functional and place-specific approach. In addition, we can add the conditions of connectivity, strategy, inter- and transdisciplinarity, and social inclusiveness (Tzoulas, et al. 2021).

In order to implement measures aligned with nature-based solutions, it is necessary to define a systematic prior assessment of the areas where improvements are intended to be made in order to reveal shortcomings and assess possible opportunities.
To this end, a methodology is proposed based on the analysis through indicators that provide us with a prior diagnosis, with the aim of implementing appropriate measures that respond effectively through tools supported by nature-based solutions.
Focusing the problem on the case study of peripheral landscapes, we must define specific indicators that allow us to bring together the varied characteristics of these heterogeneous areas.

6.1 Indicators and reference methodology

Recent studies assessing both quantitative and qualitative indicators of green areas are referenced.
The so-called Grenn Area Indicator GEA is a basically quantitative indicator, that does a valoration of the area of biologically available surfaces (i.e., those covered by vegetation, open water, permeable paving and storm water infiltration, etc.) compared to total parcel area. Likewise, ecosystem approaches provide a conceptual framework to aid decision making in urban planning for green infrastructure (Stange, et al., 2022).
Despite their complex development, the GEA indicators, used as ordinances to guarantee a minimum of green areas in new developments, are exclusively quantitative in nature and are, therefore, incomplete for assessing edge areas, which are located on the boundary between urbanised and undeveloped territory.

Other indicators such as sustainability indicators related to green areas add aspects related to proximity to green spaces and urban green corridors, recommending maximum distances depending on the size of the green area under consideration (Barcelona, 2008).
With regard to the quality of green spaces, other authors add other aspects (de la Barrera, et al., 2016) associating size with greater diversity in the ecosystem services provided, also point to the greater capacity to host cultural offerings of those green areas that have the capacity to host a greater variety of people. (older people, young people or children) favouring greater social interaction. Greater vegetation cover is also considered to provide greater biodiversity and environmental comfort.
If we interpret green areas as part of other natural or naturalised superstructures, we can also add topological indicators, that can assess the potential of defining green infrastructures capable of connecting natural areas of regional character with other smaller areas of peri-urban and urban scale. The valuation of green areas, not only for their isolated status as environmental havens, but also because of its capacity to connect with others of greater or lesser size, it adds a more complex vision that makes it possible to contribute to territorial environmental improvement at different scales (Lafortezza, et al., 2013).

Another key aspect is related to the accessibility of green areas, which is particularly important given the particularities of the peri-urban landscape.
In terms of equity and inclusion, other authors propose indicators to measure the Quality and accessibility of green spaces: (Yao, et al., 2014)
‘(i) the Effective Green Equivalent (EGE) referring to the GS area that effectively has a benefit for each inhabitant; (ii) the Average Effective Green Equivalent (AEGE), which is the average of EGE for all inhabitants; and (iii) the Inequality Coefficient (IC) which is based on the Gini coefficient of income inequality, exchanging income with the EGE of residents’

As for the methodology of analysis, we propose as a methodological basis the one proposed by Fariña, Higueras, Román and Pozo in the Guide for Planning Healthy Cities (Fariña, et al., 2022) in its section on the Introduction of nature in the city, referring to peri-urban green areas in the vicinity of the city. The proposal consists of mapping existing public spaces and urban green areas, also representing the peripheral open areas and valuing the identified green areas as a whole from their potential to generate a green infrastructure. In this way, the value of the existing green is signalled and enhanced in order to connect it and shape a resilient continuous system.

7. Conclusion

7.1 Possible indicators for the evaluation of green areas in the peri-urban landscape

We found a series of indicators associated with green areas, which we could characterise and qualify for application in the analysis and diagnosis of peri-urban areas (Fig. 11)
We therefore define several groups of indicators:
- Intrinsic indicators: quantitative and qualitative indicators of the areas to be analysed such as size, heterogeneity, biodiversity, landscape quality, environmental comfort,
- Contextual indicators: proximity to protected natural areas, proximity to areas of agricultural or livestock use, proximity to residential areas, continuity with urban public spaces, pedestrian, cycling or public transport accessibility.
- Extrinsic indicators: fragmentation due to large infrastructures, edge uses with environmental impact: landfills, industries, logistics centres, power stations,
- Social indicators: daily use of the space, citizen involvement in the implementation, transformation and design of the green area, citizen involvement in the care and maintenance of the space, identification with the place, physical and mental health.

Figure 11: Proposal of indicators for green areas of the peri-urban space. Based on benchmark indicators in Point 6 (Indicators and reference methodology)
Source: Prepared by the authors of the paper

Social indicators are especially relevant, as they reflect the impact that a green area can have on the population that can enjoy it, providing health benefits, as long as the open space has quality, provides environmental comfort and is well connected and easily accessible to citizens of any age and condition.
Just as the search for a healthier city generated the first garden city and infinite city models, nature-based solutions are well suited to respond to basic social needs for health and well-being. The permeability of natural spaces to urban spaces on the periphery is a fundamental factor in ensuring a better quality of life. For this reason, it is necessary to emphasise the strategic character of greengates as places of connection of urban edges with quality and wide-ranging natural spaces.

7.2 Greengates as a strategic enclave for integration between nature and city. Identification and Project

With the use of the proposed indicators and being aware of the problem of peri-urban areas and the existing situations of disconnection between urban peripheries and nearby natural spaces, the analysis and design of greengates is key to their role as nodes of continuity of green infrastructures.
Taking as a model the design of the urban edge elements of the cities that make up the Midden-Delfland and assuming as a case study the northern periphery of the municipality of Fuenlabrada, we can propose a working methodology for the identification of those spaces that can be transformed into greengates favouring green and natural continuity.
With the aim of ensuring greater continuity between urban and peri-urban green spaces, it is proposed:

- Represent, characterise and quantify the system of urban green spaces, with their hierarchy, such as neighbourhood parks, urban parks, ornamental gardens, boulevards, street trees, etc. And also, if there are private landscaped areas of interest (because of their size or the size of the vegetation).

- Represent, characterise and quantify the peri-urban green system, with protected natural spaces on a territorial scale, blue infrastructure, reforested areas, wetlands, orchard areas, paths, etc., and all spaces with environmental or landscape potential in the surrounding area.

- To analyse, with the help of the proposed indicators, this structure from the point of view of quantity and quality of the green system, so that it can become a green infrastructure, capable of generating a healthy physical and mental environment for the entire population.

- Finally, in the potential green infrastructure revealed, key nodes or transition points between the peri-urban public space and the immediate natural space will be identified. These greengates will be defined in order to prioritise continuity from the built space and to encourage the shaping of the previously identified green infrastructure.

The project and design of connection nodes between the urban and its natural environment is relevant in peripheral areas. The complexity and growth of cities has created barriers and blurred spaces of natural value that are beginning to be recovered through the definition of green infrastructures. The proposal and development of the greengates could reduce uncertainty and respond with contemporary criteria to the necessary proximity between the urban environment and the natural environment, as already announced by the first visionaries and creators of the garden city.

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Rethinking the waste of planetary urbanization for urban challenges: Potential, Strategies and Governance in Terrain Vague projects

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Abstract

Planetary Urbanisation puts pressure on undeveloped spaces in cities. Although perceived as wastelands, such spaces are of unacknowledged socioenvironmental value. Conceptualised as *Terrain Vague*, they have potential to address social and ecological urban challenges. This paper demonstrates how the Terrain Vague can be activated through alternative repurposing strategies and governance. We present three case studies indicative of diverse strategies adopted from different European contexts: Porto Healthy Corridor, a nature-based solution part of URBINAT research project; R-Urban (2013-2017), a community garden in Colombes, near Paris, managed as Urban Commons; Cody Dock, a community-led regeneration and river revitalisation project in London. The analysis shows how rethinking the waste of planetary urbanization can support the circular economy, biodiversity, urban ecology, community development and climate sustainability.

Keywords: wastelands, strategies of repurposing, socioenvironmental value, urban commons, urban ecology

1. Introduction

In a world of cities and of Planetary Urbanisation (Brenner and Schmid 2011; Brenner 2013) advancing with increasing speed and frequency, the scale of the urbanization process, the alternation between sprawling and urban shrinking, and the complexity and ineffectiveness of planning processes have led to the emergence of uncertain urban spaces that seem to challenge the traditional dichotomies between urban and rural, city and countryside, value and use.

To refer to such spaces, we adopt the term 'Terrain Vague' coined by Catalan architect and academic Ignasi de Sola-Morales (1995) as a more pluralistic, metaphorical framing, allowing multiple interdisciplinary interpretations. The origins of Terrain Vague spaces can be of different natures (Berger 2006; Clément 2022; Kamvasinou 2011): geography, the presence of particular natural elements, alternating sprawling and shrinking, processes of deindustrialization, ineffective planning or lack of cooperation between different political entities, the abandonment or obsolescence of large built-up areas, spaces awaiting future development, leftover spaces related to large infrastructures such as bridges, motorways, railways, and the design and construction of large public buildings. Such spaces are not integrated into the urban system of public spaces and are temporarily cut off from the city's productive system, usually unnamed and without a specific productive function. In contrast to traditional public spaces of collective use, nowadays increasingly controlled and institutionalized, these spaces are often reclaimed for activities not allowed elsewhere (Kamvasinou 2011). Although often identified as problems and sites of precarity, they have great potential for addressing socioecological challenges.

Indeed, Terrain Vague spaces are refuges for plant and animal species at risk and dynamic places of encounters between different species, generating a rich biodiversity (Gandy 2022, 2013; Clément 2022). They are places of spontaneous appropriation by different communities, informal uses, community gardens, informal agriculture, artistic experimentation (Kamvasinou and Roberts 2014; LaFond 2010). Alternative practices in these spaces challenge traditional planning dichotomies between temporary use and long-term visions, between ownership and use, between top-down and bottom-up planning. Even initial spontaneous and temporary occupations can both bring immediate benefits (such as the strengthening of a sense of community) and influence long-term transformation; even if the property is private, it may be granted temporary public status through concessions to incentivize use of space, bringing benefits to both the user and the owner; finally, there may be an integration of spontaneous and bottom-up initiatives with top-down planning policies and visions (Kamvasinou, 2017).

2. Theoretical Background

Since the late 20th century, terrain vague spaces have been the subject of increasing multidisciplinary interest and study (from architecture to biology, from urban planning to economics, from social sciences to geography). Due to their ambiguous, uncertain, and changing nature, their peculiar characteristics, the inapplicability of the traditional categories of urban public space theory, and the wide variety of disciplines that study them, there isn't one single and unequivocal definition or term for these spaces. Many authors have attempted definitions using varied terms, including Terrain Vague (Solà-Morales 1995; Mariani and Barron 2014; Lévesque 2001), Urban Voids (Lopez-Pineiro 2020), Vacant Land/Lot (Kamvasinou 2011; Bowman and Pagano 2004; Accordino and Johnson 2000; Northam 1971), Drosscape (Berger 2006), Third Landscape (Clément 2022), Urban Wildscapes (Jorgensen and Keenan 2012), and Wasteland or Brownfield (Gandy 2013; Berger 2006). While the specific terminology differs, this range of scholarly attempts to categorize such interstitial spaces not

integrated into the formal urban fabric highlights their ambiguous yet increasingly recognized potential from multidisciplinary perspectives. Although these definitions refer to essentially the same object of study, each of them reveals a disciplinary perspective, a particular nuance, a set of values and visions for the future of these spaces. In a generic and synthetic form, these spaces can be described as open, abandoned, underdeveloped and underused, without a specific function and outside the city's productive circuit, which are not traditional public open spaces such as squares, plazas, or gardens, nor formal agricultural spaces. Among the various definitions, we prefer the definition of Terrain Vague, for several reasons.

First, this definition represents a turning point in the 1990s, because for the first time it values emptiness positively, not as a lack but as freedom, hope, possibility. Secondly because, by tracing the first discovery of these spaces back to artists and photographers, it reveals their close connection with artistic practices and activities and with a free, creative, and utopic vision for these spaces. Finally, because Ignasi de Solà-Morales (1995) advocates the need for a new approach, a new vision for these spaces, which goes beyond functionalism and the traditional dichotomies of urban planning, to preserve and fully exploit the potential of terrain vague spaces.

2.1 From Waste to Terrain Vague

The causes behind the creation of Terrain Vague spaces are undoubtedly the processes of urbanisation and the ineffectiveness of urban planning in controlling the scale of these processes. In the last thirty years, increasingly invasive and rapid urbanisation processes, have challenged traditional definitions of the city. Many authors have attempted to define this form of urbanisation (Sieverts 2003; Brenner and Schmid 2011; Balducci, Fedeli, and Curci 2017; Soja 2000; Brenner 2013), with some common points: i) the end of the traditional dichotomy between urban and non-urban, between town and country; ii) a new scale of urbanisation, reaching as far as the regional, national or global scale, generating increasingly hybrid and blurred boundaries; iii) the creation of a new urban form, which often lacks the fundamental characteristics of the city (Sawyer et al. 2021), characterized by sprawl and dispersion. Furthermore, it is possible to think of wastelands as urbanisation's inevitable by-product (Berger 2006).

However, if we turn upside down our way of thinking, in a vision of recycling and reuse, valuing the local dimension rather than the large scale, we can conceive of these spaces as valuable resources, easily accessible and with great social potential: "Spaces discarded by productive logic but valuable for local communities" (Perrone and Russo 2019, p. 13).

2.2 Social and Ecological Value of Terrain Vague

Terrain Vague spaces intersect social and ecological interests, functioning as sites of daily informal appropriation by local communities (Kamvasinou and Roberts 2014; Careri 2006; Brighenti 2013; Iannizzotto 2023; Mariani and Barron 2014) and biodiversity hotspots where species prohibited elsewhere find refuge and coexist (Gandy 2022; 2013; Clément 2022; McPhearson, Kremer, and Hamstead 2013). Their abandoned state devoid of human control enables spontaneous community uses revealing local needs (Kamvasinou and Roberts 2014), catalysing relationships between residents, collective space management, and an enhanced sense of community (Iannizzotto 2023).

Terrain Vague spaces also hold immense ecological value, already performing vital environmental functions like absorbing rainwater, cleaning air, enabling biodiversity corridors, and providing ecosystem services (McPhearson et al. 2013; Cortinovis and Geneletti 2018). Studies highlight their richness in rare wild species (Gandy 2022, 2016, 2013, 2011; Clément 2022), revealing potential for enhancement through simple interventions and design as nature-based urban solutions (Nunes et al. 2021).

2.3 Terrain Vague as Urban Commons

A reciprocal relationship exists between terrain vague spaces and Urban Commons, allowing projects and practices in these spaces to be viewed through the Urban Commoning lens (Akbil et al. 2022; Dellenbaugh-Losse et al. 2018; Borch & Kornberger 2015; Petrescu et al. 2021; Stavrides 2016). First, the origin and history of many terrains vagues link to common lands, like the UK's common land system, Portugal's rural baldios (Travasso 2022), and Italian movements reclaiming abandoned spaces (Perrone et al. 2022). Second, the informal everyday practices (Chase, Kaliski, and Crawford 1999) and experimental projects occurring in these spaces exemplify "commoning" - managing urban resources not-for-profit and participatorily as Urban Commons (Dellenbaugh-Losse et al. 2018). The Terrain vague suits such projects due to immediate availability, existing community management, its green potential, and separation from market logic favoring use over exchange value (Moniz 2021; Petrescu & Petcou 2023). Urban community gardens epitomize this ecological Urban Commons model (Urban Commons Research Collective 2022).

3. Methodology

We present a qualitative comparative case study analysis of three projects indicative of different strategies adopted for repurposing terrain vague spaces, intentionally chosen from different European contexts - Southern (Porto Healthy Corridor, a nature-based green corridor realized through co-creation processes as part of the URBINAT research project in Porto, Portugal), Central (R-Urban, a community garden with agriculture and cultural events managed as Urban Commons in Colombes near Paris, France from 2013-2017), and Northern Europe (Cody Dock, a community-led post-industrial site regeneration, river revitalization and social enterprise project in Newham, East London, UK). By analysing these varied case studies from different scales, terrain vague types, time durations, strategies and governance models presented side by side, we aim to demonstrate how rethinking the waste of planetary urbanization through alternative repurposing approaches can support the circular economy, biodiversity, urban ecology, community development, and sustainability against climate change.

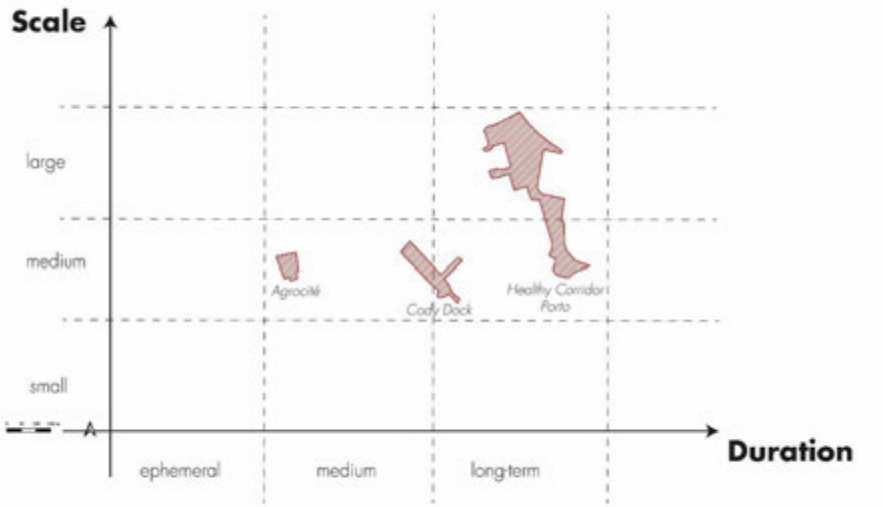

Image 1. Graphical comparison of case studies, represented according to scale and duration.

4. Case studies

4.1 Porto Healthy Corridor

Urbinat (2018-2024), whose acronym stands for 'URBan Inclusive and Innovative NATure', was a six-year project funded within the Horizon 2020 programme, focused on the regeneration and integration of underserved city districts through the design and implementation of nature-based solutions and using participatory and co-creation methodologies (Nunes, Björner, and Hilding-Hamann 2021). The consortium, consisting of partners from public institutions, universities, and private entities from seven European cities (Porto, Nantes, Brussels, Høje Taastrup, Siena, Sofia, Nova Gorica) and other institutions from all over the world, was based on the simultaneous achievement of academic goals and realization of concrete examples, the work of local units and network collaboration at European and international level.

The Project interventions focus on the design and realization of a new type of urban green corridor in the seven partner cities, called healthy corridor, conceived as linear public spaces and clusters of different nature-based solutions, through the inclusion and involvement of residents and local communities in the different project phases, using participatory and collaborative methodologies and the co-creation process. For the entire duration of the process, the Project operates simultaneously through the integration of two different scales: a local scale, through the creation of local living laboratories, relations with the municipality and institutions, involvement of residents, the community, local associations, with events and activities; the international scale of the network, coordinated mainly by universities and academic entities, with the main objective of developing and sharing a single language, a catalogue of solutions,

methodologies, processes and toolkits in common, through continuous activities between partners, meetings, workshops, shared platforms, publications.

The Healthy Corridor concept and strategy, as it was conceived and defined by the network, is based on the creation of linear parks or green corridors connecting different areas, specifically social housing neighborhoods, that are clusters of different nature-based solutions, which are chosen, designed and implemented in stages through a process of co-creation, thus initiating an attempt to connect human and ecological interests and goals (Moniz 2021).

Since the objective of the healthy corridor is the creation of new paths and green public spaces in neighborhoods with fewer services and infrastructures, by intervening in the existing city and without proposing major demolitions, it is consequently quite clear that one of the privileged sites of intervention are the terrain vague or abandoned spaces. Indeed, in the first conception and theoretical definition of the healthy corridor, terrains vagues are proposed as privileged intervention spaces, implicitly revealing their social and ecological potential: "the Healthy Corridor is a cluster of NBS that can occupy urban voids or common ground that is not being used or needs regeneration, becoming a link between different areas of the city, contributing to avoidance of the segregation effect and to the promotion of social and urban cohesion" (Moniz 2021, p.19).

In the city of Porto, *Campanhã* parish has been identified as one of the priority areas to intervene on and chosen for the design of the healthy corridor. This area, mainly residential and with a high percentage of public social housing, presents some criticalities and challenges, mainly due to partial isolation, fragmentation, lack of accessibility, lack of a sense of security or safety itself, scarcity of quality public spaces and public services. However, this area is particularly rich in Terrain Vague spaces, which are, from the early stages of study, analysis, and diagnosis, identified as possible areas for intervention and as spaces with high potential. As in many other cases, as we have reported previously, the presence of terrain vague spaces is due to the fragmentation of the territory, which, from being an agricultural area until the relatively recent past, has been subjected to rapid, invasive processes of urbanization, punctual, zonal and in the absence of an effective overall plan or vision, which, together with the creation of various road infrastructures (motorways and railways) has contributed to the fragmentation of the area.

In fact, even today these abandoned spaces retain ruins, traces, and memories of their agricultural past, blending in and almost disappearing amidst the new residential buildings, and “this represents a unique opportunity to properly occupy such areas in order to connect key areas and create a multifunctional green continuum in the territory – a Healthy Corridor” (Moniz 2021, pp.36-37).

From the very first phases carried out together with the residents and the population, i.e. the phase called co-diagnosis, these spaces were immediately identified both by the community as priority spaces on which to intervene, and by the experts who recognized their ecological and social potential. An initial phase of identification and mapping of these voids was followed by a second phase in which cadastral checks were carried out to identify abandoned areas owned by the municipality, with the aim of selecting the areas on which it was easiest to intervene. Then, through local activities with residents and the community, solutions and functions began to be outlined. Thanks to the flexibility of the proposed solutions and the methodology used, the consortium's catalogue of solutions was enriched with solutions proposed during the activities, and it was also possible to think up solutions that were suitable in specific contexts and in accordance with the community's wishes, as in the specific case of the historical ruins of

an old farm, which it was decided to keep because it was part of the inhabitants' collective memory.

In fact, the diversity and peculiarity of terrain vague spaces stimulates a variety of different solutions, difficult to design or plan a priori, without knowledge of the context and the actors involved. Due to the large scale, the large number of institutions, bodies, associations involved, the costs and the complexity of the healthy corridor, the project envisaged several implementation and feasibility phases, thus taking time into account as a factor in the project.

At the end of the Research Project, the Project was presented to and accepted by the municipality and all the various stakeholders, and on 20 February 2024 the Porto Healthy Corridor was officially realised, inaugurated and opened to the public: "The realisation of the Campanhã URBiNAT Healthy Corridor is a good example of how collaborative planning and community involvement can lead to meaningful and beautiful urban transformations, setting a precedent for future projects in Porto, in other cities across Europe, and beyond" ('[Porto PT] Inauguration of the URBiNAT Healthy Corridor in the District of Campanhã, Porto', n.d.).

4.2 R-Urban, Paris

R-Urban (Petcou and Petrescu 2020, 2015; Petrescu and Petcou 2023; Atelier Architecture Autogérée 2022) is an ambitious strategy, conceived by Atelier Architecture Autogérée, based on the introduction of a network, entirely managed by the residents in a bottom-up way, made up of a series of hubs, each with its own specific function but interconnected with each other, with the objective of managing material and immaterial flows by promoting a new model and lifestyle, sustainable and resilient, managed directly and autonomously by the residents and alternative to the capitalistic and profit oriented model of the city.

R-Urban, was conceived after three years of research by the collective platform Atelier Architecture Autogérée as a model, as a theoretical network that can be applied and implemented in various contexts, then adapted to the specificities of the local context; some hubs have already been tested in Colombes (near Paris), Paris and London. The concept, which is inspired by models of resilient cities from the history of architecture and town planning (Garden City, Regional City and Transition Town), is guided by a clear ecological and political approach based on Lefebvre's concept of the right to city (Lefebvre 1968) and especially Harvey's more recent reformulation of it (Harvey 2008) as not only the right to live, but above all the right to decide and change the city by residents.

The Project is conceived as an infrastructure, a network capable of managing material flows (production, consumption) but also, and above all, immaterial flows (exchange of knowledge, relationships), which proposes another model of urban lifestyle, alternative to that of profit, the capitalist state and the logic of the market and exploitation, based on flows of production and consumption based on sustainability and resilience and entirely managed from below, in accordance with the vision that sees closely correlated ecological, social and political instances.

The fundamental concept is resilience, "…a dynamic concept, which does not have a stable definition and identity outside the circumstances that produce it… resilience is adaptive and transformative, inducing change that offers huge potential to rethink assumptions and build new systems" (Petcou and Petrescu 2020). R-Urban operates simultaneously at the global, regional and local scales: while on the one hand it proposes almost a concrete utopia, a strong political critique realized in practice, on the other hand it proposes a system of resource flows and

exchanges that functions on a regional scale, at the same time it is based on the complete and direct bottom-up management of residents, thus absolutely flexible to local peculiarities and contexts.

In fact, the aim is to boost, together with experts and institutions, a process that will later be completely autonomous and managed directly by residents and associations. Finally, it is useful to note that in the case of R-Urban, but also of other projects, Atelier Architecture Autogérée, on the basis of its direct experience, prefers as intervention spaces abandoned or underused, easily accessible and outside the city's production and profit circuits, i.e. exactly the terrain vague spaces, revealing a real strategy of interstices that “involves spaces, actors, local partners, time” (Petcou and Petrescu 2020).

There are at least two reasons for this: it enables prompt action by avoiding lengthy negotiations over private property, and more importantly, it redefines and devalues the power of private property as the basis for urban planning choices, instead revaluing the use value of spaces. After three years of research, the collective proposed R-Urban to local authorities and grassroots organizations in France. In 2011, the first implementation began in Colombes, a Parisian suburb of 84,000 residents with a "typical mix of private and council housing estates," with support from local institutions, associations, and residents. Three interconnected hubs were planned, though only two were realized: Agrocité, an agricultural unit with a small farm, community gardens, and educational spaces on sustainable resource management; and Recyclab, a space for recycling, tool storage, and resident-built eco-housing using discarded materials. The unrealized Ecohab was envisioned as a cooperative, partly self-built eco-housing project with shared spaces. Significantly, all the realized Colombes hubs occupied abandoned spaces resulting from large-scale planning oversights, exemplifying the potential of terrain vague: "Agrocité was located on a 2000 sqm vacant lot near Fossés Jean; Recyclab was built on a disused road; and Ecohab was planned for a vacant plot between the other two hubs" (Petrescu and Petcou 2023), demonstrating in practice the value of these ambiguous urban spaces.

During the period of regular activity, from 2011 to 2016, the Colombes R-Urban network achieved important objectives and results and a considerable involvement of the population, in fact from the ecological point of view, it has initiated processes of information, sustainable production and consumption of food, agriculture and livestock, recycling, rainwater absorption, air cleaning, and many others; from the social point of view, around 6900 people have participated in the site's activities, 400 of whom have become active stakeholders, learning and sharing skills, techniques and knowledge on agriculture, recycling and sustainability, as well as participating in workshops and cultural activities of various kinds; some residents have started small business activities within the network, thanks to the skills acquired and the voluntary work carried out. Paradoxically, the greatest threat and difficulty for the project came from the municipality and politics: in the name of a phase of urban regeneration of the neighborhood and social housing complexes, and following a change in the city's political direction, the mayor of Colombes decided to replace Agrocitè with a car park and to dismantle Recyclab to clear the space for new projects in the future.

This negative and unexpected occurrence demonstrates both the fragility and transience of projects implemented in terrain vague spaces, especially of a temporary and tactical urbanism nature, when they are not adequately foreseen, framed and protected within the legislative framework; and the difficulty of proposing and implementing real alternatives to speculation and the private market linked to investment and profit in the context of the contemporary city.

However, this threat stimulated several interesting reactions and reflections. First, it gave rise to a protest movement against the demolition by residents, thus demonstrating people's attachment to the project and the community's positive assessment of the benefits.

Then, in order to counter the municipality's main thesis, i.e. a faster economic return resulting from the activity as a car park, it stimulated a research aimed at calculating the economic value of the value produced by urban commons and resilience, i.e. calculating quantitatively and economically, in a language more easily understood by the business enterprises and the municipality, all those advantages, benefits and acquired values, both material and immaterial, resulting from the network's activity in those years.

Finally, despite the decision of the court and the municipality in 2017 to proceed with the actual demolition of the two R-Urban hubs in Colombes, the project and the community showed a great spirit of adaptation that brought the project to a second life, in another location. In fact, following negotiations with some neighbouring municipalities that were more attentive to the project, both Agrocité and Recyclab were dismantled and reconstituted in other locations, in Gennevilliers and Nanterre respectively, thus testing and demonstrating both the conception and adaptability of both the project (conceived with recycled material and following the principles of resilience, ready to be quickly assembled and disassembled) and the community, which had over time acquired the knowledge and experience necessary to carry out and manage this type of relocation.

4.3 Cody Dock, London

Cody Dock is a community-focused environmental project that aims to promote ecology, biodiversity, and creative industries in an urban setting. It is located in a post-industrial site along the River Lea in the East London borough of Newham. It has undergone a transformation from an industrial dock used for transporting coal and byproducts in the Victorian era, to a derelict and contaminated brownfield site after its decommissioning as a port in 1967. The surrounding area features a mix of warehouses, industrial parks, cement works, and vacant post-industrial sites.

In the early 2000s, Simon Myers, the current CEO of the Gasworks Dock Partnership (GDP) who are the legal tenants and manage the site, discovered the dilapidated Cody Dock while living on a boat on the River Lea (Interview with Myers 2013). He began engaging with the key stakeholder, Thames Water who owned the site, to acquire a lease. After initial failed attempts, the 2008 economic crash provided an opportunity and in 2009 Myers secured a 999-year lease for the site (Kamvasinou 2017). GDP was established first as a social enterprise in 2009, and later formalized as a charity in 2011. Its mission was to transform Cody Dock into a working marina and arts hub through providing moorings for live-in boats, renting artist studios, and restoring public access to the River Lea. Environmental restoration, education about local history and ecology, and community-building through events and partnerships were core aims (Kamvasinou 2017).

The project’s governance model is anchored in GDP as the lead organization, but involves collaborations with numerous other charities, businesses, individuals and community groups who help shape the site through partnerships (Interview with Myers 2013). An openness to unexpected events, like increased visitors during the Covid-19 lockdowns, allowed new meanings around health, wellbeing and greenspace to emerge.

While Thames Water owns the dock itself, the London Borough of Newham controls the access points. This multi-stakeholder situation, along with Cody Dock's complex history across pre-industrial, industrial and post-industrial eras, creates challenges but also opportunities for innovative governance models bridging top-down and bottom-up approaches.

Over time, the focus evolved from temporary activities like music events and art exhibitions, to more permanent facilities like an exhibition space, a therapeutic horticultural classroom ('The Growing Space'), and ecological infrastructure like floating reedbeds, the last two interventions associated and built in collaboration with live studio student work at the School of Architecture and Cities, University of Westminster (see https://www.architectsjournal.co.uk/buildings/university-of-westminster-completes-community-space-at-londons-cody-dock). Community participation and an incremental, organic approach to placemaking have been central philosophies in the evolution of the project from temporary to permanent, and from a physical site to a site of education and knowledge exchange, including the University of Westminster's research, teaching projects and community engagement exercises exploring topics like temporary urbanism, climate urbanism, biodiversity, socio-ecological relationships, and skills for interdisciplinary climate/health projects (Kamvasinou et al 2023).

The project combines ecological conservation efforts with artistic and creative installations. For instance, as Gino Brignoli, biodiversity officer, informed us on the occasion of a University of Westminster staff and students visit in March 2024, they are currently working with an artist to install a sound art piece that incorporates recordings from the area and involves placing hydrophones in the river to allow visitors to listen to the underwater sounds and aquatic life. Cody Dock also provides affordable studio spaces for artists, sculptors, sound designers, and architects, helping to keep the creative industries alive in the area. However, the demand for these studios far outweighs the supply.

Cody Dock aims to enhance biodiversity along the River Lea corridor through habitat creation and management efforts on their site. Part of Cody Dock's work involves ecological restoration of the dock area, carried out largely by volunteers. The charity collects ecological data and conducts biodiversity monitoring and conservation through various means. For example, as Brignoli mentioned, they conduct regular bird surveys every Friday along the river, culminating in collecting 8 years' worth of data that are shared with the British Trust for Ornithology to contribute to nationwide monitoring efforts. They host monthly "Beer and Bats" events where they teach about bat identification and conduct bat surveys, sharing the data with the Bat Conservation Trust, thus contributing to national databases and research.

Brignoli highlighted that the project heavily relies on volunteers who participate in various ecological activities, such as identifying bumblebees, bird watching, bat monitoring, and gardening. Field training and workshops are provided to volunteers to equip them with necessary skills, while community engagement is a significant aspect of the project. They host seasonal open days, film clubs, and workshops that are open to the public. They also work with local schools, bringing students to the site and conducting educational activities. A major focus is providing environmental education opportunities, especially for urban youth who may have limited exposure to natural areas. To this end, they bring school groups on boat trips on the river to experience being on the water in a natural setting. Some of the school children visiting have never even sat on grass before, so they aim to connect urban communities to local ecology. They are transitioning from movable planters to building permanent brick planters with help from local college students and volunteers, establishing more permanent green spaces.

Not everything is easy, however. As Brignoli confirmed, the project faces challenges in securing long-term funding. While they receive grants and funding from sources like the National Lottery, many of the staff positions are grant-funded and have limited duration. There is an ongoing conflict with local developers who sometimes engage with the project for consultation but then proceed with their plans without fully considering the recommendations. The project aims to expand its operations to other parts of the dock area, with plans to build a musical pavilion and restore an old lifeboat if funding becomes available.

Overall, Cody Dock represents a unique initiative that combines environmental conservation, community engagement, artistic expression, and support for creative industries in an urban setting. Particularly biodiversity conservation through monitoring, habitat restoration, and promoting awareness and appreciation of local ecology and wildlife seem to be core tenets of their environmental efforts at Cody Dock. They encourage volunteer participation and partnerships to achieve these goals, highlighting the importance of such projects in promoting biodiversity, education, and sustainable development.

5. Discussion: Potential, Strategies and Governance in Terrain Vague projects

The three case studies provide an overview of the potential of projects in Terrain Vague sites. Below we discuss this potential and compare and contrast the strategies and governance models adopted in the three case study projects as well as how these projects support the circular economy, biodiversity, urban ecology, community development, and sustainability against climate change.

5.1 Potential in Terrain Vague

By approaching terrains vagues as not just 'empty' or 'abandoned' but as transitional spaces with the potential for transformation, architects, planners, nonprofits and community stakeholders can draw upon their inherent ambiguities to reimagine and revitalize the urban narrative and to integrate with formal design and planning practices on terrain vague sites. The abundance and variety of Terrain Vague spaces in urban areas, as seen in Porto and Colombes, highlights their potential for repurposing.

The socio-ecological value of these neglected spaces lies in offering opportunities for nature integration and community appropriation, both crucial for a more resilient and regenerative approach to urban development. In this process, important features are the flexibility and adaptability of Terrain Vague projects, as showcased by R-Urban's relocation capabilities. Temporary uses of such sites contain clues to the potential diversity of future activities they might contain (Mostafavi and Najle 2003, p.7). The theory of Urban Political Ecology discusses the concept of nature as ‘a constructed rather than a pre-given concept…subject to political re-definition and re-articulation’ (Keil 2003, pp.726-27). Indeed, the Landscape Urbanism movement supports the idea that urban and natural landscapes come together in complex and important ways; under this theory, abandoned terrain vague sites form part of a larger urban ecosystem (Corner 2003). Vacant land is thus an opportunity, not just a problem, more easily incorporating interim uses that can reveal potential for bottom-up, community-driven placemaking that creates more inclusive spaces than top-down imposed development.

5.2 Strategies applied

Several distinct strategies can be discerned through the case studies. First, co-creation and participatory processes, as employed in Cody Dock's community-focused and participatory approach involving volunteers, local communities, and local partnerships, and in the Porto Healthy Corridor project, involving residents and local communities in various project phases of design and implementation. This strategy involved also a multi-scalar approach, operating at both local and international levels, with local living laboratories and a network of partners sharing knowledge and resources. Similarly, R-Urban employed a bottom-up, resident-managed network of interconnected hubs, each with specific functions (e.g., agriculture, recycling, eco-housing), suggesting a model that be adapted to local contexts and specificities. In addition, this strategy was enhanced through environmental education in the case of Cody Dock.

Second, tactical urbanism and temporary interventions acting as experiments, exemplified by R-Urban's temporary hubs that can be relocated and reassemblied in different locations when necessary, and Cody Dock's incremental and organic placemaking approach based on community engagement through temporary events, artistic installations and workshops, evolving over time to more permanent facilities.

Third, Terrains Vague spaces as intervention sites for the implementation of nature-based solutions (NBS) and ecological restoration, as seen in the green corridors and clusters of Porto, and in the ecological conservation and habitat creation efforts at Cody Dock.

Finally, intentional focus on intervening in abandoned or underused urban spaces (terrain vague) like R-Urban's approach, promoting adaptive reuse and repurposing of post-industrial sites in a way that respects their inherent qualities and history, like Cody Dock's transformation from an industrial dock to a community hub.

5.3 Governance models

The case studies show that temporary interventions allow for more experimentation, iteration and organic evolution based on diverse users and that partnerships between grassroots groups, local authorities, and developers can be mutually beneficial if balanced. Programming and activities are important - physical spaces alone don't guarantee inclusivity.

In the Porto project, a collaborative governance model operated at two scales involving a local scale consortium of local authorities, public institutions, universities, private entities, and local communities, engaged as stakeholders in the project, and an international scale a network of partners, universities, and academic entities. Community involvement and co-creation processes allowed residents to participate in the decision-making and design of the interventions.

R-Urban championed a bottom-up, resident-led governance and management of the hubs and network, involving local institutions, associations, and residents in the implementation process. This model was conceptualized as an alternative, autonomous model managed by residents, independent from capitalist urban development.

Collaborative and multi-stakeholder governance with the Gasworks Dock Partnership (GDP) as the lead organization was the model at Cody Dock while partnerships with various charities, businesses, individuals, and community groups contributed to shaping the site. An expansion of this model included the involvement of the University of Westminster through research,

teaching projects, and community engagement exercises, culminating in the building of structures on the site as part of live student projects. GDP had also to navigate a complex governance situation with multiple stakeholders, including Thames Water (site owners) and the London Borough of Newham (controlling access points).

In conclusion, Terrain Vague projects tend to promote bottom-up, community-led initiatives, and multi-stakeholder collaborations and partnerships, as demonstrated by Cody Dock's evolution and governance by the Gasworks Dock Partnership, as well as urban commons and collective management, as practiced in the R-Urban project's resident-managed hubs. However, these models of governance are not without their challenges, exemplified in the role of municipalities and potential conflicts, as seen in R-Urban's clash with the municipality of Colombes, and a precarious balance relating to funding (of jobs, maintenance works and everyday running costs) seen in the case of Cody Dock.

5.4 Addressing Urban Challenges

Circular Economy
The reuse and repurposing of Terrain Vague spaces could be considered a form of urban resource optimization. For example, Cody Dock has been turned from a working dock and industrial site to a community and arts hub, working marina for live-in boats and river restoration project.
Practices of material reuse and recycling are at the foreground, highlighted by R-Urban's Recyclab hub and the reuse and recycling of discarded materials in their eco-housing construction, as is promotion of sustainable resource management and urban agriculture, as illustrated by Agrocité in R-Urban and the community gardens in Porto.

Biodiversity
Both Cody Dock and the Porto Healthy Corridor project demonstrate significant efforts in habitat creation and ecological restoration, like the floating reedbeds and horticultural interventions at Cody Dock, enhancing biodiversity along the River Lea corridor through habitat creation and management, or the bird surveys and bat monitoring activities contributing to national databases and research. Similarly, integration of nature-based solutions and green corridors, which can contribute to enhancing urban biodiversity and creating ecological connections, as seen in the Porto Healthy Corridor project. Crucially, awareness and appreciation of local ecology and wildlife can be strongly promoted through educational activities and community engagement, as seed in Cody Dock, reiterating the importance not just of the physical space but of programming and appropriate activities to provide an alternative experience of the urban environment that can have transformational effects in addressing urban challenges.

Urban Ecology
The role of Terrain Vague projects in enhancing urban biodiversity and creating ecological corridors is exemplified by all three case studies. The implementation of linear green corridors and nature-based solutions can support urban ecology by introducing green infrastructure, creating habitats, and promoting ecological connectivity within the urban fabric. The projects chart the evolution of the potential for spontaneous nature to thrive in these neglected spaces, free from human control, to a purposeful integration of urban agriculture, community gardens, eco-housing principles, and promotion of rainwater absorption and air cleaning through green infrastructure as seen in the work of R-Urban. The projects connect urban communities to local

ecology through educational and community engagement activities, like Cody Dock's river trips and educational work with local schools, especially targeting urban youth, or their ecological restoration work of the dock area, carried out largely by volunteers, including integration of ecological infrastructure like floating reedbeds and permanent green spaces (brick planters).

Climate and Sustainability
The ease of integration of green infrastructure and nature-based solutions in terrain vague sites can contribute to urban greening, climate resilience and sustainability by mitigating the urban heat island effect, promoting rainwater absorption, and enhancing air quality. The promotion of green spaces and ecological conservation efforts as seen in Cody Dock and the Porto Healthy Corridor can contribute to urban resilience and sustainability Community gardens and urban agriculture, as seen in R-Urban, can contribute to local food production and reducing carbon footprints, while putting emphasis on resilience, adaptability, and sustainable urban lifestyles as an alternative to profit-oriented urban development through promotion of sustainable resource management, production, and consumption practices.

Community Development
The case studies demonstrated diverse strategies for fostering community development through participatory processes, capacity building, and the creation of shared spaces and resources.

In Porto, the Healthy Corridor project actively involved residents and local communities through co-creation processes, participatory activities, and capacity-building initiatives. This approach promoted social cohesion and cultivated a sense of community ownership over the urban interventions. Similarly, Cody Dock adopted a community-led approach, emphasizing strong community participation, engagement, and capacity building through various activities, workshops, and volunteer opportunities.

The R-Urban project placed significant emphasis on community involvement, facilitating skill-sharing and knowledge exchange through workshops and cultural activities. It provided shared spaces for collective resource management and enabled residents to initiate small business activities based on the skills and voluntary work within the network. Crucially, R-Urban championed the "right to the city" principle, empowering residents to actively shape their urban environment.

All three projects contributed to enhancing community connections and environmental awareness. For example, Cody Dock collaborated with local schools and hosted educational programs, strengthening community ties and promoting appreciation for local ecology. Similarly, the provision of affordable creative spaces, such as artist studios and moorings for boat dwellers, supported alternative lifestyles and artistic expression within the community. Overall, by creating green public spaces and integrating community-driven activities, these projects aimed to improve the well-being and quality of life for residents, particularly in underserved areas, promoting social and environmental sustainability.

6. Conclusions

This analysis has demonstrated the immense potential of rethinking and repurposing terrain vague spaces beyond their perception as ‘waste’ through alternative strategies and governance models. The case studies of the Porto Healthy Corridor, R-Urban in Colombes, and Cody Dock in London reveal how activating these neglected urban sites can powerfully address critical

urban challenges related to the circular economy, biodiversity conservation, urban ecology, community development, and sustainability against climate change.

The projects exemplify diverse approaches ranging from participatory co-creation processes involving residents and multiscalar collaborations, to tactical urbanism through temporary interventions acting as urban testing grounds. A unifying strategy lies in the intentional focus on terrain vague as prime intervention spaces - embracing the inherent ambiguities and indeterminacies of these sites to integrate nature-based solutions, test alternative living, and enable community appropriation.

Significantly, the cases point towards governance models promoting urban commons and bottom-up, resident-led initiatives over profit-driven urban development. Multi-stakeholder collaborations between grassroots groups, local authorities, NGOs and academic partners enabled knowledge exchange and capacity building. However, the projects also navigated complex stakeholder relationships and precarious balances relating to political conflicts and funding insecurities.

Ultimately, rethinking terrain vague through an ethos of shared resources, environmental stewardship and community empowerment can catalyse more equitable, resilient, and regenerative forms of urbanism. As cities grapple with intensifying social and ecological pressures, the latent potential of terrain vague offers an opportunity to re-envision the urban experience through smaller-scale, locally-attuned interventions capable of transformative impacts.

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An analysis of current integration of urban agriculture and domestic garden into urban planning: the case of Île-de-France region

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Abstract
More than a passing trend, urban agriculture (UA) has become a part of modern cities. According to some authors, it provides some ecosystem services (well-being, food, water catchment, biodiversity…) contributing to creating more liveable cities. Although these functions are recognised, not all municipalities integrate those functions into urban planning. The survey conducted on 240 land-use local plans and their integration of UA and Urban Domestic Gardens functions and issues reveal that the most expected functions are environmental, landscape management and social. We also observe that these topics are considered more in the presentation part of the plan that remains more declarative than operational and regulatory. There seem to be contextual and technical constraints on the implementation of regulatory mechanisms to preserve and develop these areas.

Keywords: land-use plan, functions, zoning, resilient cities

1. Introduction
More than a passing trend, urban agriculture (UA) has become a part of modern cities. According to some authors, it provides some ecosystem services (well-being, food, carbon storage, water catchment, biodiversity…) contributing to creating more liveable cities (Stella *et al.*, 2022). Although these functions are recognised, they cannot be generalised. The various forms of urban agriculture[1] (e.g. urban domestic gardens, allotment and community gardens, multifunctional urban micro-farms, peri-urban farm in short chain) provide specific services. Home gardens, despite the non-commercial nature of food production can also contribute to the food and ecological resilience of cities by reducing the vulnerability of households in the event

[1] Urban agriculture is considered as all agricultural practices and forms which supply products and/or services to the city (Aubry *et al.*, 2022) and whose use of space and resources competes with other urban activities (Moustier and Mbaye, 1999).

of economic, supply or other insecurity crises (Seeth *et al.*, 1998, Buchmann, 2009, Cerda *et al*., 2022) and by providing a range of ecosystem services (Cameron *et al.,* 2012).

Reliable methodologies to characterise and quantify these services and their interactions are still lacking. Concerning the contribution of UA to food resilience, the literature is fragmented and not consensual. The estimations depend on UA forms and the calculation methods. On the one hand, some forms of UA have been studied more than others where home domestic gardens now seem to be gaining more attention (Marie, 2019). On the other hand, data are still needed to assess their contribution. Methods of analysis also vary from surveys that rely on declarative data to photo-interpretation estimations. Payen *et al.* (2022) examined urban agricultural productivity by a meta-analysis literature review. They demonstrate that the productivity varies according to the location (e.g., ground-based, roof-based, indoor), growing systems (e.g., hydroponics, vertical or horizontal, controlled environment or open-air, soil-based agriculture), and crops. It is even more complex to understand the correlations between functions. For example, there are still discussions with respect to the environmental efficiency of urban agriculture, which is questioned (Goldstein *et al.*, 2016) and vary according to growing systems and agricultural practices (Hawes *et al.*, 2024). As a result, statements are highly variable, and may be conflicting, depending on the context, practices and methods used. Despite this context of scientific 'uncertainty' and the absence of robust methods for calculating and valuating their contribution, local stakeholders enhance and implement agricultural activities into urban and peri-urban areas to expect different functions. The proliferation of public actions in favour of the development of UA seems to be mainly motivated by the potential contributions expected from the various UAs in accelerating territorial transitions (food, ecology, agriculture).

In France, the debate on sustainable cities has been profoundly impacted by legislation on planning and environment in the late 2000s, known as the "Grenelle laws" (2009-2010). This legal framework promoted the integration of environmental objectives in planning policies. It was implemented through a national action plan for "sustainable cities" (*Plan Ville Durable*, 2010), which included the program "Restoring and enhancing nature in the city" initiated by the French State Secretary for Ecology.
Maintaining urban and peri-urban agriculture has been therefore recognised as a major challenge for sustainable land management. Ten years later, in 2020, the Ministry of Social and Ecological Transition and the Ministry of Territorial Cohesion launched a new '*roadmap for the city of tomorrow*'. In this context, the National Agency for Urban Renewal (*Agence Nationale de la Rénovation Urbaine)* started in 2020 a call for "Fertile Neighborhoods", to support urban agriculture in deprived districts.
These urban planning policies identify UA as a lever for urban transformation in several dimensions which are economic (promoting the attractiveness of neighbourhoods through job creation), social (through improved living conditions and social cohesion), and environmental (through the preservation of natural resources). This transformative capacity of UA is also highlighted by the French Economic, Social and Environmental Council (CESE) in its opinion on "Urban agriculture". However, the CESE's recommendations point to the need to better integrate UA into regional planning, and to develop policies and projects that complement peri-urban and rural agriculture (in particular, food planning projects, in French "*Plans alimentaires territoriaux*"). These recommendations suggest to adapt the legal, regulatory (local land-use plans, zoning, building design) and fiscal regulations, as well as research into sustainability by taking into account the diversity of UA forms in order to promote sustainable development on a territorial scale. As noted by Consalès *et al.* (2018) it seems that only allotment gardens are truly integrated into land-use plans.

More recently, planning policies in France have moved to quantitative objectives regarding land take limitation. The 2021 Law for Climate and resilience set out a binding objective of "no net land take" ("*Zéro artificialisation nette*"), fostering a renewed interest for conciliation between urban densification and preservation of green spaces. According to the law, the planning principles may avoid damage to biodiversity, and where such damage is unavoidable, reduce it as far as possible before offsetting any residual impact that could not be prevented. These objectives are supposed to guide planning principles in terms of biodiversity protection.

In this contribution we question the role play by urban agriculture and private gardens have in the city fabric. We aim to demonstrate how urban agriculture is being integrated into urban planning, and what functions it may fulfil. How do municipalities integrate UA and UDG in territorial projects? Which issues and functions are related to UA and UDG? How does the territorial context determine the consideration for those functions?

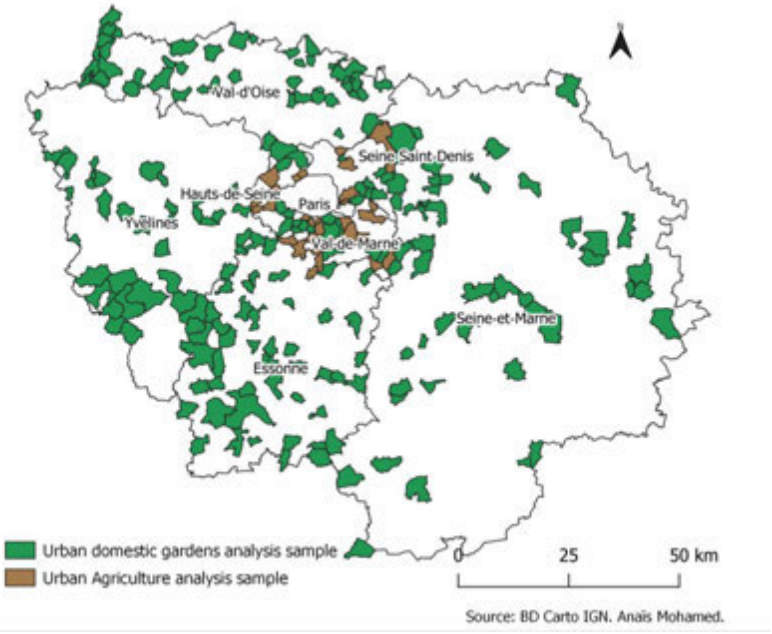
2. Methods

This article is based on two lines of work carried out by the authors: one specifically on domestic gardens and others on urban agriculture. These research thus have two different objects of study, on the one hand, private domestic gardens on individual housing plots in urbanised areas and, on the other hand, on urban collective agriculture's forms: allotment gardens, community gardens, and urban microfarms (Fig.1).

Fig. 1 Urban Agriculture's Forms

Although distinct, the two surveys both question the integration of those forms of urban agriculture into the urban planning at municipal level within the Ile-de-France Region. The scope of the study focuses on urban planning documents respectively on 200 municipalities for the UDG and 40 municipalities for UA located in the Ile-de-France Region. The data set presented in this paper covers the 240 local land use plans (Fig.2).

Fig. 2 Samples of municipalities in the Paris region according to datasets



The interest to explore this geographical area is based on several criteria. First it is the region that concentrates the most UA projects, around 900 according to the French Professional Urban Agriculture observatory. Second, it is the most populated area and most of the population lives in an urban unit. Finally, the urban fabric is very heterogeneous including many private gardens. Indeed, in a geographical analysis of two intercommunal territories inside the Paris Region, Darly *et al*. (2021, p. 18) stated that *'vegetable home gardens account for almost half of the urban cultivated surfaces dedicated to domestic self-provisioning (alongside allotment gardens), and therefore, should be considered as a significant element of a sustainable suburban food system'.*

The analysis was conducted on the four main documents composing the local land-use plans. Those plans are composed of the overview report, the strategic project ("*plan d'aménagement et de développement durable*"), the urban design guidelines ("*orientations d'aménagement et de programmation*") and the bylaw. The overview report sets out the characteristics of the municipality and the reasons for the choices made in the more binding documents, the strategic project and the urban design guidelines. The strategic project summaries the major planning issues and objectives that guide a municipality's planning. The urban design guidelines focus on a limited number of major urban projects that the town hopes to implement and the specific terms and conditions for each of these projects: landscape aspects, objectives in terms of urban renewal and social diversity, targeted land and terms and conditions of acquisition, etc. Only the bylaw has legal power, as they set out the rules to be respected by each land stakeholder (developers, builders, residents).

A quantitative lexical analysis was first carried out by counting the number of occurrences of a selected word (collective or private or community or allotment garden, urban microfarms, urban agriculture, private gardens, etc...) in the urban plans. The goal was to quantify the presence/absence and frequency of different terms within the different part of those plans. This

quantitative analysis was then supplemented by a thematic analysis (Thomas, 2006) to detect the role assigned to collective urban agriculture and UDG. We choose to group the functions provided by them as faithfully as the meaning given in those documents and without applying the ecosystem services grid (biodiversity, landscapes, food provisioning…) to avoid interpretation bias.

We delved deeper with some interviews to local stakeholders (10 for collective urban agriculture and 17 for UDG). Those local stakeholders were deputy mayor delegate to town planning or environment from our respective samples who answer us positively for an interview and members of town planning firms working on the Paris region.

3. Results

The date of approval of the 240 selected documents varies between 2005 and 2021. After this date, certain municipalities approved an urban planning plan at the inter-municipal level. However, it seemed interesting to present this photograph at the municipal level. At the municipal scale, it is easier to territorialise the issues and to better appreciate a diversity of treatment according to the municipalities and the UA's forms. At this scale the differences between political and territorial contexts emerge which are sometimes hidden at the inter-municipal scale.

3.1. Mention of urban agriculture in local land-use plans: a limited use of the concept

We quickly notice that there are significant differences in treatment: i-among the municipalities selected but also ii-between the presentation report, the strategic project and the urban design guidelines.

Regarding the first point, there are some municipalities that mentioned the different forms of urban collective agriculture 52 times at most and 84 times at most for urban domestic gardens, and other municipalities only once in a passive form such as *'there are urban domestic gardens in this area'*. Furthermore, concerning the urban collective agriculture, few municipalities (n=6) do not refer to any forms looked for in the text (collective gardens, community gardens, allotment gardens, urban microfarms and urban agriculture). The reasons for their absence in the land-use plans could be manifold. For example, some territories seem not to have developed such projects yet (e.g. Levallois-Perret municipality), or their implementation does not entail integration in the documents. For example, the Clichy municipality which established its plan in 2010 and modified several times till the 2019 does not mention the allotment gardens despite the fact that they have been renewed in 2018 and have been considered, as it appears on the city's website, as an '*island of freshness within a very mineral environment*'. Conversely the municipality of Boulogne-Billancourt launched a modification procedure to allow '*the introduction of provisions to promote the development of urban agriculture*'.

Concerning the second point, the presence and frequency of UA forms are greater in overview reports than in strategic projects and in urban design guidelines (document in which there are fewer). On average, the keywords researched are much more frequently mentioned in the presentation reports: an average of around 10 occurrences can be observed in these reports, compared with around 1 occurrence in strategic projects and in urban design guidelines. If we assume that there is an upward hierarchy in terms of political commitment between these documents, we can therefore say that those terms are less frequently stated in the context of concrete measures, implying a regulatory implementation. Even more so as most occurrences - regardless of the document - are passive uses of the term where 'garden' is a qualifier to describe suburban landscapes without any targeted issues being raised.

3.2. What functions for urban agriculture and domestic gardens in cities?

The thematic analysis of references in the local land-use plans carries out to highlight a ranking of stakes according to municipalities and UA forms (Tab.1).

Tab.1 Functions associated to selected keywords.

Functions associated with UA	Datasets		
	Urban collective agriculture (n=40)*	Urban domestic gardens (n=200)*	
Environmental functions	50 %**	Services for biodiversity	68.5%**
		Green and blue networks	51%
		Water management	34.5%
Landscape planning functions	45 %	76.5%	
Social functions (living environment, social life)	45 %	28%	
Economic	10 %	N/A	
Food self-production	5 %	4%	

**number of local land-use plans analysed within the two surveys*

** % of the number of local land-use plans *that mentioned* related functions

In the table 1 we considered all forms of urban collective agriculture have been considered without making a distinction by type, which has been done in the following analysis.
Environmental functions are one of the most highly quoted in the two datasets, all land-use plan parts combined. For urban collective agriculture, they are in first rank, quoted by 50% of municipalities they also appear to be a quarter of the total functions identified by the survey. They are related to allotment (46.8%) or community (23.4%) gardens and professional urban agriculture (14%). Most of these issues concern their contribution to the green grid and corridor, and biodiversity protection. There are specific features based on the UA types. Concerning professional urban agriculture, it is also cited as a tool to fight against heat islands and be more resilient to climate change. Furthermore, the roofs are identified to few municipalities as an undeveloped space to enhance those projects. Regarding community gardens those stakes are often associated with the social ones. For example, by emphasising that gardens are spaces where biodiversity and social bonds can be strengthened: '*Biodiversity protection must be seen as an element of "living together": community gardens or planted terraces, these spaces are meeting places that strengthen social ties, enabling people to play an active role in their well-being in the city'* (Nanterre, Local land-use plan). Regarding UDG, biodiversity support functions are in second rank, after landscape functions and are quoted by 68.5% of local-land use plans. There, advantages of UDG for green and blue networks (51%) and for water management (34.5%) are less often quoted. The pollution issues are considered in two different ways: on the one hand making sure the quality of the soil is not polluted to allow cultivation, and, on the other hand, pointing out how these spaces can contribute to reducing air pollution. One can see that municipalities do not have the same perception and management of risk (Baudelet, 2015).

The functions related to 'landscape planning' are quoted by 45% of the urban collective agriculture dataset and 76.5% of the UDG dataset. Two main issues emerge regarding urban collective agriculture. On the one hand, the desire to maintain and enhance UA areas to guarantee a balance between greens and built spaces (42% of local land-use plans). The

presence of green areas in some municipalities is also identified as characterise the territorial identity: '*Chevilly-Larue is an urbanised town with a combination of urban forms and an interweaving of planted and built-up areas that give it its identity and landscape*.' (*Chevilly-Larue's land-use plan*). On the other hand, UA projects as indicated as a tool to reclassify and manage the border and the fringes (17% of local land-use plans). For UDG, landscape planning - first quoted function- is related to urbanisation fringe issues too. It is also cited related to residential area identity issues because they are recognised as an important element of this area's aesthetics.

The social function emerged in second position for urban collective agriculture (45%) and lower down the ranking for the UDG dataset. For urban collective agriculture, they concern 22% of total issues quoted. Differences between urban agriculture forms emerge for the social dimension. Regarding UDG, they are associated with leisure and relaxation needs of inhabitants in an intimate space hidden by vegetation and also to the idea that UDG improve their living environment beyond private areas boundaries by greening streets. The allotment gardens are also associated most to leisure and relaxation (e.g. allotment *'gardens provide a previously underestimated means of evading the world through nature and gardening' – Montreuil's land-use plan*). The community gardens there are more references to the reclaim and opening of space to citizens and to the convivial dimension. They can also be seen as places to create new social relations between social groups based on shared issues, as in this case between peri-urban farmers and urban allotment gardeners: *"This area is also a meeting place for the gardens and the farming world. A shared space could be created to perpetuate the crops of yesteryear while fostering social links."*(*Soisy-sur-École's land-use plan*).

The economic functions are cited only by 10% both of municipalities and issues count and it is related to professional urban agriculture. In the Morangis urban development plan, urban agriculture is perceived as a tool for revitalising agricultural areas suggesting innovative projects and activities. In other municipalities it is more traditionally identified as promoting local activities that encourage short chains and local production. For UDG, this dimension didn't rise during the inductive thematic analysis given the non-market nature of individual gardening. The economic benefits of self-produced food for households were not discussed either.

Among the least mentioned is the food function. The issue of self-production is mentioned by only 4% of municipalities. In the following extract, the most detailed one on self-consumption that we could find, the idea of urban food governance emerges: vegetable garden would be a means of overcoming socio-economic inequalities between resident: "*However, it is worth noting the importance of gardens to local residents, as they contribute to a comfortable lifestyle (leisure gardening, production of fruit and vegetables for household consumption, for example). They also play an economic role for modest households, by encouraging the self-production of vegetables*" (*Brunoy's land-use plan*). Out of 200 local land-use plans, this is unfortunately the only time this dimension has been substantiated. Paradoxically, the feeding function of vegetable gardens is emphasised more often, not for human consumption, but for wildlife. They are thus seen as favourable to urban biodiversity: *"Orchards, gardens and, more generally, the 'urban' environment should be taken into account for their ecological function, particularly those linked to older housing, which can host and provide food resources for a whole range of wildlife adapted to these environments."* (*Bouray-sur-Juine's land-use plan*). Concerning urban collective agriculture, the supply function is cited only in two plans and it is associated with allotment and community gardens respectively as spaces that fulfil '*space for harvesting own*

grown fruit, vegetables and flowers' (*Champigny-sur-Marne's land-use plan*) and '*nourishing production function'* (*Boulogne-Billancourt's land-use plan*).

3.3 Implementation in planning bylaws

For the moment, we focused our analysis on the more descriptive parts (overview reports, strategic projects and urban design guidelines), where the issues and functions associated with urban agriculture are detailed. However, it is in the bylaw that the general rules and land-use restrictions required to achieve the objectives are set up, in line with the strategic development vision. The bylaw is binding on all public and private bodies for the execution of any works or constructions and specify the use of the land (use, nature of activities). The affectation uses are regulated by zoning according to the French Urban Planning Code: 'Urban zones' for already urbanised areas (i.e. developed areas already served by water and electricity networks), 'development zones' for underdevelopment zone, 'agricultural zones" for fields and others cultivated areas and 'natural zones" for forests, meadows and other areas of environmental interest. Each type of zone permits or prohibits specific land uses. For the dataset on collective urban agriculture, we analysed which of these zoning types was used to classify the surface areas occupied by allotment gardens, micro-farms and so on.

Almost half of the documents analysed do not address collective urban agriculture in their bylaws. Furthermore, their integration into town planning regulations is often limited to building regulations. The rules often concern the size of garden sheds regarding allotment gardens or infrastructures for urban agriculture. The French Urban Planning Code does not identify an exclusive zoning for urban agriculture. So, the municipalities care therefore free to allocate zoning according to function's priority and their development strategy. In terms of zoning, most cases of collective urban agriculture are in urban or natural zones.

If we examine in more detail, those zoning have some limitations. On the one hand, urban zones are specifically intended for urbanisation because are the '*already urbanised areas and areas where existing public facilities or those have sufficient capacity to allow constructions to be built*' (*article R151-18 of French Urban Planning Code*) and this zoning does not in itself protect urban agriculture forms. Collective urban agriculture can be incorporated into some sectors of this zoning, often those designated for green spaces. However, as the emphasis is elsewhere, the protection is not fully guaranteed in these zones, complementary protections should be associated. Regarding the natural zones, the article R151-24 of the French Urban Planning Code defines them as areas of the commune areas of the commune to be protected '*their character as natural areas*' or the need to '*preserve or restore natural resources*'. Construction is limited in these areas, to preserve the zone as much as possible, and thus the gardens. The written regulations may modify the rules of constructability, by accepting garden sheds, for example. The natural zone is well suited to this purpose because, in addition to including the protection of gardens in the territory's objectives, it allows the definition of specific and customised rules. However, there are also cases where these projects can be installed in all zones. For example, the municipality as Boulogne-billancourt allows the implementation of urban agriculture projects in almost all areas without confining them to a specific zoning. However, they do not think that this choice has had an impact in the development of these areas.

In very limited cases are allocated to specific zoning or agricultural (A) zones. The first solution is the least chosen, the municipality of Thiais or Vitry sur Seine mobilised a specific zoning: Nj defined respectively as a '*reserved for allotments or collective garden sites*' (*Vitry's land use plan*) or "r*eserved for leisure activities (archery, allotment gardens)*" (*Thiais' land use*

plan). The Montreuil's land-use plan zoned the major agricultural area of '*Murs à Pêches*' as agricultural zones and the municipality identified a "derogatory area". These derogatory areas are defined in the French legislation as "sectors with limited size and capacity" where limited building rights are allocated although in agricultural or natural zones.

The exception of a few derogatory areas in natural zones is also implemented to UDGs, which are almost always located in urbanised areas. So, in the UDG survey, we focus more on sub-zonings of urban areas. Municipalities can use different kinds of rules, set out in bylaws such as sub-zonings which limits the uses and actions on both public and private land within a freely defined perimeter of the urban territory:
First, there is 'protected cultivated land': It applies to land in urbanised areas such as allotment gardens, tree nurseries, orchards and any other land with agricultural vocation that has been cultivated in the past, if it is not currently being cultivated at the time of its classification. In theory - by its title - this is the protection zoning most likely to maintain the food production purpose of UDG. However, the goals of this sub-zoning defined in the national urban planning code are above all focused on the functions of maintaining biodiversity and ecological corridors: *'It may locate, in urban areas, cultivated land and undeveloped areas necessary to maintain ecological continuities to be protected and non-constructible regardless of the facilities, if any, that serve them.*' (Article L.151-23 of the French Town Planning Code). It is also used in setting up landscape buffer zones in some municipalities: "It should also be noted that to preserve landscapes, a steeper setback from agricultural and natural zones is imposed in the parts of land covered by the 'cultivated land to be protected' grid in order to ensure smoother landscape transitions." (*Longevlliers' land-use plan*). In terms of regulation, just like zoning based on 'landscape components' - defined by the same article - the defined perimeter is considered un-buildable. Unlike 'classified wooded areas' and other 'landscape features', no prior declaration is required for work on or removal of orchards. Furthermore, there are no specific rules to guarantee the quality of cultivated soil, for example, or to ensure the continued presence of certain inherited or vulnerable cultivated species. This raises the question of the relevance of this regulation in relation to its theoretical aims.

Municipalities can therefore choose to classify their UDG as 'landscape features', which gives them greater control over their land use. To justify this classification, but also because it is a function perceived more systematically than their self-production function, municipalities justify the vegetable garden's contribution to urban landscapes. It brings a hint of 'countryside' to the city: '*A significant amount of greenery, in the form of vegetable gardens, fruit trees and climbing plants on the party walls bordering the Yvette, gives the whole area a rural feel.*' (*Bures-sur-Yvette's land-use plan*).
More indirectly, vegetable gardens appear to be a positive externality on land that has been classified as un-buildable for other motives. As for example, in this commune crossed by a river, with a 'flood risk area' perimeter: '*We do have a few plots that remain, particularly at the bottom of neighbourhood X, on the banks of the Yvette, so we are in a flood-risk area. So, thanks to that, it has kept a bit of its use as a vegetable garden'* (elected town planners from an intermediate density municipality).

On the contrary, other rules that do not aim to protect these cultivated areas can have a negative impact on the practice of vegetable gardening by limiting the potential for cultivation, as illustrated here by a member of a town-planning firm interviewed: *"You have to be careful when you introduce such zoning or rules, with the actual design of the rules and the way in which they are superimposed, because you can block any use of the garden, the possibility of installing a garden shed or cultivation by prescribing too many trees, and that can also be negative for*

biodiversity because people say: "well we can't do anything about it.". Similarly, in an almost all municipalities studied, legal uncertainty surrounding infrastructures such as greenhouses, resulting from a poor foresight by planning authorities and consultants, may be a disincentive to the establishment of perennial crops in UDGs.

4. Discussions

4.1. Integration of UA and UDGs in urban planning is heterogeneous

Although we did not carry out a comparative analysis between our keywords and other topics of interest to the planning as transport, as realised by Blanchart *et al.* (2019) concerning their survey on soil and biodiversity integration on land-use planning, the results seem similar. The findings reveal that UA and UDGs are issues which are not largely addressed in studied land-use plans. The number of occurrences is relative (52 times at most for urban collective agriculture and 84 times at most for urban domestic gardens) considering the size of these documents, which can lay 1000 pages. Moreover, it has been observed a diversity of treatment of the subject according to the municipalities based on their territorial context and willingness to integrate or not this matter in their political and territorial project. However, even when this topic is addressed, we observe that they are regarded more in the presentation part of the local land-use plan that remains more declarative than operation and regulatory.

Other unequal treatment also appears according to the urban agriculture forms. If the UDGs are almost always considered because they are associated with specific urban fabric (suburban area or individual housing), our results regarding the collective urban agriculture confirmed, as demonstrated by Consalès *et al.* (2018), that the allotment gardens are one of the forms of UA best considered by urban planning.

4.2. A food function not contemplated in urban planning.

We would like to emphasise that not all functions are equally considered. If environmental, social and landscape planning functions and associated issues (biodiversity support, flood risk management, balancing of urban and unbuilt space, social bonding…) are more or less quoted, the food production function is largely omitted. We noted a discrepancy between the functions provided by UA identified in land-use plans and those highlighted in the academic literature. Although there is still no precise estimation of the food contribution as indicated in the introduction, some authors underline vegetable gardens contribution to the food resilience (Taylor and Lovell, 2014). They increase the food security of low-income individual households (Kumar and Nair, 2004; Buchmann, 2009; Gerster-Bentaya, 2015; Siegner *et al.*, 2018), decrease the vulnerability of households in times of economic, supply or other crises (Seeth *et al.*, 1998; Buchmann, 2009) and enhance social resilience in unsecured context by promoting values such as *"diversity, self-organisation, and adaptive learning and management leading to and positive feedback loops"* (Tidball and Krasny, 2007, p. 151).

For UDG's this lack of consideration from urban planning actors can be attributed to several factors: firstly, a difficulty in identifying the extent of the vegetable gardens within UDGs: aside from food production, UDGs support a diversity of practices. When they are cultivated, it is difficult, without photo-interpretation analysis, to identify the extent of cultivation.
Secondly, there appear to be some cultural obstacles. Indeed, there seems to be a prejudice on planners' perceptions that any resident who owns a house with a garden would have an above-average income and would therefore have no economic interest in cultivating their own garden. However, some research conducted on vegetable gardens showed an important intra-

urban variation in the spatial distribution of vegetable gardens depending on the social composition of neighbourhoods and the structure of the housing stock: proportion of houses with gardens, proportion of homeowners (McClintock, 2016; Marie, 2019) and parcel size (Darly *et al*., 2021). Furthermore, drivers for self-production may have other purposes than just economic ones, as the literature on food production in UDGs and collective gardens has shown (Schupp and Sharp, 2012; Pourias *et al*., 2012) it can be led by rejection of unsustainable industrial food (Weber, 1998; Kortright and Wakefield 2011), cultivation of varieties or species that are not or no longer found locally - which could also be seen as an interest in the biological conservation of biodiversity (Aguilar-Støen *et al.*, 2009; Galluzzi *et al*., 2010); or maintenance of inherited practices and varieties that contribute to the cultural identity of the inhabitants (Kortright and Wakefield, 2011; Mazumbar, 2012). However, the local urban plans analysed for this study do not take account of such issues. At urban planning scale, the food self-production is still not recognised as they should by cities to enhance local resilience.

4.3. In search of zoning regulations suited to the multifunctionality of agricultural spaces

Lastly, we would like to stress that they are no common and dedicated planning tools for UA regulation. UA projects are mostly classified in natural or urban zones, but more rarely in agricultural zones. This could be explained by the fact that the classification of an agricultural zone by national urban planning code is based on the agronomic, biological or economic potential of the agricultural land. Therefore, development rights are restricted and should be connected to agricultural activities. The urban and natural zones in some cases may be more relevant for environmental and social functions of UA. At the same time, planning regulations in urban zones allow a reversibility of land use (and greater flexibility for building rights supporting diversification in farming activities (conditioning, on-farm sale, agri-tourism, etc.). By contrast, agricultural zones may be more restrictive, except in except for derogatory areas. Aragau and Desrousseaux (2023) explored the difficulties and barriers to the implementation of agriculture into planning, through field surveys in the Paris region, and underline that local planning authorities are reluctant to implement protective regulations for farming activities, in order to give some flexibility for future housing projects. But in some cases, local initiatives promoting re-territorialisation of agriculture may help to design adapted regulations for these farming activities. A better integration of agricultural activities in planning policies is in line with on-going initiatives to connect urban and food planning (Liu, 2023).

Furthermore, the adoption of the Climate and Resilience Act[2] edicting the no net land take objective by 2050, will sharply limit urbanisation of forested and agricultural areas and favour densification in already urbanised areas. However, according to recent implementation decrees (Decree nr. 2023-1096, 27 November 2023) a typology of urban soils has been drawn up in which 'Areas used for residential purposes, secondary or tertiary production, or for infrastructure such as transport or logistics, where the soil is covered by herbaceous vegetation' under 2500 m² – in which most of UA could belong- will be considered as artificialised and could be used in building projects. If UA projects are not conceived and protected over a long-term period, they may be vulnerable to pressure on land in a context of intensifying urbanisation. In our opinion, the ability of stakeholders to perceive issues involved in this relocation of agriculture within cities is the main condition for the introduction of regulation protecting urban agriculture.

Our study also leads to recommendation for a dedicated legal framework (with both flexible and protective zoning) taking into account all the functions and related differences among the urban agriculture types. We suggest that specific assessment tools could be designed for UA,

[2] Law n° 2023-630, 20 July 2023, facilitate the implementation of objectives to reduce land take and strengthen support for local elected representatives.

providing analysis of their potential contribution to local food consumption and to ecosystem services taking account of spatialised social inequalities (Qiu *et al.*, 2023). All forms being multifunctional, it remains a specificity linked to the vocation of market or non-market production. The challenges among the different forms of UA are not the same: a distinction should be made among the amateur gardening and the professional urban agricultural. The challenge is to be able to manage the trade-offs between social, environmental and food production functions according to the specific vocation of those different forms.

5. Final Remarks

The survey conducted on 240 local land-use plans and their integration of UA and UDGs functions and issues highlight that the most expected functions are related to environment, landscape management and social dimensions. The economic and food production functions are limited and not considered yet. These findings are consistent with the analysis of bylaws (which concerns in particular urban and natural zones). With our approach taking into account the various forms of urban agriculture, we were able to show that both domestic garden and collective agriculture functions need a better understanding of their functions and better tools in local land-use plans for cities' resilience.

Rethinking the place of agriculture in the city has become all the more urgent in the context of the battle against urban sprawl, which recently led to the adoption of the Climate and Resilience Act. Local authorities should increasingly be looking at the place of non-urbanised spaces and the renaturation of towns and cities including UA and UDGs' protection. Urban agriculture and urban domestic gardens are likely to contribute to cities' resilience at the lever for climate change adaptation but also for food provisioning. To be more effective the land-use planning should be integrated. Policies at a greater scale and sensitisation of local stakeholders on UA's function could lead to a better integration of environmental, social, and economic resilience provided by UA in local land-use plans.

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Planning tools and building regulations towards greening densely-built Greek cities: scales of 'urban green grabbing'

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Abstract
'Green' urban development is the dominant paradigm of spatial planning and is framed by changing overarching concepts such as sustainability, resilience and more recently climate neutrality. As the Greek spatial planning system has incorporated the objectives of greening cities, the paper highlights the need to assess new tools of urban development and planning in Greece in terms of their cumulative impact on the urban landscape, both in terms of the image of the city and their actual contribution to the pressing goals of improving environmental conditions and adapting to climate emergency. The paper activates the concept of 'urban green grabbing' as introduced by Garcia-Lamarca et al. in 2022, that studies green urban development through a socio-political lens and highlights the grabbing of urban common resources that is promoted in the context of environmental protection and energy conservation. Through this perspective, the paper critically presents the nature of environmental incentives and planning tools related to urban greening, that were introduced during the financial crisis and discusses the outcomes of such tools in the image and the environmental conditions of densely built Greek cities.

1. Introduction

Urban development in tandem with the natural environment, from the local to the planetary, has been a dominant 'paradigm' of spatial planning since the early 1990s, promoted through international organisations and networks, national and urban policies and framed by changing concepts such as sustainability, resilience, and more recently climate neutrality. Planning at all scales, from regional planning to urban design and the regulation of development of individual plots, has been driven by the environmental protection mandate. There is common understanding that this mandate does not anymore concern only untouched landscapes of exceptional aesthetic or ecological value or tamed agricultural land. Environmental protection, during the last decades, has been extended to include socio-natural urban ecosystems, which are recognised as a critical spatial level for promoting sustainability, resilience and, more recently, targets such as decarbonisation and climate neutrality. These changing framings of environmental protection are introduced as global goals, through non-binding documents of international organisations, such as the UN Sustainable Development Goals (SDGs) and the European Green Deal. They have also been incorporated into the institutional framework of spatial planning in Greece and have been integrated into the discourse and targeting of urban interventions, through EU funding programmes and international networks.

The economic crisis that broke out in 2008, starkly affected Greece since 2010, while its ending year is debatable and blur. Between 2008 and 2016, private construction activity in the country recorded a continuous decline (ELSTAT, 2019). Amidst the full spectrum of austerity

politics, spatial policies acquired a prominent position. The years of the crisis have been rich in the production of laws and regulations, reforming the legal framework of urban planning and land development. Notwithstanding the environmental rationale of many introduced tools and codes, the dominant imperative of this period was to accelerate the implementation of land use plans, facilitate land development and overall 'improve the business environment' in the country. Construction activity started to recover reluctantly since 2017 (ELSTAT, 2019). Thus, the effects of new planning tools and regulations concerning development of public and private land started to become visible in cities from 2020 onwards.

The paper focuses on new planning tools and building codes that were introduced in the Greek framework of spatial planning and land development, during the period of the economic crisis, with the stated intention to promote sustainability & energy transition and more specifically to "green" densely-built cities.

First, the concept of 'urban green grabbing' is introduced and its application is extended to the 'commons' of the urban landscape, as produced cumulatively by the development of small individual plots of private property, as well as through larger and more salient urban development projects, led by public or private actors, or the combination of the two. Then, the characteristics of urban green grabbing in the urban landscape of densely built Greek cities are explored in the contemporary condition of the presumably post-crisis era. Specifically, the paper examines the incentives introduced by the New Building Cod (NBC) of 2012 and the environmental objectives embedded in the relatively new planning tool of Special Urban Plans (SUPs), which concerns usually large properties or areas, within urban areas or beyond.

It is argued that urban green grabbing, performed through new planning tools introduced by the state to regulate land development and promote urban greening, concerns 'urban commons', such as the image of the city, the urban landscape, public space and ultimately the quality of life of the city's inhabitants.

2. Urban Green Grabbing

Land grabbing is a global phenomenon and refers to encroachment and illegal use, selling off in terms that harm the public, privatisation and changing institutions that create conditions for land privatisation (Hadjimichalis, 2014). Green grabbing refers to land grabbing legitimated on the grounds of environmental protection. Like land grabbing in general, 'green grabbing' is an international trend with local manifestations and specificities and with a clearly more pronounced appearance in poor countries of the Global South. The term belongs to the Guardian journalist John Vidal (2008), who referred to the privatisation of land to protect biodiversity, to capture carbon dioxide, to reduce global warming and climate change, to grow energy crops in order to make the energy transition from fossil fuels to renewable sources. In the post-financial crisis period, the term can be used with reference to large-scale renewable energy installations - wind farms and photovoltaics - which, in the name of mitigating the planetary problem of climate change, degrade landscapes and ecosystems and legitimise the grabbing of land in Greece and other countries (Apostolopoulou & Adams, 2015).

Land grabbing for the promotion of environmental goals is part of the general discourse on 'green economy', i.e. the possibility of accumulating capital and at the same time promoting environmental protection, or better still, accumulating capital through processes aimed at protecting nature. This is a dominant approach, developed as early as the 1990s, in the context of 'ecological modernisation' (Mol & Spaargarden, 2000) and the related target concept of sustainable development. Environmental protection has since been placed at the

centre of the global economy and is no longer associated with a critical discourse towards the dominant development model, as was the case with earlier manifestations of the environmental movement. Instead, 'ecological modernisation' supports that the only way to protect the environment is through economic growth within the capitalist model.

As Fairhead, Leach and Scoones (2012, p. 242) observe, this entanglement of environmental protection with market mechanisms "is doubly valuing nature: for its use and for its repair". The first valuing refers to the use, degradation, and depletion of any kind of natural resource by humans, and the second refers to the production of value from the very need to protect and repair nature. The former creates the basis for the later to occur, and the two together create the full value of nature.

Garcia, Lamarca et al. (2022) explore the urban dimensions of land grabbing in cities, introducing the concept of "urban green grabbing". They examine the role of "greening" projects in urban areas in extracting greater value from investment in housing construction in European and North American cities. Adopting a socio-political lens, "urban green grabbing" illuminates the ways in which, interventions to "repair" the urban environment, adapt to climate change or mitigate its impacts are linked to the production of additional economic value. Urban land investors appropriate greater profit, social capital and prestige by locating their investments in close proximity to new "green" projects, near parks, greenways, green and blue infrastructure. At the same time, Garcia Lamarca et al. highlight phenomena of 'green gentrification' and intensification of social inequalities associated with urban strategies aimed at urban sustainability, climate change adaptation and resilience.

In the quaternary constitution of land proposed by Hadjimichalis (2014, pp. 28-30), inspired by Lefebvre, land is not just its physical-geographical delineation on the map, but also the intangible relations that are created between specific parts of land and specific individuals, groups and regions. In this sense, urban plans, land use and other conditions that regulate the terms of use and development of land constitute one of the four dimensions of land. These intangible relationships are created by the state, that still allocates development rights and designates land uses. Thus, they selectively assign "the privilege of collecting high rents", in other words, the privilege of extracting high value from their land (ibid. p. 29).

Through such an understanding of land, the concept of urban green grabbing is extended to highlight how, privileged development conditions are created for specific parts of land, development rights and permissible building heights of specific urban plots are haphazardly increased, and thus the urban landscape is unpredictably transformed and cumulatively undermined through specific institutional provisions that seek to promote environmental objectives for Greek cities.

3. "Greening" with incentives

In Greece, the introduction of incentives aiming at producing environmentally friendly buildings was introduced with the New Building Code (NBC) of 2012 (Government Gazette 79/A/9-4-2012). The NBC provides voluntary incentives for high environmental performance certified through Leadership in Energy and Environmental Design (LEED) or other international rating system, for renewable energy installations and for reducing buildings' coverage on the ground to increase green spaces in densely-built urban areas.

In particular, Article 10 of the NBC gives incentives for "environmental upgrading and improvement of the quality of life in dense urban areas". These concern the entire territory of the prefectures of Attica and Thessaloniki, as well as the municipalities of Patras, Larissa, Heraklion, Volos and Nea Ionia, Magnesia and Ioannina. Traditional settlements, traditional parts of towns and areas designated as historical sites are excluded.

The main aim of these incentives is to increase the amount of unbuilt open space in urban areas. Thus, new buildings constructed in the aforementioned areas are given a bonus of floor area and bigger permissible height, with the precondition that they cover a smaller proportion of the plot, than permissible in the area. Under certain conditions, a bonus of additional floor area is allowed on properties that reduce the coverage implemented to between 10 and 35 percent (%). The bonus of additional floor space can be up to 25 percent (25%), in excess of what is permissible in the area, when public access is granted to the resulting unbuilt part of the plot and a pre-existing "lower energy class" building is "withdrawn", i.e. demolished, from the same plot. However, the bonus is also given for smaller reduction of ground coverage, and without the condition of public access to the remaining unbuilt space (Article 10, paragraph 1, case a). As permissible plot ratio is linked to permissible height, the incentive to increase building automatically means a corresponding increase in permissible building height.

For large properties of at least 4000m², which concede 100% of their unbuilt part of the plot to public access, the bonus provided increases the permissible floor space by 35 percent (35%), also adding up to 30 percent (30%) extra height, again subject to a reduction of ground coverage (Article 10, paragraph 1, case g). The resulting unbuilt area is open to public use, and is landscaped and maintained by the municipality.

Article 10 seems to be inspired by the 1961 New York City Zoning Resolution, which is one of the first planning tools based on incentives to achieve goals for the common good. The ordinance incentivised additional building rights and height to buildings that reduce coverage of the plot and conceded the remaining unbuilt surface - small plazas or arcades - to common access. It allowed up to a maximum of 20 percent (20%) more floor area above that permissible in the area, in exchange to the creation of accessible open space on the ground (New York City Planning n.d.). This law became very popular among developers and led to the creation of the so-called POPS (Privately Owned Public Spaces). There are currently more than 550 POPS (NYC Planning n.d.) in downtown New York City, including high-profile examples such as Paley Park, notable for its design and handling of environmental conditions, and Zuccotti Park where the Occupy movement unfolded in 2011. New York City Zoning Resolution, through successive amendments, set a number of restrictions regarding the location, the size and the shape of the resulting open spaces, as well as design specifications with regards to the orientation, amenities, accessibility, planting and interior pathways. However, the "publicness" of POPS has been widely questioned. It has been observed, that POPS are not really open to the public, who are often actively discouraged from using the plazas, either through design strategies or with a variety of operating rules introduced by the owners and managers (Smithsimon, 2008).

In the case of Article 10, the bonus of additional floor area is granted, even when there is no public access to the resulting unbuilt area on the ground (case a). For higher percentages of coverage reduction, common access is required, and is granted to the municipality by a notarial deed. The municipality is responsible for landscaping and maintenance of the ceded open space. However, there are no restrictions regarding the shape and size of the accessible

part of the plot, except that it must be "continuous with a common use area as designated at the urban layout and one side of the ceded space, must coincide with the entire length of the plot's boundary towards the street, provided that it [the ceded open space] is at least 1.5 metres deep" (Government Gazette, 2012).

Figure 1 A newly built apartment block in Thessaloniki, utilising the combined effect of several environmental incentives of NBC and its publicly accessible open space

Given the small size of plots in Greek cities, the benefits of granting public access to these unbuilt remnant spaces are debatable. The case shown in Figure 1 is indicative. The 486.05m² plot is located in Kalamaria which is one of Thessaloniki's municipalities, at the eastern part of the urban conglomeration. It is a relatively large plot, given that the minimum buildable plot size in the area is 200m². Taking advantage of the provisions of Article 10 of the NBC, (paragraph 1, case d), a bonus of about 25% extra floor space and 5.4m extra height - from 26m, which is the permissible height in the area, to 31.40m - was granted to this plot. These bonuses were won by reducing the plot coverage by 12 percent (12%), providing public access to 97.22m² of open space, creating a green roof and a swimming pool on the roof and demolishing a pre-existing building "of lower energy class". The space granted for common use is distributed on two sides of the corner plot and is L-shaped, while the depth of it measured from the property's boundary towards the street to the building is a maximum of 4.85m (Figure 1). As the example illustrates, the publicly accessible space produced in a relatively big plot is rather small and divided into two parts. At the same time, the combined effect of different NBC incentives, result in a building that stands out in the neighbourhood, with its enlarged volume and protruding height.

In addition to Article 10, Article 15 of the NBC gives bonus height of 1 metre when a green roof is constructed. The resulting height may exceed the height permissible in the area and the maximum permissible anywhere in the country, which is 32 meters. Also, Article 19 allows a main use built space of 35m² in excess of the permissible height, when a green roof is

constructed. The same bonus applies when renewable energy facilities are installed on the roof.

Finally, Article 25 provides height and floor area incentives to new buildings with reduced energy consumption. In particular, a 5 percent (5%) increase of the plot ratio, i.e. more floor space, is granted to buildings with up to 10 kWh/m^2/year energy consumption for heating, air conditioning, ventilation and lighting, and a 10 percent (10%) increase to buildings certified by an international rating system, such as the American LEED.

It should be noted that in addition to the above, which can be utilised in combination when applying for planning permission, permissible floor area is increased by other NBC provisions, that do not have an environmental objective. For example, stairwells, attics and mezzanines are not calculated in the building's gross floor area.

The specific urban planning regulations, through an environmental protection rationale, promote the increase of built floor area and, thus, urban densities in the already densely-built Greek cities, increase pressure on existing technical and social infrastructure, create contestations between neighbouring sites in the name of increasing green spaces and saving energy.

Incentives promoting green practices for new buildings also lead to increased building height, which often far exceeds what is permitted in urban plans, currently in force. Increased building heights contribute to the production of a new haphazard urban landscape, characterised by lack of control, coherence and continuity, and unpredictably interspersed with salient 'landmarks' of 'green architecture'.

These extra building heights are introduced randomly, without any documentation, without any control of the desired urban image and without addressing the negative impacts and planning for the necessary infrastructure. In addition, they degrade the environmental conditions of the neighbourhood, in particular the conditions of insolation and ventilation of the streets and surrounding buildings, and restrict the views of buildings adjacent to them. At the same time, the actual gain in accessible green spaces, mostly because of the small size of plots in Greek cities, is disputable. Lack of detailed design specifications regarding the size, shape and amenities of these spaces also reduces their positive impact.

The effects on the structure, function and image of the city from the implementation of the above have already become apparent, as many new apartment buildings under construction seem to far exceed the heights of their neighbouring buildings. Given that designated historic areas are excluded from these provisions, these random additions of incongruent heights, protruding several storeys above their neighbouring builidings, do not occur in historic centres, but in the densely built neighbourhoods beyond the centres, which lack infrastructure, identity and general care as they are not particularly visible, adding a further layer of degradation.

Moreover, incentivising additional built square metres of floor area and greater height for new buildings to "withdraw buildings of lower energy class" promotes the demolition of older uninsulated building stock. These older builidngs, may not be listed, but contribute their smaller scale, rich texture, architecture and memory, thus enriching the identity of neighbourhoods. It seems predestined that, not only unbuilt plots will take advantage of the voluntary environmental incentives of the NBC, producing enlarged and taller buildings, but

also that there will be a swift "withdrawal" of any remaining evidence of past architecture and memory from the neighbourhoods of Greek cities.

It should also be noted that, although the aim of the incentives of the NBC is to increase open space in densely-built urban areas, excessive volumes and heights also materialise in suburban neighbourhoods that are not densely-built and do not lack green spaces, undermining the urban landscape and the quality of life in these areas. Such suburban municipalities in Athens have recently appealed to the Constitutional Court to block buildings, that utilize such incentives from being constructed in their territory (Lialios, 2024).

4. Green landmarks

All the above, have started to become apparent in recent years as construction activity in the country was relaunched, after years of almost total halt. At the same time, proposals for new large-scale developments utilising the planning tool of Special Urban Plans (SUPs), as well as other types of legitimate exceptions to existing plans and regulations, are proliferating. Introduced in planning legislation, initially as Special Spatial Plans, during the crisis in the context of the so-called 'urban planning reform', SUPs '.... may modify previous Local Spatial Plans and any general and specific planning regulations applicable to the area of the project, in particular as regards permitted landuses and building codes and restrictions'[1].

The introduction of the Special Urban Plans (SUPs) legitimates bypassing existing planning provisions for projects of "supra-local scale or strategic significance", including programmes of urban regeneration or environmental protection or plans dealing with the consequences of natural disasters and when there is 'the imperative for rapid completion of first-level urban planning by the state, due to critical spatial problems that require immediate action or the prevention of the creation of ad hoc conditions, due to a lack of or inadequate planning". Special Urban Plans may be initiated by different agents, public or private, and may concern different scales of planning and different themes.

It should be noted that, the 2020 Law (Government Gazette, 2020) that finalised the specifications of SUPs, was aimed at "simplifying, accelerating and improving the efficiency of the spatial planning system" (Chapter A). Through this selective "acceleration" of spatial planning processes, the possibility of comprehensive planning and regulation of urban space is undermined or even substituted. In Thessaloniki, in particular, more than 10 such plans are currently being discussed, are at different stages of development or have already been approved, most of which are located in the central municipality and are initiated by private actors.

The most recently approved SUP in Thessaloniki (Government Gazette 734/D/15-9-2023) is indicative of the way environmental rationale is utilised to legitimate bypassing existing regulations and restrictions in force. The SUP concerns the development of an abandoned industrial complex, Kerameia Allatini, which is owned by a local entrepreneur. It envisages, for the first time in the city, the construction of a tall building 100 meters high (Figure 2). As mentioned above the maximum permissible building height anywhere in the country is 32m. The tallest building in the country so far, is the Tower of Athens which is 100m. The Tower and a handful of other buildings in Athens were mostly built during the dictatorship, taking

[1] Initially, Law 4269/2014 Spatial and Urban Planning Reform - Sustainable Development introduced the Special Spatial Plans. Then, they were amended by Law 4447/2016 Spatial Planning - Sustainable Development and took their current form in 2020 by Law 4759/2020 when they were called Special Urban Plans.

advantage of Compulsory Law 395 (Government Gazette 1968) "About building height and the system of fee-standing construction".

The choice of a tall free-standing tower, instead of the typical configuration of the urban bock, for the development of the site of Kerameia Allatini, is legitimated in the SUP on the basis of the reduction of ground coverage and the creation of a publicly accessible green park. It is also argued, that the tower endows the project with characteristics of metropolitanism and supra-locality and "materialises the concept of a landmark". The 100-metre tower will be located only 50 metres from the south side of the listed buildings of the historic industrial complex, which are maximum four storeys tall. In this case, as in other cases of SUPs, important qualities of the urban landscape seem to be undermined, and the image of the city is being transformed *ad hoc* in the name of a dubious environmental benefit. Moreover, the remaining open space, although publicly accessible, introduces a new hybrid type of public space, which is privately owned and managed.

5. Grabbing the urban landscape

According to Article 24 of the Constitution of Greece, "the formation, development, planning and expansion of cities and settlements in general is subject to the regulatory competence and control of the State, with the aim of serving the functionality and development of settlements and ensuring the best possible living conditions" (Constitution of Greece, 2019).

Figure 2 The tower proposed at the Special Urban Plan for the development of the site of Kerameia Allatini in Thessaloniki. Source: Sovitsli 2022.

Both in the Constitution of Greece and arguably throughout most of the history of urban planning, there is an implicit assumption that planning provisions, which regulate, among other things, landuse and land development, aim at promoting the common good or the public interest (Lennon, 2022). This concept is, of course, difficult to define and recent approaches to urban planning have challenged or undermined it (ibid.) However, urban plans and codes that regulate land use and development rights remain the responsibility of the state and are intended to manage urban space, to control density, height, volume, incompatibilities of landuses and contestations and thus, influence positively and equitably the urban conditions and the image of the city. Indeed, the quality of life, environmental conditions and the overall

image of the city are gradually and cumulatively produced by the development of individual plots of land, large and small, public or private.

The legal excesses of floor space and height of new buildings and of the large developments of the SUPs undermine the very identity of the landscape of Greek cities as it has been shaped since World War II, with the medium-rise building block, of predominantly 5 to 7 storeys, produced through the mechanism of *antiparochi* (see Maloutas, Siatitsa & Balabanides, 2020, Theocharopoulou, 2022) as its cell of increment. Architecture historian and theoretician Kenneth Frampton (1987, p.14) described this landscape as a "special civilised level of urban construction, without equivalent in any part of the modern world. ...a very dense and unique texture, woven, one might say, into the fabric of the 19th century, with the weave of a disciplined modern building regulation, which determines both the coverage of the plots, and the height of buildings."

The incentives of the NBC may contribute to achieving the global mandate of reducing greenhouse gas emissions and, thus, mitigating climate change in a measurable manner. However, the environment is not only planetary and measured, but also local and lived. These provisions cumulatively undermine the urban landscape, the image of the city as perceived in the neighbourhoods where city residents live their everyday lives and the environmental conditions of the immediate urban environment (Papageorgiou, 2022). At the same time, the loosely controlled property-led developments facilitated by SUPs, often adopting an environmental rhetoric and a "greening" agenda, introduce new scales and typologies of development to the fabric Greek cities and greater building heights.

The environmental incentives for the development of individual urban plots, the incremental cell of urban development, combined with the large developments of SUPs prescribe the new incoherent landscapes of "urban green grabbing", which is dotted with unpredictable "green landmarks" and new types of public spaces. Through the planning tools of the period of economic crisis, the objective of environmental upgrading of the building stock and improvement of the environmental conditions in cities became inextricably linked to the mandate of accelerating processes of land development and, thus, boosting the economy. A more flexible framework for the production of the urban landscape, is thus sought after, one that encourages more investment on construction and partially outsources the obligation to produce public space to private investors. The open spaces produced, which in some cases may not even be accessible to the public, depart from the traditional model of publicly owned and managed public space and shift to different hybrid models, whose "publicness" is debatable.

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Greening the void: actions for the de-sealing and renaturalisation of soils in brownfield regeneration processes

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Abstract
The decommissioning of industrial sites has started a complex 'season' in which different actions for their reuse have emerged. In addition to the preservation of existing structures, projects have emerged that have chosen to combine the actions with soil de-sealing interventions. This 'demolition without reconstruction' has generated a new permeability and created the conditions for new public facilities and the partial renaturalisation. The analysis of a selection of brownfield redevelopment experience makes it possible to compare both the spatial effects and the relative variety of planning policies adopted. The contribution proposes the identification, analysis, and comparison of some regeneration processes of large brownfield sites, selected in two different Italian cities, which are characterised by the promotion of soil de-sealing and the implementation of NbS.

Keywords
Browfield, de-sealing, Nature-based Solutions, Urban regeneration, Urban planning tools

Introduction

We often make the mistake of considering human settlements as natural events because they are influenced by autonomous, uncontrollable, and unpredictable laws of development like those of biological organisms. Cities do not grow out of their own, inscrutable instincts, but are built piece by piece by their inhabitants (Rykwert, 1976). With deliberate actions, communities continue to modify the city, increasing it with multiple elements according to an alternation between use, disuse and reuse that appears as an entirely physiological fact in the history of human societies (Scaramellini, 2018). Within this latter assumption, we can place those phenomena of the decommissioning of large industrial areas, which took place from the 1980s onwards, and which triggered a long phase of investigations, reflections, and applications. It was a complex season that recognised in the recovery of brownfields a common challenge for public policies (Atkinson at. al., 2014) and a relevant factor for the activation of territorial redevelopment processes (Erba, Guastamacchia, 2002).
In the transition from a society with a strong industrial identity to a new post-industrial one (Arcidiacono et al., 2015), different approaches have arisen to rethink these places (Garda, 2018). In addition to the maintenance and re-functioning of existing structures - for only those cases worthy of conservation - and the construction of new buildings by means of demolition and reconstruction, one can recognise experiences that have taken a different approach. As in the two cases discussed in the following paragraphs, one can recognise transformation processes that have also adopted partial or total demolition of the built-up areas with consequent increase in soil permeability and renaturalisation. With this third approach, which is more oriented towards promoting an idea of 'urbanism of demolition' (Rusci, 2021), it is possible to obtain the liberation of areas previously 'sealed' by volumes or built-up areas, increasing soil permeability, creating the conditions for the restoration of certain functions inhibited by sealing processes (Garda, 2020) and promoting the activation of renaturalisation processes. This idea of the removal of built-up spaces as a precondition for the return of soil permeability and nature is recognised in the concept of de-sealing (Garda, 2022) which 'means restoring part of the former soil profile by removing sealing layers such as asphalt or concrete, loosening the underlying soil, removing foreign materials and restructuring the profile' (EU, 2012).

In the paper, going just beyond the definition just mentioned to include interventions of greater entity and complexity, with the concept of de-sealing we intend to consider a set of actions that foresee, in addition to the removal of two-dimensional elements, such as parking surfaces, also the demolition of three-dimensional elements, such as unused buildings, to guarantee the achievement of different benefits. The advantages that can be obtained by interventions to increase the permeability of soils and the consequent renaturalisation, acquire great importance for urban areas, especially those characterised by intense soil sealing processes (Adobati, Garda 2020) due to the numerous negative effects produced by anthropogenetic soil sealing (Scalenghe, Marsan 2007; EEA, 2013). With de-sealing it is possible to mitigate or compensate for this negative situation by ensuring: i) increasing green areas that are crucial for the health of inhabitants (Kabish et al. 2015); ii) reducing the urban heat island phenomenon (Magliocco, Perini 2014); iii) restoring soil infiltration and improving the water cycle management capacity (Brears, 2018); iv) recovering the ecological function of soils by promoting ecological reconciliation (Francis, Lorimer 2011). Through these new urban porosities (Viganò, 2010), it is also possible to (re)activate ecosystem functions (Garda et al., 2023) and promote the application of Nature-based Solutions (NbS).
This contribution confronts the issues just presented through the analysis of two experiences of redevelopment in the Italian cities of Trento and Milan. In both cases we are dealing with complex processes of radical transformation of physical and morphological assets that have favoured the creation of new green areas through de-sealing, albeit with dissimilar results in terms of green areas created.
The two case studies were selected because of certain common features:
- These were two redevelopment processes in which all the interventions included in the projects were almost fully realised.
- The industrial areas were unified in terms of architectural and ownership structure.
- Before the transformation, the areas had high levels of soil sealing.
- The projects that guided the transformation reconfigured the two areas morphologically and functionally.
- The creation of new green areas was an aspect that characterised both urban planning instruments and specific urban projects.

Case Studies Presentation
The former Michelin of Trento includes a rather important area for the city, located in the south/west area of the urbanised territory and about half a kilometre away from the historic centre of the city. The history of the industrial site began in the 1920s when Michelin took the decision to build an initial production plant in Trento to manufacture tyre materials. The company, after several reinforcements, reached its maximum level of development in the 1970s, involving approximately 1,800 workers to become the most important labour pole for the province. The importance of this place for the city was not only due to its territorial extension, albeit considerable with its 116,000 square metres, but was justified by other reasons. A significant role was played by the economic operator who for decades owned and employed this site, profoundly conditioning the labour market and community life. Even the functional choices hypothesised and then realised during the transformation process have connoted the new district because of new territorial relations, as well as the interaction with territorial elements that have been at the centre of political and urban planning debate (e.g. the role of the Adige River). At the same time, the former Michelin can be considered as the metaphor of a city that in recent decades, like other Italian cities, has been confronted with structural phenomena (Mazzeo, 2016) such as the end of the long cycle of demographic growth, the progressive ageing of the population, the decommissioning of some military structures and the crisis of the industrial sector (creating some 'urban voids'). The spatial conditioning of these

irreversible processes has long influenced the debate and characterised the scenarios adopted in municipal urban planning instruments, also because of the strategic role attributed to many of these areas (Franceschini, Ulrici 2011). After Marcello Vittorini's new urban plan of 1989, many modifications to the plan alternated, attempting to confront the needs of an area in search of a new balance, until assimilating the development hypotheses proposed at the beginning of the 2000s by the Catalan urban planner Joan Busquets and the subsequent master plan for the city of Trento (Cerone, 2004).

The new district that replaced the decommissioned industrial structures, now known as Le Albere, is the outcome of a long process of transformation that since 1998, the year in which the Michelin company decided to shut down operations, has solicited stakeholders, places, and planning tools. The first hypotheses for the area had already been proposed by the 1989 Urban Plan, which had envisaged a fragmentation of the structure into mixed-residential blocks set in green spaces, aimed at inserting a new centrality in the city system. This forecast, given the criticism raised locally with respect to fears of an acceleration of the process of dismantling, had been eliminated with a variant to the urban plan in 1994 (Ulrici, 2011) to postpone an inevitable change to the future. A few years later (1998), the Trento City Council returned to this specific case, undertaking to start the process of revising the urban plan with the aim of reconsidering the urban destination hypothesised in 1989.

The 2001 update of the urban plan played a fundamental role in the new trajectory. Alongside the management of some general issues, such as the need to consider the river Adige as a structuring element for future urban planning policies and environmental requalification actions, the updating provided for the former Michelin the need to draw up a 'guiding plan' to which to subordinate the subsequent drafting of implementation plans.

The masterplan was drafted in 2003 by the Renzo Piano Building Workshop, which had been commissioned directly by the new owner of the area (‘Iniziative Urbane’). The study proposed for the masterplan dealt with themes that have become recurrent throughout the Le Albere experience, such as the desire to promote the reconnection of the area with the rest of the city and the recovery of the relationship with the river Adige. The two main design choices proposed by the project concerned the creation of a multi-scalar mix of functions. The second theme dealt with the choice of concentrating the new building volumes in a limited part of the area, creating the minimum conditions for the formation of a large park. The masterplan, in addition to more specific choices on different issues (tree-lined paths, road network, building fabric, etc.), provided for a series of interventions along the boundaries of the project area at the expense of the public administration, fundamental to accelerate the realisation of a more comprehensive urban redevelopment of the district (Antoniaconi, 2010). These interventions concerned the construction of several pedestrian subways under the railway (elevated), road and pedestrian bridges over the Adige, and the construction of interchange car parks. These works also included a project of particular importance for the new park and for integration with the Adige, namely the burying of Via Sanseverino as an element of strong separation between the area and the river.

After the City Council's approval of the masterplan (2004), the following year it was the turn of the subdivision plan, the drafting of which was once again assigned to Renzo Piano's Studio, guaranteeing a certain continuity in the design approach. This further refinement involved the definition of six design guidelines that dealt with four different 'systems' (energy, water, green and built), the road system (including paths) and the relationship between park and water. The importance given to the green system and, above all, the hypothesis of creating a large park area were again recognised as fundamental and characterising aspects for the new district.

The building works begun in 2008 led to the construction of new structures for residential (approximately 44,000 square metres), tertiary (approximately 29,000 square metres) and commercial (approximately 10,500 square metres) use. Another important and symbolic

intervention implemented concerned the construction of the Science Museum (MUSE), again designed by Renzo Piano, located in the northern part of the district. In addition to an important share of mainly underground parking areas (about 2,000 parking spaces), the interventions on the open spaces must also be mentioned, which involved both squares, pedestrian paths, and water channels (about 28,000 square metres), and the construction of the new public park that affected a large portion of the district (about 50,000 square metres).

The biography of the former OM of Milan, an area located to the south in a particularly urbanized context, is rather extensive. Its history began at the end of the nineteenth century when the Miani Silvestri industry, then engaged in the manufacture of railway materials, decided to settle in this part of the municipal territory. A few years later (1899) the area took on the name Officine Meccaniche (OM) and in a short time, thanks to the positive effects of its proximity to the Porta Romana railway station, it became one of Milan's most important industrial realities (4,000 workers). Starting in the 1930s, this company underwent various changes in its management and ownership structure, gradually becoming part of the FIAT Group and modifying its production of vehicles destined to operate in different economic sectors. Between the Eighties and Nineties, just a few years after the definitive replacement of the OM trademark with that of 'Iveco' (1975), the gradual process of divestment of production activities began at a historical moment that for Milan, as for other major urban areas in Europe and North America, represented the start of that powerful season of planning, political and cultural reflection about abandoned areas.

In Milan, the debate on the fate of large ‘urban voids’, from the point of view of urban policies, was tackled by means of newly planned instruments that were often far from the more traditional town-planning schemes at the municipal level then governed by national and regional regulations. Since the 1980s, Milan has decided to adopt rather innovative 'Documents', not without criticism for their reference to deregulation aspects, which, moving away from the ordinary and regulated forms of planning, have taken on a look more interested in promoting the strategic dimension.

A first relevant act produced by the municipal administration, created to go beyond the urban plan and take advantage of the start of works for the construction of the new commuter train (Oliva, 2002), was the ‘Documento direttore per il progetto passante’. This was a tool introduced as a strategic and management contribution to coordinate public and private interests (Bolocan, 2009) and to stimulate reflection on certain areas worthy of reconfiguration through the activation of urban projects. Many of the areas considered by this tool, then affected by phenomena of progressive decline, have frequently returned in the reflections of the following years also because of their size and strategic location in the metropolitan system. Among the various proposals identified by the cartographic elaborations of the Document, the former OM still appeared with a secondary role and as an area of possible redefinition because it was susceptible to urban redevelopment through the rethinking of permitted uses and the redesigning of substantial parts of the territory (Doni, 2009). Parallel to the first Director's Document was another document (‘Studi di inquadramento’) which, through a more in-depth analysis of Milan's disused or underused areas, came to suggest new transformation strategies. For the OM area the theme and the potential role of urban greenery emerged for the first time, suggesting the need to build a 'green system' capable of redefining the relations between the city and the external agricultural spaces (Doni, 2009).

In the mid-1990s, a second important moment for urban planning policies, especially for future decisions concerning the former OM area, was the project ‘Nove Parchi per Milano’ (1995). This design experiment proposed a set of urban transformation measures for extensive peripheral areas of the city that were to take place around a large new park. Through the creation of new neighbourhoods equipped with public spaces and facilities, the aim was to define new centralities in the peripheral areas with the aim of contrasting the monocentrism that

traditionally characterised the forma urbis of the city. Similarly to the experiences proposed for Barcelona and Paris, there was a tendency to rethink the structure of the city starting from the identification and action of urban projects characterised by the foundation of a new urban park (Marinoni, 2007). In this new vision for the OM area, several hypotheses were envisaged, later taken up in subsequent years in other more concrete and effective initiatives with respect to the real transformations of the area. For example, an expansion of the existing Parco Ravizza, located north of the area, was suggested, through the creation of new green areas in the industrial area, obtained by demolishing the industrial buildings. The Nove Parchi per Milano Project also envisaged the creation of new connections, called promenade, between the project and other significant areas. With this indication, the OM area found itself inserted along the 'Naviglio Romana' promenade, which also included the Porta Romana railway station and part of the railway belt.

The process of radical transformation of the area began institutionally with the municipality's participation in a national funding call intended to support building and functional redevelopment of urban areas. After the preliminary identification of the urban areas to be evaluated for a possible request for financing, some real estate companies responsible for the area submitted a proposal for the ‘Programma di riqualificazione urbana’ (PRU) of the former OM (later named 'PRU OM-Pompeo Leoni'), for a total area of 313,652 square metres, which was subsequently approved by the Municipality and forwarded to the Ministry for evaluation. Following the positive outcome and the allocation of the financing, the Programme Agreement was signed in 1997 between the Municipality, the Lombardy Region, and the Ministry of Public Works. With the Agreement, all the fundamental design indications were defined to start the subsequent technical design phases and, at the same time, guarantee the simplified modification of the 1980 town-planning scheme in force, which did not provide for the transformation of the area. Work began in 1999, while construction was mainly concentrated between 2003 and 2005. The reconversion of the area led to the creation of a new neighbourhood characterised by a rather ordinary mix of functions common to the urban projects promoted in Milan. On the whole, of the approximately 153,000 square metres of floor area ratio, a very significant part was destined for residential use, i.e. 79,000 square metres, following the strong demand for housing present in the local market. The remaining quantities were destined for commercial structures (9,000 square metres), spaces for the tertiary sector (34,000 square metres) and, finally, spaces for manufacturing functions (approximately 31,000 square metres).

Of the approximately 116,000 square meters that made up the project for the former Michelin (later renamed ‘Quartiere Le Albere’) a considerable part was allocated to the formation of the new green areas and a new public park (about 43%), which, as mentioned in the previous paragraph, represented a characterized and identifying choice for the entire redevelopment process. The creation of these new green areas was made possible by a combination of the complete demolition of existing building structures and the concentration of building potential in the eastern part of the neighborhood. The new fabrics created were designed with the aim of defining a specific relationship between built volumes, open spaces and building heights, comparable to that present in the historic center of the city of Trento. The increased permeability of the areas was manifested as the result of the conversion project of an area that, due to the morphological and functional conditions of the previous activities, was characterized by a high degree of soil impermeability.

De-sealing took the form of a necessary action to facilitate the creation of the new public park and meet certain needs (Garda, 2020). The first need, emphasized by the planning documents, concerned the attractive role given to the large, equipped park, which was supported by the provision of specific elements. The spatial components, intended to ensure attractiveness and that characterized its spatial composition and organization, concerned the creation of paths, equipped meadows, and wetlands. The second requirement proposed by the project was related

to the desire to restore connections with the Adige River by encouraging a return to the dialectical relationship that had been denied with the progressive urbanization of these areas. The park was, likewise, considered as a connecting element between the consolidated city and the river and between the latter with the new architecture of the neighbourhood and the planned receptive/commercial functions. The specific choices adopted included both the proposed burying of Via Sanseverino, which was essential to give continuity to the park given its condition as a physical barrier, and the creation of a network of canals and bodies of water intended to serve different functions.

Water represented a complex issue for the project because of the functions: i) recreational due to the presence of ponds made swimmable thanks to a phyto-purification system; ii) technological due to the realization of water surface ponds to be used as storage basins for irrigation, firefighting or first rainwater lamination; iii) didactic-scientific due to the possibility of intercepting a cultural type of fruition.

The proposed design framework for the final subdivision plan adopted a taxonomic approach because in it the different elements that made up the large, equipped park are treated separately. In the technical-descriptive report and the in-depth documentation, the organization of the spaces took place through the use of "diversified landscape environments" that corresponded with: i) a central environment treated as a lawn and equipped with paths; ii) a wet garden composed of essences usual for river environments; and iii) groves consisting of prime tree essences distributed along the edges. It is an archipelago of spaces with a strong ecological, physical, and functional characterization that has found, as stressed in the project, in the tree rows a connective system together with the networks of pedestrian paths and water channels.

The complex system of green areas that now characterize the Le Albere neighborhood faithfully return the principles and design directions provided by the former Michelin transformation project. In it it is possible to recognize both the spatial design imagined in the various elaborations of the project, and the variety of elements that characterize it which return a certain complexity in the interpretation of the concepts of urban nature.

The principles adopted in the design of the new green areas planned for the former OM area in Milan centred on a different approach than in the Trento case. According to the design proposed by French landscape architect Frederic Cristophe Girot, the new park was organized into different spatial and thematic areas. This hypothesis compared with the indications included by the PRU project carried out by the municipal administration albeit with some difficulties and limitations related to the impossibility of surmounting the physical barrier constituted by the railway line and Viale Toscana. The obvious criticalities prevented the implementation of the idea of creating a unified public park, as also envisaged by the Nine Parks for Milan project, achieved through the connection and continuity between the existing Ravizza Park, located north beyond Viale Toscana, and the new park planned for the former OM area. The architect proposed a park structured in three environments alternating with the new buildings, organized along east-west directions, and integrated with the Vettabbia canal that ran through the entire area (for which reclamation and redevelopment were planned).

Further north, between the railway and Toscana Avenue, the Culture Park was planned, characterized by the construction of a large amphitheatre for 1,500 people, new wooded and planted areas with fruit trees and outdoor sports facilities. In the center was planned the Park of Industrial Memories instead intended to ensure a possible integration between new green areas (lawns and rarefied trees), bicycle and pedestrian paths and some technological and architectural elements maintained to preserve the historical memory of the industrial area. To the south, the project envisioned the Vettabbia Park, which derived its name from the presence of the Vettabbia canal and its relationship with this hydraulic element. In this case, the design indications were oriented toward the enhancement of the canal through the creation of bicycle and pedestrian paths, tree-lined strips, and small squares that overall related to the new lawn

areas to be placed between the Vettabbia and the new built-up areas. Between the Memorial Park and the Vettabbia Park were the areas intended for the construction of the new residential and tertiary buildings.
In the center of the built-up spaces, again along the east-west axis, was the main road axis for the entire project (the present Giovanni Spadolini and Carlo de Angeli streets) whose design was characterized by the presence of paths alternating with green spaces (lawns and tree rows) aimed at improving the aesthetic and environmental quality of the new road system. Given the current condition of the area, this specific part of the new neighbourhood can be considered as a boulevard and a characterizing thematic section.
The various thematic sections were connected along the north-south axis by pedestrian-cycle paths intended to provide continuity between the areas due to the discontinuities planned to interrupt the otherwise wide frontage of new blocks and buildings. Girot's proposals were later considered in the project carried out in 1998/99 by the Land studio and renowned landscape architect Andreas Kipar, who developed the executive proposal by adapting it to new requirements agreed upon with the City of Milan without radically altering the original layout of the project. Park construction was started immediately and completed in 2006 except for the Culture Park, which is currently still being concretized following the decision, after several decades of disuse and the formation of large fragments of the ‘third landscape’, to build an underground station for electric buses and new green roofed areas set aside for loisir-related functions.

Fig. 1 The image shows the former Michelin area in its current state, in the centre of which the extensive park created by the transformation of the area can be identified (source: Google Earth)

Fig. 2 The image shows the former OM area in its current state, in the centre of which can be identified the new buildings created by the transformation of the industrial area and the new parks and green spaces (source: Google Earth)

Discussion

The proposed Trento and Milan case studies allow us to reflect on some issues while recognizing common or, in some cases, divergent elements. The first aspect to remember inevitably concerns the concept of de-sealing, which in the two processes found full implementation through the demolition of buildings and covered surfaces, the increase in the permeability of the freed soils and the consequent creation of new equipped green areas and new NbS. In both cases, the new permeability was more the indirect result of a design approach more interested in building a new ecology or supporting the demand for new recreational spaces (e.g., new park facilities).

This first consideration is linked to the issue of the design and technical language that guided the two proposals, which is characterized by the use of concepts that are not directly aligned with the current debate on urban regeneration, on opportunities to contribute to the fight against climate change through the reconfiguration of urban spaces, or by concepts that are increasingly usual (e.g., NbS, Ecosystem Services, Green Infrastructure). Despite this distance, if only from the concept of de-sealing, which is almost absent, the two neighbourhoods make an active contribution to the urban contexts in which they are embedded, for example, in terms of ecosystem services provided (for microclimate regulation and temperature reduction). Another aspect concerns the urban planning tools used in guiding the transformation of the two industrial areas. With the same starting conditions, i.e., areas with relatively similar architectural and morphological characteristics, the two cases show the adoption of different planning and design tools.

For the former Michelin, the redevelopment process was sustained with a traditional approach both with respect to the direct relationship between the indications of the municipal plan (always updated to encourage transformation) and the subsequent implementation plan, which was approved and used in full compliance with the municipal plan, and with respect to the type of instrument used (this type of instrument was introduced in Italy in the late 1960s). For the former OM, it was a different path that benefited from some instruments introduced at the local

scale directly by the City of Milan (such as the Director Documents as a variant to the municipal plan) or from instruments adopted at the national scale such as complex programs like the Urban Redevelopment Programs (indifferent to the indications of municipal plans). Given the fairly similar results at least in terms of high allocation of vacant areas, it could be argued that the adoption of new instruments is not always essential for the implementation of an innovative idea.

Comparison of the structure and composition of the green spaces created in the Le Albere neighborhood and in the former OM area shows important differences with respect to the overall organization of the various components that make up this system and the characterization of the individual elements. In Trento, the new park and the network composed with the other secondary elements have the function of ensuring integration between the various spaces, but, above all, of creating strong relationships with an important territorial and ecological element present beyond the boundaries of the new neighborhood. The concentration of the new green spaces, especially of the more forested areas, along the west side, the burying of Via Sanseverino (a previous element of separation between the former Michelin and the River) and the creation of a green point, are part of a strategy to redefine the dialogue between the city and the Adige River. With respect to the individual elements that make up the overall system, there is considerable variety and diversity among spaces intended to provide outdoor recreational functions (equipped gardens, pedestrian paths), forested areas and wetlands.

This variety not only ensures a certain diversity in the ecological and ecosystem functions provided, but also pursues an objective of education and dissemination consistent with what is proposed by the Science Museum (MUSE) present in the Le Albere neighborhood. These are spaces that between two-dimensional (meadows) and three-dimensional elements (rows or forested areas) are characterized using vegetation essences consistent with the territorial context of reference.

The overall structure of the green system present in the former OM area of Milan, shows different characters. Its division by thematic areas and the absence of prominent structural and multiscalar elements, as in the case of Trento, reduce the perception of the presence of a general pattern of organization. Observing these spaces, one has the perception of a buffer zone role to separate and distance (Bricocoli, Savoldi 2010) the new architecture built at the center of the neighborhood and the urban context of reference, seeking a spatial, psychological, and symbolic isolation that has characterized many other interventions of similar size proposed in Milan in recent decades. From a compositional point of view, the new surfaces present less articulation due to the greater presence of lawns and trees that on the whole respond more to recreational purposes for the residential functions of the neighborhood and the urban context of reference. From an ecological-environmental and biodiversity point of view, therefore, the case of Milan shows less variety research in contrast to the case of Trento.

Conclusions

In the transformation processes of large brownfields, renaturalization interventions play a key role in fostering the improvement of the well-being of built spaces (Lehmann, 2021) due to their ability to remind people of the importance of biodiversity, ecosystem services, and green infrastructure.

The two proposed cases offer an opportunity to observe how topical issues and needs, for example, increasing soil permeability and promoting renaturalization interventions to improve the urban environment and counteract the problems generated by soil sealing and climate change, can also find ‘unconscious’ support within urban design experiences that arose at a stage that anticipates the full awareness we now have toward the many global crises (Garda, 2022).

The unawareness referred to concerns the adoption of design approaches and concrete interventions that, although supported by a language seemingly distant from the concepts adopted today, such as Nature-based Solutions, we can nonetheless reinterpret with today's sensitivity and awareness, thanks above all to the actual outcomes of such choices. This also supports the idea that, to implement innovative interventions consistent with current needs, we should not necessarily wait for the introduction of new technical and regulatory tools, but on the contrary seek to reorient even the most traditional methods.
The redesign of brownfields and the concomitant release of soil are the first step in a series of possible choices for the return of nature to denser urbanized areas after the long season of growth.

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Greening the void: actions for the de-sealing and renaturalisation of soils in brownfield regeneration processes

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The city of tomorrow is already with us

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Abstract
This paper title provokes us and brings us back to the New Athens Charter published in 2003 by the European Council of Town Planners[1]. The aim is to discuss the city's planning based on the urban features we have inherited from the past, with the understanding of history in its evolutionary form and the city as an open-ended process in continuous construction. It's not about preserving, but adapting, reusing and creating again, reinforcing urban resilience and the identity of each place. Today's needs and the crises we face - climate change, the housing crisis and migration - call for a transformation of the city and behaviour so that cities become sustainable, healthy habitats that guarantee quality of life for all.

Keywords: reuse, heritage, sustainability

Introduction
In 2015, the United Nations defined a set of goals for 2030 aimed at sustainable development, which included the 11th Goal: Inclusive and sustainable cities and communities (UNDP, 2015). This reveals, on the one hand, the awareness of the impact on citizens' health, quality of life and well-being of the space where they live and use, particularly in terms of work and other activities, and, on the other hand, that urban areas are crucial because the majority of the world's population lives in urban areas. Several studies (Marans and Stimson, 2011; Ballas, 2013, M. van den Berg et al, 2015, Kostas, 2021) have addressed the impact of space and environment on human life, from air quality, lighting and noise, to functionality, aesthetic quality and cultural value (Shekhar et al., 2019). Thus, it is recognised that cities can be a catalyst for transformation. This awareness has also led the EU to prioritise a New Urban Agenda focusing on a set of urban goals. The Leipzig Charter affirms the responsibility of cities to 'lead the transformation towards just, green and productive societies' and states further that 'cities are unique historical centres of exceptional cultural value that shape Europe's urban heritage and the identity of its citizens' and culture must be at the heart of any sustainable urban development, including the preservation and development of built and other cultural heritage' (EU, 2020, p. 2).

In this sense, urban transition to meet the new challenges must be achieved by planning and intervening in the existing city and valuing its social and cultural values. This awareness requires that urban planning acts in the city built over time, reading the various marks of time and the associated social values. This does not intend to prevent transformation but should inform and contextualise it. Urban planning must be place-based and sensitive to the physical, historical and social context. Throughout time, cities have been built in this way and we can

[1] In a conference held in Athens in 1998, the ECTP-CEU adopted the New Charter of Athens: A Vision for Cities in the 21th Century, and resolved it should be kept under a constant process of revision and updating. Symbolic this happened in Athens, where the original Charter was adopted during the International Congress of Modern Architecture in 1933. This was revised during the ECTP-CEU's 2003 General Assembly in Lisbon, the New Charter of Athens and promotes a vision for The Connected City.

learn from the past and previous processes of change, also from the social processes that support cities today.

This article aims to discuss the planning and transformation process of the existing city to meet the current challenges, in a sustainable way and through a circular approach, supported by sensitive thinking to each city's context, history and social values. It is organised into two parts: a brief analysis of the historical process of building cities, which marks the evolution of urbanism, with processes of continuity or radical change. Next comes a reflection on the intervention in the existing city, understanding that this intervention has sometimes been trapped in a conservationist policy of heritage protection but today, with the widening understanding of what heritage is, it can be seen as part of the urban change and development for more sustainable, resilient and inclusive cities. We conclude with some recommendations for achieving urban planning that can create more sustainable and resilient cities that favour quality of life for all.

Cities as a dynamic and open process

Most European cities result from years of transformation, adaptation and growth. Marked by processes of continuity and sometimes rupture, cities are both a reflection of and one of the main manifestations of a culture. However, as living spaces, they are also dynamic spaces that are constantly changing to meet the needs and expectations of each time. So continuous change is an intrinsic part of what characterises and defines cities. History reveals the processes of building and transforming the city, usually through continuity, punctual changes and extensions. However, history also shows a series of events, typically catastrophic and related to natural phenomena or the result of man's actions, which have led to processes of rupture and transformation of the existing city. Still, we can say that these are the minority. In the majority, urban development occurred through additive processes of extending the urban fabric, filling urban voids or small urban reforms.

The history of urbanism shows that these urban enlargement and transformation processes took place very slowly until the 2nd Modernity (Ascher, 2012) and gained expression after the Industrial Revolution and the urban growth of the 19th century all over Europe. Thus, in most European cities, the structure of the old town, or the so-called historic centres, is the result of several years of adaptation and it is this slow process that makes these the most characteristic areas, marked by a specific urban morphology, defined by the grid of streets, plots and buildings defining their identity and heritage. Beyond the possible monuments that may punctuate the city, the collective ensemble produced over time is now recognised as heritage, as a manifestation of local culture and as part of its identity.

Urban fabric reform also happens in the history of cities, whether due to catastrophic events (fires and battles, for example) or to reform the cities and demonstrate the power of the king, or other entity. Examples include the rebuilding of Rome after the Great Fire, the remodelling of London after the Great Fire or the Baixa Pombalina after the great earthquake. For beautification, the remodelling of Rome by Pope Pius V, or more recently the remodelling of Paris by Haussman (Lavedan, 1959). All these examples led to a more or less radical reform of large urban areas. But after they were also subject to the natural change that happens to every city.

As Corboz (2001) argued, the city is a palimpsest, which recognises that the city is a complex entity made up of overlapping layers which each time is relevant to the construction of the

contemporary city. Each time is a new layer, the mark of an epoch, a style and a way of life. But beyond this overlap, it is important to emphasise that it assumes an evolutionary process, preserving what has value, use and utility and replacing what has no or little value/function for something new that responds to new needs, be they taste, functional or cultural.

This notion of a palimpsest also emphasises the need for each era, each period to write its city, each time to leave its cultural mark on the city. And this doesn't mean erasing previous traces or starting from scratch, as we've seen rarely happens. The palimpsest to which Corboz refers is a continuous rewriting, a sensitive selection of what needs to be adapted to meet the needs of each time, and this is precisely what we are defending here. This change and evolution are evident in all our cities and are related to the idea introduced by Geddes of the city as a living organism in continuous change (1915), which also meets the idea of circularity that we now defend as essential for sustainable development.

It is important to emphasise that this evolution is a response to the needs that arise, but it depends on a value system and a hierarchy that values some elements and discards others. It's not a question of changing everything or conserving everything, but a sensitive selection process that must be understood to recognise how it was made and how it can be used nowadays. In other words, this selection is characterised by looking to the future rather than the past.

This idea of the future inspired the decision to rebuild Baixa de Lisboa in Portugal with a new plan after the 1755 earthquake. This catastrophic event that led to the destruction of the entire downtown area inspired a radical reform of the city of Lisbon and the development of Portugal's first urban plan. We know the layout of the old city well, recorded shortly before the fateful event by Manuel da Maia in 1716. And we know the hypotheses studied by the reconstruction engineering team. The final decision was hypothesis 6, which envisaged rebuilding the entire area with a new grid of wide, orthogonal streets in opposition to the previous layout. However, despite the novelty of the layout, it's interesting to note that the new plan didn't reject everything, but rather replicated the original organisation of the urban fabric from the previous plan, organised around two squares, one by the river and the other on the edge of the built-up area, and kept the vast majority of the churches, even though this included the construction of new façades. The image and shape of the new neighbourhood are completely new, but it replicated the previous urban structure with a new morphology. The choice to discard the previous morphology is justified for safety and health reasons, reinforced by functional and aesthetic reasons.

Figure 1 – Manuel da Maia, *Levantamento da Baixa de Lisboa em 1716*, drawing from 1756 [Gabinete de Estudos Arqueologicos de Engenharia Militar, Lisboa]

Figure 2 – Eugénio dos Santos e Carlos Mardel, *Estudo para o Plano de reconstrução da Baixa*, 1756 [Instituto Geográfico Português]

In addition to this example, there are countless examples of buildings and groups of buildings that have been transformed over time, such as the Machado de Castro Museum in Coimbra, located in the former Bishop's Palace, which was built on top of the old Cryptorchid created to support the Roman Forum. Today this remarkable building shows the practice of reuse very clearly. Its ground floor occupies the area of the old forum and the buildings reuse parts of other buildings, mostly former college buildings that were sold or converted to other functions during the 19th century. For example, it reused the Santa Ana's portal. This portal belonged to the College of Santa Ana, transformed into a barracks in the 19th century after the religious orders were disaffiliated and whose portal was moved to the Church of St. Salvador (Calmeiro, 2015). By reusing the portal of the College of Saint Thomas, which belonged to the college of the same name located in Sofia Street and which in the 19th century was converted into the residence of the Counts of Ameal, the portal was reused in the museum's courtyard and today forms an integral part of the Machado de Castro Museum.

Figure 3 - Portal of Santa Ana in its original location (early 20th century) [AMNMC, Photographs folder]. Figure 4 - Its reuse in the S. Salvador Church (c.1930) [AMNMC, Photographs folder]. Figure 5 – St. Salvador Church today

Figure 6. College of St. Thomas at the end of the 19th century [AMNMC, Photographs folder]; Figure - 7. Construction works visible the reuse of the St Thomas portal on the back façade of the Machado de Castro Museum (1935 and 2022). [AMNMC, Photographs folder]. Figure 8 - Today

Like this, there are countless traces of the change of buildings to respond to new uses and needs, such change represents one of the essential characteristics of the city, its ability to adapt and evolve. Although the image of buildings is easy to change, sometimes even reusing elements from other buildings, the urban fabric has a greater tendency to remain, with minor adaptations. It is this apparent permanence that justifies the importance of the urban heritage and intangible heritage that characterise the historic urban landscape because it is these elements that, often unconsciously, allow the community to recognise the spaces and their identity beyond the constant image changing.

Heritage from conservation to transformation and sustainable development

This idea of building the city as a palimpsest recognises the city's stratigraphy and the mark of each one of its periods, acknowledging the value of every change. This idea is linked to the broadening of the concept of heritage. The concept of heritage and the need to protect and safeguard it for future generations arose in reaction to the changes wrought by the French Revolution and the reforms of the 19th century, aimed at establishing a new social order and a new regime, destroying the marks of the past, in consequence, it adopted a very restrict concept, limited to monuments (Choay, 1965).

In reaction to this destruction and to prevent the loss of memories and traces of the past, monument and heritage protection was institutionalised through the first national monuments service in France. This approach and concept expanded and densified throughout the 20th century and across Europe. In the aftermath of the war, in 1945, UNESCO was created and the debate on the protection of urban heritage and the connection between heritage, development and sustainability began to be institutionalised (Labadi and Logan, 2016).

The beginning of the 20th century was also a fruitful period for the development of urban planning theories and for the definition of new models to meet the challenges of the industrial and modern city. The Modern Movement presented its alternative, radically breaking with past forms and endeavouring to establish a new, fairer and more egalitarian society through urbanism and architecture, where everyone had the best living conditions. The rejection of traditional models was justified by their unhealthiness and the alternative was urban renewal and renovation of old urban areas. This was set out in 1933 by the CIAM Charter of Athens, aimed at launching a new way of designing cities. However, apart from the theories, in practice cities experienced accelerated growth towards peripheral and rural areas and the progressive

abandonment of old urban areas or their sanitation with the opening up of wider streets and larger blocks.

In 1972, UNESCO adopted the Convention Concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention), precisely in the same year that the book Limits to Growth (Meadows, 1972) commissioned by the Club of Rome was published, calling attention to the dangers of growth and the depletion of existing resources. This Convention signalled the concerns existing at the time about ongoing changes and unsustainable development and its impact on heritage.

There was a bridge between the desire to preserve the marks of the past and heritage for future generations, and at the same time preserve natural resources and nature. However, in practical terms, this vision does not coincide, and planning practices are not aligned with heritage conservation practices. In fact, throughout Europe, there have been distinct policies and institutions opposing heritage conservation and urban development (Jokilehto, 2007). This perpetuates a perception of incompatibility between modernity and the vestiges of the past.

Despite this, post-war reconstruction allowed for the development of more culturalist visions, valuing existing urban tissues and advocating the need for their reconstruction. A few conservation plans for Italian cities stand out, such as the Bologna conservation plan developed by Leonardo Benevolo, which managed to reconcile urban planning and safeguarding heritage in an exemplary way (Bandarin, 1979).

However, these two approaches seemed difficult to reconcile, due to the limited understanding of the concept of heritage, limited to historical, aesthetic and identity values that should be preserved and was mainly limited to the scale of the object or monumental structure. The extension to areas and sites with historical and heritage value embodies a paradigm shift based on recognising the citizen's perception. This perception of the urban by the citizen, explored in the theory of urbanism by Gordon Cullen and Kevin Lynch, was very important for broadening the theories of heritage conservation, focusing on people and questioning what to conserve and for whom. This emphasises not the value of the heritage itself, but the importance of the attribution of value by someone or a group. This later enabled heritage to be recognised as a social and political concept and allowed it to be extended to other typologies (Smith 2006; Veldpaus and Pereira Roders, 2017).

In the 21st century, this broadening took on a new dimension by recognising the value of intangible heritage in the Convention for the Safeguarding of the Intangible Cultural Heritage (UNESCO, 2003). Two years later the Faro Convention stressed the role of heritage in the development of communities (CE, 2005). These documents opened the way to the Historic Urban Landscape Recommendation (UNESCO, 2011), which endeavours to reconcile urban development with heritage management to achieve the sustainable development desired. Heritage is thus recognised as a continuous construction over time, close to Geddes' thinking, and understood as a process of continuous construction of overlapping layers that broadly includes the historical context, the geographical characteristics (article 8), also the parcel, the spatial, social and cultural organisation, the practices and values and the intangible dimension of heritage.

The recommendation aims to establish a new approach to managing change, advocating a set of tools such as the involvement and participation of the population, the production of new knowledge and planning tools, and the definition of new legal mechanisms and funding

strategies. On the other hand, this recommendation establishes a link between heritage conservation and economic and social development, emphasising the opportunities for economic development through tourism and the valorisation of traditional practices and knowledge as a way of promoting economic and social development. However, it also draws attention to several threats that can make the sustainable management of historic urban landscapes unviable and even put it at risk, such as accelerated urbanisation and densification, and tourism that can lead to gentrification and climate change. From these dangers emerges the perception that despite the broadening of concepts and the discourse used, the scope of this document and the conservation it defends is still restricted to the conservation of images and materialities (Fouseki and Nicolau, 2018), ignoring what we defend as one of the essential characteristics of the city, which corresponds to its need for change and adaptation.

Despite the enlargement of concepts and the inclusion of the role of communities in recognising what heritage is and the definition of innovative instruments, such as the urban development plan, the discourse remains very much marked by the idea of containment and management of change.

However, if we recognise values in the continuous process of urban transformation, we also have to accept that their preservation requires this same continuity. Change must be seen as an engine of development. This doesn't mean that we should think of change *per se*, but change is based on valuing and boosting what exists. The change and dynamics are behind the city we recognise as having an identity and heritage value.

The question that remains is how to continue transforming the city, respecting the essence of change that characterises the city and responding to the challenges of the 21st century.

The 21st century faces many challenges that have given rise to new city models that aim to help overcome and achieve more sustainable, resilient and inclusive cities (UNPD, 2015). New technologies and the "smart cities" model make it possible to simplify and optimise the city to better serve citizens' needs (Ekman, U. (2018). Beyond the utopian visions, technologies have gradually made cities more functional and efficient, and some of these technologies, related to infrastructure, are barely perceptible to citizens. We also advocate the need for greener cities that reinforce the relationship with nature through Natural Base Solutions and that make it possible to overcome some of the risks caused by climate change, such as floods and heatwaves, and also capture pollution (Seddon et al, 2020), as well as providing areas for socialising and quality of life, which have been highly valued since the COVID-19 crisis. In addition to these, there are proposals to change the way spaces and buildings are used, creating shared-use spaces and services such as cohousing and car sharing. Although disruptive, all these solutions can be made compatible with the existing city. But despite these attempts, there are still unresolved issues, particularly in terms of social cohesion and sustainability.

The issue of valuing the social has been promoted by governance policies and strategies involving the citizen and with measures centred on improving the quality of life of the most vulnerable groups. However, the idea of a liveable city includes not only physical health issues but also well-being, which has to do with some non-material factors, such as community involvement, a sense of belonging, culture and traditions. In this sense, it is important to create spaces that provide not only healthy living conditions but also mental health conditions. The idea of belonging to a place plays a fundamental role here, and cultural value is one of the main ways to reach it.

On the other hand, the need to reduce the negative impacts of urbanisation on the environment accentuated the need to focus on energy efficiency, spreading renewable energy production systems, and above all imposing an energy-saving strategy through a wave of renovation of Europe's building stock to improve energy efficiency and reduce consumption. To this end, states have created incentive and funding programmes for the refurbishment of existing buildings. Moreover, the need to promote circularity in the city led to a growing emphasis on the need to take advantage of existing vacant buildings, imposing regeneration policies for vacant areas, particularly former industrial and brownfield sites.

With these motivations, it is important to discuss intervention in the existing city, either to improve buildings thermally or to give them new uses and, in the case of urban areas, to create dynamic and attractive areas by reusing vacant areas within urban fabrics or in peripheral areas. The aim is to promote circularity and the reuse of installed resources, both in terms of infrastructure and building materials. The construction industry is one of the industries with the greatest impact in terms of resource consumption and a larger carbon footprint. Thus, intervention in the existing city and its buildings can combine the valorisation and reuse of resources, promote energy saving and contain the consumption of urbanised areas, which justifies the new emphasis that has been placed on a set of intervention strategies in vacant areas and unused buildings. A wide-ranging debate is emerging on a set of concepts such as the concept of reurbanisation, regeneration, revitalisation and reuse as ways of creating more sustainable urban areas. Although distinct, all these concepts relate to the principles of making cities more sustainable by valorising what is already there.

However, the existing city, besides the material resources that we value and reuse, is defined by a set of immaterial values, adding a social layer, and allowing important feelings of belonging, identity and memory.

It is therefore possible to create a bridge between intervention in the city to reuse its material resources and the enhancement of the immaterial resources that characterise each urban area and define its identity. The connection is established within the *genius loci*. This provides the opportunity not only to valorise and promote the tangible but also the intangible, so these interventions in the existing city are an excellent opportunity to improve living conditions and a sense of belonging. Focusing on dynamic practices and networks, including social capital, community involvement, participatory engagement, cultural traditions and inclusion and the mitigation of social inequalities (Dempsey et al., 2011). The social use of heritage in the mix of historic and renovated urban environments promotes identity, belonging, happiness and health for all citizens.

However, for this to happen, these interventions need to be planned in an integrated way with the city as a whole. And also, with the communities that live there or have some relationship and bond with those places. Therefore, it is not enough for these interventions to be supported by detailed historical research, based on the methods of type-morphology analysis that we have already experienced since the intervention in the Bologna Conservation Plan, but besides studying the history of the transformation of the site and the place, it needs to based on the values that the communities recognise and what characterises each area. There have been several studies that have debated the contribution of these reuses to the collective memory of the place and to how communities perceive and receive these interventions, and they can make some contributions to the way we act (Florentina-Cristina et al, 2014; Vardopoulos, 2023) and despite the studies that already exist, more initiatives need to be put into practice.

The ability to adapt reinforces urban resilience and has an enormous capacity for transformation. It is argued that the city is a collective construction that continues over time, in which the past and cultural heritage is an important asset for the development and planning of the city (Teran, 2009). Using the concept of "deep cities" (Fouseki et al., 2020), we recognise that past and historical change are a fundamental resource for current urban planning, as long as they are supported by interaction with the community. Places are socially constructed and therefore can only be conceived with communities.

Planning and heritage experts have to work with stakeholders to build a commitment to the future. This also opens up new possibilities to care for and conserve valuable sites. Empathy with the places guarantees their continuity, dynamics and vitality. Thus, the city of the future will be a collective construction, recognising the values of the past, and its resilience and ensuring its future success. As long as everyone is committed, the changes that guarantee resilience and continuity over time will also be guaranteed.

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Strategies to mitigate the urban heat island effect in Mediterranean promenades of France, Italy, and Albania

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Abstract
Cities are currently confronting with a variety of challenges stemming from climate conditions, urbanization, and urban planning, resulting in increasing social, health, and economic issues. This study specifically examines the Mediterranean coastline promenades in Albania, France, and Italy as a unique type of built environment. The aim of this study is to examine the influence of different cooling system scenarios on the thermal comfort experienced by pedestrians, while considering climate data. We generate multiple scenarios by analyzing ways to mitigate urban heat island (UHI) effects. These strategies include revitalizing promenades by replacing current pavements, utilizing water bodies and sprays, increasing the presence of artificial shade, considering the proper greenery, and implementing advanced cooling systems using smart technologies.

Keywords:

Mediterranean coastal promenades, urban heat islands, outdoor thermal comfort

1. Introduction

In recent decades, climate change, urbanization, urban structure, architecture, and urban planning have all had a significant impact on urban thermal comfort. Over the past few decades, developed nations have conducted extensive research on climate change, urban heat islands (UHI), and cooling systems in the built environment (M. Giorio, 2023). Urban areas are currently grappling with a wide range of difficulties stemming from climate conditions, urbanization, and urban planning, resulting in rising social, health, and economic concerns. Distinct urban features have a direct impact on the microclimate of outdoor areas, as well as the general climate of the city. The Intergovernmental Panel on Climate Change (IPCC) reports that the average global temperature has increased by around 1.1°C since the late 19th century, with the recent decades having the most dramatic increase in temperature (Change, 2021). The Climate Pulse interactive web application, which is developed and maintained by the Copernicus Climate Change Service (C3S), allows users to observe the variations in daily surface air temperature from the past to today, as shown in Figure 1. Urban areas have a direct impact, not only on the microclimate of outdoor spaces, but also on the overall climate of the city. Particularly in urban settings, microclimates naturally form and can exist on various scales. This study will primarily focus on the micro-scale, based on Oke's climatic scale classification (Oke, 1987), specifically in relation to urban-level readings. Oke defines the space encompassing buildings, streets, trees, squares, and parks as the urban canopy layer (UCL), which extends from the ground to the top of buildings. Within this layer, the microclimate varies depending on the region's environmental conditions. Figure 2 displays a drawing of the UCL study's urban size.

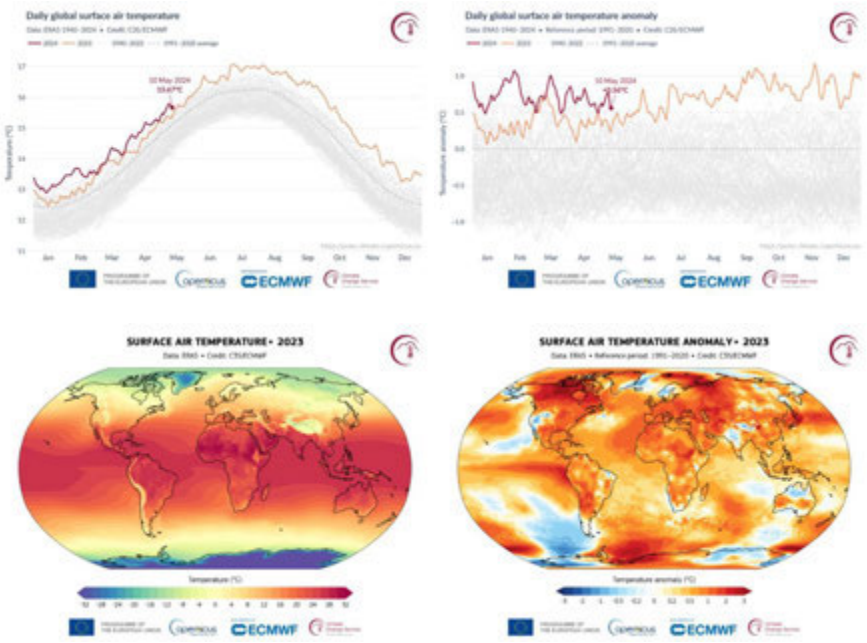


Figure 1 Daily global surface air temperature and anomaly rate **(Copernicus, 2024)**

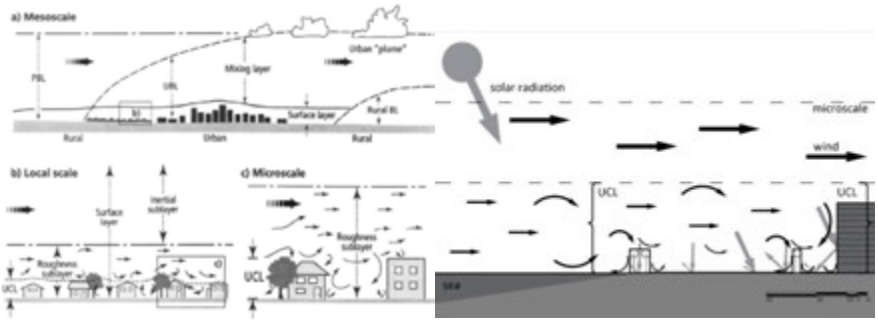


Figure 2 Climate Scale in urban areas, according to Oke 1987 (lef); The urban scale in the study (right) (source: author)

The presence of urban water bodies has a significant impact on lowering air temperatures by up to 6 °C in their vicinity, particularly in the summer months. This effect yields comparable outcomes to the situation observed in the microclimate parks (Grant, 2016, p. 76). As a result, in coastal cities, particularly in the sections of the promenade along the coast, the sea breeze plays a significant role in shaping the microclimate. (Fig. 2.1-2). Nevertheless, we observe that the sea breeze effect occurs in the late evening hours.

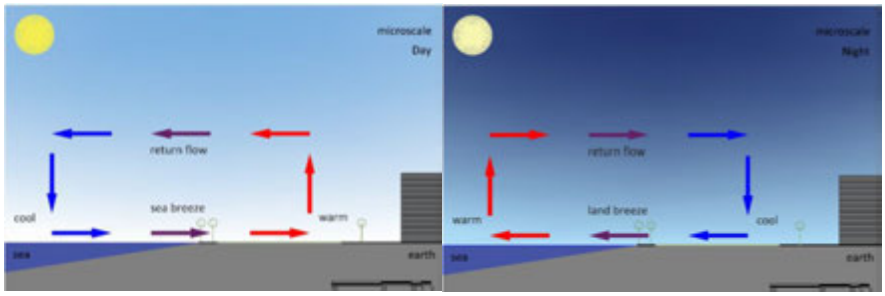


Figure 3 Sea breeze (left), Land breeze (right) (source: the author)

This study will exclusively focus on outdoor thermal comfort, which is described as "the psychological state that reflects satisfaction with the thermal conditions" (ASHRAE, 2005). Thermal comfort significantly affects the usability and livability of a space (Nikopoulou, M., Beker, N., Steemer, K., 2001). The livability of a space is determined by users themselves, taking into account their identity and how often they utilize the space. A livable place refers to an area that is accessible to pedestrians and is used at any time of the day or year. What makes a space attractive to a pedestrian or resident then? While functionality and design are undoubtedly crucial, it is equally necessary to prioritize user comfort. In the preface of the book "Cities for People" by Jan Gehl, Richard Rogers asserts that a well-planned city, with thoughtfully built streets, squares, and parks, brings enjoyment to both tourists and residents who live, work, and engage in recreational activities there on a daily basis (Gehl, 2010). Aside from its functionality and aesthetics, it is crucial that you experience a sense of comfort while standing or walking in it.

Research on urban thermal comfort is predominantly undertaken in developed countries and to a lesser extent in underdeveloped ones. These studies typically focus on analyzing public spaces in urban areas, with a specific emphasis on a single factor. This study, on the other hand, specifically examines the Mediterranean coastline promenades in Albania, France, and Italy as a unique type of constructed environment. The aim of this study is to examine the effect of different cooling systems on thermal comfort at the street level, while considering climate data. This study initially highlights the issues that arise from an analytical examination of the promenades in six cities located in the Mediterranean basin. The research specifically focuses on doing field measurements and computer simulations of one case study, namely the promenades in Durres. These case studies are notable for their Mediterranean climate according to the Köppen-Geiger climate classification (M. Kottek, 2006). Subsequently, we create scenarios using computer simulation, taking into account the intricate specifics of the built environment. Subsequently, we assess the outcomes by considering the degree of urban thermal comfort. The study aims to find out the impact of physical elements in the built environment on the improvement of urban thermal comfort, while also considering climatic aspects. When evaluating the level of urban thermal comfort, especially in coastal promenades, it is essential to evaluate both the physical and climatic factors together, as they are interconnected. The study will examine the impact of urban design and architecture on the thermal comfort of pedestrians in urban areas. Furthermore, this methodology can serve as a fundamental approach not just for promenades in Albania, but also for all public spaces, including promenades and squares, in the Mediterranean basin and other regions with different climate conditions. It is important assess thermal comfort in promenade, to encourage more outdoor activities for all day long and to prevent people staying indoor using air condition (Liang Chen; Edward Ng, 2012). Architects, urban designers, and decision-makers should reconsider public spaces being aware of thermal comfort and prioritizing it. It

2. Methodology

The study combines quantitative and qualitative methods, integrating three complex methodologies: experimental, semi-experimental, and comparative research. An assessment of the urban texture is undertaken in the coastal promenades of Durres and Vlora in Albania, Cannes and Nice in France and Genoa and Sanremo in Italy. Following a comprehensive analysis of the urban environment, measurements were taken and computer simulations were conducted for a section of the promenade in the city of Durres, located in Albania. The field measurements in the promenade of Durres were carried out through thermal camera, and weather instruments (Fig.4). We measured the temperature using a digital thermometer and compared it with the temperature obtained from the local weather station. At the same time, thermal camera measurements were added to these measurements. An infrared camera identifies the infrared energy emitted, transmitted, or reflected by all materials at temperatures above absolute zero (0°Kelvin) and converts the energy factor into a temperature reading or thermogram (FLIR, 2018). After the site measurements we utilized the ENVI-met software to conduct computer simulations. The software enables urban planners, architects, and engineers to create sustainable living conditions in a dynamic environment by thoroughly examining all components of the microclimate system and evaluating the effectiveness of urban design (Anon., 2021). It calculates the values of the degree of thermal comfort by setting the parameters for geographical position, solar access, wind, air temperature, and humidity (Arens, E. and Bosselmann, P., 1989). The index of physiologic equivalent temperature (PET) measures the level of thermal comfort (Matzarakis, A.; Mayer, H.; Iziomon, M.G., 1999).

Figure 4 Instruments used for site measurements

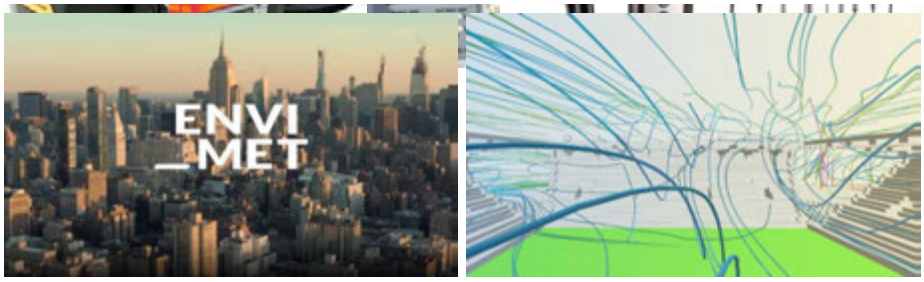


Figure 5 ENVI_met software for computer simulation

The initial scenario is executed considering the current conditions, with an emphasis on PET (Physiological Equivalent Temperature) and STS (Simulation-derived Material Surface Temperature). We generate different scenarios by analyzing diverse mitigation strategies for tackling UHI (Urban Heat Island) , such as revitalizing promenades with cool pavements (Ani Tola, Paul Louis Meunier, Parashqevi Tashi, Elton Hala, 2017), integrating green areas and

trees (Fazia Ali-Toudert, Helmut Mayer, 2005), utilizing water bodies and water spray systems, enhancing the availability of both artificial and natural shade (P J Littlefair, M Santamouris, S Alvarez, A Dupagne, D Hall, J Teller, J F Coronel, N Papanikolaou, 2000), and implementing smart cooling technologies. We evaluate the outcomes of these scenarios by comparing them to the current situation specifically examining the two parameters indicated earlier, PET and STS. A typical summer day is selected to replicate the present state of the promenade in the city of Durres. The field measurements and simulations of the existing condition (scenario 0) of the promenade are analyzed to determine the level of thermal comfort. Subsequently, a hypothetical scenario (scenario 1) is developed under the same weather circumstances to examine the impact of each parameter in reducing thermal stress. Scenario 1 is compared to scenario 0 in order to determine the impact of pavement material properties, water bodies and sprays, as well as natural and artificial shades on outdoor thermal comfort at the pedestrian level.

3. Case studies

Globally, Mediterranean cities are renowned for their "La Dolce Vita" lifestyle, characterized by leisurely strolls along the coastline and a greater preference for outdoor activities due to the delightful Mediterranean climate. The architects, urbanists, and decision-makers must not overlook the substantial potential of this. In order to get optimal results, it is crucial to consider not only the visual and functional aspects but also the methods to guarantee consistent thermal comfort and livability throughout the entire year (Massa, 2005). Assessing the thermal comfort of the promenade is critical for encouraging long-term outdoor activities and decreasing dependence on indoor air conditioning. The chosen cases in this research consist of the Genoa and Sanremo promenades in Italy, the Cannes and Nice promenades in France, and the Durres and Vlora promenades in Albania (Fig. 6). Before choosing them, we carefully considered the Mediterranean lifestyle and the city's development. The objective was to identify promenades in Mediterranean cities that shared the same geographical region, had similar terrain characteristics, but featured distinct urban layouts and somewhat different climate conditions. Another factor considered was the size of the urban population and the level of development in the same tourism sector. Furthermore, these cities have nearly identical needs for promenades and share similar urban structures and features. Sea breezes frequently create the impression that urban microclimate is not a concern in coastal communities. Furthermore, it is generally believed that significant levels of anthropogenic heat, which have an impact on the urban microclimate, are mostly found in major cities. Previous case studies have shown that coastal cities, whether located downtown or near the coast, also experience significant levels of thermal discomfort.

According to the Köppen-Geiger climate classification, the six cities chosen for this study have a typical Mediterranean climate with a temperate, dry summer (Cs category). Seas and cold ocean currents inextricably link the Mediterranean climate zones. This climate extends beyond the Mediterranean region to many parts of the world, albeit with varying temperatures (Köppen, 1918). The cities were chosen to represent Mediterranean climate zones, including historical Mediterranean basin cities such as Athens, Algeria, Barcelona, Beirut, Istanbul, Izmir, Jerusalem, Marseille, Rome, and Tunisia. Additionally, cities within Mediterranean climatic zones like Lisbon, Casablanca, Cape Town, Adelaide, Pert, Santiago, and Los Angeles, Tashkent, and Dushanbe were included (Figs. 8 and 9). Much of the Mediterranean coast enjoys a hot, summer Mediterranean climate. However, most of its southeastern coast has a hot desert climate, and much of Spain's eastern (Mediterranean) coast has a cold semi-arid climate, while most of Italy's northern (Adriatic) coast has a humid subtropical climate. Although they are rare, tropical cyclones occasionally form in the Mediterranean Sea, typically in September–November.

Figure 6 Case studies location in the Mediterranean basin

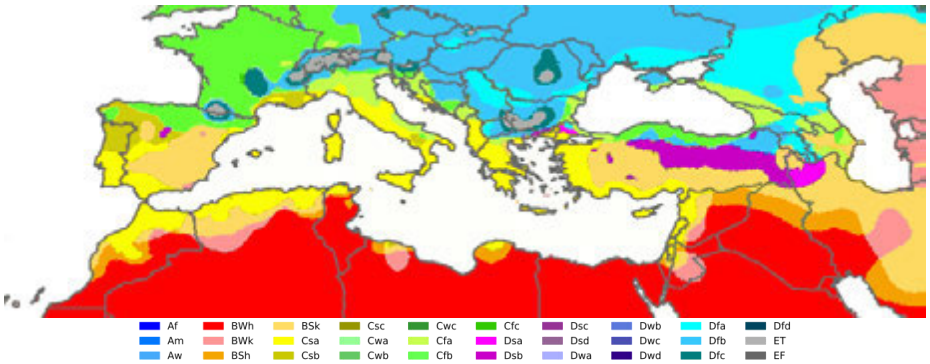


Figure 7 Climatic classification, Köppen – Geige World Map, Mediterranean Sea Area

3.1. Genoa Promenade in Italy

Genoa is a port city and the capital of northwest Italy's Liguria region. The population record in 2023 is 558,745. It is known for its central role in maritime trade over many centuries. The topography of the city rates with an elevation from 0-50m. The city promenade extends along the seaside and in between the sidewalk and buildings lies the road for vehicles, bus and motorcycles. From the photos, we can notice that the promenade is fully exposed to the sun, due to the urban design and its geographical position. The trees are missing, only some palm trees and shrubs are present.

Figure 8 Genova Promenade map and photos (source: google, 2024)

Genoa has a Mediterranean climate (Csa) in the Köppen climate classification, with plentiful precipitation due to its location on a common storm track. Due to its position between the sea and mountains over 1000 meters high, each neighborhood of Genoa has specific climatic characteristics. In Genoa, the summers are short, warm, humid, and mostly clear and the winters are long, cold, and partly cloudy. Over the course of the year, the temperature typically varies from 5°C to 27°C and is rarely below 2°C or above 30°C.

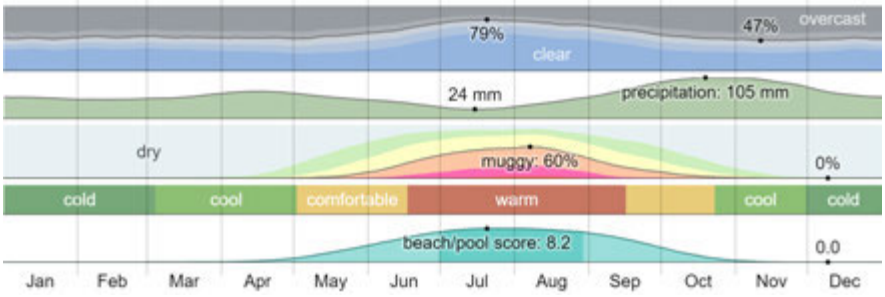


Figure 9 Climate Data, Genoa (weatherspark, 2024)

3.2. Sanremo Promenade in Italy

Sanremo is a coastal city in northwestern Italy. The population record in 2021 is 55,000Its green spaces include the park of Villa Ormond, with a Japanese garden, palm trees and ancient olive groves. The topography of the city rates with an elevation from 0-15m. The promenade is located in the southern part of the city, where by the coast are the beaches and smalls piers. The promenade is fully exposed to the sun due to its geographic position but also the urban design. We can clearly notice from the photos that there is vegetation but only palm trees by the coast.

Figure 10 Sanremo Promenade map and photos (source: google, 2024)

Sanremo experiences a hot-summer Mediterranean climate (Köppen climate classification Csa). In Sanremo, the summers are short, warm, humid, dry, and mostly clear and the winters are long, cold, and partly cloudy. Over the course of the year, the temperature typically varies from 7°C to 28°C and is rarely below 4°C or above 31°C.

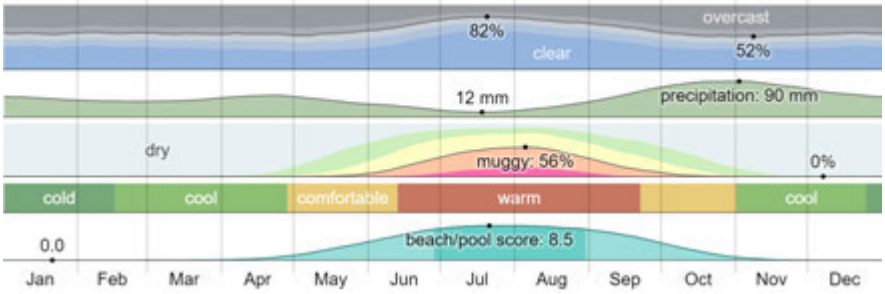


Figure 11 Climate Data, San Remo (weatherspark, 2024)

3.3. Cannes Promenade in France

Cannes, a resort town on the French Riviera, is famed for its international film festival. Its Boulevard de la Croisette, curving along the coast, is lined with sandy beaches, upmarket boutiques and palatial hotels. City elevation is 0-260m. The population record in 2021 is 73,255. The promenade is located in the southern part of the city. From the photos we can notice the presence of pine trees with big crown, alongside the promenade. In between the promenade and the buildings are located the path for cycling and separately the lane for vehicles.

Figure 12 Cannes Promenade map and photos (source: google, 2024)

Cannes has a subtropical Mediterranean climate (Köppen: Csa) and the city enjoys 11 hours of sunshine per day during summer (July), while in winter (December to February) the weather is mild. Cannes summers are long and warm, with summer daytime temperatures regularly hitting 30 °C, while average temperatures are about 25 °C (Anon., 2023). Temperatures remain high from June to September, the busiest time of the year. Over the course of the year, the temperature typically varies from 4°C to 28°C and is rarely below 0°C or above 30°C.

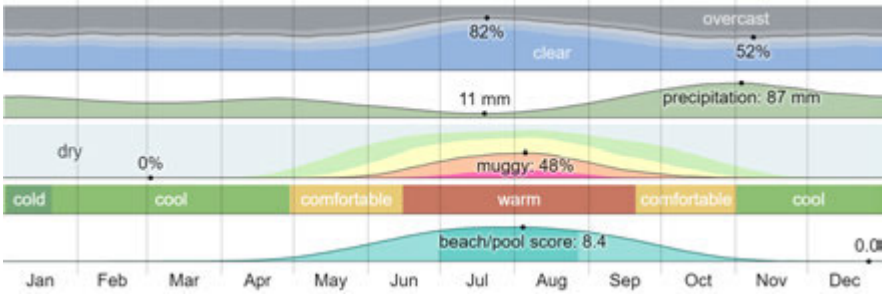


Figure 13 Climate Data, Cannes (weatherspark, 2024)

3.4. Nice Promenade in France

Nice, capital of the Alpes-Maritimes department on the French Riviera, sits on the pebbly shores of the Baie des Anges. Founded by the Greeks and later a retreat for 19th-century European elite, the city has also long attracted artists. The population record in 2021 is 348,085. The promenade is located in the southern part of the city. From the photos we can notice that the promenade is fully exposed to the sun due not only its geographic position but also for its design. There are only some palm trees alongside the road between the promenade and the buildings.

Figure 14 Nice Promenade map and photos (source: google, 2024)

Nice has a hot-summer Mediterranean climate (Köppen: Csa), enjoying mild winters with moderate rainfall. It is one of the warmest Mediterranean climates for its latitude. Summers are warm to hot, dry, and sunny. The temperature is typically above 26 °C but rarely above 32 °C. Summer temperatures, therefore, are often higher in the city. The average maximum temperature in the warmest months of July and August is about 27 °C (Anon., 2023). Over the course of the year, the temperature typically varies from 5°C to 28°C and is rarely below 2°C or above 30°C.

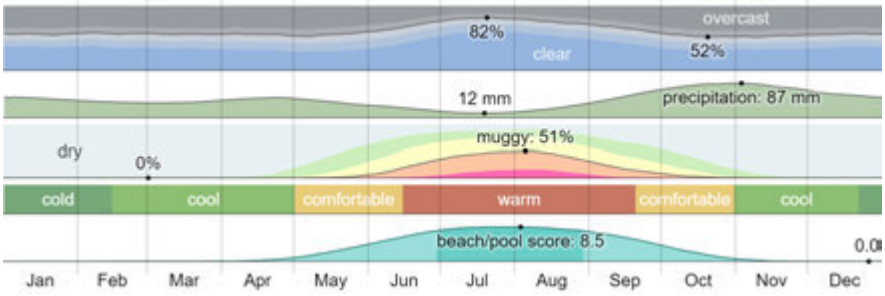


Figure 15 Climate Data, Nice (weatherspark, 2024)

3.5. Vlora Promenade in Albania

Vlorë is the third most populous city of the Republic of Albania. Located in southwestern Albania, Vlorë sprawls on the Bay of Vlorë and is surrounded by the foothills of the Ceraunian Mountains along the Albanian Adriatic and Ionian Sea. The population record in 2021 is 187,675 (Instituti Kombetar i Statistikave, 2021). The promenade is located in the southeastern part of the city, east part of the port. The first phase of the promenade was reconstructed on

2017, by considering not only a sidewalk, but also having different activities. From the photos we can notice also a green park and Aleppo pine trees alongside the promenade in 2 rows.

Figure 16 Vlora Promenade photo 2018

In Vlorë, The summers are predominantly hot and dry, the winters relatively mild, and falls and springs mainly stable, in terms of precipitation and temperatures (Anon., 1992). According to the Köppen climate classification, has a hot-summer Mediterranean climate (Csa) zone. Over the course of the year, the temperature typically varies from 6°C to 30°C and is rarely below 1°C or above 33°C.

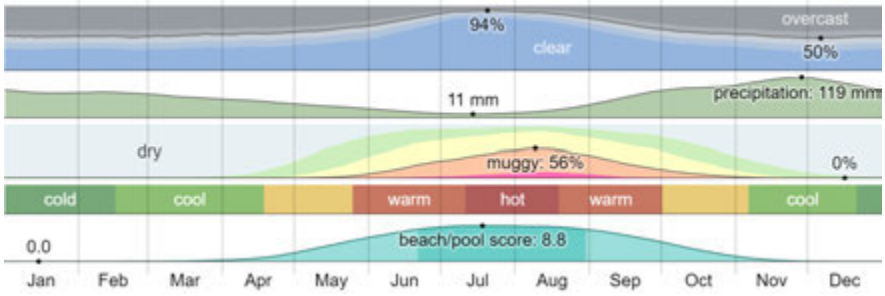


Figure 17 Climate Data, Vlore (weatherspark, 2024)

3.6. Durres Promenade in Albania

Durrës is the largest port city in Albania, and lies in the western part of the capital Tirana. It is also a main port city on the Adriatic Sea in western Balkan. It's known for its huge Roman amphitheater. Nearby is a 9th-century church with mosaic-covered walls. The bay of Durrësi has shallow waters. The population record in 2021 is 292,029 (Instituti Kombetar i Statistikave, 2021). The promenade is located in the southern part of the city, western part of the port. On 2020 one part of the promenade was reconstructed by replacing the pavement, changing the

geometry, adding greenery and trees with a small crown. Even having a new promenade, it is still fully exposed to the sun.

Figure 18 Durres Promenade photo 2020

According to the Köppen climate classification, Durrës is classified under the periphery of the hot-summer Mediterranean climate (Csa) zone. The summers are predominantly hot and dry, the winters relatively mild, and falls and springs mainly stable, in terms of precipitation and temperatures. Over the course of the year, the temperature typically varies from 4°C to 30°C and is rarely below -1°C or above 33°C.

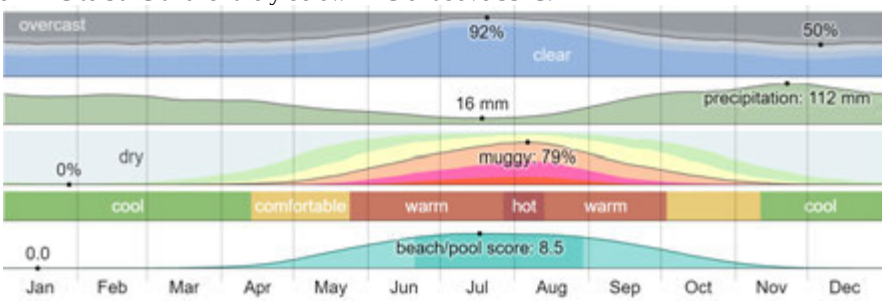


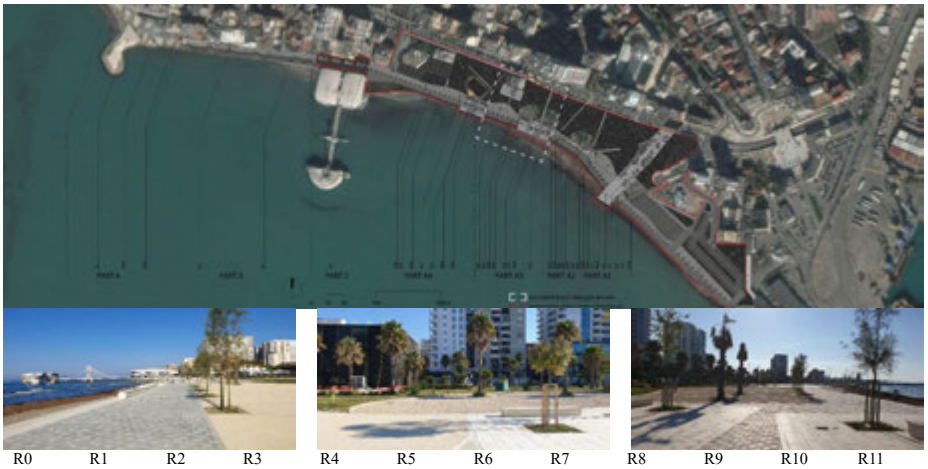
Figure 19 Climate Data, Durres (weatherspark, 2024)

4. Results and discussion

The field study begins with on-site measurements conducted in Durres Promenade utilizing thermometers and weather data obtained from IGEO[1]. The entire Durres Promenade is oriented towards the sun, with limited presence of natural or artificial shade. The presence of light color

[1]Institute of GeoScience, Albania

materials and trees with small crown causes thermal and visual discomfort. Field measurements are capable of detecting thermal stress. Discrepancies in air temperature were observed between on-site measurements and data collected from the local weather station.



R0	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11
4/6 Cromofiber concrete, beige	4b/1 Cromofiber concrete tiles, white	4a/3 Concrete stairs and border, gray	21/4 Grass	2/4 Gray & white stone (75&25 %)	4/6 Cromofiber concrete, beige	21/5 Grass	4a/3 Concrete stairs and border, gray	1/4 White stone	2a/2 Gray & white stone (60&40 %)	1/5 White stone	6/2 Gravel

Figure 20 Durres Promenade map and photos

4.1. The field measurement results for the current condition were obtained on September 5, 2020.

We conducted field measurements on September 5, 2020, at 08:00, 12:00, 16:00, and 20:00, due to the completion of implementation works on the Durres' promenade. Initially, we obtained weather data from the local weather station via the IGEO, including air temperature, relative air humidity, wind speed, average radiation temperature, dew point, visibility, cloud height, water vapor tension, precipitation, wind gusts, and UV index. According to site measurements, the air temperature on site (Tup at 1.7 m) is higher than that from IGEO (Tair), with an average difference of 4.3 °C at 08:00, 5.7 °C at 12:00, 0.5 °C at 16:00, and 0.6 °C at 20:00, depending on the surface temperature of each material and sun hours of exposure. Furthermore, the average air temperature recorded at 0.0 m (Tdo at 0.0 m) compared to Tair is 4.2 ˚C higher at 08:00, 6.4 ˚C at 12:00, and 0.5 ˚C at 16:00, while it is 1.7 ˚C lower at 20:00 (Fig. 2). When comparing the relative humidity on site (H1) to that obtained from IGEO, it was 55% lower than the average. During the day, the STT per material on site is higher in a range of 2–24 ˚C than the Tair, mainly due to the absence of shade. After 19:00, the STT is lower than Tair 3.7-8.2 ˚C, due to the light-colored pavement materials (Tab. 1).

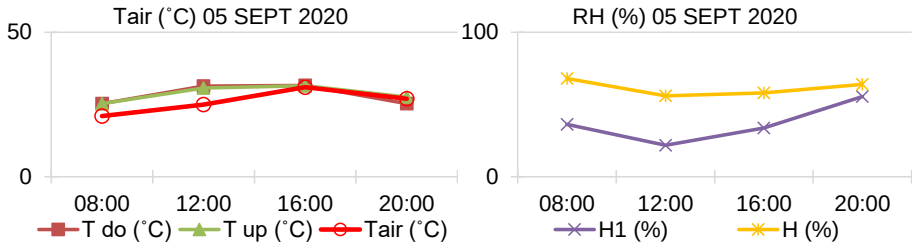


Figure 21 Air Temperature (left) and Relative Humidity (right), 5 Sep 2020, Durres Promenade

Table 1 Sample of Surface Temperature measured with Thermal Camera, 05 September 2020, Durres Promenade

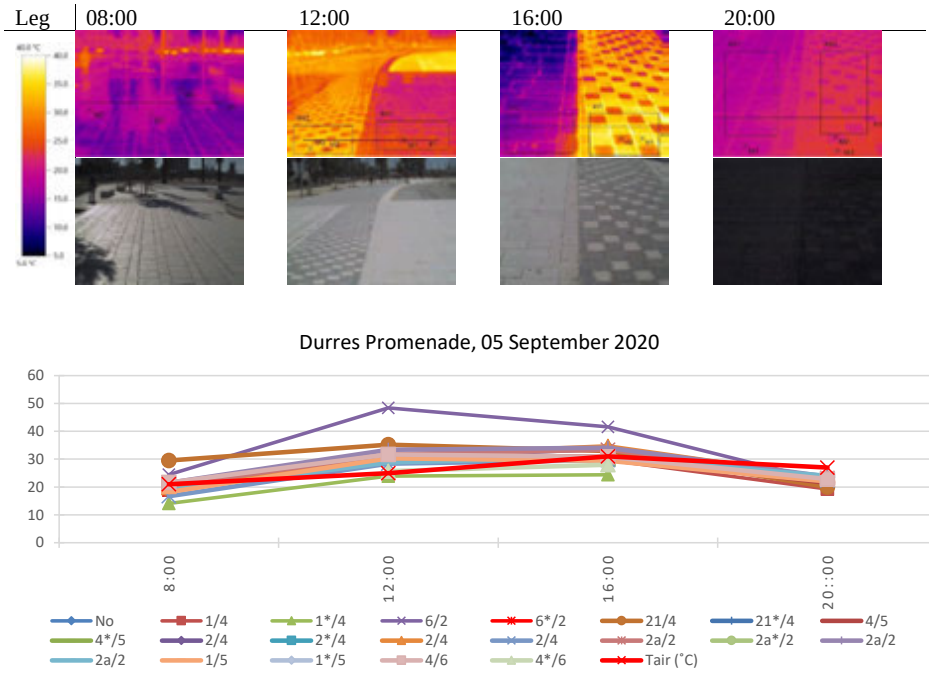


Figure 22 Durrës Promenade – Material Surface Temperature with thermal camera (STT), 05 September 2020

4.2. Simulation results

In each simulation, we entered Durres promenade's geographic position, time zone, and geometric pattern, as well as weather data from the local weather station. We only simulated a portion of the large-scale model, measuring X = 100 m, Y = 120 m, and Z = 40 m, using a grid of dx = 1 m, dy = 1 m, and dz = 1 m. We ran the simulation at the same time and under the

same weather conditions as the field measurements. Results indicate a high degree of thermal stress on September 5, 2020, throughout the entire day until 8 p.m. After these result we chose July 20, 2020, a typical summer day, to run the simulation for the hypothetical scenarios. We used the current promenade simulation (Scenario 0) as a benchmark to validate the hypothetical scenario (Scenario 1). Scenario 0 depicts the existing promenade with light-colored paving materials, a grass surface without an irrigation system, and rare small-crown trees like palms, Tamaris gallica, and Eleagnus angustifolia. The model sets the trees at maturity rather than their current age. We have placed 12 receptors in this section of the promenade to monitor the simulation results as of July 20, 2020. In the scenario 0 we have kept the same design as the current situation. The paving materials in the southern part of the promenade are primarily gray, in other parts are white cube stone in 60%x40% and 75%x25% combinations, along with local white stone, beige-colored chromofiber concrete, gray-colored concrete curbs, and steps. The beach boasts a kelp-covered surface, while paving materials, including beige chromofiber concrete, green surfaces, and local white stone, adorn the north of it. Most of the promenade's greenery is low, but we have planted new trees like Tamarix galica and Eleagnus angustifolia alongside the existing palm trees to create high greenery.

In scenario 1 we modeled Durres promenade by incorporating all the urban design elements explored in previous studies. We added more green surfaces into replacement pavements with abundant Ceratanio Siliqua and Aleppo Pine; installing shades as canopies with varying levels to generate the Venturi effect (Fig. (Tola (Panariti), Ani; Veleshnja, Juljan; Meunier, Paul Louis; Bisha, Geri, 2023). We positioned water surfaces and sprinklers at a height of 30 cm near the curb on the promenade's edge. Receptor R10 is located close to the sunshades, while receptors R8 and R9 are close to the Ceratanio Siliqua trees and the artificial shades. Receptor R2 is close to the water sprinkler, whereas Receptor R5 is near the water surface. The other receptors maintain the same position and material surface as in scenario 0. By combining all four variables, we can determine the extent to which urban thermal comfort will change while keeping the promenade's built environment unaltered.

We independently ran both of these computer models under the same climate conditions, time, and date. Then, we looked at the simulation results for the sky view factor (SVF), the surface temperature from the simulation (STS), and (PET) one by one and in relation to each other to see if there was a dependency ratio between these three factors for the two scenarios.

Figure 23 Urban furniture considered in scenario 1

Table 2 2D and 3D presentation of 2 scenarios in the Durres Promenade

Scenario 0	Scenario 1

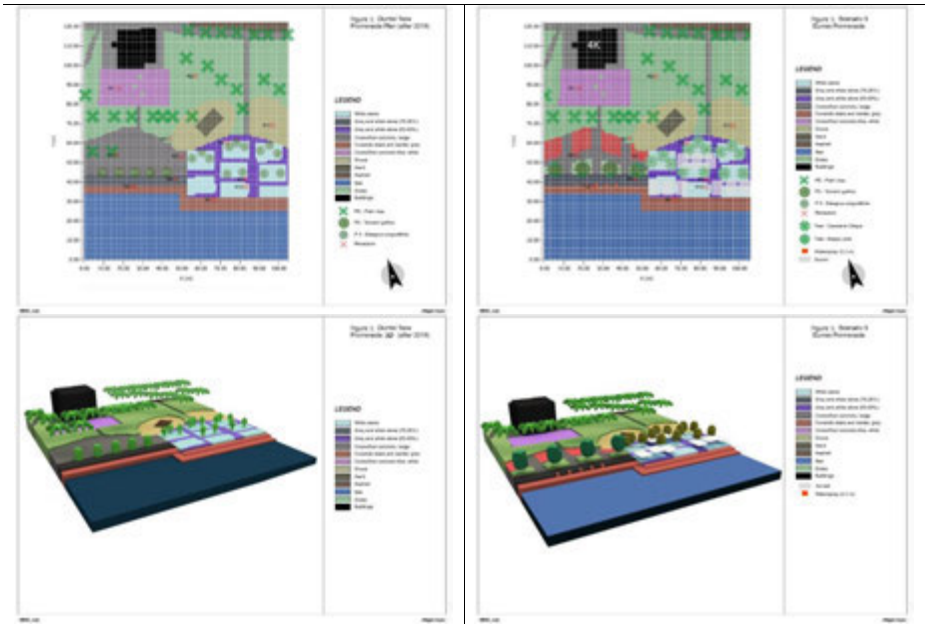
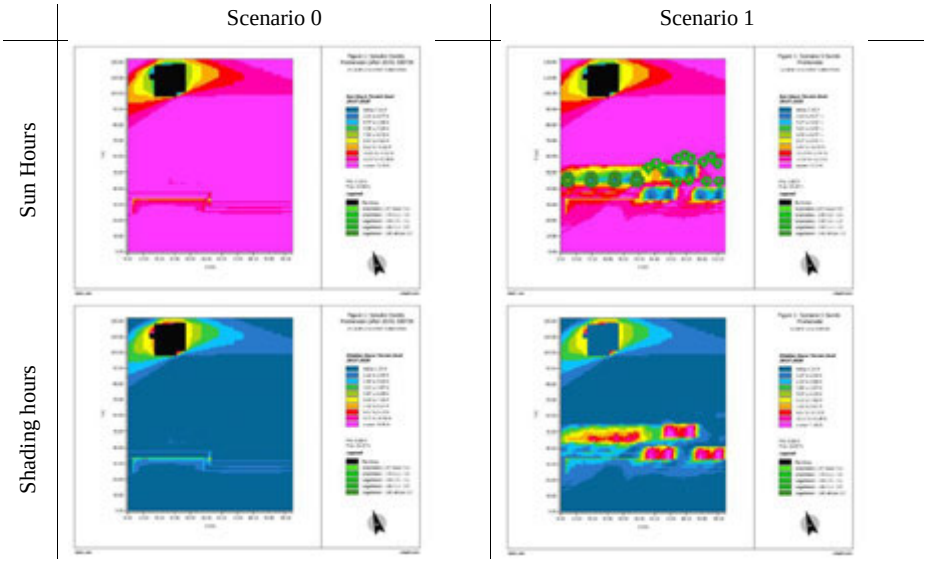
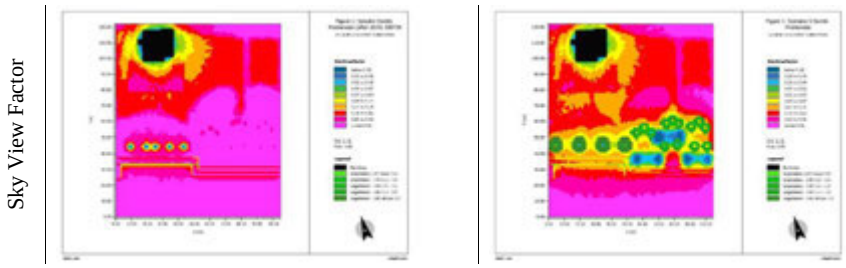


Table 2 presents the 2D and 3D models of scenarios 0 and 1, which include 12 receptors for reading the findings. The table provides information on sun hours, shade hours, and sky view factor (SVF).

Table 3 Sun and shading hours, Sky View Factor 20 July 2020 for two scenarios

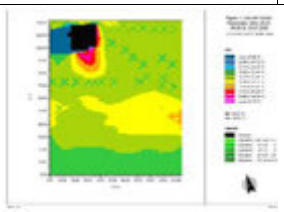
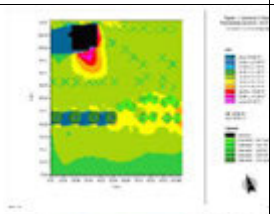
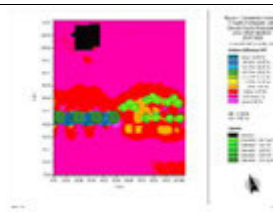
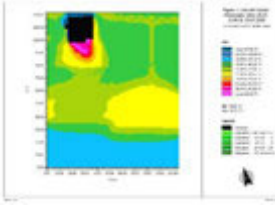
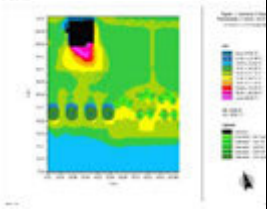
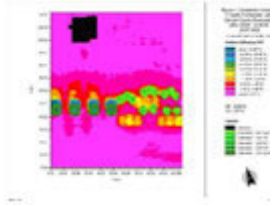




The simulation results indicate that the current Durres promenade (scenario 0) is exposed to the sun for more than 12.07–13.28 hours in the uncovered areas, where the SVF ranges from 0.78 to 0.92, and 1.28–10.27 hours in the spaces occupied by the shadow of the four-story structure, where the SVF ranges from 0.35 to 0.71. According to scenario 1 (mixed design), the part of the promenade is exposed to the sun for 3.1 to 11.97 hours, with SVF values ranging from 0.28 to 0.83 in the area close to the building. While in the part of the promenade covered by artificial shades, tree sun exposure varies from 3.1 to 8.17 hours with an SVF between 0.28 and 0.59 (Tab.3).

According to the simulation results, in Scenario 0, thermal comfort reaches a neutral level after 19:00, and there are three levels of thermal comfort from 08:00 to 18:00: warm, slightly warm, and very hot. Interpreting these results in terms of stress levels, we found moderate stress, strong heat stress, and extreme heat stress. In scenario 1, we achieve neutral thermal comfort after 19:00 on July 20, 2020, mirroring scenario 0. During the daytime hours from 08:00 to 18:00, there are five levels of thermal comfort, such as neutral, slightly warm, warm, hot, and very hot. Interpreted as a stress level, we have no thermal stress, moderate stress, strong stress, and very strong heat stress. Unlike scenario 0, where three levels of thermal stress were present, in scenario 5, the level of thermal stress decreases by one degree as it improves between the hours of 08:00 and 16:00. In addition, note that in scenario 5, the daytime PET has lower average values than in scenario 0, namely 2.4˚C at 08:00, 2.8˚C at 12:00, 2.5˚C at 16:00, 1.3˚C at 17:00, and 0.5˚C at 18:00. This difference is also observed after 18:00 to 04:00, but in values of 0.5-0.6˚C.

Table 4 PET section at 1.5 meter, ENVI-met, 20 July 2020, for Two Scenarios

Time	Scenario 0	Scenario 1	SC1-SC0
08:00			
12:00			

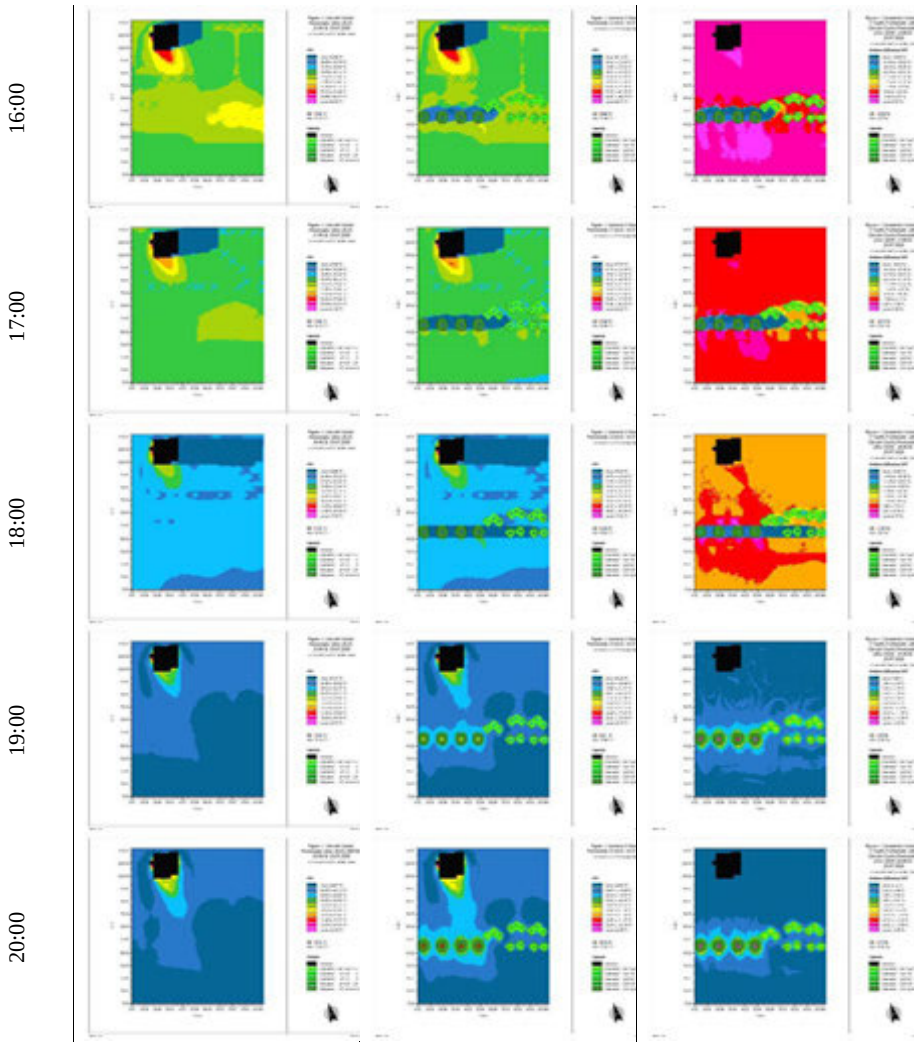


Table 5 Thermal stress levels

PET (°C)	17-26	27-29	30-37	38-42	>42
Thermal Comfort	neutral	slightly warm	warm	hot	very hot
Stress Level	No thermal stress	No thermal stress	Moderated heat stress	Strong heat stress	Extreme heat stress

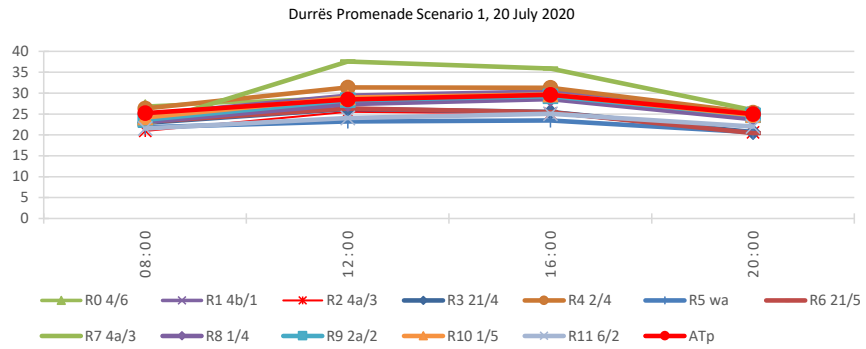


Figure 19: Durres Promenade Scenario 1, 20 July 2020, comparing STS with ATp

5. Conclusions

Site measurements obtained with a digital thermometer and thermal camera have revealed that the temperature measured on-site is 2,8 to 7 degrees Celsius higher than Tair as a result of urban heat emission and the lack of shading. Due to the promenade's complete sun exposure without any shade, surface materials like concrete and gray stones radiate intensely throughout the day. The on-site humidity is less than 55 percent, which is less than the humidity measured by the local weather station.

The simulation results reveal an improvement in the relative PET difference between scenario 1 and scenario 0, particularly in areas with altered paving materials, water surfaces and sprinklers, trees with a large crown, and artificial shade. The temperature ranges from 0.1-13.7 °C at 8:00, 0.3-9.2 °C at 12:00, 0.1-12.1 °C at 16:00, 0.1-10.7 °C at 17:00 and 0.4-5.7 °C at 18:00, and further represents a difference of 0.1-2.4 °C. Depending on the direction of the shade, STS presents values 0.3–8.9 °C lower than in scenario 0, in areas where natural and artificial shades have replaced the paving materials. According to the results of the simulations, proper consideration of the types and positions of greenery and artificial shading during the planning phase would improve the thermal comfort at pedestrian level in the built environment of the Durres coastal promenade by between 12 and 45 percent. For the greenery, it is necessary to note that the outdoor thermal comfort will appear sooner the larger the trees are on the site. Examining the relationship between STS and PET reveals that some light-colored materials have reduced STS compared to dark-colored materials, but PET has higher values. This is due to the complete exposure of these "white" surfaces to sunlight, which in turn raises the air temperature on site through reflection. Promenades, particularly during midday and afternoon hours in the summer, have become a "dead space" (Ranasinghe, 2004) due to temperature stress, rendering them unsuitable for pedestrian use, irrespective of any activities or events that may take place there.

Table 6 the relative difference of STS and PET between scenarios 1 and Scenario 0

Date	20 July 2020												
Output	ΔSTS (°C) (SC1-SC0)				Δ PET (°C) (SC1-SC0)								
Time	8:00	12:00	16:00	20:00	8:00	12:00	16:00	17:00	18:00	19:00	20:00	0:00	4:00
Receptor													
R0	0.1	-3.6	-2.2	0.0	-0.3	-4.5	-8.7	-0.4	1.2	0.6	0.8	0.6	0.8
R1	0.1	0.0	0.0	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
R2	-4.4	-6.1	-6.7	-4.6	-0.9	-1.1	-0.2	0.4	0.7	0.6	0.6	0.6	0.6
R3	0.2	0.1	0.1	0.1	0.0	-0.7	-0.5	-0.1	0.2	0.3	0.2	0.3	0.3
R4	0.1	-0.1	-0.1	0.1	-13.7	-8.4	-12.1	-10.7	-3.9	2.2	2.4	2.2	2.3
R5	-4.5	-8.9	-8.1	-4.2	-1.5	-4.6	-3.0	-1.4	0.4	0.8	0.8	0.6	0.8

R6	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.2	0.2	0.0
R7	-5.9	0.7	0.6	-1.1	-1.5	-2.2	-0.4	0.4	1.2	1.0	1.0	0.9	1.0
R8	0.0	-0.2	0.1	0.1	-6.5	-9.2	-4.2	-3.0	-0.4	1.2	1.3	1.1	1.2
R9	-0.3	0.2	0.2	0.3	-2.5	-1.1	-0.2	-0.1	0.0	0.0	0.1	0.1	0.1
R10	1.2	1.5	1.3	1.2	-1.5	-0.9	-0.8	-0.5	-5.7	0.3	0.3	0.4	0.2
R11	0.0	0.0	0.0	0.0	0.0	-0.3	-0.3	-0.2	0.0	0.0	0.1	0.1	0.0
Average	**-1.1**	**-1.4**	**-1.3**	**-0.7**	**-2.4**	**-2.8**	**-2.5**	**-1.3**	**-0.5**	**0.6**	**0.6**	**0.6**	**0.6**

6. Recommendations

The results obtained for the coastal promenades presented in this study serve as guidelines for the measurable improvement of the level of urban thermal comfort in any new or built urban areas.

When designing new or newly built urban spaces, it is advised to:

First, examine the climatic factors such as air temperature, solar radiation, relative humidity, wind speed and direction, precipitation, cloudiness, atmospheric pressure, direct and reflected short-wave radiation, as well as the UV index.

Consider appropriate paving materials (neither too open nor too dark), the presence of water (water surface and water sprinkler), the proper selection of the type of vertical greenery (tree with large crown) and its position (ways of placement to make shadows), maintenance of grassy surfaces, and placement of artificial shades (tents of unleveled pieces to create the Venturi effect).

Perform environmental and thermographic analyses using field measurements and computer simulations to predict the level of thermal comfort in urban spaces during each season of the year.

7. Further studies

This study focused on specific days during the summer months. Despite only running the scenarios for the Durres Promenade, the cities of Vlora, Genoa, Sanremo, Nice, and Cannes are very likely to experience a common summer day, such as July 20, 2020. Future research should examine the role of urban design in outdoor thermal comfort in any season of the year, whether in Mediterranean cities or elsewhere. It would also be essential to investigate the relationship between architecture and urban planning. Because of the complexity of an urban environment, it is necessary to employ computer models to predict and understand how urban design might affect the urban microclimate and the level of outdoor thermal comfort. This study used the computer software ENVI-met and BioMet to jointly evaluate climate conditions and various urban aspects. Note that the larger the simulation space with a small modeling scale, the closer the conclusion is to reality. Large-scale modeling necessitates the use of computer equipment or specialized modeling labs with high computational capacity. This enables the acquisition of results for every day of the year within a shorter timeframe.

This future study will deepen and widen architects', urban designers', and decision-makers' understanding of urban thermal comfort analysis and the factors that affect it. It will provide the necessary guidelines for sustainable urban development, improving the quality of urban spaces and cities by making them healthy and livable, so that people can breathe and enjoy them at any time of the year. Other countries in the Mediterranean basin will adopt it, and it could serve as a fundamental approach for countries with diverse climates.

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Quantifying the Effects of Spatial Determinants of Cooking Fuel Choices in India

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Abstract
Household energy consumption constitutes approximately 30%, of India's overall energy consumption, with cooking alone accounting for about 40% of this household energy usage. According to the recent consumer survey of India, approximately 30% of the population is still using polluting fuels in India, and several policies like the Pradhan Mantri Ujjwala Yojana have been launched to improve the penetration of LPG as the primary cooking fuel in households. While studies have examined the influence of socio-economic factors on household fuel choices, research focusing on spatial socio-economic dynamics remains limited. This study seeks to fill this gap by investigating the role of regional economies in shaping household cooking fuel preferences, thus addressing concerns related to sustainability and indoor air pollution. This study hypothesises that regional economies might play a significant role in influencing the cooking fuel choice of households. Given the fact that the subsidies and policies governing the cost and distribution of fuel are implemented on national or regional levels, coupled with existing regional disparities in India, studying the influence of spatial variables is imperative. Utilizing Spatial Regression Analysis, specifically the Spatial Lag Model, this research examines the impact of various regional variables on household fuel choices. Findings indicate that GDP per Capita, Built-up Area per 100 sqm, Percentage of main workers in the district and Percentage of households with land ownership exceeding 1 Ha significantly influence the prevalence of LPG usage as the primary cooking fuel in Indian households. For instance, an increase of INR 20,000 in GDP per capita of a district causes a 1% rise in LPG adoption among households in that district. Furthermore, the spatial lag coefficient highlights the spillover effect, indicating that a 1% increase in LPG usage among all the neighbouring districts leads to a 0.42% rise in LPG adoption among the households of the target district. This study underscores the implications of improved technology or new policies on energy usage patterns, suggesting a need for nuanced policy measures tailored to regional disparities. The insights generated from this analysis offer valuable guidance for policymakers and regional planners in formulating targeted interventions to address regional inequalities and promote sustainable development. Additionally, this spatial perspective enables an understanding of resource allocation for efficient regional development. Future research could enhance these findings by incorporating more detailed datasets and refining the Spatial Weights Matrix to account for factors such as connectivity and policy influences..

Keywords
Spatial Regression Analysis, Urban Energy Economics, Household Energy, Cooking Energy

1. Introduction
Approximately 29 percent of the net national energy consumption is in the residential sector, and cooking represents the largest portion of consumption within this sector (IEA, 2020). Specifically, for rural and urban areas, cooking constitutes for 78 percent and 66 percent of the net household energy usage respectively (Yawale et al., 2021).

A business-as-usual scenario of cooking fuel use might lead to approximately 2.7 billion people using unclean fuel by 2030 globally (Stoner et al., 2021). In India, approximately 115 million of its urban population still relying on unclean fuels as of 2012, while only 68.7 percent of utilizes Liquified Petroleum Gas (LPG) for cooking.

Given this substantial reliance on unclean fuels, research has exhaustively examined the factors influencing their usage. The existing literature has extensively explored regression techniques like logistic regression to establish that the household characteristics play an important role in

defining household cooking fuel choice, thus suggesting that with the socio-economic upliftment of the household, the population shifts towards using cleaner fuels. Such outcomes often suggest subsidy-based policies to promote cleaner fuel use, specifically in the developing countries like India.

However, the studies on the influence of spatial factors on household cooking fuel usage is limited. Variables like per capita GDP might indicate the overall socio-economic upliftment of a region, and thus might positively influence the uptake of cleaner fuel for cooking in the households. The variables like connectivity and electrification, which show spatial clustering, might also produce errors in in simple regression methods. Moreover, the subsidies and policies governing the cost and distribution of fuel are implemented on national or regional levels. Such uniform policies, coupled with existing regional disparities in India, might not produce the desired results, leading to inequity among population groups and regions. Thus, studying the influence of spatial variables for cooking fuel choice becomes imperative.

This study hypothesises and demonstrates using Spatial Lag Model that spatial factors play a significant role in influencing the cooking fuel choice of households. Thus, suggesting that merely promoting cleaner fuels using schemes like subsidies might not be effectively successful in influencing the household fuel choice. For developing and highly populated countries like India, which aims to reduce its net carbon emission, more efficient and multi-pronged approaches are necessary to reduce emissions. This study provides such opportunity by studying the influence of spatially autocorrelated variables on the uptake of household cooking fuel choices.

2. Literature Review

Studies classify cooking fuels as traditional (unclean or polluting) or modern (clean or non-polluting) fuels (Katutsi, Dickson and Migisha, 2020). Common traditional cooking fuels include biomass, charcoal, coal, and kerosene, while their modern cleaner counterparts typically comprise gas and electricity (Stoner *et al.*, 2021). Apart from the concerns about pollution, efficiency also varies among traditional and modern fuels, with biomass at 8 percent, coal at 18 percent, charcoal at 25 percent, kerosene at 45 percent, and gas and LPG at 50 percent (Dzioubinski and Chipman, 1999).

Research literature has extensively studied the variables influencing households cooking fuel choices. Studies classify these variables into into demographic, economic, consumer attitude, and climatic factors climate (Bhattacharjee and Reichard, 2012). Demographic and economic variables have been extensively studied in the literature (Kastner and Stern, 2015).

The literature has established that the demographic variables such as household size, age of household/head (Yu, Zhang and Fujiwara, 2011; Aslam and Ahmad, 2018; Katutsi, Dickson and Migisha, 2020), gender of household head (Katutsi, Dickson and Migisha, 2020), marital status (Katutsi, Dickson and Migisha, 2020), and level of education (Katutsi, Dickson and Migisha, 2020; Mperejekumana *et al.*, 2021), influence the cooking fuel choices of households.

Similarly, the significant economic variables are GDP (Garba and Bellingham, 2021), employment status, income (Acuner and Özgür Kayalica, 2018; Kuo and Azam, 2019; Katutsi, Dickson and Migisha, 2020), expenditure, land ownership, number employed, type of employment (Liao *et al.*, 2019), credit access (Mperejekumana *et al.*, 2021), ownership of ICT (Acharya and Marhold, 2019), ownership of housing (Pundo and Fraser, 2006; Acharya and

Marhold, 2019), housing type (Pundo and Fraser, 2006; Yu, Zhang and Fujiwara, 2011) and area of housing unit.

Literature has also shown the relationship between use cooking fuels with initial investment cost of modern fuels (Pohekar, Kumar and Ramachandran, 2005; Reddy and Balachandra, 2006), lack of LPG distribution networks (Reddy and Balachandra, 2006), ingrained habits of using traditional fuels like cow-dung or firewood (Sharma, Parikh and Singh, 2019), the availability of Solid Biomass Fuel (SBF) through agricultural produce (Sharma, Parikh and Singh, 2019), culinary preferences (Sharma, Parikh and Singh, 2019), HDI (Dutta and Sahu, 2022), and electrification (Gupta and Pelli, 2021).

These studies have attempted to estimate the influence of various factors on each of the cooking fuel being used in the households. As the fuel choices are polychotomous variable with a dominant category, Multinomial Logistic Regression is a popular regression method in such studies (Danlami, Applanaidu and Islam, 2019; Baek, Jung and Kang, 2020; Katutsi, Dickson and Migisha, 2020; Kapsalyamova *et al.*, 2021; Mperejekumana *et al.*, 2021; Niyonshuti, 2021). Moreover, some works have also employed the Ordered Probit Model (Rahut, Behera and Ali, 2017) and Multiple Discrete-Continuous Extreme Value (Biying, Zhang and Fujiwara, 2012; Yu, Zhang and Fujiwara, 2013; Acharya and Marhold, 2019) for analysis.

However, few research works have attempted to study the influence of spatial factors such as GDP of the region, regional employment type or the extent of urbanisation, specifically using spatial regression analysis methods. Searching for the following code on Scopus outputs 15 studies, only one out of which by Wang *et al.* (2021) suggest that the per capita gross regional product and per capita disposable income of urban residents influence fuel choice of the households.

Most of the studies which have used spatial regression analysis in the context of fuel or energy are related to air pollution or electricity consumption. Studies suggest that total population, population density, urbanisation rate, per-capita gross regional product, economic growth, industrial structure, road density and climatic factors influence air pollution (Zhou, Chen and Wang, 2018; Ren and Matsumoto, 2020; Tan *et al.*, 2021). Whereas, income, employment density, ratio of employee in retail department, transit fare, and distance to city centre (Yin, Mizokami and Maruyama, 2013; Li *et al.*, 2022). These studies suggest policy improvements related to spatial pricing policies (Zhang *et al.*, 2023), transition of the economic structure (Ren and Matsumoto, 2020), and influencing built-up and employment density (Yin, Mizokami and Maruyama, 2013). Several variables in these studies are common with the variables which have been found to be significantly influencing the household cooking fuel choices.

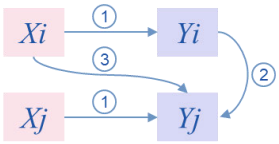
Moreover, variables like population density, urbanisation rate, electrification and connectivity exhibit spatial clustering, and hence considering this characteristic is required during analysis. However, the studies focusing on household fuel choices have failed to take the spatial clustering or spatial autocorrelation into account. To address this gap, this study utilises spatial regression method for the analysis.

3. Methodology

Research highlights that the spatial regression models perform better than the Ordinary Least Squares (OLS) regression when there is spatial interaction between the variables (Ward and Gleditsch, 2008). While linear or logistic regression techniques study the relationship between the dependent and corresponding independent variables, the spatial regression models often

incorporate the influence of variables corresponding to spatially neighbouring entities (spatial units) on the target variable of the target spatial unit. The description of simple regression models and spatial regression models is shown in Figure 1.

Figure 1 Description of Simple regression and Spatial Regression Techniques



1. Regression Model: $Xi \rightarrow Yi$ or $Xj \rightarrow Yj$
2. Spatial Lag or Lag Y Model (SAR): $Yi \leftrightarrow Yj$
3. Spatial Cross-Regressive or Lag X Model (SLX): $Xi \rightarrow Yj$

As established in the literature, several variables shown to influence household fuel choices significantly might be spatially correlated. To address the spatial influence of such variables, using spatial regression models for this study is required. The influence of the socio-economic variables explored in the previous studies is limited to the same spatial unit, and their influence might not directly extend to the neighbouring spatial units. However, the socio-economic upliftment of the population in the neighbouring spatial unit might also cause a similar development in the target spatial unit, leading to a spill-over effect in the uptake of cleaner fuels for cooking. Since the socio-economic factors of one spatial unit might not affect the fuel choice in the neighbouring spatial unit, the SLX model is out of scope, and the SAR model is used for the study.

The spatial lag model considers the effect of one dependent variable on the neighbouring one, and is represented by the Eq. 1.

$$\boldsymbol{y} = \rho \boldsymbol{W y} + \boldsymbol{\beta X} + \boldsymbol{\varepsilon} \qquad \textbf{Eq. 1}$$

where,

y = Dependent Variable
ρ = Spatial Lag Coefficient
W = Spatial Weights Matrix with size a '$n \times n$', where n is the total number of observations
β = Coefficient of Independent Variable
X = Independent Variable
ε = Error

However, it is necessary to find out the extent of spatial autocorrelation in the dataset to perform the spatial regression analysis. Spatial autocorrelation is indexed by calculating Moran's I, which measures the spatial clustering of the variables (Moran, 1950; Cliff, Ord and Cliff, 1981). The value of Moran's I ranges from -1 to +1, negative value representing no clustering or dispersed features, and a positive value representing clustered features, corresponding to a z-score greater than 1.96, at a 0.05 significance level (Ord and Getis, 1995).

4. Data Description and Pre-processing

A district level dataset for 601 districts of India was created for this study. The data was available from various sources listed in Table 1. All the datasets were then transformed at the district level resolution, where districts will be acting as one spatial unit. Since LPG is the predominant fuel choice with 68.7 percent of the Indian population using it as the main cooking

fuel (MoSPI, 2014), the fraction of households using LPG in the district as their main cooking fuel was considered as the dependent variable for the analysis.

Table 1 Sets of independent variables were considered for the study

S. No.	Variables	Source
Dependent Variables		
1	Fraction of Households using LPG as main cooking fuel	Household Consumption of Various Goods and Services in India, 2011-12, NSS 68th Round, Sch 1.0, Type 2, National Sample Survey Office (NSSO), Ministry of Statistics and Program Implementation (MoSPI, 2014), Government of India
Independent Variables: Spatial Economy		
1	Gross District Product (GDP) (in Crores INR)	NITI Aayog (2016), Government of India (For the states with no data for GDP, the state GDP was distributed according to the population weightage of the districts)
2	GDP per Capita (in Crores INR)	GDP divided by the population of the district (obtained from Census of India, Government of India (MoHA, 2014))
Independent Variables: Household Economic Status		
3	Average Household Expenditure (in Thousands INR)	Household Consumption of Various Goods and Services in India, 2011-12, NSS 68th Round, Sch 1.0, Type 2, National Sample Survey Office (NSSO), Ministry of Statistics and Program Implementation (MoSPI, 2014), Government of India
4	Fraction of Households with more than 1 ha of Land Owned	
Independent Variables: employment types		
5	Fraction of Working Population	Census of India, Government of India (MoHA, 2014)
6	Fraction of Main Workers	
7	Fraction of Agricultural Workers	
Independent Variables: Socio-Demographic Status		
8	Total Population	Census of India, Government of India (MoHA, 2014)
9	Total number of Households	
10	Average Household Size	
11	Fraction of Households with Head having a Graduation Degree	
12	Fraction of Literate Population	
13	Average age of Household Head	Household Consumption of Various Goods and Services in India, 2011-12, NSS 68th Round, Sch 1.0,

		Type 2, National Sample Survey Office (NSSO), Ministry of Statistics and Program Implementation (MoSPI, 2014), Government of India
Independent Variables: Spatial Development		
14	Fraction of Population living in Urban Areas	Census of India, Government of India (MoHA, 2014)
15	Average Night Time Light in W/cm²/sr	Average Night Time Light (NCEI, 2013)
16	Built-up area per 100 m^2 of Land	Built-up density (GHSL, 2023), European Union

Spatial Weights Matrix

The calculation of W matrix is important in determining the model properties. W is defined as a '$n \times n$' matrix, where n is the total number of observations. Creating the W matrix for the study included following steps:

1. Initially, the value of n_{ij} is kept equal to 1 if the i^{th} and j^{th} entries are neighbours. But that ensures that all the neighbouring districts will have a unit impact on a district, essentially meaning that if a district has more neighbours, then it will have more impact on its dependent variable.
2. To overcome the error, row-wise normalisation is done. This ensures that the unit effect is observed. But practically, not every district will provide a uniform impact, and the districts which are highly influential might impact more.
3. To overcome this error, the values were weighted by district GDP and then normalised to ensure justified impacts. The current W matrix can be described as Eq. 2.

$$W_{ij} = GDP_j \,/\, \sum_{j=1}^{N} GDP_j \qquad \textbf{Eq. 2}$$

where,

GDP_j = GDP of the District j

$j \in \{1,2,3,\ldots,N\}$ is the set of neighbouring districts of the district i

Spatial Autocorrelation

It is necessary to find the extent of spatial autocorrelation or clustering in the dataset to perform the spatial regression analysis. The clusters of developed and under-developed regions can be observed primarily through the maps shown in Figure 2 and Figure 3.

Figure 2 Fraction of Households in the district using LPG as Main Cooking Fuel

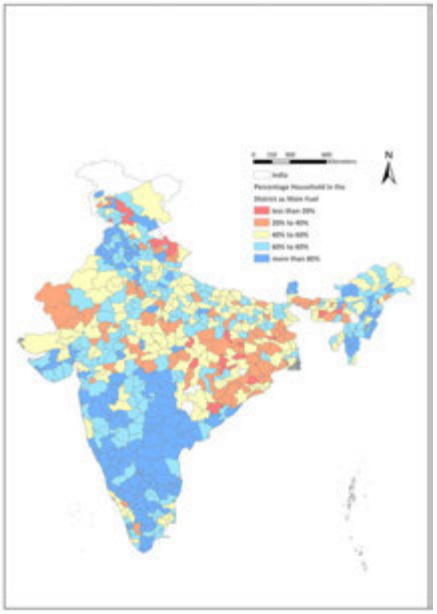
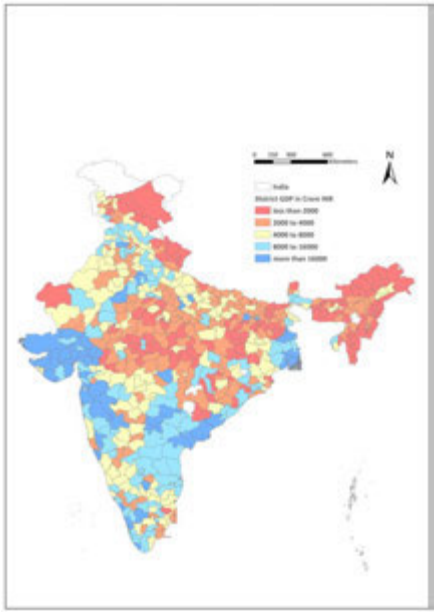


Figure 3 Gross District Product (GDP) (in Crores INR)



To study the extent of clustering, spatial autocorrelation analysis by calculating Moran's Index was done on the dependent variable i.e. Fraction of Households in the district using LPG as the Main Cooking Fuel in Districts as spatial units. The results showed that the value of Moran's I is 0.335299 and the z-score is 22.58 for the Fraction of Households in the 601 districts using LPG, at less than 1 percent likelihood of clustered pattern being result of a random chance.

Correlation Analysis

The correlation analysis is conducted and at least one from each set of correlated variables is to be chosen as the final independent variable. The correlated sets are:

1. GDP, GDP per capita, Total Population, Total number of Households, Fraction of Population living in Urban Areas, Night Time Light Intensity and Built-Up Density are highly positively correlated to each other.
2. The variables describing employment types, Night Time Light Intensity and Built-Up Density are negatively correlated with the Fraction of Households with more than 1 ha of Land Owned.
3. The fraction of main-workers in the district has a higher and positive correlation with all variables depicting higher development than the fraction of the working population in the district.

5. Results and Discussion

High spatial autocorrelation was observed in the dataset and hence the spatial lag model was implemented to consider clustering of the dataset, as suggested by previous research (Yin, Mizokami and Maruyama, 2013). The results of the analysis are depicted in Table 2.

Table 2 Description of Spatial Regression Analysis results for Fraction of Households in District using LPG as Main Cooking Fuel

Variable	Coefficients
Constant	-0.16**(0.073)
GDP per Capita in Crores	0.005**(0.002)
Built-up Area per 100 m^2	0.01***(0.002)
Fraction of main workers in the district	0.871***(0.111)
Fraction of households with land owned more than 1 ha	0.238***(0.067)
Spatial Lag	0.42***(0.045)

- Number of Observations: 601
- Number of Variables: 6
- Degrees of Freedom: 595
- Akaike info criterion: -398.995
- Schwarz criterion: -372.603
- Mean dependent var: 0.6178
- S.D. dependent var: 0.2147
- Pseudo R-squared: 0.3839
- Spatial Pseudo R-squared: 0.2752
- Log-likelihood: 205.4975
- Sigma-square ML: 0.0285
- S.E of regression: 0.1687

The results can also be described in the form of Eq. 3:

$$\boldsymbol{y} = \rho \boldsymbol{W y} + \boldsymbol{\beta 1 X 1} + \boldsymbol{\beta 2 X 2} + \boldsymbol{\beta 3 X 3} + \boldsymbol{\beta 4 X 4} + \boldsymbol{\varepsilon} \qquad \textbf{Eq. 3}$$

where,

y = Fraction of Households using LPG as the Main Cooking Fuel
ρ = 0.42, W = Spatial Weights Matrix
$\beta 1$ = 0.005, $X1$ = GDP per Capita in Crores
$\beta 2$ = 0.871, $X2$ = Built-up Area per 100 m^2
$\beta 3$ = 0.238, $X3$ = Fraction of main workers in the district
$\beta 4$ = 0.01, $X4$ = Fraction of households with land owned more than 1 ha
ε = -0.16

Four independent variables, namely GDP per Capita, Built-up Area per 100 m^2, Fraction of main workers in the district and Fraction of households with land owned more than 1 ha, were significant. Their description is given below:

1. GDP per Capita in Crores: GDP per capita showed a better significance than net GDP as some of the districts have extremely high or low populations as compared to others. With highly industrialised as well as remote districts present in the dataset, a measure which could depict the economic characteristic at a disaggregate level shows better

results. As the coefficient for the GDP per capita is positive, an increase in the GDP per capita of a district causes a rise in LPG adoption among households in the district.

2. Built-up Area per 100 m^2: Built-up density is a measure of urbanisation as well as accessibility, which ensures the uptake of cleaner fuels. As higher night-time light intensity can be obtained from industries, built-up density showed a higher significance. The positive and significant coefficient shows that if the total built-up land increases, the LPG usage will increase as well, irrespective of all other factors.
3. Fraction of main-workers in the district: The fraction of main-workers depicted the state of employment in the district, and since more stable employment types increase the uptake of cleaner fuels, it provided significant results. The coefficient values depict that a percentage increase in the main workforce of the district increases LPG adoption among households.
4. Fraction of households with land owned more than 1 ha: The average land ownership of Indian households is approximately 1 ha, and better economic well-being increases the uptake of cleaner fuels. Coefficient values depict that an increase in the proportion of households owning up to 1 ha land leads to an increase in LPG usage of the households in the district.
5. Spatial Lag Coefficient: The Spatial Lag Coefficient depicts the effect of LPG usage in neighbouring districts on the target district. Moreover, the effect of independent variables on the LPG usage in the target district also shows up in the coefficient ρ. An increase in LPG usage among all the neighbouring districts leads to a rise in LPG adoption among the households of the target district without any change in the socio-spatial characteristics of the target district. However, LPG usage changes in neighbouring districts with higher GDP would be proportionately higher. However, the value of ρ can also be understood as a limiting factor, meaning any amount of increase in LPG consumption in the neighbouring district cannot lead to more than ρW times of increase in the target district.

6. Policy Implications

In India, subsidy policies like Ujjwala Yojana, which subsidises LPG for a defined socio-economic group, are implemented uniformly nationwide. However, the spatial socio-economic disparity might hinder uniform regional development. Moreover, previous research has extensively explored the influence of socio-economic upliftment on the uptake of non-polluting fuels, suggesting an improvement in such variables to ensure higher uptake of cleaner fuels. However, this research shows the influence of spatial proximity on the uptake of cooking fuels like LPG, indicating a need for nuanced policy measures tailored to regional disparities.

The study indicates that improving the economy or technology or implementing new policies in any urban area might sub-urbanise its periphery by a defined amount. This can be known as an energy usage spill-over effect limited by the value ρW.

Additionally, this spatial perspective enables an understanding of resource allocation for efficient regional development. Such studies can also assess the regional changes in the energy usage scenario after a greenfield development. The insights generated from this analysis offer valuable guidance for policymakers and regional planners in formulating targeted interventions to address regional inequalities and promote sustainable development.

7. Conclusions

This study contributes to the existing literature by introducing the use of the spatial lag model to study the factors influencing cooking fuel choices in households in India. This study

quantifies the spatial influence of socio-economic variables and the spill-over effect of LPG usage on its usage in the target spatial units. The findings of this study are:

1. The positive and significant coefficients for GDP per Capita, Built-up Density, State of Employment and Land Holdings in the Spatial Lag Model indicate that an improvement in these variables leads to increased uptake of LPG as the main cooking fuel in Indian households.
2. The spatial lag coefficient indicates that the uptake of LPG as the main cooking fuel in neighbouring districts positively influences the uptake of LPG in the target districts due to the spill-over effect. Moreover, improvements in GDP per Capita, Built-up Density, State of Employment and Land Holdings in the neighbouring districts influence the LPG uptake of those districts, causing an indirect influence on the target districts.
3. Several socio-economic variables previously used in the studies show spatial clustering or autocorrelation, and the phenomenon must be accounted for. The spatial regression models perform well in such cases and explain the effect of variables influencing household cooking fuel choices while accounting for spatial clustering.
4. To promote cleaner fuel usage in households, the policies must consider the spatial aspects of the region, specifically regional economy and spatial inequalities, instead of proposing uniform blanket schemes.

8. Limitations and the Way Forward

Methodologically, inputting variables such as built-up height or forest cover, and considering weightage dependent on connectivity, policies or state boundaries (which govern fuel pricing) for the calculation of the Spatial Weights Matrix might produce better model results. The data resolution can be further improved to achieve better results. Since socioeconomic disparities and heterogeneity exist in India (Reddy and Balachandra, 2006; Balakrishnan, 2016), and barring a few studies, fuel choices of the population in a region has been assumed to be homogeneous, improving on socio-economic variables, specifically in spatial aspects might be helpful for future studies.

Moreover, since that dataset used for the analysis is from 2011-12, it merely depicts the cross-sectional pattern of consumption among Indian Population. A panel analysis might provide even better insights into the fuel usage pattern, impact of new policies such as Ujjwala Yojana, and future policy improvements.

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The Built Environment Policy and Practice Context to Facilitate Climate Change Action - the Role for Planning and Design

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Abstract
Human settlements are key sites in which there is a need for effective climate change action. This paper reports findings in summary of a wider study into the integration of climate change adaptation and mitigation actions across the built environment in Australia. It reports on a process map of the built environment, describes Australian built environment policy; the preparedness of Australian built environment professionals; identifies action across the life cycle of the built environment; and barriers and facilitators experienced by Australia urban designers.

Key words: climate change, built environment, professionals

1 - Introduction

In its 6th Chapter, the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report, "Cities, settlements and key infrastructure" (2022), states that planning and urban design are essential to climate change action. However, it also highlights that impediments to action must be overcome. With this in mind, finding ways for planning and built environment practitioners to take meaningful action on climate in circumstances where there is a lack of clarity is important. This often takes place within complex urban management processes and systems (IPCC, 2022: 6-90, 6-105).

This paper reports summary findings of a large Australian Research Council funded study into integrating climate change action (adaptation and mitigation) across the built environment. It explored how climate change action could be facilitated from the viewpoint of built environment practitioners in Australia, paying heed to the policy context. The research brought together an interdisciplinary team of built environment researchers, with a range of academic and practice backgrounds. Considerable engagement with practitioners and policy makers was included. Its overall aim is to identify actions in policy and practice that assist to achieve effective and efficient climate change adaptation and mitigation actions in the main sectors of Australia's built environment, including: design (architecture, landscape architecture and urban design); urban planning; construction; and property. Policy is understood in this work to include policies, strategies, regulations, codes and legal Acts (A. Hurlimann et al., 2024; A. Hurlimann & A. March, 2012).

Caused by anthropogenic greenhouse gas (GHG) emissions, climate change is having increasing impacts on systems globally. Considerable international recognition exists of the urgent need for reduced GHG emissions to avoid catastrophic climate change, and adaption

to deal with changes in climate that are unavoidable (IPCC, 2015). This action of climate change mitigation, in addition to climate change adaptation dealing with existing and future impacts has particular importance in cities (Gleeson & Steele, 2010; McGuirk, Dowling, & Bulkeley, 2014). Built environments are where the majority of the world's population live and produce the most GHG emissions. The impacts of climate change such as extreme weather, wildfires, floods, storms and sea level rise are also increasingly felt in cities, including in Australia (BoM & CSIRO, 2020).

Australia is a highly urbanised country and has an urgent need to address climate change. In this paper the manner in which production and modification of the built environment occurs focussed on, including the activities of the design, urban planning, construction and property sectors. Australian governments at federal, state and local levels have developed many policies to address climate change (A. Hurlimann et al., 2024). While action to address climate change has occurred, it appears unlikely to be of a scale extensive enough to deal with the problem. Effective policy that can achieve climate change targets are an essential factor in dealing with this challenge (IPCC, 2022).

Built environments, also known as cities, urban areas, or human settlements are defined variously. For this research we follow the 2016 Australian State of the Environment report definition:

…the human-made surroundings where people gather to live, work and play. It encompasses both the physical structures where people do these activities and the supporting infrastructures, such as transport, water and energy networks. The built environment is a material, spatial and cultural product of human labour and imagination." (Coleman, 2017: 2).

To consider barriers and facilitators of climate change adaptation and mitigation, the paper reports findings relating to: 1) mapping the Built Environment Life Cycle; 2) describing the Australian built environment policy context; 3) assessing the preparedness of Australian built environment professionals, including planners; 4) identifying the mechanisms for influence and action across the life cycle of the built environment; and, 5) the barriers and facilitators experienced by Australia urban designers.

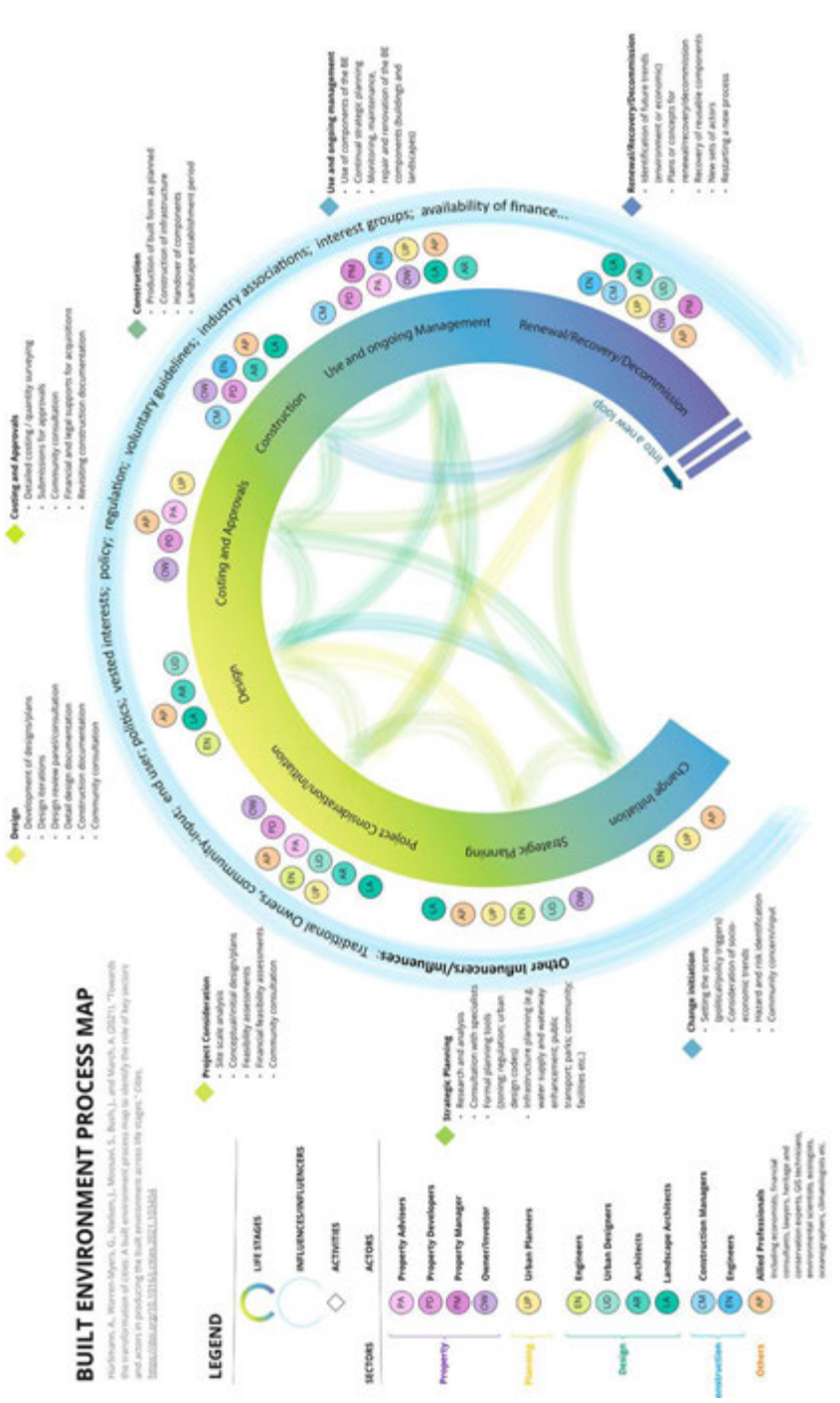
2 - Climate Change and the Built Environment Life Cycle

This section sets out a process map to describe the production of the built environment as a life cycle developed at the beginning of this project (Hurlimann et al 2022). Process mapping allows the development of a model to show "relationships between the activities, people, data and objects involved in the production of a specified output" (Biazzo, 2002: 42). They are recognised for their descriptive value in assisting defining, improving, and re-designing processes (Biazzo, 2002). Biazzo (2002 p.43) sets out four common perspectives represented in process maps: 1) the process or fundamental activities; 2) when and how the elements of the process are carried out; 3) where and by whom they are undertaken; and 4) the structure and relationship between the stakeholders in the process. The process map developed and presented of the built environment in this paper identifies key activities in producing the built environment. At the same time, it identifies the key sectors and actors contributing to the production of the built environment across life stages.

Distinct phases were followed to develop built environment process map (Hürlimann et al., 2022). Drawing on the methods of Sanders, Ross, and Coleman (1999) and Biazzo (2002),

the following actions were taken 1) establishment of temporal via life stages 2) identification of the activities contributing to producing the built environment 3) identifying key sectors' involvement across life stages 4) identification of key actors and professionals across the life stages (Sanders, Ross, & Coleman, 1999). Diagramming was developed to describe the arrangements showing the structure and relationships between stakeholders.

Following internal development, external input from industry professionals assisted to verify and further refine the process map. An expert reference group comprising 18 members met to critique and discuss the preliminary process map was undertaken, including breakout sessions. Outcomes of meeting with the expert reference group led to a number of changes and ongoing iterations of the process map. Further feedback was then sought from the expert reference group for verification, thus finalising the built environment process map. The final built environment life cycle map is shown in Figure 3 below (Hürlimann et al., 2022).


BUILT ENVIRONMENT PROCESS MAP
LEGEND
LIFE STAGES
INFLUENCES/INFLUENCERS
ACTIVITIES
ACTORS
SECTORS
Property Advisors
Property Developers
Property Manager
Owner/Investor
Urban Planners
Engineers
Urban Designers
Architects
Landscape Architects
Construction Managers
Engineers
Allied Professionals
Property
Planning
Design
Construction
Others
Other Influencers/Influences: Traditional Owners, community+input, end users; politics; vested interests; policy; regulation; voluntary guidelines; industry associations; interest groups; availability of finance...
Strategic Planning
Project Consideration
Design
Costing and Approvals
Construction
Use and ongoing Management
Renewal/Recovery/Decommission
Change Initiation
Use and ongoing management
Renewal/Recovery/Decommission
Construction
Costing and Approvals
Design
Strategic Planning
Project Consideration
Change Initiation
into a new loop

The design of the built environment life cycle map highlights the non-linear nature of the ways that the built environment is produced and maintained over time, represented by a horse-shoe shape. This is because the renewal/recovery/decommissioning stage may lead to initiation of a new projects, rather than rather than the same cycle. The diagram sets out eight main stages, demarcated by shifts in actors' involvement, the roles taken on, and their influence. Internal connections between stages represent non-linear and iterative characteristics fundamental to the process. While some projects may follow a linear progression through the stages, more often the processes include numerous feedback loops, short-circuits and iterative modifications.

This process map developed seeks to improve understandings of the ongoing production of the built environment. It addresses gaps in current approaches by describing the extensive range of life stages. It considers diverse built environments sectors and articulates the role of key actors, and the relationship between them, while visualising the process. There are limitations to the process map, particularly regarding its complexity being represented in a simple two-dimensional form and acknowledging the diversity of different and particular context-specific circumstances. Notwithstanding, this representation contributes to understanding how the built environment is produced, as a step to finding ways to make transformative changes in practice to address climate change. This could be applied to contexts ranging from climate change action, sustainability objectives, to the incorporation of improvements to address disability.

3 - Understanding the Built Environment Policy Context

Built environments are important places in which social and economic activities are focused. They are also sources of significant GHG emissions. To transform built environments so that they can facilitate and incorporate appropriate action to address climate change, appropriate policy instruments must exist. Typologies suited to describing and analysing built environment policies in an holistic way are limited.

Based on a wide review of literature we developed (see Table 1) a 'built environment policy framework' consisting of a policy instrument typology (strategies, laws, regulations, guidelines, voluntary instruments and programs) and a built environment policy setting (governance level, sector, property type, life stage, timeframe) (A. Hurlimann et al., 2024).

Policy categories from existing literature:	Regulatory	Regulatory	Informational	Informational	Financial/other incentive	Government provision and direct action
Policy instrument Types and examples	Law • Legislation • Statutes	Regulation • Building regulations/ standards • Codes •Development controls e.g., zoning, overlays,	Strategy • Strategic plans • Spatial plans	Guideline • Policy advice/guidance • Guidelines	Voluntary instrument • Voluntary standards • Awards • Voluntary certifications • Grants and subsidies	Program •Implementation of projects/ programs of action • Professional education •Experimentation

		growth boundaries •Environmental and other impact assessments • Taxes / rebates / buy-backs • Financial levers				
Definition	Rule/s enacted and recognised as requiring or forbidding certain actions. Binding force.	Prescribed rules to guide practice and implement law/s. Can include those with financial implications.	Long term plan or policy which articulates goals and methods of achieving them.	Principle/s guiding or directing action. Can be compulsory or non-compulsory, depending on how it is implemented.	Non-compulsory instruments to guide practice, including fiscal incentives.	Planned activity/ies to assist realisation of goals.

Table 1 - Policy instruments typology with relevance to the production of the built environment
Source: (A. Hurlimann et al., 2024: 5)

The framework was tested in Australia to consider three local municipalities. Policy instruments that influence decision making regarding, and management of, the built environment in Victoria, Australia were identified and analysed using an iterative process. Policy instruments that met the key criteria were selected: influential in explicitly guiding decision-making (of public or private actors) regarding the built environment of the jurisdiction; local, state, national, international and non-government. In assessing relevant local governments, policy emanating from international, national and state levels was included if it met the inclusion criteria.

The first local study area, The City of Melbourne, centres on a high density, globally-connected central business district within greater metropolitan Melbourne in the context of surrounding suburbs. Its population is 154,000 (greater metropolitan Melbourne has a 4.9 million 2021 census population), a land area of 37.33 km^2. The City of Greater Geelong (Geelong) second largest city in Victoria and includes urban settlements, growth areas, regional towns, rural land, and has a coastal location. Its population is 271,000, with a land area of 1252 km. Wellington Shire Council (Wellington) is a regional municipality, including 45,000 persons and an area of 10,811km^2.

Overall, Melbourne had 33 built policy instruments, Geelong 23, and Wellington nine. By a considerable amount (as shown in Figure 1), the dominant policy instrument type was ‘strategy’. Melbourne and Geelong had many biodiversity, environmental, sustainability and climate change strategies, while the more remote regional Wellington municipality had few. Across the all governance levels, with a focus on the City of Melbourne at the local level, the policy instrument type were ranked in order: strategy (44), guideline (30), law (17), regulation (12), voluntary instrument (9), and program (5). State government had the most policy instruments (47), followed by the local government (37), federal government (21), international (7), then non-government (5). State government had more than double the number of laws than the federal level, while local government had more strategies than any other level of government. This may be due to their role in the built environment, which differs in comparison to the federal and local levels, with more responsibility distributed. The mapping identified that strategies were the dominant policy instrument. Fewer policy instruments were found to directly address the built environment’s later life stages, and there were fewer at federal and international levels of governance.

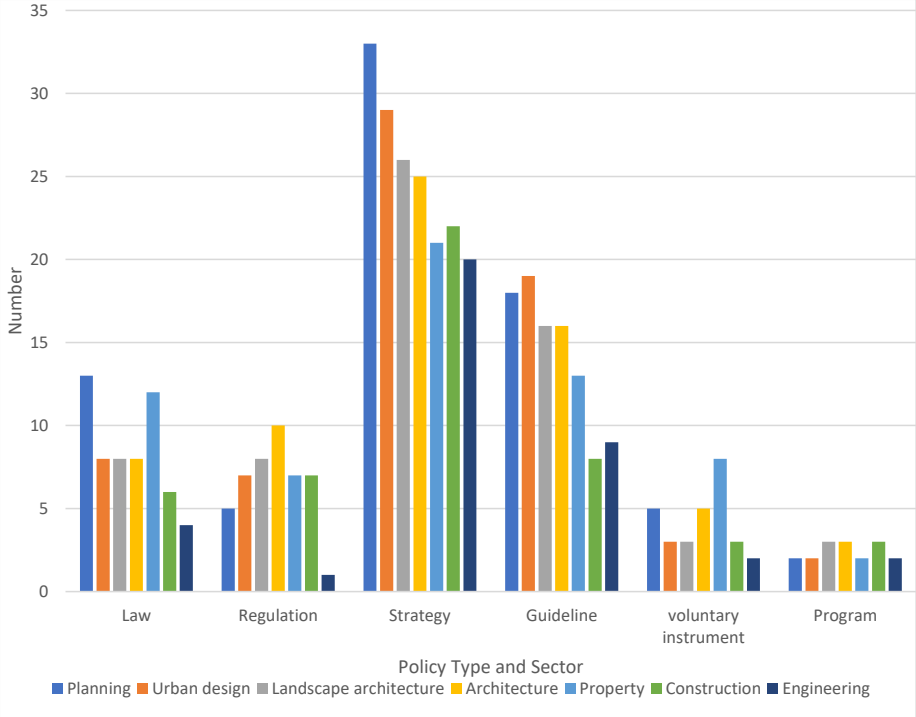


Figure 1 - Victoria's Built Environment Policy Instrument type by built environment sector

Examination of the documents revealed that, according to sector, they were applied across the life cycle of built environment elements revealing distinct, albeit overlapping, stages as shown in Figure 2 below.

Change Initiation
Strategic Planning
Project Consideration and Initiation
Design
Costing and Approvals
Construction
Use and Ongoing Management
Renewal, Recovery, Decommissioning

Figure 2 - Built Environment Life Cyle Application Evident in Policy instruments

Overall, the results show a relative dominance of 'strategy' compared with the limited amount of implementation via 'programs' that guide action and achieve goals. This suggests that there is a need to seek greater diversity of policy instruments at all levels government. Generally, strategies appeared to be non-binding and more easily prepared, without certainty of action. Broadly, there appears to be a need to have more effective policy in the later life stages of the built environment, suggesting that identification of and augmentation of policy gaps in stages such as 'renewal and recovery' would facilitate transition to a more circular economy. It is noted that actions taken by the European Union, specifically, the Circular

Economy Action Plan (European Commission, 2020);(Spani, 2020) recognises the environmental and climate change impact of resource extraction and greater circularity. Federal government in Australia appears to have insufficient policy instruments if it is seeking greater influence to enhance its climate change leadership and to meet international goals (such as the Paris Agreement). There is a general lack of strong 'command and control' policy instruments of regulation and law implemented across the entirety of life stages and governance levels. These will be necessary to allow government to achieve increased uptake of climate change goals. The next stage of the research is to assess the extent to which these policies address climate change and this is currently under peer review.

4 - The Preparedness of Planners and other Built Environment Professions for climate change action

We now turn to considering the preparedness of planners and other built environment professionals to take climate change action, based on a review of literature in English. The research assessed existing scholarship that considered climate change preparedness of professionals within built environment sectors (A. C Hurlimann et al., 2022). The problematizing review was an 'opening up exercise' to enable researchers to rethink existing knowledge in a generative manner (Alvesson & Sandberg, 2020).

Moser and Luers's (2008) framework for climate change preparedness was followed. Accordingly, this examined awareness, analytical capacity, and action of built environment professionals in the context of their sectors (Moser & Luers, 2008). The review assessed reported facilitators and barriers of climate change action. The main data base used was Scopus, in parallel with discipline-specific journals. Scopus is a source-neutral abstract and citation database curated by independent subject experts (Elsevier 2020). The database includes 25,000 titles from over 5000 publishers, the majority being published after 1996. The research reported here (A. C Hurlimann et al., 2022) was guided by the following two questions:

1. What barriers exist to climate change action in and across the built environment sectors: urban planning, property, construction, and design (including urban design, landscape architecture and architecture)?

2. What facilitates action to address climate change in and across these built environment sectors?

Following the screening and selection methods of Moher et al., 175 articles were included in this research (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group*, 2009), with 50% of the articles published in the period between 2017 and 2020. Detailed analysis was undertaken in an excel spreadsheet. The review began with the collection of basic meta-data such as sector of focus; type of research (empirical/non- empirical); details of the method; location of the research; and whether climate change adaptation, mitigation or both, were examined. In terms of overall numbers, papers addressing barriers, facilitators, and climate change awareness were highest in urban planning, property, and construction literature, whilst urban planning also had a strong focus on climate change action as shown in Figure 4 below.

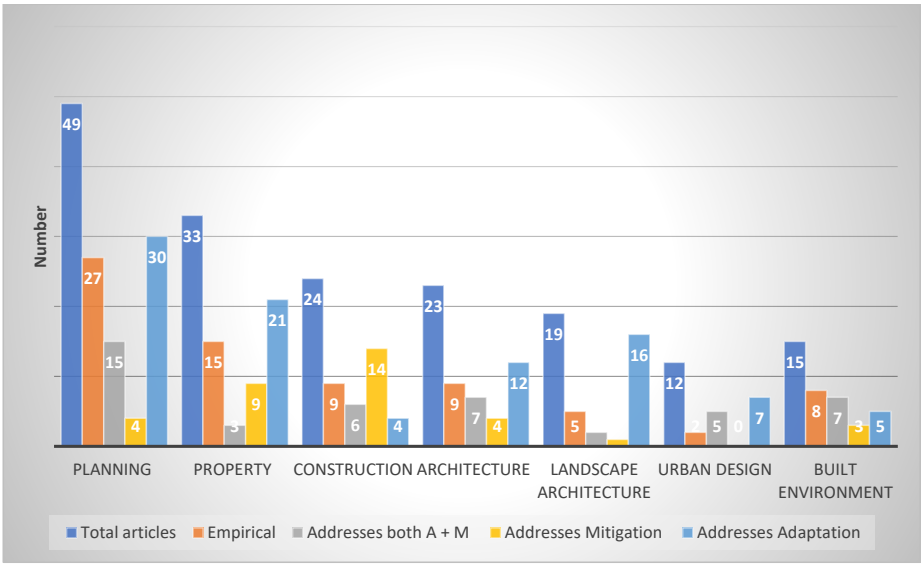


Fig. 4. Literature review results: number of papers that addressed: climate change preparedness (awareness, analytical capacity and action); barriers or facilitators of climate change action - across built environment sectors (note: papers could be in multiple categories). (source: A. C Hurlimann et al., 2022)

Table 2 below shows the key barriers to climate change action identified in literature reviewed across the built environment. The left column shows the broad themes of barriers identified from across the literature, with the right column showing specific barriers. The three major barriers to climate change action identified in the literature are funding and cost, knowledge, and time frames.

Category	**Specific Barriers to Climate Change Action**
Risk Evaluation	First movers' risk Pricing climate change risk into asset values
Roles and Responsibilities	Lack of leadership Not viewed as responsibility among developers
Funding/ Cost	Perceived high cost Lack of resources Budget constraints
Policy/ Regulations	Limited regulations Policy/ regulatory confusion Uncertainty of planning policy
Knowledge	Inconsistent and unclear language Lack of awareness/ belief of CC Lack of knowledge/ scientific information Uncertainty of CC impacts Lack of adequate education
Time Frames	Short political time frames Short budget time frames Short local need time frames Long term adaptation horizon

Clients/ community engagement	Low demand from residential sector Lack of interest from clients Community opposition
Conflicting priorities	Influence of CC works on amenity values Low priority among developers Climate change versus economic growth Environmental performance versus social values
Tools	Lack of domestic tools Lack of tools for performance metrics

Table 2 - Barriers to climate change action across built environment sectors – reported in literature. Source (A. C Hurlimann et al., 2022).

Table 3 shows the primary facilitators of climate change action distilled from literature. The most reported facilitator was financial levers, mainly in the construction, property, and urban planning literature (Gurran, Norman, & Hamin, 2013; Lützkendorf, Fan, & Lorenz, 2011). Improved climate change knowledge, its effects, and practical or viable strategies for action were reported to be important facilitators, across all sectors, but particularly within urban planning. The third highest identified facilitator was disciplinary capacity and skills, identified mainly within the design sub-sectors, as well as the need for more integrated approaches and use of knowledge from related fields such as ecology. “Supporting actors and champions’ beyond the discipline, were also identified as critical, notably in the urban planning literature, which often seeks to achieve integrated and multiscale approaches to taking climate change actions (A. C. Hurlimann & A. P. March, 2012).

Category	Specific Barriers to Climate Change Action
Knowledge	Increased awareness/ education Consideration of long terms CC impacts Access to technical support Place based knowledge Effective communication of risk
Financial Levers	Financial stakeholders Access to international/ national aid Incentives for innovation Customer demand Lower green premiums Value discounts/ Brown discounts
Policy / Regulations	Carbon pricing Performance-based decision making Energy efficiency standards Rating tools
Organisational Governance	In-kind support Organisational values/ strategies Breath of sectoral support
Supporting actors/ champions	Environmental NGOs Frontline practitioners Community Innovators
Political support	Political will and commitment Supportive multi-level political environment
Climate related disasters	Severe weather events
Disciplinary capacity/ skills	Ecological knowledge Integrated and multi-stakeholder processes Visual communication techniques Considering uncertainty and time horizons

Table 3 - Facilitators of climate change action across built environment sectors – reported in literature.

Being able to apply generally agreed upon high-level concepts, evidence and thinking to practical, complex and non-routine problems is the basis for professionals taking action (Webber & Ruge, 2019), and will be critical for climate change action. A starting point for this is the existence of trustworthy sources of fundamental knowledge, such as evidence-based literature suitable for application by built environment professionals, decision makers and educators. This review of literature raises many implications for the built environment professions, and for the achievement of climate change goals in the production and use of built environments. It suggests a need for increased strategic action to locate climate change capacity-building on the agenda of both private and public built environment actors. There may be opportunities to improve preparation for climate action within the professions. This could include professional education; improved climate change accreditation of university education; and membership of professional associations. However, the review has shown that research in some built environment sectors is not well covered (e.g. for urban planning see (Hamin & Marcucci, 2013; Anna C Hurlimann, Moosavi, & Browne, 2021; Preston-Jones, 2020). The review highlights the limited integration of skills and resources across built environment sectors and professionals within them to maximise climate change knowledge capacity and action.

5 - Barriers and Facilitators to Urban Design Climate Change Action

The ability professionals to take climate change action is fundamental to finding ways to transform the built environment via climate change adaptation and mitigation. This final section reports results of an empirical study of the main categories of action which urban designers in Australia are taking to address climate change, and the barriers and enablers that they face in doing this (reported by March et al., In-press). The large Australian Research Council Grant is taking a focused look at practice across each built environment sector, which in addition to urban design are at various stages of publication including urban planning (under review), landscape architecture (Moosavi et al., 2023); architecture (under review) and sustainability (under analysis); in addition to earlier studies focused on the construction (Anna C Hurlimann, Browne, Warren-Myers, & Francis, 2018) and property sectors (Warren-Myers, Hurlimann, & Bush, 2020).

Here we focus on urban design, and begin by considering the practice of urban design itself, we argue that, despite some variations across urban design practices, shared goals and core challenges exist. They are into five categories. The first, Inter-relationships and Integration, acknowledges that urban design action in complex arenas of diverse interests, actors and responsibilities is both a core benefit or, and challenge to, its effectiveness (Elrahman & Moureen, 2021). The second, Scalar Connections seeks to understand that urban design acts at a range of scales: the macro scale, encompassing planning, transportation and infrastructure systems, narrowing down to small -scale matters such as street lights, materials and furnishings (Department of Infrastructure and Transport, 2011). Third, urban design is deployed for increasingly Diverse Aims, while seeking simultaneously seeking integration (Carmona, Heath, Oc, & Tiesdell, 2021: 3). Fourth, Public Values and Regulation via integration of disparate goals is central to effective urban design (Carmona et al., 2021; Moughtin, 2003) often taking the form of state sanctioned intervention (Carmona, 2016). Finally, Urban design's orientation is towards Strategic Public Orientation and Professional Legitimacy, such seeking to further the interests of public, common, or interstices land's "values" that are otherwise afterthoughts (Elrahman & Moureen, 2021).

Urban design practice includes overarching themes seeking to make the links between human settlements, natural systems and environmental sustainability. However, it is also the case that when climate change action is included, even a goal, its manifestation is often contextual or an aside rather than being core. Limited direct urban design scholarship examines barriers and facilitators to climate change mitigation and adaptation.

Hebbert (2009) highlights that while exemplary case studies exist, a lack of substantive knowledge within practice is a barrier to turning existing climate change focused urban design decision-making tools into action (Hebbert, 2009). He suggests that there is tension between public spaces aimed towards resilience and good place-making outcomes. Other state that urban design concepts such as the *compact city* may challenge adaptation efforts, such as in relation to flood control. Others such as (Childers et al., 2015) and (De, Kerselaers, Van, & Rogge, 2017) maintain the potential for urban design to play an important role in helping to develop solutions to climate change adaptation. Urban designs abilities in collaboration and sectoral knowledge integration were seen as potential facilitators of climate action (Childers et al., 2015), as well as using design workshops to develop grounded local climate adaptation needs (Jones et al., 2018). Lenzolzer et al (2020) sought to understand urban climate awareness and the urgency to adapt internationally among citizens, local politicians, urban planners and designers.

Uncommon until the 1980s, urban design is now prominent in Australia. Kozlowski (2006) noted that most major strategic plans in Australia have made some reference to urban design. Almost all design and planning programs in Australian universities now include urban at least some design. Similarly, the majority of large city-based municipalities now employ urban designers. Urban design does not have a dedicated professional body in Australia and it is not included in the Australian census as a job, nor are there statutes governing qualifications, roles and responsibilities. A quasi-accrediting agency for urban design is the Planning Institute of Australia (PIA) which can accredit planning programs with an urban design emphasis (Planning Institute of Australia, 2020: 13, 16, 22). Five currently have an urban design focus (Planning Institute of Australia, 2022). The Australian Institute of Landscape Architecture (AILA)'s recognise urban design projects in its annual awards.

To understand climate change actions taken by Australian urban designers and the barriers and facilitators for climate change action that they face, interviews with 22 urban designers from diverse locations and firm types within Australia were conducted, as reported in March et al In Press. Practitioners from diverse locations, agency and firm types within Australia were identified and interviewed. Semi-structured interviews focused on the participants' practice, organisation, and profession at large, seeking to understand the barriers and facilitators to climate change action in the built environment.

A qualitative thematic analysis was undertaken using a quasi-inductive or abductive approach (Piekkari 2018). Seven key types of climate change action were identified across the practitioners interviewed, as shown in Table 4 below.

Policies and Strategies (establishing, enforcing or following)
Education & research
Project designs & practices
Reducing carbon footprints
Advocating or lobbying
Sustainability measures & ratings
Type of projects & tenders undertaken oriented to climate change action

Table 4 - Type of Climate Action Taken (ranked: highest incidence at top)

While the themes above emerged strongly across the interview subjects, the ways they took these actions were diverse, reflecting the breadth of activity inherent to urban design, the respondents' diverse roles and the need for urban designers to be interdisciplinary. While a relatively small sample, the results indicate that the practices of these Australian urban designers are strongly linked with climate change action. When the results were analysed in terms climate change the five top *facilitators* were found, as shown in Table 5 below.

Culture, values, expertise, or reputation that prioritises sustainability measures & CC action to influence positive outcomes
Government targets, priorities, resources, & regulations
Building, promoting, & refining CC awareness
Design practices & outcomes that improve the ability to produce sustainable built environment outputs or inherent consideration of sustainability and climate change (e.g. passive design)
Accessibility of sustainable materials & practices. May include increasing accessibility through affordability, supply chains, information or resources

Table 5 – Climate Action Facilitators: Experienced or Observed by Respondents

Note: Ranked in order of mentions from most frequent at top, to least at bottom.

It is noteworthy that the theme of *culture, values, expertise, or reputation that prioritized sustainability measures & climate change action to influence positive outcomes* emerged as important. Similarly, most respondents indicated the importance of *government targets, priorities, resources, & regulations* facilitating climate change action in the broader built environment. However, it is important to recognise that only two suggested this was the case within the urban design sector itself, but rather in the wider suite of policies described above in *Understanding the Built Environment Policy Context*. This is likely to be a result of urban design being largely unregulated as a profession in Australia, but rather, being a bridging or facilitating role. The *building, promoting, & refining climate change awareness* and *culture, values, expertise, or reputation* were also reported as important facilitators. In contrast, the five main barriers to climate change action by urban designers interviewed are presented below in Table 6.

Limited influence, reach, or decision-making capabilities
The externality of sustainability leading to a lack of accountability, including the ability to get away with greenwashing, or lack of incentives
Management or structural issues pertaining to things like available resources or power distribution
Competing project deliverables and constraints on budget, time, and resources
Poor government policies & leadership

Table 6 – Barriers to Climate Action Experienced or Observed by Respondents.

Note: Ranked in order of mentions from most frequent at top to least at bottom.

Most respondents indicated that a key barrier across the broader built environment was *limited influence, reach, or decision-making capabilities* and that the *effects of non-sustainability being externalised* and a *lack of accountability (including ability to get away with greenwashing) or lack of incentives to action*. Many also indicated that *poor government policies & leadership* across the built environment was a barrier.

Overall, the results indicate ways that urban designer practitioners, the organisations within which they work, and government agencies, can facilitate greater climate change action. Demonstration of strong leadership, whether at state or local government level, or within the private sector was seen by practitioners to be an important enabler. Establishing key targets and firm regulations assisted in association with financial and other relevant incentives was considered fundamental. The provision of accessible and trusted information for practitioners and decision makers was considered essential and a facilitator of integration in actions across multiple temporal and spatial scales. This aligns with the general understanding expressed amongst urban design practitioners that collective outcomes going beyond single projects or interests are a defining characteristic of the profession. Organisational leadership and culture, allied with a need for government to provide avenues for integration of outcomes was also highlighted.

6 - Conclusions

While there is now widespread recognition internationally that urgent action is needed to reduce GHG emissions to avoid catastrophic climate change, and that adaption is needed to deal with changes in climate that are unavoidable (IPCC 2015; 2018) actual action in the built environment is challenging and complex. This paper set out in summary a number of

findings of a project that considered the integration of climate change adaptation and mitigation action in Australia's built environment. It took the viewpoint of built environment practitioners in Australia, while seeking to understand the complexities of policy.

The paper began with a description of the Built Environment Life Cycle, set out so that diverse built environment sectors could be understood across sectors that are typically understood in isolation, including the articulation of key actors' roles, their relationships, and the potential for key transformative actions to be taken. The paper then presented a framework to describe built environment policy, including policy types and tiers of governance. By application to the Australian case via assessment of three municipalities', it was shown that there is a dominance of 'strategy' compared with the limited amounts of implementation via more direct 'action programs'. Further, it was seen that there was a need for more effective policy that considered the end of life cycle in the built environment, and a need for more instruments of direct regulation and law implemented to encourage meeting of targets.

The paper then reported on the preparedness of Australian built environment professionals, including planners, based on a wide review of literature in English. It showed that there is a strong need for trustworthy, evidence based literature that can be used to take action by practitioners, for improved education and accreditation, and for more strategic, integrated and long term approaches to be developed. Finally, findings of a more detailed study into the perceptions of Australian urban designers were reported. It showed that the main climate change action taken by urban designers are via establishing, enforcing or following clear policies and strategies, by preparing or undertaking education or research, and by direct action via design. It also highlighted the importance of strong leadership at all levels and across public and private sectors in providing opportunities and examples for climate change action – typically in association with strong regulatory and incentives-based contexts.

Overall, this research suggests that climate change action in the built environment requires understanding of the entire built environment life cycle, the various actor's roles in this, and ensuring integration is occurring. For example, it appears that in Australia, there is a need for additional work in the renewal/ recovery/ demolition phase to close the loop. There is for greater leadership across tiers of government and in the private sector, allied with easily access information to aid decisions.

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The self-government approach to the planning of the Gran Sasso Laga Park

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Abstract
Thanks to the substitutive function of every other planning tool, recognised by law for any Italian park plan, the Gran Sasso Laga National Park Plan was conceived, within the Italian system of hierarchical cascade planning, as vice versa a non hierarchical coordination tool of a co-planning process based mainly on self-government patterns of the communities that live and act in the park territory. Such a co-planning process can be considered as an inherent part of the broader co-evolutionary dynamics of relationships between humans mediated by non-human elements of the environment, according to a specific interpretation of Socio-Ecological Systems (SES), which we in turn interpret as Socio-Cultural-Ecological Systems (SCES), recognising humans as eco-factors and referring to the eco-diversity of SES/SCES rather than simply their biodiversity.

Keywords
Natural parks; Self-government; Territorial co-planning; Coevolution.

1. Introduction
The approach followed in planning the Gran Sasso Laga National Park, in which the authors participated through a collaboration agreement between the University of Molise and the Park Authority, envisions the park plan as a coordination tool for the territorial co-planning process.
The conceptual framework critically examines the technocratic and economistic approaches to environmental issues, which are becoming increasingly prominent. These approaches often lead to externally directed and centralised environmental protection policies aimed at reducing human activity in natural contexts. In addition to exacerbating inequalities among different communities in defining autonomous development paths, these approaches do not recognize the co-evolutionary role of the human eco-factor within ecosystems. As a result, they do not allow the protection of ecodiversity, which also derives from human action.
Instead, the Gran Sasso Laga National Park is conceptualised as a Socio-Cultural-Ecological System (SCES), in which the complex of (human) social relations mediated through interactions with non-human entities is crucial. The interactions between human and non-human factors in the cooperative SCES, which can also be considered a landscape (sensu European Landscape Convention), also include the processes of co-planning and territorial co-design, thereby establishing coevolutionary paths within the SCES.
This innovative approach has been fitted into Italy's existing institutional and regulatory framework for environmental planning, which, on the other hand, is really rigid and unwilling to rapid changes. Some agreement tools encompassed in the co-planning and territorial co-design process have been linked to objectives of the National Strategy for Biodiversity, supporting the development of a continuous co-planning and co-design process of the park's territory.
In this way it was intended to trigger a dynamic, flexible, and adaptive method for managing and envisioning territorial evolution, utilising tools that can contribute to the activation of forms of commoning of environmental resources.

2. Environmental policies and technocratic approaches
As a consequence of the increasing prominence of environmental issues in the public, scientific and governmental debate, particularly in the Western world over the last decades, numerous

policies and measures have been introduced to mitigate the negative effects of human activities on environmental balances.

A common element in policies developed by institutions at various levels is the persistent underlying division between the categories of human society and natural environment. This division simplifies the complex relationships and socio-ecological balances between humans and their environment, often reducing them to paternalistic-conservationist approaches or technical-functionalistic tools.

The first group includes policies based on the principle that humans must take care of nature and which tend to exclude, in whole or in part, the possibility of carrying out human activities in certain areas.

This approach suggests a view of nature as incapable of self-preservation and in need of human action to be protected (by man himself), in which it is considered as 'the nature of nostalgia, of conservation' (Fabbri, 2019, p. 115). This perspective emphasises the need to bring nature back to an original, untainted state, ignoring that nature 'has no origin and it is perfectly indifferent to our concepts of origin and purpose' (Baudrillard, 2019, p. 103).

The second group includes policies that support forms of valorisation of biotic and abiotic elements based on their usefulness for human survival and the financialisation of natural capital. This approach involves an ontological shift in nature, which goes from being 'the material basis of the reproduction of living things to a provider of biological or eco-systemic services' (Leonardi, 2017a, p. 183). While this concept has increased awareness of the value of natural elements for human life, it has also led to the creation of markets and institutional structures to support their functioning (PES - Payment for Ecosystem Services, carbon credits market, PPP - Polluters Pays Principle).

This process presupposes the creation of fictitious goods, corresponding to the services offered to man by natural elements, which can be sold or exchanged on the markets. Going beyond the strictly regulatory approach to resource consumption and pollutants release, these new valorisation mechanisms position natural capital as an active market factor (Iannuzzi, 2018).

In addition to the intrinsic criticality of the ontological change, the technical-economic approach to the environmental issue also poses problems of inequality. There are in fact large grey areas regarding knowledge and sovereignty over the goods included into the markets, which produce improprieties and accounting biases (Iannuzzi, 2018), as well as on the political fairness of economic-social compensations for the negative effects induced by polluters (Leonardi, 2017b).

While recognizing that these policies can lead, in general, to an improvement in the effects of human actions on environmental balances compared to those from the industrial era, it is necessary also to note that the persistent split between the human and non-human realms continues to reflect an anthropological need to establish dominion over natural things.

3. Environmental protection and neo-colonial approaches

The considerations on the critical issues emerging from technocratic approaches to environmental issues, as illustrated in section 2, are significant in the field of planning studies because they produce relevant effects on the organisation of land uses. This is particularly evident in the case of protected natural areas, which we can broadly define as those parts of territory (regional, national, or global) deemed necessary to preserve in their ecological form or functionality by limiting or inhibiting substantial human activities.

Studies on international contexts indicate a greater presence of protected areas where there are low-income communities, with reduced access to services and minimal political representation in government institutions (Hammer et al., 2012). These socio-economic vulnerabilities make such communities particularly exposed to authoritative environmental protection regimes imposed from above, which hinder the possibility that the communities themselves can

establish autonomous development paths due to restricted access to territorial resources (Hammer et al., 2012).
Through this large-scale compensation approach, according to which compensation can be made towards nature in some places (Magnaghi, 2010) for the environmental damage caused in more economically developed places, forms of spatial injustice are perpetrated, as it enables some populations to maintain high quality of life and consumption levels thanks to the imposition of development limitations on territories inhabited by weaker populations.
Environmental policies conceived according to dualistic, globalised and economistic approaches are configured as forms of cultural neocolonialism, in which solutions are imposed by the centres of power that rely on the ideology of centralised knowledge, which suppresses local knowledge, believing that 'it is possible to save nature regardless of the indigenous people or local populations who in reality are the only ones who can safeguard it' (La Cecla, 2019, p. 73).
The presence of such neo-colonial approaches is noted by many, even within ecological movements. For example, the KBA Partnership highlights the need for the 30x30 initiative (the international community's commitment to protect 30% of the earth's surface by 2030), signed by The High Ambition Coalition (HAC) for Nature and People, to ensure that the protected 30% is 'the right 30%'. This means that areas designated for protection should primarily be 'key biodiversity areas', since instead 'areas are often designated as protected or conserved where it is convenient rather than because they are important for conserving biodiversity. Protected areas tend to be created in remote places (...)' (Plumptre et al., 2021).
The challenges that environmentalism poses today, however, require the introduction of radically new relational paradigms between human societies and the natural environment (Guattari, 2019), which also recognize the central role of the recovery of local sovereignty in defining solutions (La Cecla, 2019).

4. A political ecology approach to planning

A substantial potential for supporting transformative change in the definition of spatial policies and planning practices lies in recognising human societies as eco-factors, that is, viewing humans as elements interacting equally with other non-human natural elements, rather than as separate entities affecting nature from an external standpoint. It means acknowledging that human societies exhibit behaviours with varying degrees of adaptability or maladaptivity (Mainardi, 2008), through which the human species is fully immersed within ecosystem dynamics (Soave, 2010) interacting via a 'ecological intelligence', that is, its ability to adapt biologically, technologically (Goleman, 2009), and culturally (Mainardi, 2001) to their environment. Through ecological intelligence, infinite local behaviours adapted to the specificities of the environment and adaptation of the environment to human needs have therefore developed, demonstrating the deep immersion of humans in ecosystem dynamics. Therefore, especially in the definition of spatial planning policies and practices aimed at leveraging transformative change, it is more useful to refer not just to biodiversity, but rather to the concept of ecodiversity. Ecodiversity operates at the landscape scale, accounting for the environmental complexity of organisms and processes, including biodiversity, environmental heterogeneity, and geodiversity, thereby incorporating the human eco-factor (Conti and Soave, 2006; Farina, 2001; Halvorsen et al., 2020; Jedicke, 2001; Naveh, 1994).
Incorporating ecodiversity into planning processes means considering land use organisation paths that foster human interaction with environment components and the development of local solutions that enable mutual adaptations, leading to the progressive enrichment of ecodiversity within the territorial system. To overcome technocratic and economic approaches to environmental issues, which, despite their effectiveness, carry intrinsic ethical-political issues, a shift in planning paradigm is needed to allow the proliferation of local experiences and

'particular cultures' through 'new contracts between citizens' (Guattari, 2019). Such a change can 'derive from a political and cultural choice' (Gorz, 2015), enabling social formations and individuals to interact co-evolutionarily with the environment, regaining sovereignty over land use practices through self-regulated forms of territorial planning.

5. (Protected) territories as Social-Cultural-Ecological Systems (SCES)

With regard to the above self-organising and coevolutionary processes, it is very useful to refer here to that specific interpretation of SES, Socio-Ecological Systems, which identifies them as a 'subset of social systems in which some of the interdependent relationships among humans are mediated through interactions with biophysical and non-human biological units' (Anderies et al., 2004), and in which the cooperative aspect of these relationships may be sometimes fundamental (Anderies et al., 2004). In particular, referring to the example of a fisherman who can change the outcomes of another fisherman's activities 'through the interacting biophysical and non-human biological units that constitute the dynamic, living fish stock' (Anderies et. al, 2004), it seems quite clear that the interdependence relationships between humans (fishermen) mediated by the common pool resource (CPR) (the fish stock) exist regardless if they take on a cooperative nature or not. But it is equally clear that the less the relationships take on a competitive or even conflictual nature, the more easily the sustainability of the living fish stock will be ensured. Regarding this last aspect, we believe it is useful to further develop the fruitful concept of SES mentioned above in the direction of those that we have proposed to define anew, not having found specific traces of it in the literature, such as SCES, namely Socio-Cultural-Ecological Systems. (De Bonis and Ottaviano, 2023). In the SES concept proposed by Anderies et al. (2004), the co-evolving unit coinciding with it, more or less cooperative, by definition cannot be homogeneous (cospecific), but must always be formed by different species. In other words, it cannot be delimited without including the non-human factors through which the human factors interact, moreover in a variable way depending on the human behaviour considered (Bateson, 1976). This means that it can be likened to both the landscape as defined in the ELC, European Landscape Convention - 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Council of Europe, 2000) - and to 'cultural landscapes' identified by UNESCO (1994) as those 'sites' created by the 'combined works of nature and man' (UNESCO, 1972), 'illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment ad of successive social, economic and cultural forces, both external and internal' (UNESCO, 1994, p. 13). Such assimilation to some form of landscape makes the 'cultural' aspect of the SES evident, which is self-evident considering the intimate interrelation between human and non-human entities that characterises them, and therefore authorises us to define them as SCES. But what really matters in identifying the landscape with the SES as defined by Anderies et al. (2004), and/or with a SCES, is the *advantage* of these concepts compared to the *objectifying* perspective found in other definitions of SES, which are still focused on an ecological system (external to us) with which the (our) social system interacts, as well as compared to the definition of landscape in the ELC, where the interaction between humans and nature shapes an objective entity (territory), which is then subjectively perceived by humans (thus shaping a landscape). In the concept of SES/SCES, instead, the distinction (and latent dualism) between objective/subjective disappears completely, making room for a notion of *mediation* entirely internal to social (human) relations. It is closer to this kind of *mediation* the UNESCO definition of cultural landscape when it refers to 'human society and settlement' and to *their* environment, despite the evocation, again latently dualistic, of both *external* and *internal* dynamics. However, our analogy is based on the complete abandonment of UNESCO's view of (few) cultural landscapes as *illustrative*, or as having 'outstanding universal value', to instead consider the

complex of SCES potentially extended to the entire territory (like the landscape in the ELC), as well as of its purely conservationist purpose.
In this regard, it should be noted that even in the field of nature conservation the mainstream seems to be a long way from a conception of SES/SCES like the ones mentioned above, as well from a vision that seeks to encourage the preservation of the natural environment through inherently protective human activities (Dematteis and Magnaghi, 2018).
About this, what we find particularly problematic is the fact that according to IUCN the primary management objective of a national park is that of ecosystem conservation and recreation. This unique alliance mirrors the prevailing attitude in the international arena towards cultural heritage. The tourist-recreational use of the latter is in fact generally considered as the only form of compatible utilisation of cultural resources, even though contrary evidence is becoming increasingly apparent in certain instances of overtourism. Our main concern, in this regard, is precisely the limited effectiveness of the exclusive association between conservation and recreation. Indeed, this association can be *sterilising* in terms of regenerating the natural and cultural heritage, as it fails to re-establish the relationships between people and nature by which they have been generated and/or sustained over time (De Bonis, 2020).

6. The Gran Sasso Laga Park Plan as a coordination tool for a continuous co-planning process

In order to counteract the above sterilising drifts, the Gran Sasso and Monti della Laga National Park Plan (hereinafter GSLPP) has been conceived since its inception to promote forms of autonomous initiative by social actors, provided that such initiatives align with the requirements for the protection and enhancement of the park area. Nevertheless, to achieve this objective, the relationship between the Park Plan and the Italian planning system needed to be carefully considered.
In Italy, urban planning (at municipal level), territorial (at provincial level), landscape, (at regional and state level): i) constitutes a *system*, composed of different interacting tools, ii) is *formal*, in the sense that it is defined by law as a permanent procedure of government activities (Mazza, 1996), iii) is *public*, i.e. it falls within the competence and responsibility of a public administration, iv) is *cogent*, i.e. it produces effects to which the actors operating in the planned territory must compulsorily conform, v) is *rigid*, i.e. every modification of a plan instrument entails the need to go through the entire approval procedure. Furthermore, and above all, the fundamental principle of interaction between the different elements of the planning system is based on the so-called *cascade hierarchy*, according to which the plan formed at a certain administrative level prevails (is *superordinate*) compared to the one formed at an immediately lower level (and the latter is naturally subordinate to the former).
But, within this general framework, the park planning presents a non-negligible peculiarity: in accordance with the law governing the establishment, management, and planning of protected areas (No. 394 of 1991) the park plan, a unique case in the national planning system, *substitutes* for all other plans concerning the territory of the protected area, instead to be hierarchically superordinate to them. The sole exception to the substitution regards the provisions for the protection of the landscape contained in the landscape plan (not the latter as a whole).
It is precisely on the basis of such a substitutive nature of the park plan, in combination with other legislative devices, that we have been able to set up the GSLPP as a non-hierarchical coordination tool, inside a hierarchical planning system, for a continuous co-planning process, based mainly on patterns of self-government of the communities that live and/or act in the park territory.
Title III of the Zoning Bylaw, 'Planning Process', is the plan document that most reflects that pattern, while fully adhering to legal requirements for format and content. In fact, it defines the GSLPP as a 'planning coordination tool' aimed at incorporating and enhancing any other plans

and project initiatives developed within the park territory, that pursue the management objectives and policies for areas referred to in Title II of the Zoning Bylaw, or at least do not conflict with them. These plan and project initiatives can be: 1. general and implementation urban plans; 2. detail plans or territorial projects; 3. specific interventions for the protection, enhancement and compatible use of the park's environmental resources, requiring clearance by Park Authority.

The planning process is thus aimed at creating a circular connection between the environmental planning of park sites and the environmental planning of the entire park region, through the interpretation of local authorities' plans, detail plans/territorial projects and specific interventions projects not as merely *executive* tools, but as feedback devices capable of initiating the process anew continuously (Rolli and De Bonis, 2001).

In other words, this strategy recognizes the *substitutive* nature of the park plan as an opportunity to fully implement the principle of subsidiarity in physical planning, transferring responsibilities and possibilities from the Park Authority to other entities. Within this framework, the aspects of vertical subsidiarity (predominant in co-planning agreements) and horizontal (dominant in specific interventions clearances) tend to blend into a form of subsidiarity that could be described as 'holistic' (De Bonis, 2019) or 'circular' (Zamagni, 2018).

In this regard, however, it is necessary to clarify that we did not intend to assimilate these forms of subsidiarity characterising the GSLPP to any kind of *participatory* planning (or *collaborative*, *communicative*, etc.); i.e. to any kind of planning, in which the multitude of interactions are once again reduced, arbitrarily and also unrealistically, to a dyadic interaction (Mandelbaum, 1986) between planners and the planned, promoters of participation and participants, etc.; and in which professionals, technicians, consultants, are the sole operators of knowledge production and use (Crosta, 1998). On the contrary, in the GSLPP we did intend multiplicity as the coexistence of multiple forms of knowledge (professional and non-professional) and multiple forms of action by individual actors or groups of actors (Crosta, 1996).

7. The co-planning of the park as a framework for territorial self-government

The innovation introduced in the GSLPP acknowledges the double evidence that the classic planning system, envisaged by Law 394/1991, is mostly unimplemented, and that the effectiveness of the co-management experiences of protected areas between environmental authorities and local communities is well-documented (García López, Concepción and Torres Abreu 2018; Iannuzzi, Mourato and Santos, 2020; Oldekop et al. 2015; Pallares-Blanch, 2012).

Building on these observations, the GSLPP proposes a significant advancement that could extend beyond park planning, interpreting planning as a co-evolutionary process in which the planning action is implemented through continuous formation of territorial self-government tools. These tools enable the autonomous definition of the multiple practices that express the relationality between human societies and the environment. Coevolutionary approaches redefine the planning system in a trans-scale and nonhierarchical manner, implemented through detail and thematic plans in which territorial entities interact with the Park Authority to define territorial visions, realising 'forms of multi-actor, multi-sector and multi-functional contracts and agreements to address the governance of the territory as a common good' (Magnaghi, 2015, p. 151). A potential application of these paradigms was prefigured in the context of the approval process of the GSLPP, and in particular in the definition of the monitoring plan envisaged in the environmental report of the Strategic Environmental Assessment (SEA). In this circumstance, it has been decided to consider, as indicators of the effectiveness of the PP, the arrangement of agreements on detail plans and territorial projects related to the GSLPP and the NSB objectives. Some land management tools usable for this purpose were identified, referring to Section 24 of the Zoning Bylaw, which describes potential plans and projects that could be

implemented in the park. Connecting the SEA monitoring plan and the PP objectives has been conceived as a way to support the realisation of the planning process scenario envisioned in Title III of the PP.

These detail plans and territorial projects serve as frameworks for practices that are continuously redefined, in which planning tools rely on dynamism and flexibility to respond effectively and quickly to socio-environmental needs, mirroring the adaptive processes of ecosystems (De Bonis, 2019).

The co-planning process can support an incremental identification of the territorial resources as common goods, expanding upon existing collective domains recognised in the park area and assuming the paradigm that community usage practices define the *commonality* of the goods, beyond its legal status (Capone, 2016). The tools for implementing this scenario may take on a contractual nature, involving agreements between various social, economic, and institutional entities that share interests in defining some kind of land use and transformation of the territory, Thus, they shape new frameworks of local (self) governance through agreements for specific purposes and themes, also drawing upon existing tools such as river contracts, landscape contracts, etc. (Dematteis and Magnaghi, 2018). The planning framework of the GSLP is intended as an application of new paradigms that could be extended to general planning, supporting the reactivation of practices that express fecund relationships between human societies and the non-human natural environment.

8. Conclusion

A vision far from both the technocratic setting of dominant environmental policies (see section 2) and the neo colonial leanings of mainstream environmental protection (see section 3), and vice versa grounded on a political ecology approach (see section 4), as well as on a consideration of the territories, starting from protected areas, as SCES, Social-Cultural-Ecological Systems (see section 5), led the authors to interpret the planning activity conducted for the Gran Sasso Laga National Park as a continuous process, mainly based on schemes of territorial self-government (see sections 6 and 7).

In essence, the latter are attributable to emerging or consolidated forms of commoning, in turn based on the identification of the park with a set of Common Pool Resources (CPRs, see again section 5), i.e. as a set of (collective) natural or man-made resource systems, potentially providing a flow of (individually) usable resource units (Ostrom, 1990).

With particular reference to the consolidated forms of commoning mentioned above, it is worth specifying that the identification of the park with a set of CPRs is not merely hypothetical, as the majority of its territory is made up of collective domains (Catonica et al., 2017). This circumstance, however, transcends itself, revealing an issue that is perhaps of the greatest importance among those discussed so far.

In short, the GSLPP, conceived as a stage in a continuing planning process aimed at promoting forms of sustainable self-government of the CPRs (already existing or emerging), deliberately offered itself, at least in the planners' intentions, as a sort of meta-institutional framework, or more precisely as a state institutional framework of the self-governed institutions of the CPRs (Ostrom, 1990).

But what types of self-government institutions are we referring to here precisely?

The subtitle of the well-known Ostom book 'Governing the Commons' reads: 'The Evolution of Institutions for Collective Action'.

In this regard, already in the prefaces of the same book the belief is clearly expressed that 'stable institutions of self-government can be created if certain problems of supply, credibility, and monitoring are solved' (Ostrom, 1990, p. xi), as demonstrated through the rich collection of cases study gathered by the author and several colleagues of her. Furthermore, the author herself, basing on the observation 'that neither the state nor the market is uniformly successful

in enabling individuals to sustain long-term, productive use of natural resource systems' (Ostrom, 1990, p. 1), declares that her book is an 'effort to develop better intellectual tools to understand the capabilities and limitations of self-governing institutions for regulating many types of resources' (*ivi*, p. 2).

Well, taking up the subtitle of Ostrom's book, we conclusively advance here the hypothesis that a possible evolution of the institutions for collective action, in the very complex current socio-technical-cultural context, can be constituted precisely from those kind of territorial agreements (see again section 7) to which the GSLPP entrusts the continuous development of the planning process.

In other words, we posit that a planning no longer understood as a hierarchical form of government of the territory, but rather as a set of territorial self-government and self-organising governance tools, can not only escape from the declining parabola to which it now seems destined (at least in Italy), but evolving the fruitful Ostromian legacy, it can even aspire to identify in its own devices the contemporary forms of institutions of collective action, which according to Ostrom are the only ones capable of ensuring adequate management of natural resources.

Author Contributions

Although this work as a whole arises from the close collaboration between the authors, the writing of § 1, 2, 3, 4, 7 is by Giovanni Ottaviano, the writing of § 5, 6, 8 is by Luciano De Bonis.

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Track 08: Public Space

PUBLIC SPACE - Planning for cultural diversity, peace and the experience of places

Chairs:

- Dimitra Kanellopoulou, Ecole Nationale Supérieure d'Architecture Paris-Malaquais
- Christine Mady, Aalto University
- Margherita Gori Nocentini, Politecnico di Milano

Keywords: *care, culture, digitalisation, diversity, identity, inclusion, memory, political urban space, spatial justice, temporality, transformation*

Public spaces were always at the forefront of urban life, playing significant roles and functions in shaping urban settings. Although the progressive complexity of a clear definition of what public space is, the track draws on the hypothesis that this polysemous concept is exemplary in expressing political and social realities but also thrives debates around physical, tangible space as a pillar space of urban experience. Our first encounter with cities and urban experiences occurs in their public spaces. These spaces represent current lifestyle trends but also echo memories. Public spaces are often "game changers" that herald alternative urban realities. One example includes transformations following the COVID-19 pandemic. Public spaces accommodate a panoply of activities, from mundane acts of conviviality to demonstrations or endeavours that try to belong and partake in democracy and different expressions and claims for spatial and social justice. Public space as a "game changer" is ironically the time-space of conflict and its dissolution. These spaces reflect the discourses and practices of tolerance towards differences and display or disguise the tensions immanent in encounters and exchanges across diverse urban cultures.

Several authors in urban studies have underlined public space as a central element of the built environment for the community and public life. Since the 1990s, the concept has attracted researchers from diverse disciplines, leading to the emergence of transdisciplinary debates on public space. Several scholars have had critical insights on the social impacts and risks associated with the profound transformation of urban public space, especially with recent environmental constraints and challenges on life quality faced with increasing densities in global metropolises. The complexity of the open public space's landscape underlines the elusive character of the subject while continuing to stimulate new streams of methodological investigations and theories.

This track aims to engage in a debate confronting contemporary realities of mass immigration, global conflicts, recurrent financial crises, and environmental urgency. We are particularly interested in discussions highlighting the potential of public space as an act of negotiation of territorial thresholds at different scales. Within a more homogenised world (through the globalisation of trends, norms, and costumes), we seek to revisit the discussion on public space

planning and the significant challenges of addressing questions of appropriation (from minorities or marginalised populations), dominance (of gender, political groups), and belonging (ethnic, geographical, cultural, religious groups). The entry of cultural diversity could be a legitimate one to unveil dynamics of creation, practice and representation of public spaces outside the geographical dominance of the Western world but also by tending to bridge regions with significant differences in terms of political and social organisation (for example countries of the Mediterranean Bassin). The continuing debate and understanding of public space as a construction of tremendous volatility could offer the necessary decentring of planning to questions of tolerance, differentiation, civic power, and justice. This 'step aside' will allow Occidental and European planning to learn by examples of Global South & East regions and establish dialogue on new toolkits of analysis and understanding of public space through citizens' aspirations, engagements and beliefs.

This track invites abstracts that explore the construction of peace or "game-changing" at different scales and through diverse disciplines to reflect the position of urban studies within this process and build on observations, experimentation, and narration of the transformative power of peace within public spaces. We particularly encourage papers that examine how bottom-up initiatives, out-of-the-box policies, and internationally constructed movements find anchorage in public space transformations and shaping within their political position, cultural identity, and the demand for peace.

36th AESOP Annual Congress 2024 Paris, France

"GAME CHANGER? Planning for just and sustainable urban regions"

TRACK 08: PUBLIC SPACE

Planning for cultural diversity, peace and the experience of places

The Open Orchestra project in the public spaces of Athens: an urban utopia with transformative power?

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Abstract

The Open Orchestra is a group of about 150 professional artists and amateurs, founded in spring 2021, in Athens, Greece. Its establishment is directly correlated to the Support Art Workers Action Group that has emerged during the pandemic of Covid-19, as a way to resist to the depreciation of culture and art-workers themselves, many of whom remained unemployed and with no support from the state, during the long quarantines imposed as a protection measure[1]. Even more importantly, the Open Orchestra comes as a continuation of the Paris Occupation of Odeon, when, on March 27, 2021, during the Agora organized by the occupants of the Théâtre de l'Odéon, professionals from the French Symphonic and Lyric Orchestras, musicians from specialized orchestras, occupiers of the Odéon, and students formed a large orchestra of solidary musicians[2]. Following this line, in spring 2021, the Support Art Workers Action Group gathered in Propylaia, Athens, sang and played the piece "El Pueblo Unido Jamas Sera Vencido", exactly as did the solidary orchestra at Odéon, Paris, a couple of months earlier.
This has been the starting act of the Open Orchestra (O.C./ A.O. in Greek). Which started rehearsing once a week, at the Filopappou Hill, in a central public park of Athens, yet derelict and merely abandoned by the Municipality of Athens. It is called Open Orchestra, because anyone who wants to rehearse with it can do it at any time: there is no limitation on artistic level or degree of commitment (one can enter and leave the Orchestra at any time). Organizationally, there is a solid core of 100 people, who rehearse every Sunday. There exists a coordination group, yet decisions are made through open circles organized regularly, in which the whole group participates. This is particularly relevant to the organization of different projects. Every one or two months, rehearsals take place in a deprived neighbourhood of Athens (Victoria square, Perama, Amerikis Square[3], etc.),

[1] https://thepressproject.gr/anoichti-orchistra-pano-apo-150-kallitechnes-enas-chronos-zois-seira-kallitechnikon-politikon-draseon/
[2] https://www.youtube.com/watch?v=kNOrtTaZnOs&ab_channel=OccupationOd%C3%A9on
[3] https://long-stories-short.org/2022/02/12/anoichti-orchistra-stin-plateia-amerik/

instead of the regular one at the Filopappou Hill, and messages such as "Lively Squares" or "We want to danse in squares, streets and neighbourhoods" are delivered in any possible means (e.g. banners, posters, etc.).
The A.O. also gives an open concert every June, in vicinity to the archeological site of Kerameikos and the Acropolis. Yet, most importantly, it provides solidarity to several people and events: performances in several trials of public interest (trial for the murder of Zac/Zackie[4]; trials for victims a sexual violence, rape[5] & murder; etc.), as well as campaigns for social justice and peace, with the most recent example concerning the war in Gaza and Palestine[6].
The aim of this presentation is to explore how this impulsive bottom-up initiative can/has become "game-changer" at the local (city) and the very local (neighbourhood) level, essentially as an antidote to the harsh regeneration and touristification policies that hit actually the Greek cities. Building upon my own participation to the A.O. during 2021-2022, I seek to understand to what extend such an initiative – a community of joy, care and solidarity, and an urban utopia, as I would like to call it – may be capable of transforming, in the mid-term, both public space and the relations performed within public space. Considering its ephemeral and sporadic performances and actions, to what extend can an initiative such the A.O. play a role in shaping the neighbourhood and the city fabric overall? I am particularly interested in examining the potential of such initiatives yet also the significant challenges they pose as regards appropriation, belonging, and reclaiming the city. After all, what would be needed, from a planner's perspective, to enhance and leverage such initiatives in a view of coming closer to the ideals of the Just City and the Right to the City? How can planners ensure that such bottom-up initiatives can be taken under consideration in decision-making processes? What kind of spaces could accommodate such initiatives that promote interaction among diverse people yet often they challenge the established status quo?

Keywords: Open Orchestra/Athens, culture, art/ist, solidarity, political action, spatial justice, public space appropriation, transformative power

[4] https://tvxs.gr/tag/anoichti-orchistra/
[5] https://www.koutipandoras.gr/article/anoihti-orhistra-emeis-georgia-se-pisteyoyme/
[6] https://www.youtube.com/watch?v=OEokUPSWKfg&ab_channel=%CE%91%CE%BD%CE%BF%CE%B9%CF%87%CF%84%CE%AE%CE%9F%CF%81%CF%87%CE%AE%CF%83%CF%84%CF%81%CE%B1%7COpenOrchestraGreece

1. Introduction: getting to know the Open Orchestra, Athens, March 2021

This is an early stage and exploratory research endeavour that emerged literally from the very title of the annual conference of AESOP this year (2024): "GAME CHANGER? Planning for just and sustainable urban regions". It concerns my personal experience with the Open Orchestra, which could provide a potential example of Game Changer in the city of Athens, Greece, for the transformation of urban everydayness towards ideas and ideals related to the Lefebvrian 'Right to the City'.

The Open Orchestra, that was established in spring 2021, in Athens, is a group of about 150 professional artists and amateurs. It emerged from the Support Art Workers Action Group (#SupportArtWorkers), which was 'born' during the pandemic of Covid-19 to resist to the depreciation of culture and art-workers. Many of those latter remained jobless and without support from the state, after the closing down of theatres, cinemas and arts spaces imposed as a protection measure from the pandemic, in the period 2019-2021[7]. The Support Art Workers Action Group and accordingly the Open Orchestra come partly after the Paris Occupation of Odeon; namely, a large orchestra of solidary musicians, consisted of the occupants of the Théâtre de l'Odéon, professionals from the French Symphonic and Lyric Orchestras, musicians from specialized orchestras and students, who were united at Odéon, Paris, on March 27, 2021, and played the protesting piece "El Pueblo Unido Jamas Sera Vencido"[8]. Some months later, the Support Art Workers Action Group gathered in Propylaia, Athens, repeating the same symbolic move: the performance of "El Pueblo Unido…".

This has been the starting act of the Open Orchestra (in Greek Ανοιχτή Ορχήστρα/ A.O.). It is called 'Open', because anyone can rehearse with it at any time: there is no limitation on artistic level or degree of commitment: one can come and go at any time. Organizationally, there is a solid core of people who rehearse together every Sunday at the Filopappou Hill, a central public park of Athens. There exists a coordination group, yet decisions are made through open circles organized monthly. This is particularly relevant to the organization of different projects; for instance, instead of the regular Sunday meeting at the Filopappou Hill, rehearsals may sporadically take place in deprived neighbourhoods (Victoria square, Perama, Amerikis Square[9], etc.); in which, messages such as "Lively Squares" or "We want to danse in squares, streets and neighbourhoods" are delivered in banners, posters, etc. The A.O. also gives an open concert every June, in vicinity to the archeological site of Kerameikos (near the Acropolis).

Most importantly, however, the orchestra provides solidarity to several people, groups and events that are thought to need support: performances in trials of public interest (trial for the murder of the queer activist Zac/Zackie[10]; trials for victims a sexual violence, rape[11], femicide; etc.), as well as campaigns for social justice and peace, with the most recent

[7] https://thepressproject.gr/anoichti-orchistra-pano-apo-150-kallitechnes-enas-chronos-zois-seira-kallitechnikon-politikon-draseon/
[8] https://www.youtube.com/watch?v=kNOrtTaZnOs&ab_channel=OccupationOd%C3%A9on
[9] https://long-stories-short.org/2022/02/12/anoichti-orchistra-stin-plateia-amerik/
[10] https://tvxs.gr/tag/anoichti-orchistra/
[11] https://www.koutipandoras.gr/article/anoihti-orhistra-emeis-georgia-se-pisteyoyme/

example concerning the war in Gaza and Palestine.[12] The A.O. also provides support to groups of residents who fight against urban interventions that are contrary to public interest (e.g. Metro station in Exarchia square in central Athens, etc.). It is important to note that this support usually comes after invitation to the Open Orchestra. The family of Zak/Zackie, after getting in touch with the coordination group, asked the A.O. to perform the day of the trial for the murder of Zak/Zackie in front of the court to provide visibility to a trial that would otherwise struggle to find its way in the Greek media. Similarly, it was the Exarchia Inhabitants Initiative that invited the Open Orchestra to support them. On the contrary, the support to the Palestinian question derived as an initiative of the A.O.

The aim of this presentation is to explore whether this impulsive bottom-up initiative could be considered as – and, even more importantly, could become – a "game-changer" at the local (city) and the very local (neighbourhood) level, as a response to the constant crises that have been hitting the inhabitants of Athens and Greece, in the recent years: debt crisis and austerity, refugee and migration crisis, Covid-19 pandemic crisis, housing crisis, also as a result of tourism regeneration and touristification practices over the last decades.

I seek to understand to what extend an initiative like this – a community of joy, care and solidarity, and an urban utopia, as I like to call it – may be capable of transforming, in the mid-term, both public space and the relations performed within public space. Considering its ephemeral and sporadic performances and actions, to what extend could an initiative such the A.O. play a role in shaping the neighbourhood and the city fabric overall?

I would also be interested in examining, in the future, the potential (if any) of such initiatives as regards appropriation, belonging, and reclaiming the city. And also, what would be needed, from a planner's perspective, to enhance and leverage such initiatives. Which, to my mind, struggle in favour of the ideals of the Just City and the Right to the City. What kind of spaces could accommodate such initiatives that promote interaction among diverse people yet often they challenge the established status quo?

To comprehend and problematize the Open Orchestra project, analytically, my study is primarily based on the Lefebvrian concept of 'the right to the city' (1968). At a second stage, literature related to this concept is also employed (Harvey, 2008; Marcuse, 2009; Merrifield, 2009 & 2011; Hess, 2021), as well as literature on the more recent discussion on urban and social commons (Ostrom, 1990; Bollier, 2016; Hess & Ostrom, 2011; Bollier & Helfrich, 2012 & 2015; Tsavdaroglou & Kaika, 2022; Tsavdaroglou, 2018; Πεχτελίδης, 2020; Αρβανιτίδης & Νασιώκα, 2015). Methodologically, the present research endeavour is based, insofar, on my own personal experience with the Open Orchestra between autumn 2021 and summer 2022 (precisely from October 2021 until September 2022). The method applied could be thus described as a retrospective participant observation. I also rely on a transcript of the discussion that took place on March 2023 with the members of the A.O. in the context of the doctoral thesis of another researcher from the Department of Geography, University of the Aegean. In the future, I intend to analyze more materials related to the A.O., such as

[12] https://www.youtube.com/watch?v=OEokUPSWKfg&ab_channel=%CE%91%CE%BD%CE%BF%CE%B9%CF%87%CF%84%CE%AE%CE%9F%CF%81%CF%87%CE%AE%CF%83%CF%84%CF%81%CE%B1%7COpenOrchestraGreece

the minutes of the Open Circles, where the members of the Orchestra discuss about everything: its function, the realization of new projects, etc.

The structure of the paper is as follows. The next section discusses the Lefebvrian concept of the right to the city, while drawing on the linkages of the praxis of the Open Orchestra with the theory of H. Lefebvre. In the following section, attention is paid to the literature on commons that has recently enriched the radical spatial vocabulary (Tsavdaroglou & Kaika, 2022). In the final section, I draft some preliminary conclusions based on my reflection on the Open Orchestra as commons and as potential game-changer practicing the Lefebvrian 'right to the city' in Athens. And, also, some insight is provided about whether it would be useful and meaningful to question the possible ways (if any) to leverage this kind of socially shared experience, as well as to 'contaminate' the planning practices, the (re)production of urban space, and the city fabric overall.

2. Recalling 'the Right to the City' ('*Le droit à la ville*'): rehearsals with the Open Orchestra in the public spaces of Athens

Tourism regeneration and touristification of urban centres are processes that have been key for urban transformation worldwide in the recent decades. Mega events and mega projects, local cultures and landscapes, Airbnb expansion even in the most remote places, golden visa incentives, yet also digital nomads, pioneer artists and other social groups included in the so-called 'creative classes' (that cities are supposed to attract in order to become more cosmopolitan, smart, entrepreneur and so on) have all become parts of the storming processes that affect the 'urban' in the twenty-first century. Among the contemporary cities, many are treated by their local and national authorities as 'commodities', while their residents and inhabitants as 'customers' (Tsavdaroglou & Kaika, 2022: 1134).

Against such developments of neoliberal take, it is not without relevance to rethink the Lefebvrian concept of the 'right to the city', introduced by French philosopher Henri Lefebvre, in the eve of the remarkable events of May 1968, in Paris. I draw on purpose on the original text ([1968], 3rd Edition/ 2009)[13], and this for several reasons; the main lying in the belief that, in the recent years, 'the Right to the City' has become a fashionable motto, a slogan and a panacea[14], which, to my mind, alienates us from some fundamental ideas of

[13] All reference to and quote from the Lefebvrian text in French is freely translated in English by the author, unless if else indicated.

[14] Analytically speaking, the 'right to the city' may be related to various urban issues, from gentrifying urban districts to neighborhood conflicts revolving around the location of a casino, and so on (see for instance John E. Balzarini & Anne B. Shlay (2016) Gentrification and the Right to the City: Community Conflict and Casinos, Journal of Urban Affairs, 38:4.). See also international agencies, such as UN-Habitat (https://unhabitat.org/sites/default/files/documents/2019-05/wuf-5.pdf). Nevertheless, it is to note the materialization of the 'right to the city' in national law in countries such as Brazil and Colombia, which resulted in that the 'right to the city' became a legal right. See the approval of Law no. 388/1997 in Colombia and Law no. 10.257/2001 in Brazil (see also https://www.cnm.org.br/cms/images/stories/Links/29092016_WhatisR2C24June2016.pdf; Fernandes, 2007).

Lefebvre, that were expressed in his text. Either applied in a variety of campaigns for a 'right to the city' across the globe (Mayer, 2009), or in scholarly debates on urban struggles, there seems to be an ambiguity in the use of the concept (Huchzermeyer, 2013): first, its meaning is taken for granted (ibid.); second, its mainstreaming in the recent literature is often summarized, thus deprived from some of its fundamental assumptions. It is not a coincidence that the 'right to the city' was translated into English only from 1996, and, still, only in part (Huchzermeyer, 2013).

Against this background, I opted for re-reading Lefebvre's original text and his own writing[15]. Which, among other things, is highly polemical towards the experts of the 'urban', such as architects, planners, sociologists, etc., as much as towards research laboratories, universities, intellectuals'[16]... This is probably not irrelevant to that Henri Lefebvre (H.L.) believed that any change in the urban everydayness will emerge from below, from the city-dwellers, 'the many' or else '*the masses*'...

According to Hess, Deulceux and Weigand (2009: xi), H.L. expresses the thought of the possible, the achievable – what *can* happen –, and he envisions it. H. Lefebvre describes an *achievable utopia*, which he outlines throughout his text: how may be transformed everydayness within and via the *urban*.

To begin, it is worth noting one of the starting points of his reflection related to centrality:

'It would be more reasonable, pleasant and meaningful to live in the city and work in the suburbs – some of which are far from inhabitable –, and not the other way around, right?' (Lefebvre, 2009 [1968]: 76).

In relation to this idea, Lefebvre sets some key questions:

'What are they – what will be – the "socially successful places"? How to identify them? According to what criteria?'

To immediately precise that by 'socially successful places' he intends those that are conducive to happiness ('*lieux socialement 'réussis', 'favorable au bonheur*') (ibid.: 100). Implying that our cities are not places conducive to happiness. Even more importantly, he posits:

'Every society, every era, every civilization imagined its heaven and hell, its ideal city, its utopia. Utopia is tied to multiple realities, more or less distant, but nowadays, in the 21st century, it is not tied to the real – to the everyday life. [...] The gaze turns away, abandons the horizon, disappears into the clouds, elsewhere...' (ibid.: 112).

This perception of today's utopia(s) is closely articulated to his description of today's everydayness. H. Lefebvre describes all those who suffer from a very arranged daily life, the catastrophic misery of housing and of suburban dwellers, of those living in housing ghettos,

[15] On this, see also Huchzermeyer (2013).
[16] For instance, H.L. writes about research laboratories, universities, experts and intellectuals: "they clash with each other in such a competitive way, with a zeal worthy of a better job, for the benefit of the great Master of economics and politics..." (1968: 111).

in derelict old city-centers, and in successive urban expansions far from downtown. He writes:

'It is enough to understand the daily life of someone who runs from his home to the nearest – or not so close – station of the overflowing subway, to the office or to the factory, to take the way back in the evening, to come home, to regain his strength, and start again, the day after. This generalized misery goes hand-in-hand with the 'pleasures' that disguise it and, which become therefore the means of escape' (ibid.: 108). However, 'neither holiday departure nor industrialised cultural production nor leisure activities solve the problem. The image of all this hinders the problem from being set. The problem is to end with the divisions between 'everyday life/ leisure activities' or 'everyday life/ feast'. The point is to restore celebration, transforming everyday life' (ibid.: 118).

The Open Orchestra comes close to this perception of everyday life and celebration: during the Sunday rehearsals, everydayness changes and it seems to convert *inter alia* to joy, happiness, and sharing. At the same time, the action of the A.O. becomes a claim and an appropriation of public space, and the city overall. The appropriation of the city, even in its most contested and derelict places, when rehearsals take place in neglected public spaces and degraded neighborhoods, becomes – among other – a social demand. Experientially, therefore, following Lefebvre, the A.O. seems to enable celebration to return into the everyday life and to transform this latter into joy yet also into claim, at least temporarily.

In the proper words of one of the oldest members of the A.O., it is explained what the Orchestra is and what it serves:

[EXTRACT 1]

"I've come up with it and I think we all agree that it serves 3 things. On the one hand it is a need for musical and artistic expression, so it has a purely musical and artistic part. On the other hand, it covers a need for a political way out in the dark times we live in, activism and political action from coexisting for 3 hours playing music to going to join other groups to, say, demonstrate in favour of a demand. And the third part has to do with socialization and the pleasure we derive from meeting people, interacting and essentially enjoying this coexistence. [...] I believe that the orchestra [...] has done many things in the public space [...] and I think it has left its imprint in a more or less obvious way at various conjunctures. [...] [The] orchestra is definitely an extroverted ensemble that intervenes in public space, that plays music and attracts people, states things. On the other hand, however, I think it changes us as well very much. [...] It has made me change attitudes, values, mood, to raise questions and motivation to develop more as a person..."

Everyday life is a central concept in Lefebvre's reasoning, and everything contributes to transform it: 'Techniques, art, knowledge, pass into the service of everyday life in order to transform it' (ibid.129).

Art in particular, is put at the service of the urban: 'Leaving aside representation, ornament, decoration, art can become "*praxis* and *poiesis*" '(poetry') on the social scale: the art of living in the city as an oeuvre/ work of art' (Lefebvre, 2009 [1968]: 124).

Into his reasoning, Lefebvre drew the term 'poetry' (or the Greek word 'poiesis'), referring to the making of creative work; or, said alternatively, the making of 'oeuvre' that is the creative as opposed to productive –profit-motivated– work[17] (Huchzermeyer, 2013). Lefebvre's engagement with people's desire for creative work was incorporated into his conceptualization of the 'right to the city'; together with everydayness and celebration (the importance of the lived experience and space), happiness, utopia and centrality, are all key – intertwined – elements of this 'right'.

As regards the importance of centrality, in Lefebvre's own words, the right to the city is the right to the 'urban life, to renewed centrality, to places of encounter and exchange, to life rhythms and time uses, enabling the full and complete usage of these moments and places' (Lefebvre,1996 [1968]: 179).

H. Lefebvre also wonders about the relation of centrality with the ephemeron:

'Why not prioritize over the eternal city the ephemeral cities, and the moving centralities over fixed centers?' (Lefebvre, 2009 [1968]: 104).

And elsewhere:

'The ideal city would be the ephemeral city, an endless oeuvre/work (of art) of the inhabitants, who themselves are moving and are mobilized by and for this oeuvre' (ibid.:124).

And, I think, again, of the Open Orchestra (A.O.), which concerns artists and amateurs, yet certainly inhabitants of Athens. Who are both *mobile* – from neighborhood to neighborhood, from protest gathering to solidarity gathering (to claim rights, justice, commons, art, the public space overall, and so on) – and *mobilized* by and for this oeuvre of transforming everyday urban life from misery and desolation to celebration (yet also to claim and demand). From this point of view, centralities are indeed shifting, depending on where are set the stakes of the A.O.: a rehearsal in Victoria Square, Amerikis Square, some derelict sites in Perama (Piraeus), the 1930s dilapidated refugee settlements in Alexandra's Avenue, or outside the Evelpidon courts ahead of the trial for the murder of the queer activist Zac/Zackie, and so on. These moving centralities are set against a fixed and eternal center, in Syntagma Square or even in the Propylaea (University of Athens).

Propylaea, being indeed the core city of Athens and its historic center, played a role in the primary act of the making of the Open Orchestra. Let us recall that the first concert took place in Propylaea, in spring 2021, when the Support Art Workers group performed the piece 'El Pueblo Unido…', just like the solidarity orchestra of the Théâtre de l'Odéon in Paris, some months earlier. It is no coincidence or surprise that this 'eternal city' center – the business and administrative center, as explained elsewhere by H.L.– did not remain on focus by the Open Orchestra; because real life and everydayness 'happen' elsewhere. Furthermore, as Lefebvre underlines, the eternal-city-center is out of reach for the majority of the city dwellers, let alone the (im)probability to live and inhabit there.

[17] Huchzermeyer (2013) notes that earlier translators of Lefebvre's subsequent book 'The Production of Space' use the English word 'work' instead of 'oeuvre' (see, Lefebvre, 1991 [1974]:73).

Lefebvre does not equate centrality with the physical centre of the town. As he will argue in a later work, 'virtually, anything is possible anywhere' [...]; 'centrality is always possible' (Lefebvre, 2003 [1970]: 130; quoted in Huchzermeyer, 2013). In other words, as above quoted, centrality is conceived as moveable and moving, entangled, therefore, to the idea of the ephemeral. Hence, the perpetual movement of centralities is intrinsic to the concept of the ephemeral city. And, as above described, the A.O. practices in purpose this volatility of centralities.

For H. Lefebvre, 'the future of art is not artistic but urban' (Lefebvre, 2009 [1968]: 125). Because, as he explains: 'the future of humans is not found in the universe (the cosmos) neither in the people nor in production, but within urban society' (ibid.: 125).

This echoes his deep interest in the everyday life, that is the importance of the lived experience (with)in the urban, which informed his thinking on the right to the city.

H. Lefebvre raised the issue of rights together with the social consequences that come as a result of – precisely – the lack of rights, or, said alternatively, the misery of everyday life, and the pressure exercised to the many – to '*the masses*': rights of age and gender rights, rights to education and training, the right to work, to culture, to rest, the right to health, to housing (Lefebvre, 2009 [1968]: 107). And yet, the right to the city is not understood as a simple right to visit or return to the traditional city: the 'urban', as a meeting place, social right and use value, but also 'as inscription into space of a time which has become a supreme good, finds its morphological basis, its realization, through people's everyday practices' (ibid.: 108). Hence, the right to the city concerns those who *inhabit* the city, and not some Olympian Gods of the new aristocracy, who 'fly' from palace to palace or from tower to tower, transcending everyday life, as Lefebvre eloquently stresses (ibid.: 108). The right to centrality is therefore in the core of Lefebvre's reflection, as much as the concepts of habitat and inhabiting, appropriation and use value (in contrast to exchange value), and, essentially, as aforementioned, the concept of the everyday life of common people.

All in all, for Henri Lefebvre, the right to the city is:

'a superior form of rights: right to freedom, to individuation in socialization, to habitat and to inhabit. The right to the *oeuvre* (the participatory activity), and the right to appropriation (clearly distinct from the right to property), are implicated in the right to the city' (Lefebvre, 2009 [1968]: 125).

The right to the city – the right to urban life – is, for H. Lefebvre, a condition for a renewed humanism and for democracy (Hess, 2009: 3). To understand the essence of Lefebvre's 'right to the city', we need to take into account, apart from his consideration of the everyday, his ideas of the city together with his critique of the state (ibid.: 4). Among other things, this is not without relevance with more recent theory on commons.

3. '*Commons*', '*commoning*', and '*the Right to the City*'

Theory on commons is not without relevance with the modus operandi of the A.O. In this section, we draw attention to the literature on commons, briefly evoking some key points of this seminal body of research.

The discussion on commons often refers to private, state and collective models for managing 'common pool resources' (CPR), that is to say resources without a clearly defined ownership status (Ostrom, 1990). CPRs or 'commons' (Bollier, 2016) are vibrant and dynamic social systems which evolve around values of self-management, collective ownership and the equitable administration of resources or goods created by different communities to ensure the survival and well-being of each of their members individually, yet also collectively through the community (Bollier, 2016; Ostrom, 1990; Πεχτελίδης, 2020: 26).

Still, commons are not simply resources or goods we share, they are the social dimension of the shared (De Angelis, in An Architektur, 2010: 5). Massimo De Angelis (ibid.: 2) points that 'conceptualizing the commons involves three things at the same time. First, all commons involve some sort of common pool of resources, understood as non-commodified means of fulfilling people's needs. Second, the commons are necessarily created and sustained by communities[18]... [...] [T]he third and most important element in terms of conceptualizing the commons is the verb "to common" – the social process that creates and reproduces the commons'. This *commoning* activity or '*commoning*' further describes the social relations that are capable of producing and reproducing, establishing and re-establishing, inventing and reinventing the commons (Tsavdaroglou & Kaika 2022).

Commons flourish and expand in all the sectors of life. They are not only material, such as earth, the oceans, energy and water, but can also be intangible, such as education and knowledge (Πεχτελίδης, 2020: 27, 29). Even more importantly, commons 'are a socially minded way of thinking and doing that crosses times and cultures and can be used in very different realms, from community-supported agriculture to software programming to cooperative forms of drug development' (Bollier & Helfrich,2019; see also https://freefairandalive.org/learning-to-see-the-commons/).

A famous critique of the commons came as early as 1968, with the article of economist Gerrit Hardin "The Tragedy of the Commons". Hardin argued that common resources will inevitably lead to a sustainability tragedy, because the individuals accessing them would always try to maximize their personal revenue and thereby destroy them. The policy implications of this approach are eloquent, as it is implied that the best way to sustain the resource in question would be through privatization or state control (quoted by De Angelis in An Architektur, 2010: 4).

[18] [...] 'Communities are sets of commoners who share these resources and who define for themselves the rules according to which they are accessed and used. Communities, however, do not necessarily have to be bound to a locality, they could also operate through translocal spaces. They also need not be understood as "homogeneous" in their cultural and material features' (De Angelis, in An Architektur, 2010: 5).

Against this conceptualization, Ostrom (1990), at the first place, and later other researchers as well, showed that there exists, indeed, a third way – beyond markets and states – and this concerns community self-management and self-government. Furthermore, in a completely different vein from standard economics and the rationale of Hardin's "tragedy" – for whom "rational" is the action of taking more than one's fair share of collective wealth, while displacing unwanted costs onto nature – Bollier & Helfrich (2019) propose the idea of "Ubuntu Rationality"; that is a different worldview, ethic, and set of social practices. As the authors explain, the Bantu tribal worldview could be summarized by the axiom "*I am because we are"*. In this perspective, they postulate that commoning does not refer to some distant utopia but constitutes an unacknowledged "Nowtopia" (ibid.) Said alternatively, commoning is a "realistic utopia" (Wright, 2018; quoted in Πεχτελίδης, 2020: 39), implemented here and now.

This conceptualization of commoning and commons resonates with the idea of utopia that goes through the text of Henri Lefebvre on his 'Right to the city'. Lefebvre writes about a realizable utopia through the transformation of everyday life *in* and *by* the "urban". This idea of a realizable utopia, that is a utopia that can be realized right here right now, or –to employ Bollier's & Helfrich's (2019) neologism – a "Nowtopia", is directly correlated to Lefebvre's questioning about the "socially successful places", which, as aforesaid, are those that promote happiness (Lefebvre, 2009 [1968]: 76). In this reasoning, realizable utopias are conducive to happiness, and this could also be the case of commons and commoning.

Stavros Stavrides suggests an additional reason that leads us towards Lefebvre and his notion of the "right to the city". For Stavrides, 'to think about a city based on commons we have to question and conceptualize the connection of space and the commons' (quoted in An Architektur, 2010: 16)). To think about space as related to the commons means to conceptualize it, after Lefebvre, as a form of relations rather than an established arrangement of positions. In this way, as Stavrides points, space becomes intrinsic to social action and "happens" through different social actions, which nurture different spatial qualities. This then means that when claiming space as a form of commons, we oppose the idea that each community exists as a spatially defined entity; rather we opt for a network of communicating and negotiating social spaces which retain a "passage" character (ibid.: 16).

This "passage" character– or versatility of commons (Bollier & Helfrich, 2019) – echoes again H. Lefevbre's urge to prioritize the ephemeral over the eternal: as briefly discussed in the previous section, Lefebvre suggests that the ideal city is the ephemeral city. The ideal city would be an endless work of art on behalf of its inhabitants, who would both be moving and mobilizing by and for this work of art (Lefebvre, 2009 [1968]: 104, 124). This mobilization to which refers H.L. is nothing less than social action, that is to say *praxis*. As Stavrides points, space becomes intrinsic to social action. Commoning, on the other hand, does become a social praxis (De Angelis quoted in An Architektur, 2010: 4). In this line of thoughts, we could maintain that the A.O. is social praxis and commons. Besides, "praxis and poiesis" '(poetry') on the social scale is 'the art of living in the city as a work of art' (Lefebvre, 2009 [1968]: 124), according to the Lefebvrian concept of the 'right to the city'[19]. Said alternatively, as pointed by Stavrides, for Lefebvre, the 'right to the city' is the right to

[19] And it also, as aforementioned, what H.L expects art to become (Lefebvre, 2009 [1968]: 124).

create the city as a collective work of art. Therefore, the city can be fashioned 'through encounters that make room for new meanings, new values, new dreams, new collective experiences' (Stavrides quoted in An Architektur, 2010: 16).

Against this background, it is worth exploring the idea of the Open Orchestra as commons. This hypothesis needs further research which lies beyond the scope of the present paper.

4. Who can do it? Planning, planners, game-changers and the A.O.

The Open Orchestra seems to enact many of the ideas that shape the concept of the 'right to the city' as theorised by H. Lefebvre. To paraphrase Stavrides (op. cit.) this is *inter alia* the right to create the city as a collective work of art. Without any doubt, the A.O. challenges the established status quo, claiming more democracy, more justice, peace, equal rights for all, open spaces in the city – beyond exchange values, regeneration programmes and hasty touristification. Despite all the above, the question remains about whether this impulsive bottom-up initiative and socially shared experience named Open Orchestra (A.O.) is somehow practicing the 'right to the city'. Similarly, we could hypothesize that, in the way that it has been created and functions, the Orchestra could be considered as commons as well. Yet, for the time being, this remains a hypothesis that needs further investigation.

The difficulty to assert whether the Open Orchestra practices the 'right to the city' as outlined by Henri Lefebvre resonates with a question which remains dominant in the existing literature: '*Who can do the Right to the City*?'

H. Lefebvre is very explicit about this:

'No one is authorized to make the synthesis of the signals of the city. Neither the sociologist, nor the economist, or the architect... Only a praxis can assume the possibility and the demand for synthesis: the 'gathering' of what is segregated, isolated...' (Lefebvre, 2009 [1968]: 92).

As a praxis, the right can only be brought about by 'groups, social classes and class fractions capable of revolutionary initiative' posits elsewhere Lefebvre (Lefebvre, 2009 [1968]: 113). These are the ones to indicate their social needs, to overturn existing authorities, and to 'claim a future that will be their own work' (ibid.).

In other words, the 'right to the city' has to be asserted from below and connected to social movements (Harvey, 2008; Mayer, 2009). Even more importantly, Lefebvre calls for a reversal of roles between 'the experts' and the many:

'Only the taking in charge by the working class of planning and its political agenda can profoundly modify social life and open another era: that of socialism in neo-capitalist countries' (Lefebvre, 1996/1968:179; quoted in Huchzermeyer, 2013).

And elsewhere:

'Urbanism' (as a profession) should 'try to model space as a work of art' (Lefebvre, 2003/1970:180; quoted in Huchzermeyer, 2013). The 'sense of the oeuvre' must be shared

also by ordinary people, or else 'urban consciousness will vanish' (Lefebvre, 1996/1968:77; quoted in Huchzermeyer, 2013).

Against this background, I am wondering whether my starting questions – regarding a planner's perspective on initiatives like the Open Orchestra – are opposing the essence of the Lefebvrian concept of the 'right to the city'. I think that, among other things, Lefebvre urges the 'experts' of the urban to find a common step with the non-experts, i.e. the city dwellers – the many. Does this mean to promote more participative planning practices? Does this mean to reflect on how such initiatives, which do shape social relations in the city even in some micro-scale, could also shape space at the metropolitan scale?

In any case, it is interesting to recall the reflection of Massimo De Angelis on commons, who suggests that it not possible to name the subject of change; expressions such as working class, proletariat, multitude, etc. – he says – 'may be more or less useful depending on the situation, but generally their usefulness is mainly correlated to crucial questions of ''frontline''' (quoted in An Architektur, 2010: 5).

At the closure of this final section, it seems that the stakes set by H. Lefebvre in the eve of the events of May 1968 are still very up to date, while the transformation of the everyday life in and by the "urban" – that is the realization of a realizable utopia – are not yet achieved. Does the A.O. succeed in getting closer to such stakes in today's Athens? This remains another open question. In this text, I tried to provide some insight based on my reflection on the Open Orchestra as commons, but also as potential game-changer that is practicing bits and pieces of the Lefebvrian 'right to the city'. I remain concerned about the possible ways to leverage this kind of socially shared experience, and how these could 'contaminate', if possible (and meaningful), the planning practices, so as to impact the (re)production of urban space and the city fabric overall.

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On freedom, public space and women's experiences of prostitution. The (in)visible world of the Bois de Vincennes in Paris[1]

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Abstract.
This paper focuses on Nigerian women's experiences of prostitution in a public space, the Bois de Vincennes in Paris, as democratic experiences questioning the value of freedom in pluralistic societies. It is based on the very provisional outputs of a collaborative field-research. It relies on an ecological-pragmatist perspective of analysis that suggests to consider public spaces as frontiers of capacitation: in-between spaces where Nigerian women reinvent themselves in the face of international and local, planned and unplanned, events. The aim of the paper is to rethink the political and cultural value of public spaces for just and inclusive territorial transformations.

Key-words: prostitution, freedom, public spaces, social justice, cultural pluralism

Prostitution constitutes a moral controversy, a public problem but also an urban and regional issue. On the one hand, diverse social groups, considered "undesirable" or "deviant", experience prostitution in public spaces by practicing their own forms of territorial appropriation and rights claiming. On the other hand, a public debate trapped in the ideological opposition abolitionists/pro-sex workers and, therefore, in the binary logic forced/free prostitution, tends to invisibilize experiences that question what human freedom means in the face of extreme human rights violations taking place in cities.

Nigerian women in situation of prostitution have been mainly represented as victims of human trafficking for sexual exploitation. Their freedom is supposed to be inhibited by traditional family and gender relations, Nigerian organized transnational networks and the black magic. Research on this topic has been conducted in clinical and court settings or in ngos. This paper extends the insight to Nigerian women's experiences of prostitution in a public space, the Bois de Vincennes in Paris, and is based on the very provisional outputs of a collaborative field-research combining ethnography, life histories and participatory research[2].

The following research questions will be taken in account: How has the relationship between prostitution and public space been studied? Can we confine

[1] The project leading to this paper has received funding from the European Union's Horizon 2020 research and innovation programme under the "Marie Sklodowska-Curie grant agreement No 844164".
[2] I was engaged as a volunteer for three years in the activities – mainly street unit and reception of Nigerian women in situation of prostitution – of the Saint Rita branch of the association *Aux captifs, la libération* in Paris. The ethnographic work I conducted would not have been possible without cooperating with Charlotte Sarah and Amel Selka, social workers in the association, who were also strongly involved, along with a few Nigerian women, Latin men and women, in the activities of the "Zuzulab", a pioneer experiment of participatory research addressing the issue of sexual exploitation, which took place at the EHESS in Paris from April 2023 to January 2024. The results of the "Zuzulab" are not reported in this paper.

Nigerian women's experiences of prostitution in the Bois de Vincennes to the horizon of the virtues of public spaces as spaces of co-presence of strangers? What arrangements do Nigerian women practice in the face of local and international, planned and unplanned, events affecting their margins of action? To what extent these women's experiences of public spaces can give a contribution to cities and urban regions more sensitive to the defense of human rights and cultural pluralism?

1. Prostitution as a territorial issue: Chicago, between Spain and the Balkans, the Bois de Vincennes

It was in the days of the Chicago School of Sociology that the social and territorial consequences of the moral crusades against prostitution were studied and the abolitionist model of care was questioned (Reckless, 1933). The red-light district was depicted as a zone of transition between the working men's world, the business district, and the women's world, the residential neighborhoods. It was an area where identities and cultures used to freely collapse and fuse. The repression of prostitution had unexpected consequences. On the one hand, vice migrated from the city to the borderlands outside city limits, making emerge a new area of transition where gang syndicates practiced their traditional tactics of invasion and occupation through intimidation of police graft and political alliances. On the other hand, women got through a new process of emancipation and individualization, rather than be redeemed by abolitionists. The brothel prostitutes, expression of organized vice business, were replaced by the "call girls", that is, a class of unregimented women outside the brothel, working in independent, emancipated and clandestine basis in apartments and flats and vice resorts in decentralized areas in Chicago, preserving their individual freedom and avoiding stigma and hardship of prostitution.

Following the Chicago School of Sociology, Tarrius (2022) extends the insight to the territories of transnational circulation traced by prostitutes who, moving between the Balkans and Spain, adjusted themselves to regional forms of cooperation between organized crime, migrant populations, illicit trafficking and local politics. Tarrius distinguishes three cross-border "moral regions": (a) around the Black Sea with the purpose to manage the traffic of women for prostitution in the Arabs Emirates and in Spain; (b) the transition area between the Balkans and Italy where the management of drug trafficking is handled by Calabrian, Apulian and Albanian-speaking mafias; (c) the French-Spanish Catalan space where the new mafias succeed in expelling the Neapolitan camorra in the management of drug trafficking and prostitution.

Unlike the individualization of prostitution undertaken by the Chicago's "call girls," women of the Balkans, moving throughout these moral regions, acquire a cosmopolitan sense of living. They propose their own idea of collective empowerment through the establishment of an NGO that supports projects of development in the Balkans thanks to earnings coming from prostitution, gives rise to an immense network of out-of-customs trade throughout Europe, reveals the force of emotional bonds shared by women having the painful experience of prostitution in common.

This paper focuses on Nigerian women's experiences of prostitution in a public space, the Bois de Vincennes in Paris, as democratic experiences questioning the meaning of freedom in pluralistic societies.

Nigerian prostitution has been represented as a story of globalization rooted in organized and transnational movements of trafficking and in a system of pawning and debt developed in West Africa in the context of colonial urbanization (Naanen, 1991).

Research conducted in clinical settings shows the magical-religious dimension of Nigerian prostitution: a ritual, the *juju*, is practiced to validate the asymmetrical power between the madame and the cadet, guarantees the paying off of the debt; regulate women's desire for migration and emancipation from generational, familial, and gender relations in Nigerian society (Taliani, 2019). In France research has also focused on ngos and courts (Jakšić 2016; Jakšić and Ragaru, 2021) and relationships between prostitution, organized crime and ethnic community (Lavaud-Legendre, 2013).

This paper adopts an ecological-pragmatist perspective to explore Nigerian women's experience of prostitution in a public place. It relies on the notion of "experience" as the result of interaction between living creatures and the environments, the "close connection between doing and suffering" that can arise from interaction, the reflective nature of such a connection (Dewey, 1920). It puts in the foreground the notion of freedom, not as freedom of will, but assuming that it is: (a) rooted in the environment, in and among actual facts and events (Dewey, 1922); (b) based on the ability to carry out plans; on the capacities to vary plans, change the course of action, experience novelties; on the power of desire (*ibid.*); (c) the result of the creative and reflective integration of impulses and interests of the self in social relationships (Mead 1938a).

Thomas (1923) studied how the young prostitutes' behavior was regulated by four wishes: desire for new experiences, desire for security, desire for response, desire for recognition. To address Nigerian women's experiences of prostitution in the Bois de Vincennes in Paris, the focus is on a public space as a "milieu of life" (Cefaï, 2019) where Nigerian women try to integrate different impulses, emotions and desires, deal with moral, affective and cognitive troubles, as well as with concernments and problematic situations, reinvent the frontiers between different "webs of life" (Mead 1938b) – inside and outside prostitution. Thus, we definitely leave the long-standing dominant horizon of the virtues of public spaces as spaces of co-presence of strangers and we enter an ecological-pragmatist perspective on urban public spaces sensitive to the notion of transaction (Crosta, 2010; Proto, forthcoming), to the study of the relations between activities and movements in urban public spaces and the political controversies in democratic political spaces (Terzi and Relieu, 2003), to the urban and regional analysis of the relations between globalization, social injustices and cultural pluralism (Cefaï, 2024; Proto, 2023), to the current debate on culture and policy-making (Cremaschi et al., 2021).

2. Route de la Pyramide: an archipelago of trajectories of freedom[3]

The Bois de Vincennes is the largest green space in Paris. Located in the 12th *arrondissement*, it is separated from it by the passage of the Boulevard périphérique, a beltway encircling Paris. Route de la Pyramide is a street, 3 km in length, within the Bois the Vincennes, connecting the suburbs of Vincennes and Joinville-le-Pont. Everyday Nigerian women reach by public transportation this street for prostitution in the afternoons or evenings while they live mainly in apartments managed by "maman" or "brokers" in suburbs of the northern metropolitan Paris region, as Sarcelles, Villier-le-Bel, Aulnay-sous-Bois or Saint-Denis.

Their journeys to Europe mainly began in Benin City. By bus they reached Kano and, crossing the border with Niger, passed through Maradi or Zinder to arrive in

[3] All Nigerian women's names as of this paragraph are not real.

Agadez. They then crossed the border to Libya, continued to Qatmmu or Sebha, and reached the coastal cities of Zuwara, Tripoli or Missatah. Others say that they crossed multiple African states before reaching Libya. The routes differed considerably upon their arrival in Italy. Women reached by boat Lampedusa, some of them moved to Catania and lived there for two or three years, before coming to Paris. Others have slowly made their way up Italy - Bari, Naples, Rome, Milan – before arriving in France. Others ones moved by sea from Libya to Lampedusa, from Lampedusa to Sardinia, from Sardinia to the North of Italy and, then by train, from Bergamo directly to Paris.

There's a strong connection between international events and changes in the presence of Nigerian women on route de la Pyramide.

First, as long as the civil war starting in 2014 in Libya strengthened cooperation between Nigerian trafficking organizations and Libyan militias, the journey to Europe turned into a real opportunity for so many Nigerian women arriving to Italy by boat. Their number soared from 1,500 in 2014 to 9,000 in 2016 and to 11,000 in 2017[4]. Meanwhile, in Paris, their presence on route de la Pyramide grew dramatically: social workers used to encounter 175 women in one hour in 2017, rather than 50 as it was in 2014. During these years judges and police officers raised awareness on the criminal evolution of Nigerian human trafficking. At the end of 2018, according to OCRTEH (*Office central pour la répression de la traite des êtres humains*), the management of prostitution in France was based on closer collaboration between "maman" and members of Nigerian cult organizations[5]: a highly organized money laundering system related to prostitution was identified and was based on the collection of proceeds from multiple cities, their transfer to Paris - to a hairdressing salon and a grocery store in the 18th *arrondissement* that acted as a depository of funds - and their sorting, by bus or by plane, to other European and African countries before reaching Nigeria.

Second, in Nigeria, on March 9 2018, Oba Ewuare II, the King of Benin ordered native doctors of Edo State to revoke all of the curses and oaths – the *juju* - placed on women exposed to human trafficking, himself invoking a curse on all those native doctors who continue to force or coerce girls into taking oaths. If the *juju* was the arrangement supposed to guarantee the paying off of the debt to the "maman" who sponsored the journey toward Europe, Nigerian women experienced the Oba edict as a liberation from debt while cultists and "maman", scared by the edict, were supposed to leave young women ready to reach Europe in Libya. The number of Nigerian women crossing the Mediterranean to arrive in Italy decreased significantly in 2018: 1250 out of 23370[6]. They disappeared altogether from the landing statistics as of 2019 in Italy and also on the streets of many Italian cities in 2019.

Nonetheless, Nigerian women remained in large numbers on route de la Pyramide in Paris until the Covid-19 crises. During the first confinement in spring 2020, they disappeared from the street and then gradually returned to it, albeit not in the same large numbers. If Nigerian women experienced the Oba edict in 2018 as an opportunity of debt liberation, the Covid-19 crises controversially extended their

[4] https://www.iom.int/news/un-migration-agency-issues-report-arrivals-sexually-exploited-migrants-chiefly-nigeria; http://www.libertaciviliimmigrazione.dlci.interno.gov.it/it/documentazione/statistica/cruscotto-statistico-giornaliero.

[5] Nigerian cults are criminal organizations that have arisen in Nigeria since the 1970s, initially configured as secret student associations, later devoted to criminal activities.

[6] http://www.libertaciviliimmigrazione.dlci.interno.gov.it/it/documentazione/statistica/cruscotto-statistico-giornaliero.

margins of freedom. Many of them realized that they could live without prostitution and asked aid to associations to get out of prostitution in large numbers. Meanwhile, route de la Pyramide has become a key-reference for inter-urban and intra-European circulations of adult Nigerian women in search of higher profits.

There are women still stable for years on route de la Pyramide, who try to maintain their own spheres of action on the street.

Camille is the oldest presence on the street. She works in a van and is familiar with social workers on the street but never asks for assistance. She lives in Saint Denis suburb. She stays in the van, in bra and loincloth, behind the wheel, without a license, playing video games, talking on the phone. Sharing the van with her means for women to pay a percentage of their earnings directly to her, rather than only to the owner of the van. She leaves every three months to Grosseto in Italy where she has lived for many years. There, she lost a 5-year son in 2016 but has a 4-year old daughter who lives with her sister, an employee in a cleaning company. Sometimes she talks about a husband living in the UK whom she would like to join, other times she complains because she cannot get papers to work in France. One evening in March 2022, she was very upset. Although she was the eldest daughter, she was unable to leave Paris while her younger brother and sister were moving to England for study and would have soon been joined by their father[7].

In addition to Camille, at least two other women are present steadily on route de la Pyramide. Both of them, not in a van. The first one is Helene. She stays at the edge of the woods, at the margins of the street, always in the same spot for years, since 2016. Determined. She wants to remain in Paris. Different girls follow next to her. Starting in December 2022, a woman in her fifties, just arrived from Marseille, appears next to her. Helen is friendly with her but aloof. Both are always hungry and ask for condoms. The other woman stable on the street is Joan. Robust, provocative and ironic, she too wants to remain in Paris. She does not hide in the bushes but sits on the sidewalk. Landed in Sicily, she was taken to a reception center in Milan and after a few days was on a train to Paris. Her grandmother, mother and aunt live in Ventimiglia, on the border between Italy and France. The aunt is married to an Italian. Joan flaunts daily contacts with Lampedusa from where she receives news of shipwrecks and deaths during the landings. "The destination is assigned to you in Libya. If the destination is France, you must go to France," she repeats forcefully as she laughs on the sidewalk and responds in kind to the insults the women receive from speeding motorists on the street.

As long as the Covid-19 fosters Nigerian women intra-European circulation, the Bois de Vincennes turns into a milieu of multiple fast outsiders' accommodations. They all practice prostitution on foot.

Violet appears in the bushes on an afternoon in June 2021. Far away from the road. She looks uncomfortable. Her eyes are dull. She has been a week in Paris after six years in Spain. She lives in Sevran, 20 km north of Bois de Vincennes. She says that it was she of her own accord who left Spain. Then, a "we passed through Marseille but there is too much violence there and too many people of different nationalities. Here are my people." A week later, Violet has already changed her attitude. Long hair with blond braids, confident, smiling, she no longer stands hidden in the bush but laughingly negotiates with men on the sidewalk and disappears with a few of them into the bush.

[7] Many of the Nigerian women sexually exploited are the eldest daughters in their families.

Cherry is at the margins of route de la Pyramide in February 2023. She is kind and smiling. She was transferred in a very few days from Lampedusa to Verona, where she stayed for six months before reaching Paris. "In Verona it's very difficult to get regularization. The documents have greater strength depending on the city. Those in Verona are stronger than those in Milan and even stronger than those in Turin," she tells social workers showing her clear vision of the attitudes of Italian institutions. She is trying to obtain documents in France and then return to Italy, to her boyfriend. She underlines that she is very attached to Italy. One evening she kneels to thank God for sending the Italians to rescue her at sea. Another night she brings dinner to social workers because she considers them part of her family in France. Still another night she cries because her friends encourage her to file a complaint against a woman as her "maman" by perjuring herself: this is the new strategy of hierarchical inversion among Nigerian women in order to regularize themselves quickly. After a little more than a year, in March 2024, she is still there, on foot, at the margins of route de la Pyramide.

Prostitution is practiced on route de la Pyramide even for very short periods. They come from Turin, Milan, Southern Italy, as well as from Normandy or other French cities to spend a few weeks or months in the Bois de Vincennes thanks to local connections. There are also women travelling between multiple French cities. At the same time, women in Paris may come back to the Bois after a long time. On March 2024 Pumpkin, purple curly wig, stands alone, on foot, on the sidewalk at the very beginning of route de la Pyramide. She looks scared, hesitant. She lives in Paris and works as a caregiver to the elderly but must pay her rent in a lull between the end of one job and the beginning of a new commitment. She stresses that she will only be on route de la Pyramide that evening. Two weeks later she is behind the wheel of a van, smiling and thanking friends who have allowed her to work inside the van in a more protected way, as many others women who prostitute themselves in the Bois de Vincennes on weekends, despite having papers.

3. Vans & bushes: a "precarious habitat" towards the Olympic Games.

Nigerian women have come to Europe pushed by the desire for emancipation and found themselves in street prostitution. They have learnt how to use route de la Pyramide to maintain peace. Who practices prostitution on foot in the afternoon reaches a sandy path next to the sidewalk, turn trees on the sandy path into hangers for their bags and vests, and wait for clients by sitting at the edge of the bushes and sharing the sandy path with families, children or groups on horseback. In the evening they move to the sidewalk and arrange themselves mostly in pairs, always keeping a distance of 20-25 meters each other, this time sharing the sidewalk with a few joggers and bike riders.

In the post-pandemics, although the Bois de Vincennes is becoming a key-reference for intra-European circulation of Nigerian women, fewer and fewer practice prostitution on foot. Many of them move to the system of prostitution inside vans.

About 20 vans station on route de la Pyramide in the evening. Women change their clothing, put on makeup, and put their wigs directly inside the van, which is organized in a "control-zone", behind the wheel, and a "work-zone" separated by a curtain. Lit lanterns on the dashboard indicate the women's availability. A heater warms the van cockpit in winter. Women inside vans may be about 30-40 in the evening. Two women usually share the van, sometimes as many as three, one of which, prostitutes herself in the bush.

In the early 2000s, when Nigerian girls appeared in the Bois de Vincennes, there was an agreement between the BRP (*Brigade de répression du proxénétisme*) and the "*tradis*" ("*les traditionnelles"*) - those women - French or French-speaking - who used to practice prostitution in the Bois after abandoning the streets and apartments of rue Saint-Denis, in the 2nd *arrondissement*, in the late 1990s. To prostitute in a van, one had to have a driver's license; be alone; comply with all sanitary regulations for the prevention of any sexually transmitted disease; and not work on Wednesdays and weekends. Nigerian women transgressed the agreement. The stationing of the vans became a disturbance of urban decency for residents of the municipalities on the edge of the Bois and caused their protests, the adoption by municipalities of special measures to prohibit the stationing of the vans, various appeals to the Minister of the Interior and, finally, in 2003, the approval of the law for internal security - Law 2003-239 of March 18 2003. It was presented as a way to fight against the rise of foreign prostitution networks and pimping starting from the end of the 1990s. It reintroduced the crime of solicitation and also the crime of human trafficking: Nigerian women found themselves both as criminals and victims at the same time. Court convictions for soliciting increased more than threefold in less than just three years, rising from 291 in 2003 to almost 1,000 in 2005. In 2004 alone, 2,000 vans were seized. Pimping crimes remained stagnant.

The van constitutes a cell of intimacy and protection in public space for women but also an essential economic unit of Nigerian pimping. In the summer of 2022, stationed in single file, morning and afternoon, alongside the Castle of Vincennes, are as many as thirty Nigerian vans, together with the vans of Moldovans, Ukrainians, and Romanians who practice import-export of food products along that road. They are stationed within the administrative area of the municipality of Paris, albeit on the edge with the territory of the municipality of Vincennes. Actually, no prostitution is practiced inside the vans when stationed alongside the Castle of Vincennes, but following protests by the Mayor of Vincennes in November 2022, only a few remain there. Some are left all day on route de la Pyramide; others find space on avenue de Saint Maurice, still inside the Bois de Vincennes, albeit further away from route de la Pyramide.

Managing the circulation of the vans requires "disguised engagements" in the public space. We are not in the horizon of Goffman's civil inattention (1963), i.e., unfocused interaction between strangers aimed at maintaining public order, but in the course of situations of "false inattention", i.e., in the course of brief focused interactions - the delivery of a van - between young Nigerian men and young Nigerian women who pretend not to know each other. In June 2023, at dusk, while the green area near the Castle of Vincennes is crowded with passersby, a young woman, in her mid-20s, warms up a white van's engine. A young man, jeans, blue polo shirt, sunglasses, in his mid-20s too, down below checks the tires, opens the rearview mirror. They don't talk to each other. While she warms the engine looking straight ahead, he uses a tablet with his back to her. When the girl moves the white van from the parking lot, he looks at the tablet for a few more minutes, crosses the street, and gets into his turquoise car. The white van heads toward route de la Pyramide, the turquoise car in the opposite direction, toward Paris.

Still moments of "disguised engagements" are those involving the removal of the vans from route de la Pyramide. In the evenings, elderly white men take the vans away, keeping the Nigerian girls hidden below so that they are not visible on the street. Other times, in the morning, around 9 a.m., white men in their 40s move the vans from route de la Pyramide to Alfortville or Maison Alfort.

The circulation of vans shows that the management of Nigerian prostitution is not a matter of ethnicity, nor of woman-to-woman interaction but the result of a multiscale and interethnic symbiosis made of disguised engagements involving "maman", cult members, money collectors, drivers, garage owners. This symbiosis can still be disrupted.

The displacements of the vans can cause frictions with other social groups. At the end of September 2021, a few months after the Nigerian vans have reappeared on route de la Pyramide, following the Covid-19 deconfinement, a group of about ten white men jump out of a truck. They are not clients. They argue animatedly with a few black women. Speaking in English, they seem to threaten them. Then, they get back into the van and drive away. Are these conflicts with the drivers who take the vans off the road in the morning, or with the Moldovan, Ukrainian, and Romanian traders from whom they take space by parking on the same street beside the Castle of Vincennes?

With regard to client violence, Nigerian groups have to find more visible arrangements to protect prostitution in the Bois. Lurking in the bush with clients exposes girls to all sorts of violence. On the street they limp as a result of scuffles with clients to defend themselves from assault and theft - of money or cell phones. At night women are exposed to vandalism by speeding cars that throw firecrackers into the street or shatter van windows by firing air guns. Violence against women can become extreme. On the night of June 8-9, 2022, a man from Guadalupe, who had just entered as a client in a van, attempts with a knife to slit the girl's throat from behind, while she was busy picking up a condom. It is her friend behind the wheel who intervenes: she puts the man on the run, calls the police in vain, calls for help on route de la Pyramide looking for someone who knew how to drive. She finds only one girl out of about twenty vans on the street, and with the latter driving the van, she manages to take the bleeding girl, saving her, to the Vincennes police station, which alerts firefighters and the Samu (*Service d'Aide Médicale Urgente*) for emergency hospitalization. After this event, for the first time, black watchmen appear on route de la Pyramide: they stand on the sandy path near the bush and show familiarity with the woman by calling the few girls still on foot and those inside the vans by name.

Protecting prostitution inside vans finally requires the elimination of any autonomous women's group. In June 2021 five girls stand on foot at the margins of route de la Pyramide. They all move together along the street. One of them keeps a bottle of whiskey in her purse because "she thinks too much". Two women share a purse where they collect the money they earn. They joke, entertaining potential clients by dancing. The fourth woman provokes: "Am I Purity or Anti-Purity?". The fifth woman follows them, smiling silently. In October 2022 the group no longer exists. One of them has not been on route de la Pyramide for some time. The woman with the whiskey bottle stands alone across the street, ignored by all the others. She says she is leaving Paris because of what "bad boys" are doing. All the other girls who were part of the group are inside vans.

Nigerian women who integrate prostitution inside vans are guided by a desire for security and search protection in ethnic community ties. But approaching the Olympic Games, their troubles and concerns are increasingly related to police violence, rather than clients. Wednesday is police day. "Fanno il giro" ("They patrol"): some girls use this expression learned in Italy to refer to police patrols. Their problem is not the police presence on the street but understanding their motives: arresting clients or girls?

In fact, what they experience more and more often are moments of suspension of human rights that reduce freedom to impulses to escape. Police officers arrive in

threes or fours, with flashlights and dogs. They look for the girls, ask them for IDs and driver's licenses. They order OQTF (*Obligation de Quitter le Territoire Français*) over the weekend making it difficult to appeal in the following 48 hours as the law requires. Other times they tell the women they have one month to appeal, forcing them to be repatriated once the 48 hours have expired.

Escapes into the woods provide the only chance to protect themselves from the cops. They run away terrified. They jump out of vans to run toward the woods. Sometimes police dogs bite their arms and legs. When they return to the sidewalk, they limp from the pits they have fallen into or touch their hair, head and eyes from the pain it causes to be caught in the branches.

The organization of the Olympic Games goes hand in hand with a repressive evolution of police practices: so many Parisian associations see it as an experiment in urban gentrification that will have consequences far beyond the end of the event, especially because of the approval of the national immigration law 2024-42 of January 26 2024. As of fall 2023, twenty police operations have been conducted in the Bois de Vincennes in nine months: 203 people checked, 44 in retention administrative for verification of right of residence, 37 in QTDF et two placements in administrative detention center before forced referral[8]. In the media, the Prefecture claims to be countering the increased risk of exploitation of prostitution. According to OCRTEH, on the other hand, no significant increase in supply was reported during the Rugby Cup in 2023, which was considered as a "test" ahead of the Olympic Games. A camp for 4500 soldiers - an extraordinary operation last conducted during World War II - will be installed in the Bois de Vincennes to ensure security throughout the Olympic and Paralympic Games.

Meanwhile, the women of the Bois have been informed that very strict police officers will replace the police teams familiar to them. What is actually changing is the way familiar police officers patrol the street. On a Wednesday evening, in May 2024, a group of police officers, all women, arrives on route de la Pyramide. Familiar faces. All, perhaps, not even 30 years old. All in plainclothes. "One black, one with Indian features, one stout, one short": that's how Giorgia, a Nigerian woman who witnessed the scene up close, describes them.

They stop Cherry, the girl from Verona, but when they ask for her papers, she runs off into the woods. Rather than letting her escape, as the police usually does, this time it is the black policewoman who runs into the woods chasing her in vain. Cherry disappears into the bushes and manages to hide in Giorgia's van while the four policewomen, who have not noticed anything, continue patrolling the street. "How could a black policewoman turn in such a way against a girl almost her own age and as black as she is?", wonders Giorgia very upset. A week later, on a Wednesday, almost all the vans are empty and without lit lanterns on the dashboard.

4. The Bois: a frontier of capacitation?

Despite turning into an ever more "precarious habitat" that exposes Nigerian women to human rights violations, route de la Pyramide is also an "in-between space" where women begin a transition of their self in the welcoming society, dealing with conflicting impulses, emotions and desires (Proto, 2023).

[8] https://www.francetvinfo.fr/les-jeux-olympiques.

On route de la Pyramide, afternoon or evening, Nigerian women express their ambivalent moral feelings in interaction with social workers. They can quickly move from shame to kindness, from embarrassment to bravado and, still, from bravado to unexpected moments of confidentiality. Route de la Pyramide is the origin of a new process of capacitation: a process of "socialization of justice" (Addams, 1902) that creates a new "web of life" (Mead, 1938b) and through which they reinvent their "public morality" (Cefaï, 2019) and develop a new civic imagination, that is, the ability to "awaken emotions, make assessments, generate representations" but above all "to act and materially reorganize the environment" (*ibid.)*.

A few of them may thus decide to reach out to social workers for the first time at the "permanence" of the association, seeking for domiciliation, French or computer classes. Then, they can enter a non-linear process of capacitation by engaging themselves in the different processes of association, cooperation and communication pertaining four spheres of action: play, inter-religious dialogue and participation, relationship with nature, engagement with justice.

First, moments of play foster out-of-ordinary horizontal forms of collective communication and association among women who are in prostitution, between the latter ones and women who are out of prostitution, among these two groups, social workers and volunteers. The Uno card or the photo-language act as "membranes" (Goffman, 1962) that momentarily disconnect them from the rest of their world and let unexpected personality traits kept hidden emerge, thus giving them the opportunity to exhibit attributes valued in the wider social world, such as knowledge, intelligence, courage, and self-control (*ibid.*).

Second, Nigerian women experiment with inter-religious imagination. On Sunday they attend Pentecostal churches in suburbs but during the week they attend Parisian associations. Symbols may create unexpected troubles. A woman arrives at the permanence but she doesn't want to play with the other women. Walking on her own in the room, she stops and stares at a wooden statue of Joseph, Mary and Jesus in a corner of the permanence for a few minutes. She takes small steps back and forth while continuing to look at the sculpture and then walks away, saying to a volunteer: "If I will have the courage, I will be back next week". Before the Oba edict, although Nigerian women are Pentecostal, catholic rituals to liberate them from the juju were extremely successful in making them stop paying debts, denounce trafficking networks and becoming activists. This doesn't work anymore after the Oba edict in 2018 but so many times the boundaries between the French Catholic church and the Nigerian Pentecostal church become porous when Nigerian women bring the sound of African drums and their singing in English to the small church close to the association.

Along with the moments of play and inter-religious experimentation, there are moments of intense emotional processing of their experiences when Nigerian women interact with unknown natural environments, as in the case of the breakup-stays, short periods – from 2 to 5 days – of time away from Paris, organized by the association. During a stay in the Jura mountains at the frontier between France and Switzerland in February 2022, a group of 5 women visit a cow farm for organic milk production. When they come back to the guest house, Pink, one of them, barely hold back the disgust she feels at how that organic milk is produced. "Producing milk needs exploitation, like prostitution!", she angrily comments and rejects a glass of organic milk given by the personnel of the guest house. She ran away from home when she was 13 because her father wanted to marry her off to a man much older than her. Then, she was forced in prostitution in a connection house in Libya in 2015 and in the Bois de Vincennes in Paris until the edict of the Oba in 2018. At that time she had given the "maman" 20000

euros out of 350000 euros of debt to be repaid. She stopped paying her but continued to prostitute herself because in a very precarious situation. One month after her travel to the Jura mountains, she goes to the BRP to file a complaint against trafficking networks but, terrified, remains very vague about her story.

The activities Nigerian women practice at the "permanence" don't act as techniques of neutralization of deviance (Sykes and Matza, 1957) but create unexpected situations of capacitation through which they reinvent themselves in the welcoming society.

Becoming familiar with the association, Nigerian women experience a new sense of home: the "permanence", equipped with a kitchen and a large room for meetings and training activities, turns into a hybrid space mixing a sense of intimacy and a sense of school. They might still share a room with eight women in apartments managed by "maman" or brokers in suburbs but each week they reach the "permanence" in Pigalle to feel their new "family of France", a few say. Little by little, they can develop a new reflexivity on their experience of prostitution. The first sign of a change in their attitude is the demand for housing to social workers: this implies that they have broken up their ties with Nigerian brokers and are eager to begin the path towards status regularization most appropriate to their situation.

The desire for affective response may strongly shape women's capacity for self-determination throughout her pathway from the Bois to the Court. Marguerite was prostituting herself in the Bois de Vincennes since early February 2016. She escaped from her "maman"'s home in Cagliari, in Italy, where she had started prostitution to repay an initial debt of 60000 euros, later negotiated to 40000 euros. The "maman" was married with a member of the cult organization Eiye Confraternity and, although she lived in Italy, Marguerite prostituted herself in Paris under the "maman"'s blackmail to kidnap her sister in Benin City. In 2016 Marguerite's boyfriend in Benin City, who acted as a broker between her and the "maman", moved from Milan to live in a Parisian suburb with Marguerite and gave her contacts to prostitute herself in the Bois de Vincennes. On March 2017, Marguerite reached at the association the social worker she used to meet in the Bois and told her about her relationship with the "maman" without mentioning the man. Marguerite didn't return to the association because the man beat her violently upon learning that she had told about the "maman" and that it could easily be traced back to him. Marguerite reimbursed the madame only 20000 euros until August 2017, she told the family that she had decided not to prostitute herself anymore but continued by handing over everything she earnt to her boyfriend to help him open a hair salon and marry her. Marguerite suffered repeated violence from the man when she used to express her desire to leave prostitution. Meanwhile, she got in touch with another association and she applied to OFPRA (*Office français de protection des réfugiés et apatrides*) for asylum, which was rejected in July 2018. In August 2018 she definitively broke up with her boyfriend and returned to the first association in September 2018. In March 2019 she filed a complaint against her "maman" to the BRP but in October 2019 her appeal to the CNDA (*Cour nationale du droit d'asile*) for asylum was rejected because her story was deemed stereotypical and not credible. In April 2022 Marguerite finally decided to provide a supplement to the BRP in which she revealed for the first time her boyfriend's role as broker with the madam, the latter's husband belonging to a cult organization and the network allowing the woman to move between France and Italy. In January 2023 she takes her ex-boyfriend to court and obtains his conviction while she falls in love with a Nigerian man who supports her for the trial. She becomes mother of two children while, engaging herself in training activities, she discovers her aptitude for construction painting and

obtains a contract of employment. She lives with her family in a social housing apartment but motherhood has forced her to give up the job.

The desire for social recognition is strong among women who file a complaint against trafficking networks. Apple bursts into tears of happiness when she realizes she has gained the freedom to work in Europe after her engagement with the French system of justice. Apple trembles as she holds in her hands the document authorizing her to work in France. "I went through five years of hell just because I wanted to work as a caregiver to elderly people", she repeats as she continues to cry in front of the Prefecture of Paris on June 2022.

The justice system however exposes women to re-traumatization. At the end of the trial against her ex-boyfriend Marguerite is shocked. He is sentenced to two years but he will not spend one in prison: only electronic bracelet and house arrest were provided. Furthermore, he leaves the court alone and some days later tries to get in touch with her again on Facebook but she will block him terrified. In 2020, the first trial took place in Paris in which a group of sixteen Nigerian girls who came of age, albeit as minors in 2015, filed as plaintiffs against Nigerian trafficking networks. Since then, they are still waiting to close a dramatic chapter in their lives that the justice system's timeframe does not allow an end to. Hearings and trials postponed, testimony repeated over and over again, on video and in person. But above all, what has been extremely controversial, as a lawyer notices, is the charismatic influence that men, rather than the "maman", exert on young women. When faced with the accused, one of them loses her words, remains silent, looks terrified and then unexpectedly becomes saddened and expressed compassion for the accused despite having received the maximum sentence as the girl herself wished.

There's another path, however, Nigerian women are increasingly practicing to leave prostitution. The law 2016-444 of April 13 2016 for the criminalization of clients decriminalizes prostitution and provides a new arrangement, the PSP (*Parcours de Sortie de la Prostitution*), with the aim to leave prostitution without declaring oneself victim of trafficking and going to Court. This law has for sure exacerbated the opposition abolitionists/pro-sex workers but little attention has been given to the results of the PSP. At only one association, from 2017 to the end of 2021, 38 persons started the PSP, 13 persons completed it. At the beginning of 2024, 67 persons are in PSP and 34 have completed it, have a contract of employment and residence papers. Despite initial resistance, the PSP is increasingly being used even by specialized associations on human trafficking for sexual exploitation. What is required is to provide firm evidence of interruption of prostitution on the basis of regular monitoring carried out by territorial commissions and social workers for two years.

Those who apply for PSP are mostly Nigerian women. They feel freer because they no longer need to persuade the court, as in the case of filing a complaint or applying for asylum. Hesitantly, they speak of new travel routes to Europe by plane, rather than Mediterranean crossings. Of interethnic networks forming around the institutional visa racket, rather than criminal traffickers. Of acts of disobedience to exploitation networks, rather than obedience to the juju. Of emotional isolation and sharp cuts with families in Nigeria. Of difficult entanglements between motherhood, housing and work in France. Of problems in re-entering ordinary life situations after a temporary "deviance", as Becker (1963) would say.

5. Conclusions

Nigerian women's experiences of prostitution in the Bois de Vincennes give research and policy-making three suggestions for understanding public spaces.

First, the moral and affective dimension of experience should be put in the foreground. Nigerian women's freedom does not coincide with the individualization and invisibilization of prostitutes as in the 1920s Chicago. Nor with a collective capacity to convert the troubles of prostitution to projects for sustainable development of the countries of origin, as in the case of the women of the Balkans. On route de la Pyramide freedom has a threefold nature. It is an impulse, with its visceral, unreflective, dimension of action. It is a desire, when a horizon of action appears. It is a non-linear process of capacitation when desire turns into ability to carry out plans, experimenting and changing plans.

Second, public spaces are frontiers of capacitation where material and immaterial transactions between human and non-human agents take place at different degrees of accessibility, publicity and visibility. Vans and their circulation turn public spaces into sites of disguised engagements and symbiosis with the world of Nigerian prostitution: Nigerian women's freedom, thus, collapses into an impulse for protection. Streets encounters between Nigerian women and social workers may disclose other possible horizons of life. Public spaces, thus, turn into "in-between spaces" where women experiment displacements towards new webs of life, partial replacements of old webs of life, accommodations between old and new webs of life, permanently in search of new balances between the desire for affective response and the desire for social recognition in welcoming societies.

Finally, we need to recover the political/cultural value of public spaces from the life histories of social groups in precarious living conditions. It has to be acknowledged that, despite constituting an international long-planned event, the Olympics Games – thanks also to the immigration law approved in January 2024 - are silencing public spaces as spaces of human capacitation, thus questioning what institutional accountability means in pluralistic societies. Only when research and policy-making will be really rooted in forms of experimental collaboration between people concerned by problems, experts and politicians, public spaces may turn into sources for just and inclusive territorial transformations.

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Study on Spatial Distribution of Fresh Supermarket Based on Street View Data

Abstract: People's demand for fresh agricultural products of fruits and vegetables is absolute, and the demand for fruits and vegetables is also continuous and regular. The outbreak of COVID-19 has increased people's requirements for food safety. At the same time, the emergence of the digital economy has gradually increased the number of take-out shopping methods that reduce contact with people. Based on open data such as Baidu map and Dianping combined with field research, this paper analyzes the distribution and use of fresh supermarket before and after the epidemic. The results showed that the epidemic further reduced the service radius of fresh supermarkets and reduced the accessibility of the roads where the stores were located. However, regional fresh markets with different online degrees have different degrees of change. Under the influence of the epidemic, fresh markets that are easier to reach and have distribution services have developed more strongly, thus distinguishing the distribution pattern of fresh stores in different regions. To a certain extent, Internet services have given stores stronger stability, and areas with perfect online development have been developed after the epidemic, and store location distribution is more closely related to geographical factors.

Key words: Fresh supermarket; Space Syntax; Space law; Accessibility

1 Research Background

In daily life, the fresh market, as an indispensable commercial type, provides people with fresh fruits and vegetables necessary for life. Under the impact of the epidemic, the importance of fresh markets has further increased, while take-out shopping methods that reduce human contact have gradually increased. During the pandemic, the daily necessities provided by the fresh market are relatively less affected; As a product supply business that must be consumed, fresh supermarket is closely related to the social economy, and the evolution of this business form can reflect the economic behavior pattern under the new purchasing environment.

At present, the use of big data for commercial spatial analysis has gradually become a new trend in commercial quantitative research. The public-oriented commercial institution point of interest (POI) data contains the spatial information of retail store location and the attribute information of business type, which is characterized by large data volume and strong real-time performance. It can improve the objectivity and accuracy of the hot spot identification of the commercial center and the analysis of the characteristics of the retail agglomeration area. With the development of information technology, the spatial analysis of commercial agglomeration by big data has gradually become a new trend of commercial quantitative research, providing more accurate judgment criteria and comprehensive technical support for urban planning and governance.

Most studies on open network data analyze the urban spatial structure through the overall business composition and apply it to urban assessment and guide urban design. For example, Zheng Xiaowei (2017) analyzed the urban and community-level service industry based on open data. The urban center system determined in the overall urban planning should be identified, and the main business forms and spatial agglomeration degree of various urban center service industries should be clarified to guide urban design [2]. On the block scale, the factors that affect the vitality of the site are judged by the quantitative evaluation of the component elements in the local area. For example, Zhao Nannan et al. found the influencing factors that affect the vitality of the commercial street of Binjiang Road through the analysis of the Dianping data [3]. Some scholars also analyze the composition of regional formats based on open data to know relevant designs. For example, Professor Sheng Qiang conducted regional potential evaluation through open data and applied it to the quantitative evaluation and comparison of different schemes [4]. Tan Xin obtained the data and attribute information of restaurants in the main urban area of Beijing and analyzed the influencing factors according to the Sixth National Population Census, Beijing Statistical Yearbook, Beijing Master Plan, Beijing Municipal Commission of Tourism Development, basic Geographic Information Network, Baidu Map, Dianping, Fantong, etc. [5]. Jiao Yao et al. obtained the business distribution of Guangzhou through Baidu map POI, and analyzed the relationship between urban land expansion, real estate expansion and commercial business space [6]. Yan Longxu obtained and distinguished the locations of catering shops and online shops under Shanghai's inner ring Road through open data such as Ele. me and Dianping, and summarized the distribution characteristics of the two [7]. Xia Lingjun et al. obtained the catering data of 355 cities in China through Dianping data and analyzed its distribution pattern, characteristics and influencing factors [8]. Wu Jianxun et al. obtained the location data of catering shops in Nanning through the open data of AmAP and analyzed the distribution and evolution of catering space [9].

Theoretically, Space Syntax theory holds that the topology of street network determines the state of motion distribution, while commercial functions are directly dependent on traffic flow [10]. For example, Shengqiang's team also found that the overall business distribution topology was obvious in many cases in Jilin and Beijing [11,12]. Through the correlation between the composition ratio of housing service facilities and syntactic parameters, Zhu Xuhuan obtained the business formation and layout rules of typical residential areas where commerce meets residents' needs [13]. In addition, the distribution law of a certain type of business is studied. For example, Tao Wei et al. explored the spatial layout law of the hotel industry from three perspectives, including the urban road network form [14]. Most studies on fresh supermarkets focus on the sales model or distribution law of certain fresh supermarkets. For example, Wang Lei et al. found the effectiveness of the hybrid innovative sales model through the case analysis of Metro Fresh supermarket [15]. As well as Wang Yun's analysis of the distribution of S fresh supermarket, the optimal site selection scheme was obtained [16]. Xiang Persisted et al. obtained the influencing factors by constructing the structural model of customer satisfaction of Hema Fresh Food [17]. On the whole, there are few researches on the distribution law of fresh supermarket at the block level by using Space Syntax.

In the study on the impact of the epidemic on industrial distribution, before the epidemic, domestic and foreign studies were carried out on the impact of various epidemics and treatment measures on the economy, including the impact of the epidemic on the market economy [18, 19] and the impact on the hotel and catering industries [20]. In the existing studies related to COVID-19, most scholars believe that COVID-19 has caused a serious negative impact on China's macro economy, but also triggered structural changes in the industry [21]. In the recent studies, Wang Yangjie et al. also proposed that the epidemic will promote the development of industry digitalization [22, 23]. In terms of the development of fresh e-commerce, the impact of product supply, logistics distribution and other aspects has been mostly analyzed [24, 25], while there are few studies on the actual distribution of business formats after the epidemic.

Based on the above background, this study, based on open network data, applied Space Syntax to study the distribution and evolution rules of fresh supermarkets in three regions of Beijing during the epidemic period, and tried to analyze the change rules and influencing factors of fresh supermarkets under the influence of the epidemic.

2. Research Data And Methods

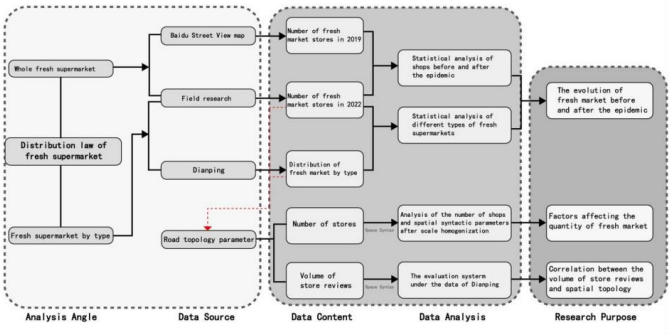
2.1 Research Object And Technical Route

The fresh market in three regions of Beijing is selected as the research object in the research area (FIG. 1). After comparing and screening the surrounding environment, road network characteristics, permanent population and other data, three similar plots located in Haidian District, Fengtai District and Chaoyang District of Beijing are finally selected. Since the constituency does not cover the whole district, the plots within the research scope are named A, B and C respectively.

Figures 1. Study area diagram

The data of fresh supermarket in three regions are studied in multiple dimensions, which can be divided into two perspectives: the whole fresh supermarket and the sub-type fresh supermarket. For the overall analysis of fresh supermarkets, Baidu map and Baidu Street View map data were used to obtain the number and location of fresh supermarkets in 2019 and 2023. The changes in the number

and distribution of fresh supermarkets before and after the epidemic were obtained through statistical analysis and Space Syntax analysis, and the correlation between their distribution and surrounding influencing factors was also analyzed. The factors affecting the quantity of fresh market are analyzed. According to the information of stores on Dianping and Meituan, the fresh supermarket is divided into offline stores and online stores. Through the regression relationship of Dianping data and Space Syntax parameters, the difference between the distribution of the fresh supermarket in store mode and the fresh supermarket in store plus distribution is analyzed.



Figures 2 Technology roadmap

2.2 Data Processing Method And Model Independent Variable Selection

2.3.1 Analysis Of Changes In The Quantity Of Fresh Market

The subjects were selected as markets, supermarkets, vegetable shops and other stores that provide daily food. In the analysis of changes in the fresh market in 2019 and 2023, the market in 2019 was obtained by the street view pictures provided by the Baidu Map time machine, and the market in 2023 was obtained by the POI capture and proofread combined with field research (Figure 4). In the comparison of the period before and after the epidemic, the changes in the overall number of fresh market were divided into three conditions: new (no stores in 2019, no stores in 2023), stable (no stores in 2019, no stores in 2023), and disappeared (no stores in 2019, no stores in 2023).

2.3.2 Selection Of Influencing Factors Of Fresh Market Distribution

The Integration of Space Syntax refers to the shortest topological distance between a certain street segment and all other street segments within a certain geometric distance, which measures the spatial potential of reaching a certain street. Choice is the number of times a certain street segment is crossed by the shortest topological path of any two other streets within a certain geometric distance, which measures the spatial potential of crossing the street [1]. On the basis of these two indicators, Bill Hillier et al proposed standardized Angle selection (NACH) and standardized Angle integration (NAIN), aiming to further eliminate the influence of the number of line segments on the analysis, so as to realize the comparison of spatial systems with different scales and complexity. On the basis of the four types of

parameters, five different distance radii representing walking, non-motor vehicle and motor vehicle were selected for analysis, namely 750m and 1000m for walkers, 2000m and 3000m for non-motor vehicles and 5000m for motor vehicles, and the syntactic parameters were analyzed respectively.

Fresh supermarkets are generally located near living areas, and their main consumers come from surrounding residents. Therefore, the number of residents in mobile signaling data is selected as the population influencing factor. For road factors, parameters such as degree of selection and degree of integration in Space Syntax are selected. At the street level, the number of shops is correlated with population and road through the homogenization process of street summing.

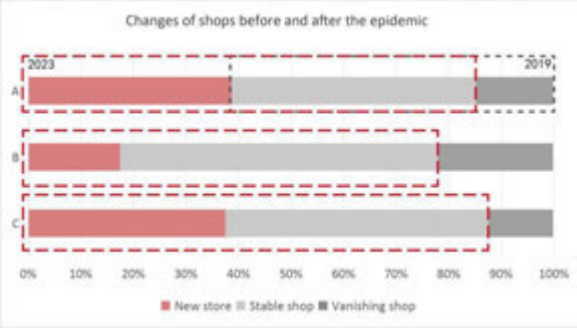
2.3.3 Classification Fresh Market Data Processing

The fresh market is divided into two types. According to the store information on Dianping and Meituan, the fresh supermarket is divided into offline stores that only rely on customers' offline purchase, and online stores with review and delivery services on Dianping, Meituan and other online stores.

3 Analysis Of Changes In Fresh Market

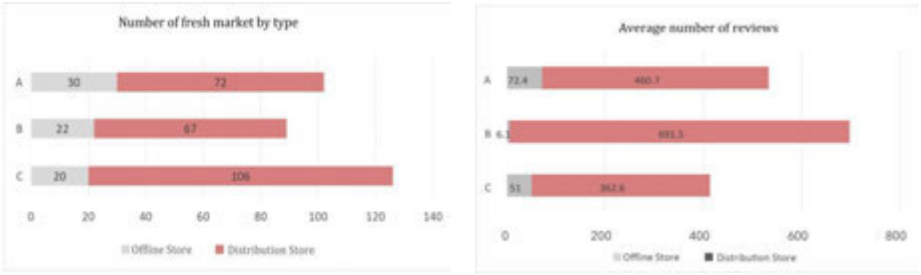
3.1 The Number And Online Presence Of Fresh Supermarkets Before And After The Epidemic

The distribution location of fresh supermarket in the region is obtained according to Baidu map (Figure 5), and the information of fresh supermarket is corrected through Baidu Street View map and POI data. Among the data in 2023, there were 132 effective fresh supermarkets in region A, 60 were added after the epidemic, 72 remained stable, and 23 disappeared. There are 126 effective fresh supermarkets in region B, 30 new after the epidemic, 104 stable, and 38 disappeared; There are 115 effective fresh supermarkets in area C, 54 new after the epidemic, 72 stable, and 18 disappeared.



Figures 3 Changes in the quantity of fresh market

Through Dianping and Meituan Distribution, fresh supermarkets in the region are further classified into online and offline types. Among them, online market refers to stores with a large number of comments on the cable. Citizens can obtain their location from Dianping software and understand the comment information such as product quality and service, and have distribution services. The offline market requires citizens to buy offline, and some markets have review services, but they do not have delivery services.



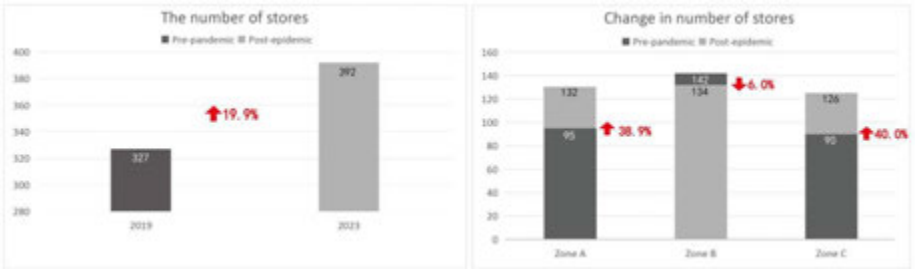
Figures 4 Number of stores in the three regions (left) and number of comments by type (right)

According to the proportion, the number of two types of supermarkets in the three regions is similar. When analyzing the volume of reviews, the volume of reviews of online stores is much higher than that of offline stores. In the comparison of the number of comments in the three regions, the average number of comments in the B region is much higher than that in the AC region, which further indicates that under the influence of the overall business atmosphere in the Chaoyang region, the fresh supermarkets in the region show strong information characteristics.

In the analysis of stores by type and the average number of reviews, the stores with delivery service in the three regions all showed a higher number of reviews. Based on the comparison of the comment rate and the average number of comments, relatively speaking, region B has a relatively concentrated online fresh market, and the online market has a considerable number of consumer audiences. The proportion of online stores in AC region is less, and consumer groups tend to choose offline purchases.

3.2 Changes In The Number And Distribution Of Fresh Supermarkets Before And After The Epidemic

Based on the overall number of fresh markets in the three regions and the online situation, the change of the number and the average distance between stores before and after the epidemic were analyzed.



Figures 5 Changes in the quantity of fresh market before and after the epidemic

For the whole study area, the number of fresh supermarkets increased significantly after the epidemic. For the fresh market in each region, the number of fresh market in AC region increased significantly, while the number in B region decreased slightly. For the average store spacing, the average store spacing in AC region decreased during the epidemic period, while it increased slightly in B region.

Figures 6 Changes in average store spacing

Under the influence of the epidemic, the quantity distribution of the fresh market has changed, and the overall trend is growing. At the same time, its distribution position also changed. This paper used Space Syntax software to position the market before and after the epidemic, and calculated its walking accessibility and vehicle accessibility respectively. The accessibility changes within the whole region were compared with the accessibility changes in each sub-region, so as to judge the distribution trend.

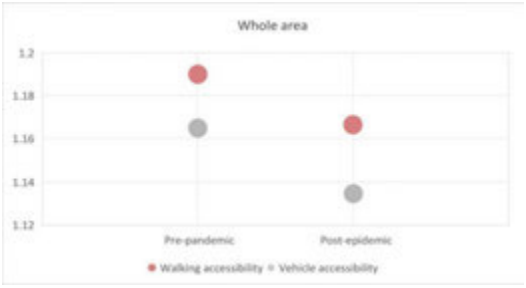


Figure 7 Changes in accessibility before and after the epidemic

Figures 8 Total number of reviews of stores in the three regions (left) and average number of reviews by type (right)

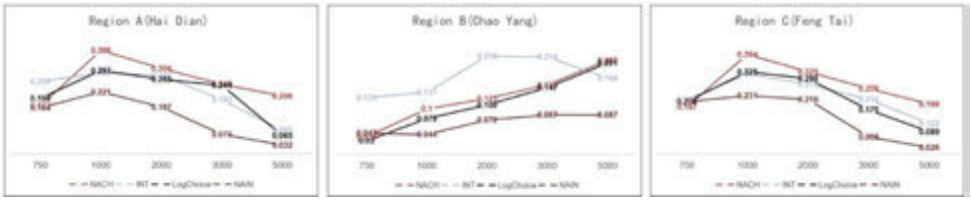
According to the analysis of the above figure, the walking accessibility and motor vehicle accessibility of the fresh market both show a downward trend; In the comparison of the three regions, the accessibility of shops in the three regions decreased, but to different degrees. The distribution accessibility of region B was lower than that of AC, but the accessibility changed little under the influence of the epidemic, and even the accessibility of motor vehicles was slightly improved.

The results showed that the total number of fresh market increased when people reduced long-distance shopping after the epidemic. But the impact varies in different regions. The obvious increase in the number of markets in AC region reflects the further increase in the demand for fresh markets under the epidemic situation. However, judging from the stable or even reduced number of stores in B region, the growth of the fresh market is limited to a certain extent. The average distance between stores in the three regions is also related to the quantity change, and the distribution radius of AC fresh market is further reduced, and finally reaches the same as that of region B. At the same time, this change may also be related to the degree of regional market online, the high-line B region showed stronger stability during the epidemic, while the AC region with a lower degree of network distribution service had a greater impact. In addition, under the impact of the epidemic, the distribution of shops has further reduced the requirements for road accessibility, and shops located in hard-to-reach back streets and alleys have become relatively more "safe" shopping choices.

4 Factors Affecting The Distribution Of Fresh Market

4.1 Distribution Law Of Fresh Market Quantity After Epidemic

The distribution of the fresh market is often related to road accessibility. When Space Syntax parameters are applied to analyze the distribution of the number of shops and the number of comments, in order to eliminate the interference of accidental factors in the space and reduce the numerical differences of adjacent space units, the number of shops within a 500M radius along the street is added up, and the parameters of integration degree and selection degree in Space Syntax are selected. Then the correlation analysis is made with the syntactic parameters in five different radii.



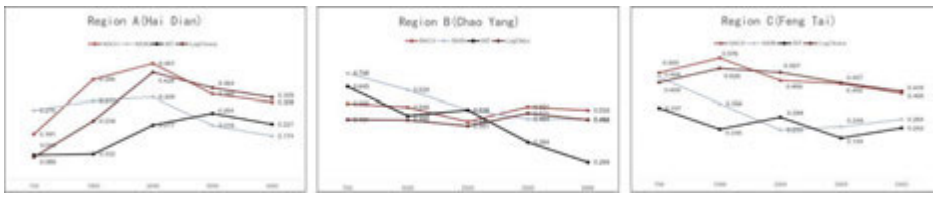
Figures. 9. Three-region regression analysis in 2023

In the analysis of the correlation between the number of fresh supermarkets and the urban topological structure, AC region has the highest correlation with the traversability parameter of 1000m radius, which indicates that supermarkets are greatly affected by the accessibility potential, and the number of supermarkets is significantly affected by the walking flow. However, the correlation between the number of fresh supermarkets and the pedestrian flow in area B is not strong, and the highest correlation is the travel degree parameter of the radius of 5000 meters. This phenomenon may be caused by the influence of the concentration of business districts in Chaoyang District, which makes the fresh supermarkets in this area have more characteristics of urban commerce.

Overall, when there is a high correlation between the number of fresh markets and road influencing factors, walking flow is often the decisive factor. In the case of the same radius, the traversal parameter correlation tends to have a higher correlation, which proves that the fresh market tends to be distributed on streets that are easier to cross. They tend to be on streets that are easier to cross.

4.2 Distribution Law Of Online Fresh Market

Since the online degree of shops in the three regions is different, the number of shop comments is taken as the research object to further explore the relationship between online shop sales and road topology.



Figures. 10 Correlation between review volume and accessibility in the three regions

On the whole, the number of shop reviews in region A is highly correlated with the selectivity parameter, indicating that shops distributed on roads with high travel are more likely to be patronized by customers. The peak values of integration parameters are all at R2000m, indicating that their distribution is more susceptible to the influence of non-motor vehicle flow. The number of shop comments in area B is highly correlated with the parameters of the integration degree system, indicating that shops are greatly affected by the accessibility potential, and the peaks of the integration degree parameters are all at R750m, indicating that their distribution is more susceptible to the influence of walking traffic. The number of shop comments in area C is highly correlated with the selectivity parameter, indicating that shops are greatly affected by the degree of travel, while the peaks of the integration parameter are all at R1000m, indicating that their distribution is more susceptible to the influence of walking traffic.

According to the parameter analysis of the three regions with the highest correlation, the stores in AC region are more inclined to be distributed in the area with high intensity of pedestrian traffic, while the stores in B region are distributed in the area with high degree of road aggregation. Among them, the regularity of store distribution in area B is relatively weak, which may be related to the high degree of online. The correlation between the number of fresh markets and the number of reviews and the urban topological structure is confirmed, while in the area with the gradual improvement of online development, the store location is to a certain extent free from the influence of geographical factors, which is also verified in area B.

5 Conclusion and discussion

The results showed that: in terms of the overall fresh market, the epidemic increased the number of fresh supermarkets and further reduced the service radius, and the service radius after the epidemic was about 350M. At the same time, the accessibility of store distribution was reduced, and stores located on remote roads were more easily selected by customers. In the comparison between regions, the regions with a relatively high proportion of online stores were less affected, and the number of stores in the region did not change significantly before and after the epidemic, and the business format was more resilient, while the number of fresh supermarkets in the regions with a low proportion of online stores increased significantly after the epidemic.

In the analysis of market and road accessibility after the epidemic, the regions with more online markets are correlated with the degree of road integration, and the market is concentrated in the regions with more dense roads, while the regional market distribution with more offline markets is correlated with the degree of road travel, and is more dependent on the intensity of road traffic flow. The number of shops in the two types of areas is greatly affected by the demand for short-distance travel. In the comparison of the correlation between the number of online fresh market reviews and accessibility, the stores with higher review volume were distributed in the sections with better accessibility and were more affected by geographical factors.

Therefore, the epidemic may have the following impacts on the distribution of fresh markets: In terms of the quantity change and distribution law, the number of fresh markets increased, and the relative distance between markets decreased, which proved that the demand for fresh products by surrounding residents further increased, and they were more inclined to reach the purchase demand in a small range. After the epidemic, the geographical location of the newly added markets tended to be far away from the area where people and vehicles gathered. The distribution characteristics of different regions showed similar accessibility in small-radius road distribution, which indicated that the construction purpose of fresh market was similar to that of nearby communities and easy to walk during the epidemic period. In terms of online service and distribution service stores, because online delivery service can ignore the impact of the actual geographical factors of the market on consumers, the fresh market is less affected under the epidemic situation, and the number of regional stores with a high degree of online service can provide distribution services changes less. However, in areas with insufficient online access, people often choose to buy consumer goods in nearby fresh markets under the impact of the epidemic, and the demand for smaller markets increases, resulting in an increase in the number of fresh markets. In short, under the impact of the epidemic, more accessible store locations and contactless delivery services have been stronger development, and therefore affect the distribution pattern of these fresh stores in the region.

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Repurposing abandoned transport infrastructure towards social inclusion: The case of Baana, Helsinki

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Abstract

With globally increasing challenges for the role of public spaces and their contribution to inclusion and justice within urban settings, this article examines the repurposing of transport infrastructure to provide dedicated walking and cycling public spaces, specifically the case of Baana in Helsinki, Finland, a former freight railway conduit. Building on the concepts of mobility design and walking as a social experience, the article examines Baana's role both as a non-motorised transit space, and one supporting fluid encounters among diverse users. The impact of Baana's design is examined – in terms of utility, attractiveness, and symbolism – on pedestrians' activities, experiences, and perceptions. Initial findings reveal Baana's barriers and potentials and serve to develop further research on addressing differential pedestrian experiences, to inform future mobility design processes.

Keywords: Baana, fluid encounters, Helsinki, inclusion, mobility design

Repurposing abandoned transport infrastructure towards social inclusion: The case of Baana, Helsinki

1. Introduction

Concerns with the environment have triggered interest in non-motorised mobility, with a focus on its utilitarian performance within transport planning (Maciorowski and Souza, 2018). Yet, non-motorised mobility affects liveability, including aspects of justice and inclusion. Cities have resorted to different approaches to promote walking and cycling, sometimes through repurposing transport infrastructure as in New York's Highline project (Davis and Gray, 2019; Lang and Rothenberg, 2017; Millington, 2015), or redesigning public spaces, including streets, which was prominent following the COVID-19 pandemic (Mukhtar et al., 2024). Understanding the relation between non-motorised mobility environments and social aspects requires an investigation beyond exploring the physical environment that addresses the utilitarian, physical act of commuting, towards considering influences of and on social practices and experiences during mobility (Sheller and Urry, 2006). Building on concepts of walking as a social practice, and mobility design, this article presents an understanding of design for walking, while considering the value of walking beyond the necessary or optional commuting activity. This research could inform planning for 'walking-friendly cities' often characterised by the environment supporting social inclusion, health, and economic benefits, and walking's potential role in generating inclusive individual experiences and social encounters (Middleton, 2018, p. 299).

Literature on mobility design identified several research gaps, one being the lack of combined analysis of functional, aesthetic, and symbolic aspects of urban environments and their impact on mobility at micro-scales (Blitz and Lanzendorf, 2020; Mehta and Bosson, 2021). This article provides such an analysis at the micro-scale for one case study through a mixed-methods methodology. The case study focuses on the initial segment of Baana in Helsinki, a network for cycling and walking, which transformed a former railway corridor for non-motorised mobility. This article presents the initial phase of a broader research on Baana, and addresses the following questions: What design elements, aesthetics, and symbolic aspects in Baana promote walking beyond the necessary activity? How is Baana perceived while walking?

2. Framing walking in lived public space beyond a transit activity

Walking is simultaneously a human right and a social practice, which enables different types of interactions based on the pedestrian's positionality (Creswell, 2009; Kanellopoulou, 2017; Scarponi et al., 2023). Walking is the oldest and least environmentally impactful mode of mobility, yet within transport planning it is often considered as secondary compared to other modes, and is reduced to a necessary linear, transit, commuting function, which occurs on the street or while traversing other public spaces. The utilitarian perspective has been questioned with the mobility turn, to emphasise walking's several 'types, forms, and characteristics' including the experiential, perceptual and social (Gehl, 2011; Middleton, 2018, p. 299; Sheller and Urry, 2006).

While walking, urban spaces unfold sequentially, affect the pedestrian, and change the experience of a place depending on pedestrians' flows and practices (Kanellopoulou, 2017; Lehtovuori, 2012). Walking is differential and relational; it varies depending on the combination of the environment comprising actors and objects simultaneously present, with a grafting of perceptions, meanings, memories, and experiences onto the space (Koohsari, Karakiewicz, and Kaczynski, 2013). The relational perspective is tied to Lefebvre's (1991) production of space explained as the interaction of planned and designed physical space, symbolism and users' social practices that affect space.

Walking is a multisensory activity that allows the pedestrian to reinterpret or even reconfigure them or interact with the city. The aesthetics and symbols generated within the environment, objects and 'human and nonhuman agents' interacting with the pedestrian, walking as a multisensory experience allows the pedestrian first to interpret stimuli – both material and immaterial such as signs, or mnemonic triggers – and second to attribute meanings to urban locations – including those related to safety, and inclusion (De Certeau, 1984; Hebbert, 2005; Kanellopoulou's, 2017, p. 188; Middleton, 2018; Mehta and Bosson, 2023; Sheller and Urry, 2006, p. 214).

The sociality of urban walking explores the actors involved, the type of involvement (how or why) and the consequences of this interaction. Depending on socio-cultural factors, encounters while walking could generate different verbal and non-verbal social interaction to various degrees, or even exclude users (Blokland, 2017; Middleton, 2018). Walking 'provides opportunities for social interaction' that could be direct or indirect, serendipitous 'fluid encounters' occurring once, or more enduring 'public familiarity', with others including maintenance staff, or law enforcement personnel, unhoused persons, youth, elderly and so on (Blokland, 2017, p. 553, 561; Kanellopoulou, 2017, p. 188; Sheller and Urry, 2006). Public familiarity refers to recognising strangers through recurrence or shared social practices, and actively or passively communicating among individuals based on tacit knowledge and unspoken norms (Blokland, 2017; Middleton, 2018, p. 308; Scarponi et al., 2023). Walking as a social practice varies in purpose and type, and entails improvisation, 'tactical learning' and adapting to different spatio-temporal rhythms while walking (Blokaland, 2017). Examples of interactions range from encounters while walking a dog, strolling, pushing a buggy, jogging, taking a shortcut, or 'emergent issues' such as an object, animal or person traversing one's path (Koohsari, Karakiewicz, and Kaczynski, 2013; Mehta and Bosson, 2021; Middleton, 2018, p. 305; Scarponi et al., 2023). It is the diverse types of sociality at the micro-scale that leads to negotiation, contestation, degrees of inclusion in public spaces, or the right to determine one's position as a pedestrian in urban spaces (Blokland, 2017; Middleton, 2018). While walking, sociability, and encounter 'are central components of urban public space' and become a resource for ensuring inclusion (Blokland, 2017, p. 560). The seemingly arbitrary encounters along the spectrum from the incidental to the sustained are often tied to spatio-temporal rhythms (recurrences at specific locations), which could be facilitated by mobility design. It is this simultaneous experience of individualism or being part of a crowd, which affect social interaction that urban spaces enable, (Blokland, 2017). While designing for walking, all types of encounters should be considered to understand and address the potentials and risks of 'subtle

forms of exclusion and the resulting reinforcement of structural inequalities' (Blokland, 2017, p. 554). This is where the investigation of aesthetics and symbolism of walking environments that could have exclusionary or inclusionary roles, is important.

Therefore, a micro-scale analysis is needed to understand the multisensory, dynamic walking experience – which is based on synergies rather than isolated elements – to ensure that designing for walking encourages social encounters essential for inclusive urban experiences (Middleton, 2018, p. 301; Scarponi et al., 2023; Spinney et al., 2015).

3 Designing for walking

Non-motorised mobility design covers various aspects of the built environment, starting with environmental considerations based on promoting a modal shift to impact travel behaviour away from the automobile, rather than promoting health and wellbeing (Blitz and Lanzendorf, 2020; Cook et al., 2022; Lozzi and Monachino, 2021; Mehta and Bosson, 2021). Planning for integrated, well connected, and continuous pedestrian flows, which are safe vis-à-vis vehicular traffic, are among the factors considered to encourage panoply of activities by diverse users (Blitz and Lanzendorf, 2020; Maciorowski, and Souza, 2018). The focus is often on ensuring travel safety while paying little attention to walking as a social activity, reducing it to a mode among other, which could be excluded in some urban environments (Maciorowski, and Souza, 2018). On streets, priority is given to automobility flows, while pedestrians wait for green signals along traffic-control barriers, which raises concerns about spatial justice, affects the experience and social practice of walking (Cohen and Almarwani, 2022; Kanellopoulou, 2017).

Cervero and Kockelman's (1997) seminal work on non-motorised mobility design refers to the impact of density of users, diversity of land use and building configuration, and design of the street network, with less emphasis on the aesthetic and symbolic, for instance how benches, lighting or vegetation affect walkability. Other considerations have been added such as accessibility and travel distances (Ewing and Cervero, 2010). Equally, considerations of pedestrians' needs, attitudes, perceptions, and experiences, relate to design's functional, aesthetic, and symbolic aspects of mobility spaces. Blitz and Lanzendorf (2020, p. 1) explain these three interrelated aspects as: the utilitarian dimension offering the possibility to commute on foot; attractive environments that trigger appreciation to walk through; and the 'semantic content' and signs that support pedestrian's construction of meanings attached to these environments. These aspects recall literature on liveable streets, which offer sufficient support from the surroundings for diverse activities that encourage spontaneous interaction among strangers (Sauter and Huettenmoser, 2008). This space-object relation together with the users' experiences, generates meanings, creates affordances that could contribute to pedestrians shaping or redefining the space with opportunities for social interaction (Mehta and Bosson, 2021). Lively streets require collaborative design processes for permeability, interaction with street frontages, designating areas for non-motorised mobility, and considerations for integrating various amenities including vegetation, and 'community-gathering places' (Al Mushayt et al., 2021; Mehta and Bosson, 2021: p. 160). In relation to the three aspects, material and immaterial obstacles could discourage walking and reduce social interaction.

On the functional level, planning and design implicitly outline power relations among urban modes of mobility, defining when, where and what pedestrians can do (Middleton, 2018). Obstacles to walking could relate to speed, ability to stay stationery, waiting at intersections, and issues of safety in shared mobility spaces, where different mobility modes negotiate priority, with limitations for the visually or hearing impaired as an example (Curl, Ward-Thompson and Aspinall, 2015; Middlteon, 2018). Aesthetically, spaces for walking should be designed as physically attractive and positively stimulating the senses through colours, materials, sounds, light, vegetation, amenities, comfort from weather conditions, providing vistas, and maintenance, which have an impact on mental wellbeing and perceptions of safety (Blitz and Lanzendorf, 2020; Koohsari et al., 2012; Scarponi et al., 2023). Symbolically, the provided information with direct or indirect signifiers could register different interpretations for the pedestrian, which are socio-culturally embedded. This includes signage, advertisements, presence of specific amenities, art, the design of the space and the objects in it, which could signify safety, who and how to use them – based on age, gender, or other user traits – and whether interaction within and with them is possible (for example changing surface material to designate walking or cycling, edges that provide affordance and so on).

Further attention should be given to safety as it is influenced by functional, aesthetic, and symbolic aspects, especially if different user groups are considered (Scarponi et al., 2023). The term safety refers to harm from vehicles or cyclists (clearly delineated paths or separate paths – addressed by transport planning), harm from the physical space (egress points, visibility, lighting, provision of amenities – addressed by designers) or harm from other people (addressed by security and governance). Safety varies temporally according to the pedestrian's positionality (considering the complexity of safety perceptions that are embedded in the pedestrian's individual past experiences and influenced by socio-cultural factors).

In summary, mobility design contributes to the design of public spaces at the intersection of transportation and urban planning and at the scales of urban design, landscape design, and architecture. The output should address the individual who makes decisions whether, when, and where to walk. Spaces designed for mobility become the communication medium between the city and the pedestrian, determining walking duration, and types. Spaces designed for walking should be functional, attractive, comfortable, safe, and enable social encounters (Scarponi et al., 2023).

4. Methodology

To identify opportunities and obstacles for social encounters and inform future considerations towards increasing the role of walking in social inclusion, a micro-scale approach enables juxtaposing planning and design aspects of the public space with walking experiences. The relations between utilitarian walking and walking as a social, multisensory practice are analysed in relation to Baana's planning and design.

Several methods are used to respond to the two research questions (Table 1). Mapping using existing City of Helsinki maps served to position Baana contextually in relation to the street network. In addition to information available on the city's website, three interviews with

planners and one designer from Helsinki City served to inform considerations for walking and pedestrians related to the research questions. A walk-along observation method akin to 'mobile ethnography' was conducted to locate while walking aspects related to comfort, attractiveness, and safety. This method allowed for describing the multisensory experience along the unfolding of the path while walking (Kanellopoulou, 2017; Middleton, 2018; Sheller and Urry, 2006: p. 217-218). Participant observation in the form of 'copresent immersion' for one year by walking along Baana served to directly observe copresence and types of interactions, while 'time-space diaries', and taking photographs were used in both observation methods (Middleton, 2018; Sheller and Urry, 2006: p. 218).

Table 1: Methodological overview

Method	Input	Output
Mapping	. Helsinki City maps (City of Helsinki 3) . Kartta Helsinki maps (City of Helsinki Map Service 4) . Openstreet maps . Helsinki transport HSL (Helsinki Regional Transport Authority) . Helsinki Region Infoshare . Google Earth	- Sub-districts - Roads and urban blocks - Main landmarks - Traffic intersections - Public transport stops - City bicycle seasonal locations - Baana initial segment
Interviews	Helsinki City planning department: . Interview 1 with transport planner 19 January 2024 . Interview 2 with non-motorised mobility planner 26 March 2024 . Interview 3 with architect, urban design 25 April 2024	-Inclusion and justice -Connectivity and networking of Baana -Considerations while designing for pedestrians -User feedback -Design considerations for the southern part of Baana
Walk-along observation	. Epicollect5 mobile application with questionnaire conducted on 30 March 2024 . QGIS	-Photographs and sound recordings (traffic, birds, other) at 94 spot locations with short notes -Map of spot observations on: . pleasant the spot is (scale 1 to 3, very, neutral, unpleasant) . safety perception (scale 1 to 3 very safe, unsure unsafe) . windy or sheltered (scale 1 to 2) . sunny or shaded (scale 1 to 2)
Participant observation	Mobile phone camera and voice recorder Visits between May 2023 and May 2024	Walking all along the segment and registering recording: -Seasonal changes -Construction-related changes -Users -Activities, events -Posts on bins and utility boxes -Materials

		-Signage -Art -Urban furniture -Vegetation -Types of walls

5. The Baana

The segment researched in this article is the former seven-metre-deep freight railway corridor that was constructed in 1894 and divided the city despite the seven bridges across it. This corridor stopped working in 2008 when the cargo port was relocated and the western harbour was transformed to a residential area, which required establishing connectivity with the city centre (Bravo, 2022). Following participatory planning, with residents and university students, and a competition for the transformation of this conduit, the Baana transformation was completed in 2012. The design maintained the industrial memory of Baana, first with the name referring to the railway, 'the series of landscaped and garden areas full of suggestive railway motifs', maintaining the existing wild vegetation and adding 'flowering creepers, several varieties of tall grass, and different types of bushes with perennial foliage to give an individual touch to each section of the cutting', keeping the original colours, materials and structures – including the seven bridges, while adding stairs to increase permeability along Baana – except for the sports zone, which alluded to the colourful containers once transported on the freight trains. The sports facilities include a basketball court, table tennis and pétanque pitches (Morethangreen, n.d.). Baana is described as 'austere, versatile and resistant project of recycling the railway track … so enthusiastically received by very different kinds of users.' In 2014, Baana received a special mention in the European Public Space prize for the collaboration and repurposing of obsolete infrastructure for non-motorised mobility, reducing the barrier effect and reconnecting the city with a non-commercial public space for 'recreation, sports and art' (David, 2022; Good News Finland, 2014; Nordregio, 2018). The provided amenities from sports to green spaces and 'picnic tables' converted Baana to 'an urban living room' (Nordregio, 2018). Moreover, Baana's success sparked the city authorities to consider implementing a non-motorised network starting from the centre, a project that has also inspired other countries (Nordregio, 2018). The initial 1.3-kilometre Baana stretch replacing the abandoned railway, became a concept for cycling highways as part of Helsinki City's vision to promote sustainable mobility and complete 150 kilometres of cycling paths (see City of Helsinki 3). (Figures 1).

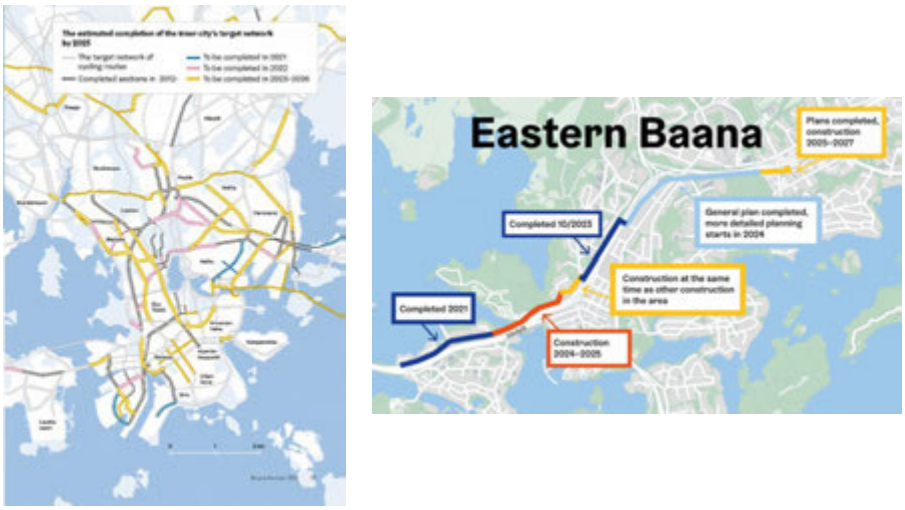

Figure 1: The cycling network and the Baana alignment (source: City of Helsinki 1, 2)

6. Analysis of findings

The analysis first positions Baana contextually, analyses it through functional, aesthetics, and symbolic design aspects. Next these findings are juxtaposed with findings from walking as a dynamic, multisensory social experience, to reveal levels of social interactions, and how Baana encourages or deters them.

Within the Helsinki City district, Baana is orientated north-east to southwest, which in this analysis is referred to as 'north' and 'south'. To the north, Baana starts at the cultural hub with the largest linear park in Helsinki, surrounded by the parliament and its extension, Oodi central library, the Music Hall, and Kiasma museum. The hub is in proximity to the central railway station, other museums, and cultural buildings. To the south, the Ruoholahti (west harbour) is a mixed-use area, predominantly residential, with offices, commercial, educational, and cultural activities. Between Baana's two ends, there are ten sub-districts, with different character areas, including mixed building uses with diverse architectural characters (Figure 2). Public transport stops are located along Baana with tramway routes at both ends, bus lines along the parallel and traversing roads. The nearest bus and metro station is east at Kamppi. Seasonally, there are four city bicycle points along Baana, one at the south end, and several in its vicinity. To the south, the tramway passes through a shared space with vehicles, bicycles, and pedestrians.

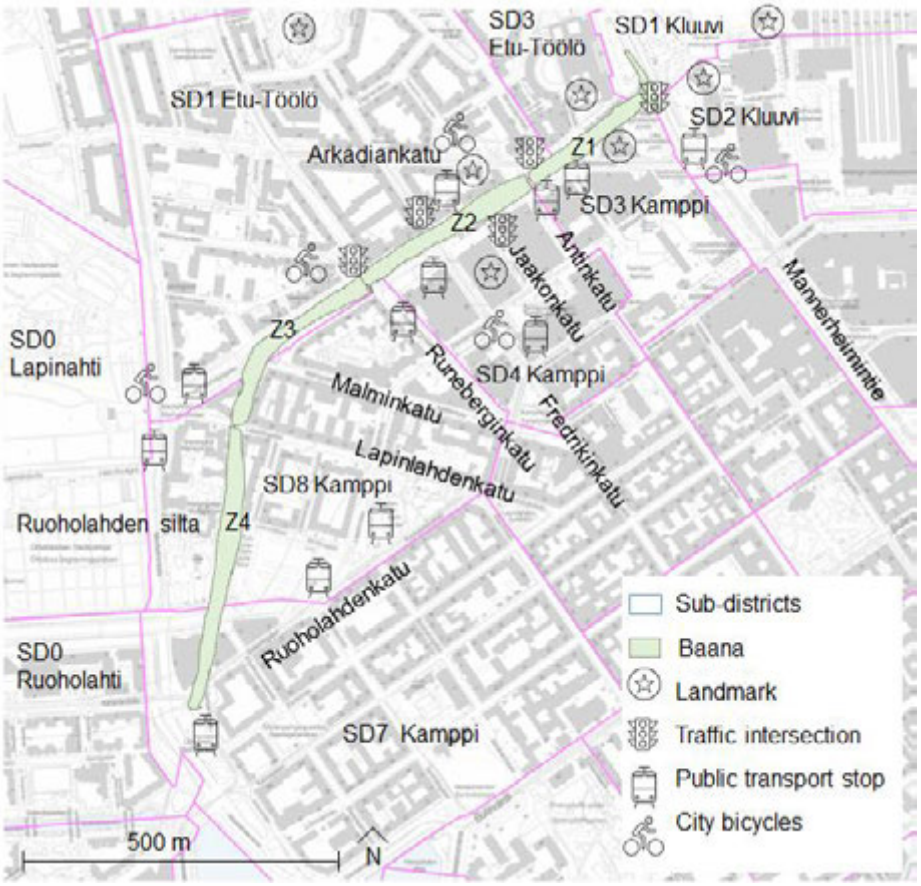

Figure 2: The Baana in between Oodi north-east and Ruoholahti south-west (Source: by author and basemap from City of Helsinki Map Services)

The decision to transform Baana aligns with Helsinki's city planning principles for 'social security, feeling of safety and attractive urban spaces, and provision of a cycling network.' (Interview 1) However, walking is still considered as a mode of transport, whereby one planner emphasised on 'understanding the term 'pedestrian' in relation to 'mobility and to streets and crossing' (Interview 1). The other planner stressed 'that everybody can walk and should walk more, and the goal is to provide safer, liveable streets and choices for the modes of transport on an everyday life basis.' (Interview 2) Both planners indicated 'the focus is on street liveability, creating places and connections to encourage short-distance walking and pedestrian routes' (Interview 2), and 'an 'environmentally friendly space that provides people with a vibrant and liveable atmosphere.' (Interview 1) Both indicated that inclusion is another principle applied to public spaces in Helsinki, yet inclusion was interpreted as facilitating the safe mobility of users with special needs – wheelchairs and visual impairment – that is supported through ramps, and cobbled stone to divide cycling and pedestrian lanes (Interview 2). When asked about gender

and age categories, ‘gender is not that much considered in the design, though the space can be experienced differently based on gender, so lighting matters in this case, and has been considered in the design; also the presence of street art and other activities (basketball) to invite other users, not only as a transit space.’ (Interview 2) When asked about seasonal conditions, one planner indicated that ‘salt and brushing’ method is used for melting ice rather than spreading gravel as in other streets (Interview 2). However, this applies to the cycling rather than the pedestrian lane as noted during the observations (Figure 3).

Figure 3: clearing ice from cycling but not pedestrian lane (Source: by author 13 January 2024)

Both planners indicated design considerations and limitations in Baana’s transformation, initially designed as a public space, with cycling being integrated later. ‘Baana was originally more a public space, inclusive for people of all age and abilities, which should apply to all city streets, so the plinth and edges needed to be reconsidered, to enable social activities’ (Interview 1). The importance of establishing connections with the surroundings and other public spaces was stressed: ‘the surroundings are very important rather than straight direct lines, as a long-distance pedestrian attraction’ (Interview 2). Baana also connects to the park in front of the parliament extension, the square in front of Oodi, the shared space at the Ruoholahti, and currently the newly planned Maria area (Interview 2). Another limitation is the corridor width ‘causing bicycle congestion and spillover to the pedestrian path as user numbers increase’, while it widens near Oodi due to space availability (Interview 1). Also, the lack of optimisation of the ‘drainage and other spaces’ was noted (Interview 2). A third concern at Ruoholahti is the

shared space design where ‘cyclists find it difficult to see where other people are walking, but for pedestrians it is easy to choose routes as it is an open ground.’ (Interview 2) In presenting these limitations, the planners did not mention shortcomings from the pedestrian perspective.

The planners indicated some concerns coming from the public, ‘Baana is considered a symbol and landmark of bicycle and walking infrastructure in Helsinki, especially in social media. Yet, a loud minority call it a waste of space or a waste tube.’ (Interview 1) No further explanation was provided regarding the criticism. Nevertheless, this segment ‘initiated the network idea’ (Interview 2), which would be applied throughout the city: ‘We want to turn interactive inclusive public space into a norm and not a highlight for people on foot, for activities, on street or on-site businesses.’ (Interview 1)

City level improvement of public spaces and non-motorised mobility network expansion directly impact Baana, which is part of this system. At the northern end, the ongoing renovation works along Mannerheimintie (City of Helsinki, 3) have temporarily disrupted Baana’s direct extension to the north-eastern public spaces (Figure 4).

Figure 4: Mannerheimentie street upgrading and impact on Baana’s northern end (source: by author 15 April 2024, 31 August 2023)

At the southern end, the upgrading of the Maria area is affecting Baana, though the cycling and pedestrian paths are not interrupted as in the northern end (Figure 5). The official city website states that the renovated southern part will shift the cycling path eastward to make space for a new ramp; relocate the ‘Helsinki’ art bench and basketball court; replace the pétanque with vegetation; renovate the benches and planted area and plant more trees (Helsinki City3, 22 March 2024). Further explanation of the project’s impact on Baana was obtained from the third interview.

The city’s concern was to connect the currently disconnected Maria area once upgraded. Therefore, changes at Baana were consequences rather than goals. Critical voices came from the public, particularly those in Baana’s vicinity. Concerns included the safety of children with the new bridge, shading Baana from the new taller buildings in the Maria area. The city authorities responded by conducting a traffic impact study with safety measures, with the design ‘mostly concentrated on the school children and their safety’ indicating that Baana’s ‘quality

remains the same, more greenery and trees and planted areas, most important functional spaces are kept but in different places.' (Interview 3) Also, the graffiti removed due to the new bridge construction will be replaced by new art (Interview 3). When asked about designing for pedestrians and their inclusion in this project, the designer indicated that there were 'no pedestrian counts, … Pedestrians were not considered as much as the bikers, though in the south there are the functional areas for people walking.' (Interview 3) (Figure 6).

Figure 5: Maria area upgrading and impact on Baana's southern end (source: by author 18 April 2024)

Figure 6: southern Baana dismantled bench and graffiti to be replaced (Source: by author 18 April 2024)

Baana's mobility design

In the interviews with planners, one indicated: 'Baana is formed of segments that vary from purely functional to stay and gaming.' (Interview 1) The current 1.3 kilometres strip accommodates parallel cycling and pedestrian lanes that diverge in two locations due to the corridor's widening, creating four zones (Figure 1).

Starting from the north, **Zone 1** is centrally located crossing Mannerheimintie, connected with a shared ramp above, and tunnel underneath, which offers vistas to the cultural hub and connects to its open public space with ample seating. This zone connects with a pedestrian ramp and two concrete stairs to the adjacent park of the parliament extension, which is monitored by a CCTV. A third steel staircase is at Arkadiankatu. Zone 1 includes art but not seating, though there are some affordances along the planted terraces. Ardkadiankatu tunnel is deep with a wide unused shoulder and is poorly lit. The cycle and pedestrian paths are divided with paint until Arkadiankatu (Figures 7, 8).

Figure 7: Zone 1 functional, aesthetic and symbolic features (Source: by author)

Figure 8: Oodi seen from the tunnel and under Arkadiankatu (Source: by author 31 August 2023 and 5 March 2024)

Zone 2 continues until Runeberginkatu with Fredrikinkatu, Antinkatu and Jaakonkatu in between, and is less connected to the west side. Antinkatu has no vertical circulation. The stair at Jaakonkatu is directed to the north, while at Fredrikinkatu is directed south. Fredrikinkatu is a new concrete bridge with columns and a CCTV underneath. Jaakonkatu comprises two separate steel and wood bridges for cars and pedestrians. Under Jaakonkatu the wider east shoulder is unused. The west side in zone 2 has no lighting, piping crosses overhead near the bridges. Seating, amenities, and art are provided. The paths are divided with paint (Figures 9, 10).

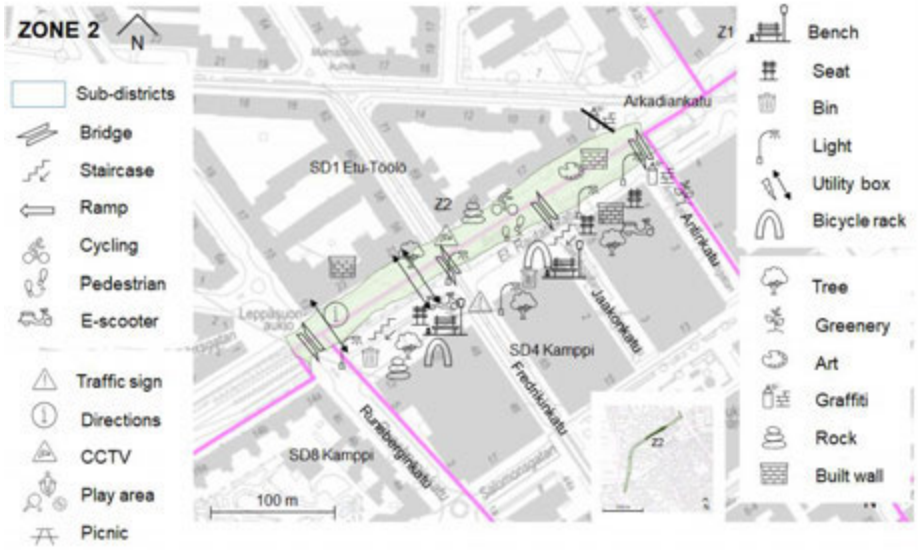

Figure 9: Zone 2 main features (Source: by author)

Figure 10: Top left: from Antinkatu looking towards Arkadiankatu; top right: from Fredrikinkatu towards Runeberginkatu; bottom left colonnade of Fredrikinkatu; bottom right pipes between the two bridges (Source: by author 30 March, 1 May 2024)

Zone 3 continues passing through the staircase at Malminkatu to Lapinlahdenkatu. It is the most visually permeable, connected to the east and west with stairs facing each other and directed towards Baana, and two ramps. The west ramp directed south joins the upper street, and the ground floor of the adjacent buildings. The east ramp is directed north at Runeberginkatu and leads to the Kamppi metro. Zone 3 lanes and ramps are divided with cobble stone for cyclists and pedestrians, yet there is a cross-circulation between cyclists and pedestrians traversing east and west (Figure 11).

Zone 3 offers diverse seating arrangements, and affordances along the planted areas on both sides. Though it has less art, it has direction signage to the nearest metro and Baana's surroundings. Between the new buildings adjacent to Baana and until Malminkatu, Baana narrows significantly, and cyclists then transgress onto the pedestrian lane if there are two and no pedestrians coming. Under Runeberginkatu with two graffiti, a pink bird house was added to the west wall, which has a wider unused shoulder that connects with the planted area. On the bicycle lane going north and just before Runeberginkatu is the only electronic panel, which is occasionally used. South just before Fredrikinkatu to the east there are two niches in the wall, with linear lights inside (Figure 12).

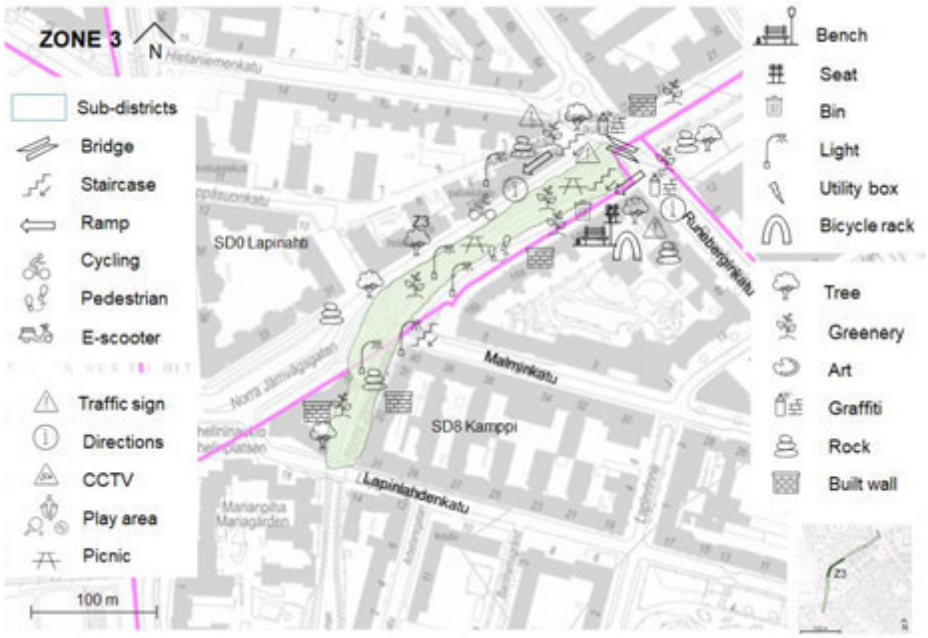

Figure 11: Zone 3 main features (Source: by author)

Figure 12: Top left stairs east and west; top right narrow part and contact with residential building; bottom left and right seating area in two seasons (Source: by author 27 April24 March, 6 January, and 17 April 2024)

Zone 4 passes by the ramp perpendicular to Lastenkodinkatu directed south, is traversed on top with the Ruoholahden silta bridge with an access stair facing Baana and ends with the shared space at Ruoholahdenkatu, thus forming two sub-zones (Figure 13).

Under Lapinlahdenkatu is the pigeon graffiti and round light. The paths divided with cobbled stone, are separated in the sports and recreation area. This area provides affordances especially on the eastern side, adjacent to the children's playground next to the ramp at Lastenkodinkatu. Moving towards zone 3, zone 4 has less visibility due to the narrow corridor. The construction in the Maria area partly blocked the open space in this zone and temporarily dismantled most of the sports activities. Zone 4 has essential signage, but less than in Zone 3. Moving towards Ruoholahti, the bridge partly blocks the view. In between, there is a picnic area, the only digital advertisement display panel located facing Ruoholahdenkatu, and a city bicycle station. Here zone 4 has direct contact with the street leading to the shared space, including one school building, with a supermarket on the ground floor (Figure 14).

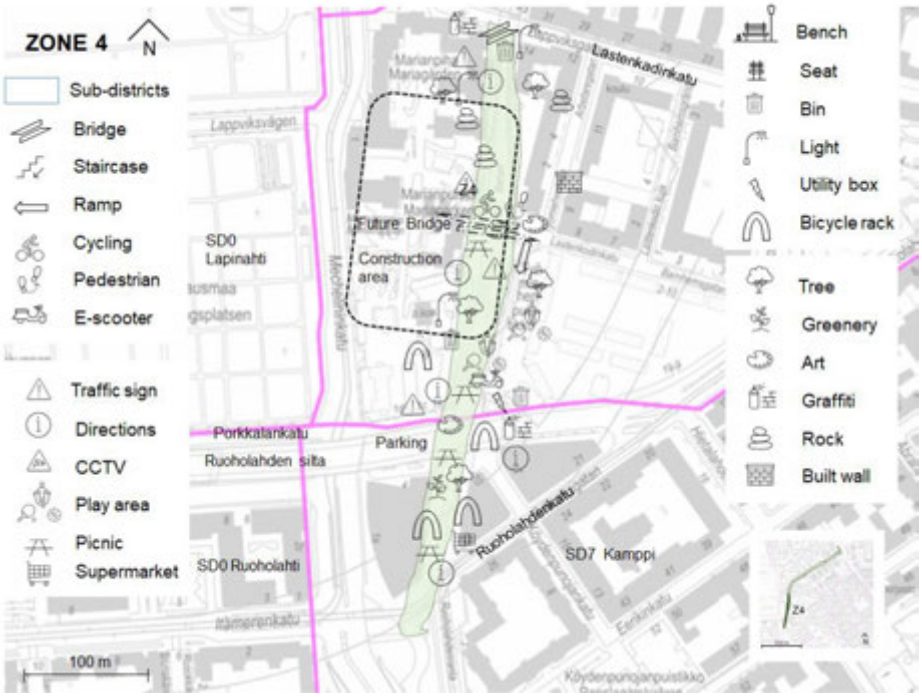

Figure 13: Zone 4 main features (Source: by author)

Figure 14: Top left basketball court; top right shared space; bottom left: Rouholahden bridge; bottom right Lapinlahdenkatu bridge (Source: by author- 6 and 30 March 2024)

To summarise, connectivity and permeability vary across the zones, with less linkages to the west. Regarding attractiveness, some zones are mainly utilitarian transit strips, while others incorporate art, seating, and diverse amenities, inviting diverse users to stay. Regular maintenance, and the presence of bins contribute to perceptions of safety, while lighting in some segments is insufficient. The non-uniform width of Baana indicated in the interviews allows for changes in levels of activities, the separation of different mobility modes, and reveals vistas, expanding cones of vision beyond the Baana to the surroundings (Figure 12). However, as mentioned in the interviews, this width variation is not optimised, with many shoulders left unused, noting their potential to provide more vegetation, art, and amenities. It is evident that zones 3 and 4 that are wider, with other amenities, offer more encounter opportunities. Signage for directions is mainly in zone 3, while in other zones it serves to inform about construction works and diversions. Safety from cyclists includes bottlenecks, crossings with pedestrians, and only paint separation in some segments. The tunnel closure north and construction of the new bridge south contribute to emerging disruptions that could impact some users from walking along Baana.

Baana's walking experiences

Walking types along Baana include mornings and evenings commuting possibly between home and work; walking to reach a destination along Baana, away from traffic intersections; taking a

shortcut across zone 3; walking a dog; pushing a buggy; leisurely walking and talking on the phone; strolling; jogging or running; walking individually, in pairs or groups.

While walking and depending on the time of day, non-humans include squirrels and hares in the early morning hours traversing Baana, especially in zone 4; ducks in zone 3 during summer; birds all around, especially in zones 2 and 3 as evident in the sound recordings. Other users include children in the adjacent play area also visiting zone 4; maintenance staff in the morning and on rare occasions police; runners at regular hours signal their fellow runners with acknowledgment; residents from the adjacent building in zone 3 walking a dog or smoking a cigarette; dogs with their owners sometimes interacting with passersby; people seated talking on the phone, eating, drinking beverages or simply looking; first-time visitors exploring Baana, youth in the sports area or sitting on the picnic places in zones 3 and 4; celebrating events, such as Vappu end of April (Figure 15). Observations indicate that the above activities provide interaction opportunities, and that different age groups and users with diverse capabilities walk along Baana. Stationery activities are reduced during harsh weather conditions, and footfall could be affected by ongoing city projects, yet children from nearby schools still come here for the outdoor hour (City of Helsinki5), and youth gather to celebrate events, such as Vappu or labour day celebration in May (Figure 15). Walking along Baana, some of the observations were validated with spot checks (Figure 16).

Figure 16: Perceptions of pleasant, safe, shaded, or windy locations (Source: by author using QGIS)

While walking, other senses are activated, and stimulated by cultural and natural elements. Art and vegetation are positive visual stimuli. Shading and wind are seasonal, favoured more in summer than winter, and often necessitating design interventions. Stairs have no cover but are

designed with the perforated metallic grid to prevent snow accumulation. The presence of deciduous rather than evergreen trees limits providing sheltering from wind and sun. The different types of seating areas cannot be used in rainy or snowy weather, something to be revisited together with the use of shoulders. Noise from the bridge in zone 4, the tramway in zone 1, and to some extent the parallel street to the west along Baana are considered noisy. However, all along, vegetation and trees offer refuge for birds, whose singing is a positive audio stimulus. In zones 3 and 4, especially in the mornings, the smell of buns from nearby bakeries provides pleasant olfactory stimuli, connecting Baana to the surroundings, while depending on wind direction, car exhausts along the western side are unpleasant. Baana is full of textures stimulating the tactile: different types of stone, concrete, wood, metal, and vegetation, combined with earth colours, or primary colours in the sports area. The rhythms of materials and colours provide a visual sequence while walking along Baana, sometimes inviting pedestrians to stop there, where the vertical blank walls disappear.

The users seem to have tacit walking rules, such as walking slowly on the right side, while keeping the left open for fast walkers and runners; wheelchair users use both cycling and pedestrian lanes; small children on bicycles could cycle on the pedestrian lane without causing discomfort; groups walking next to each other would make way when they see another pedestrian; cyclists and pedestrians equally transgress each other's lanes when there is little or no traffic; utility boxes and bins are used to display different announcements for cooking classes, gatherings and parties, entertainment shows and other (Figure 15).

Figure 15: Top left: Vappu celebration; top right graffiti indicating less visibility. Centre left: ramp adjacent to play area: centre right: post for cooking classes; bottom left: metallic stairs; beottom right: seating area (Source: by author 27 April, 5 March, 24 April, 30 March and 29 April 2024)

Redefining the functional and aesthetic aspects to shape pedestrian spaces by users not by design, is evident along Baana. Drawing graffiti or posting advertisements on bins and utility boxes codes Baana, while decoding is based on the receiver and their knowledge of what the meanings are – example classes for cooking, dancing, a concert, or jobs – which are signals for establishing encounter beyond the space for walking, whereby 'the capacity to provoke relations' unfold outside the space itself (Blokland, 2017). Sitting or walking dogs in areas non-designated places such as in zones 3, 4 opens the possibility for other users to follow. Occasionally, pedestrian groups congregate on the picnic areas or near the sports area, and temporarily reconfigure it Baana (Figure 15). These signifiers define for whom Baana is, and the 'etiquette' in Baana leads to inclusion/ exclusion.

Regarding barriers and 'subtle forms of exclusion', the variation in lighting, leaving some segments along Baana as dim especially in winter, would discourage some users, for example vulnerable individuals. While the cycling lanes are kept clean in winter, ice forms on the pedestrian lane, especially in zone 4, and the ramp leading to the parliament extension in zone 1, which would deter some users. The design of the seating and its positioning limits interaction, noting that seats are mostly at the foot of the stairs, and face blank walls. The art provided, mainly graffiti, is not to everyone's taste, though the addition of the contemporary art display in Zone 2 in summer 2023 attracted the attention of many passersby (Figure 10). The offered sports do not cater for the very young or elderly, like other public spaces in Helsinki. The lack of a public toilet or at least clear signs to where some are located at both ends indicates that the duration of stay along Baana is limited.

Regarding safety, there are few hidden or less visible areas along Baana, under some bridges, the niches between two bridges or decreased visibility between zones 4 and 3. More importantly, almost along all Baana, there is visibility from above, overseeing from the bridges or along the streets. Design considerations for safety indicate risks when stepping down from stairs, or next to shoulders that are not levelled with the pedestrian lane (zones 1, 2). Safety from others during daytime does not seem to be an issue, expect in the segments where the lanes seem visually or physically disconnected. The presence of CCTVs could instigate

contradictory feelings of safety. Walls with informal graffiti suggest poor visibility, which also relates to issues of safety (Figure 15).

Summing up from the analysis, what aspects of Baana encourage what types of walking experiences and social encounters? Baana offers traversing the city and cutting through different architectural character areas, a perspective not commonly possible along the street network. Walking along Baana is comfortable and safe, with only few interruptions, no waiting time, dwarfing the railway conduit, and paying attention to the human scale. Experiencing Baana on foot reveals differences marked by opportunities and barriers for pedestrians and possibilities for social encounters. The dynamic interplay of stimuli for different senses from the physical surroundings and the designed space create transit nodes from one experience to the next. Walking along Baana is not limited to the necessary or optional, it offers a range of fluid encounters with diverse human and non-human users, as well as exchange with familiar strangers – familiarity built on recurrence, or similarity of the type of walking, for example with children, with dogs or running. There are implicit rules that give meaning to Baana, which are accessible even to first-time users, such as when to give way, negotiate one's pedestrian status, or learn about upcoming events. 'Subtle forms of exclusion' exist, for the three aspects. Functionally, accessibility from the west is still limited, with the new Maria area project promising to mitigate this. Aesthetically, asymmetrical attention is given to different user groups in the design. Symbolically, the choice of signage, art and design of amenities communicates to some user groups better than others. Though memory of the railway is important, it is worth questioning the extent to which its preservation is enhancing current walking experiences, or whether other interpretations could serve both purposes better through the choice of art, use of shoulders, or vegetation.

7. Conclusion

This article addressed two questions in ongoing research: *What design elements, aesthetics, and symbolic atmospheres in Baana promote walking beyond the necessary activity? How is Baana perceived while walking?*

Considering walking as a social activity beyond the utilitarian mobility need, and the importance of fluid encounters, the article presented an approach to analyse pedestrian urban spaces. This approach conflated the design and experiential aspects of function, attraction, and signification to identify barriers and potentials for supporting social encounters. Unpacking walking as a social activity revealed its multi-sensory experience, social connotations, and potentials to support interaction and sociability within urban spaces for walking, ranging from public familiarity to sustained social interaction.

The article presented preliminary findings from the initial research phase, which prepares the basis for the next phase that addresses some of the research limitations. The first is the absence of information about diverse experiences based on the pedestrian's intersectional identities (both internal from the individual and external from the socio-cultural background shaping the surrounding context) to examine the extent of how just or inclusive Baana is as a pedestrian environment. The second relates to user demographics, information on origins and destinations,

choice frequency and purpose of walking, and how they link to socio-economic distributions in the city more broadly, and opportunities for long-distance walking. Third, investigate the temporal aspect and dynamism of the walking experience depending on the time and seasons. In the second phase, a survey will be developed to identify differential experiences, and could be based either on visuals analysed by respondents, or user input that is georeferenced using an application like Epicollect5. The questionnaire could be replaced with walking narratives for a smaller sample that focuses on a specific user group (Kanellopoulou, 2017; Middleton, 2018; Scarponi et al. 2023).

While the current research serves as a steppingstone for further in-depth and participant-based research, it nevertheless proposes some suggestions for planners with possibilities to enhance functional, aesthetic, and symbolic aspects of the Baana towards addressing experiential asymmetries and reinforcing social encounter that is essential within urban environments.

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The public space between land and sea. Quarteira's case

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Abstract

In the Portuguese coastal city of Quarteira, a case study of the research, the seafront is composed by two fixed linear infrastructure systems - the seashore streets and a dune park, *Passeio das Dunas* - succeed each other, separated by the port area.

Methodologically, drawing as a qualitative tool allowed us to decompose the layers that compose the public space, thereby enabling us to represent the formal characteristics and thus highlight the material and immaterial characteristics of the place.

Aim of the research is to describe the compositional grid of Quarteira urban public space, its formation and transformation process over time, as well as to debate the recent missed opportunities for effective adaptation to the effects of extreme weather events.

In conclusion, we consider that a critical theoretical reflection on the spatial planning and design of public space in coastal cities permits the definition of operative compositional parameters - which make it possible to overcome project theories that, in the face of the effects of climate change, have become obsolete.

Keywords

Public Space; Seashore Street; Passeio das Dunas; Quarteira; Portugal.

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Introduction

Since the modern era, one of the major urban transformations that affected cities was the delimitation and channelling - in pipes, embankments and conduits - of water bodies (Marsalek et al, 2008). Water bodies were progressively demarcated by rigid infrastructures that delimited their limits and distanced them - physically and/or visually - from the city.

Nowadays, because of the necessity to cope with the effects of climate change on the urban environment, a conceptual paradigm shift is taking place, choosing to "make room for water" as opposed to the idea of delimiting it (Sijmons et al, 2017). Although water has always been a shaping and structuring element of the landscape, the contemporary necessities that have arisen with the climate crisis require a more conscious management of the element, and it is in this sense that the role of public space design in the face of extreme events is strengthened (Matos Silva in Brandão, 2019). Therefore, by integrating local wisdom with scientific and technological knowledge in a design adapted to uncertainty, public spaces can improve climate change awareness and promote vulnerability reduction (Matos Silva in Brandão, 2019).

The case study, discussed in the article, is Quarteira, a coastal city located in the Algarve region of southern Portugal. Until before the 1950s, the coastal area in front of the historic core of the fishing agglomeration of Quarteira consisted merely of a long, low, sandy seashore with dunes. From the second half of the twentieth century, due to the new socio-cultural needs related to tourism, and the economic boom, the urban limit - the seashore street - was built. Moreover, the most significant urban transformation took place in the threshold space between the city and the beach. The seashore street is a linear urban public space bounded on one side by the facade of buildings and on the other by the beach and the sea. This channel space articulates the relationships between the city and the beach, and is where the main socio-cultural activities of the city take place.

Fig. 1: Quarteira. Author's editions, 2022

Nowadays, the seashore street as an infrastructural system is the first line of defence of the urban agglomeration against erosive and flooding phenomena caused by extreme climatic events. Indeed, it is estimated that, along the 943 km of Portuguese coastline where around 70 per cent of the population lives (Bigotte et al, 2014), a percentage that rises to around 80 percent in the summer months, thanks to the phenomenon of tourism (Andrade et al, 2002), urban areas are the most vulnerable in Europe to the effects of rising mean sea level.

To cope with the effects of the rise in the average sea level, in 2019, with the aim of supporting the protection, redevelopment and valorisation of the coastal strip, the Algarve's Intermunicipal Climate Change Adaptation Plan, PIAAC-AMAL (*Plano Intermunicipal de Adaptação às Alterações Climáticas do Algarve*) was approved. The plan has as its objective the adaptation of coastal cities, and in the case of Quarteira it describes scenarios of shoreline retreat, for which it suggests the continuation of artificial beach nourishment, as well as stating the need to relocate the first line of buildings after 2040. However, the continuous urban expansion of coastal areas, to meet the needs of tourism, requires the implementation of adaptation projects that do not consider the urban relocation and thus the distancing of the city from the coastline.

Among the projects reconfiguring the space next to the sea is the *Passeio das Dunas* (sea promenade), designed by João Nunes, *PROAP: Landscape Architecture and Design Studio*, inaugurated in 2016, which connects the city of Quarteira with Vilamoura, to the west along the seashore. João Nunes' project involved the creation of conditions for the dune system to settle and develop as a natural process supported by the anthropic elements created. Aim of the project was building with nature, creating and recovering the existing dunes and vegetation in the adjacent natural area. However, during implementation it was decided, by the project's controlling entities, that the dune system would be fixed, preventing its natural movement; thus, the construction of the project was conditioned regarding its initial design assumptions.

Quarteira therefore becomes a case study in which it is possible to decode the embryonic paradigm shift underway, albeit with its weaknesses and paradoxes. Indeed, along the same coastline coexist both the conventional idea of a limit defined by a fixed layout, the seashore street, and an initial attempt to create a space composed of non-linear forms/layouts related to living and evolving ecological systems such as green and blue infrastructure. Although the *Passeio das Dunas* (seafront promenade) was not constructed as designed, we consider that it remains an initial starting point for a long theoretical discussion and one of the possible paths on the future formal definition of the space between the city and the sea.

If the urban public space adjacent to the sea is the area most vulnerable to climate risks, it is simultaneously the most favourable urban space for transformation and adaptation to cope with erosion and flooding phenomena due to the effects of extreme events associated with the rise in mean sea level. A threshold space that can accommodate externalities from the effects of mean sea level rise; and thus protect the coastal agglomeration. Purpose of the article is to describe, by comparing, two possible design approaches, constituted through rigid limits or through the implementation of green and blue systems, articulating dual theories in the landscape design debate. In conclusion, we consider that the reading of the formal characteristics of the space between the city and the sea provides an opportunity to rethink the design processes of urban adaptation.

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The Time of water in the city

The duality between the desire to dwell near the water body - the riverbanks and coastal locations - has become more ambiguous and paradoxical nowadays caused by the high exposure to climate hazards (Hunt et al, 2011).

Nowadays, World Cities Report 2020 by United Nations Human Settlements Programme (UN-Habitat) estimates that by 2050, approximately 6.4 billion people will live in cities and that demand for water will increase by 55% compared to current estimates. Moreover, given that half of the world's population lives within three kilometres of a surface freshwater body, and over 40 per cent reside in coastal areas, these populations would be at risk from sea level rise and extreme weather events associated with climate change (Barragan and De Andrés, 2015; Voskamp et al. 2021). It is estimated that the combined threat of rising sea levels and storm surge in coastal cities could result in the loss of more than one trillion dollars each year by 2050 (Hallegatte, et al, 2013).

Over time, water in the territory has shaped the landscape, directing the choice of a city's foundation site and the development processes that followed. Indeed, throughout the city's history, different evolutionary phases have followed, characterised by different relationships between the urban system and the water body. Matos Silva in 2016 mentioned both Saraiva's text (*O rio como paisagem: gestão de corredores fluviais no quadro do ordenamento do território*) from 1999, in which the author identifies four main evolutionary phases; and Brown et al.'s text (*Transitioning to Water Sensitive Cities: Historical, Current and Future Transition States*) from 2008 in which the author, similarly, identifies six different phases of water management over time. The first phase, coinciding for both authors, defined by Saraiva as 'harmony' and by Brown as 'water supply city,' corresponds to pre-industrialisation in which human activities were adapted to the natural water cycle. From 1800, with the beginning of the modern age, until the second half of the 1900s, Saraiva (1999) identifies the beginning of a period defined as 'domination' in which the water body was transformed and adapted to human needs. Brown et al (2008), more precisely, identify within the same period two phases, the 'sewer city' and the 'drained city.' A period in which urban transformations were guided by theories that favoured a strict separation between the city and water, whereby the first large water containment and channelling infrastructures were built: dirty water was channelled outside the city limits, large areas were reclaimed, canals, pipelines and river and sea embankments were built (Matos Silva, 2016). The third period, defined by Saraiva as a phase of 'degradation', coincides with the economic boom after the end of the Second World War and was characterised by massive exploitation of the water resource, in which the ecological damage caused in favour of economic progress became evident. The fourth period beginning in the 1980s is defined by the increased awareness of the environmental, ecological, cultural, social, economic and symbolic value of water. Brown et al (2008) identify the 'waterways city' phase from the late 1960s, with the beginning of heightened environmental awareness. During this period, legislative plans and programmes for the regulation of water as a resource and for its protection began to be drawn up. The last period theorised by Brown et al (2008) coinciding with the beginning of the 21st century is defined as 'water cycle city' and by Saraiva in 1999, as 'sustainability.' For the authors, the concept of 'water cycle city' encompasses a multifunctional, integrated and adaptive management of the entire water cycle, taking into account the precautionary principle instigated by the ongoing climate change projections (Matos Silva, 2016).

While the two authors mentioned above dealt in their study with the paradigm shift, which occurred over time, in the relationship between the urban system and the water body from a river perspective, Miriam García García (2019) outlines similar, and temporally coinciding,

processes in the approach to the marine limit. As the author highlights the progressive increase in population, and consequently economic development, along the coastline has over time brought the construction of massive defence infrastructures and the artificiality of the margins (García García, 2019).

Since the late 1990s, with the first report of the International Panel Climate Change (IPCC), the concept of adaptation to climate change has been introduced into the scientific debate (Matos Silva, 2016). Therefore, the political and social models and techniques we have been working with need to be reformulated, for as García García (2019) states, the reinvention of the coast requires a dynamic vision based on detailed observation of the natural phenomena occurring on it. Therefore, nowadays aware that disturbances of the natural water cycle within the urban environment (such as soil sealing, channelling of watercourses, delimitation of sea banks, among others) significantly increase the negative externalities of extreme events (Ciupa et al, 2020) nature-based projects are beginning to be considered alongside hard infrastructure.

The form of the Portuguese coastline

The form of water in the city is particularly evident in the multiple relationships, spatial and temporal, that occur in the shore space, a zone of transition and tension between the anthropic system, the city, and the natural system, the sea. The reconfiguration of the interface, of the space between land and sea, through the introduction of the rigid infrastructure, the seashore street, throughout the 20th century in the Portuguese coastal landscape, changed the relationship between the city and the water (fig. 2).

Fig. 2: Portugal Coastline. Author's editions, 2022

Along the Portuguese coastline, urban settlements, located near the water line, are characterised by the presence of a linear public urban space in which the city's social and economic activities take place. Urban space that is defined on one side by the buildings' façade, mainly designated for tourist use, and on the other by the natural element, the beach. Indeed, the rise of the tourism sector and the demand for seasonal tourism, which arose after the end of World War II, and the development of the automobile as a mass commodity in the 1960-70s, induced major transformations in the urban development of coastal cities. In cases where the construction of the seashore street is older, the old fishing buildings, built adjacent to the seashore street, were demolished and replaced by tourist structures, positioned parallel to the water line to obtain a

larger built-up area facing the seascape. In more recent cases, the seashore street has served as a driver of the urban agglomeration development, to which tourist-oriented buildings have been built alongside the urban layout (fig. 3).

Fig. 3: Quarteira: Topography, Urban Layout, Built-up area. Author's editions, 2022.

Quarteira's seashore street case

On the 943 km of coastline, it is estimated that the areas affected by extreme tidal flooding and SLR will be 903.1 km2 in 2050, impacting 59.530 buildings and 145.550 residents; this value will increase to 1146 km2 (river delta areas are included in the estimate), with 82.000 buildings and 224.830 residents in 2100 (regarding the relative contemporary mean sea level on the Portuguese coast, reference is made to Cascais tide gauge data) (Antunes et al, 2019) (fig. 4).

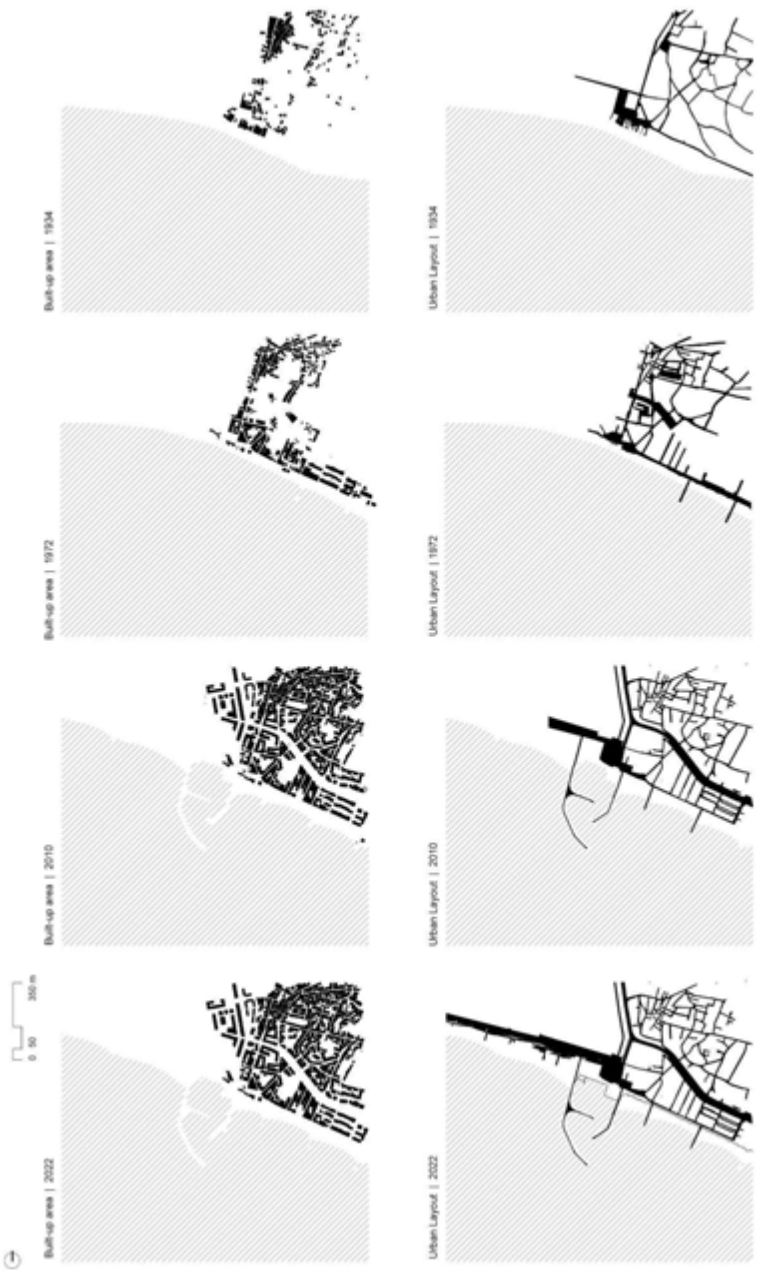

Fig. 4: Quarteira: Urban Evolution. Author's editions, 2022.

Research case study is the coastal city of Quarteira, situated in the Algarve region of southern Portugal, where approximately 24.421 people live during the year, a number that triples during

the summer period (INE, Instituto Nacional de Estatística) due to the tourism. Until before the emergence of mass tourism, Quarteira was a fishing town built far from the shoreline. The urban transformation of the coastal town of Quarteira began in the early 1950s, the construction of the street parallel to the sea, on the edge of the sandy beach, and the construction of the marina at the mouth of the Ribeira de Quarteira (Lobo, 2018); introduced a change in the relationship between the urban agglomeration and the sea. The seashore street stretches for about 3 kilometres with an average width of about 60 metres, and is situated at a height of between 4 and 5 metres above mean sea level, and is today, due to the effects of the rise in mean sea level, vulnerable to flooding and erosion. According to Teixeira, coastal erosion, caused by the prevailing wave motion from west to east, has increased with the construction of the breakwaters of the Vilamoura marina and also with the more recent construction of the defence infrastructure of the fishing harbour in 1999. Indeed, over the past three decades, several coastal protection structures have been built along the Quarteira coastline (Braz Teixeira, 2004) (fig. 5).

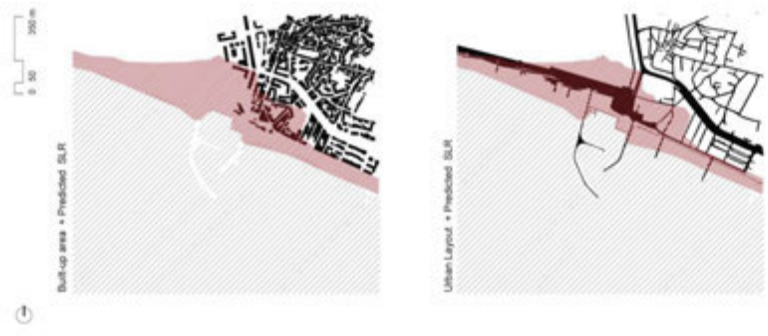

Fig. 5: Quarteira: Built-up area and Urban Layout + SLR. Author's editions, 2022.

Portugal's coastal protection policy, as of 2013, is no longer based on the construction of rigid protection structures. Indeed, since 2013, the majority of interventions are allocated to the maintenance of existing hard structures (Pranzini et al, 2013). In 2019, the Algarve Intermunicipal Climate Change Adaptation Plan, PIAAC-AMAL (*Plano Intermunicipal de Adaptação às Alterações Climáticas do Algarve*), was drafted, framed within the main objectives of the European Climate Change Adaptation Strategy (EEA) and the National Climate Change Adaptation Strategy (*Estratégia Nacional de Adaptação às Alterações Climáticas 2020*) (ENAAC 2020; PIAAC-AMAL, 2019), with the aim of supporting the protection, redevelopment and enhancement of the coastal strip. For Quarteira's urban waterfront, the PIAAC-AMAL, provides scenarios of shoreline retreat in the urban coastal front and suggests continuing to artificially feed the beach over the next decade, and subsequently proposes the construction of a dike-in-dune, while addressing the need to remove and relocate the first built line of the waterfront from 2040 (Dias and Santos, 2019). Moreover, the Algarve PROT (*Plano Regional de Ordenamento do Território*) territorial management regional plan establishes a ban on urban occupation in protected areas to ensure the continuity of ecological corridors connecting the coast and the interior (fig. 6).

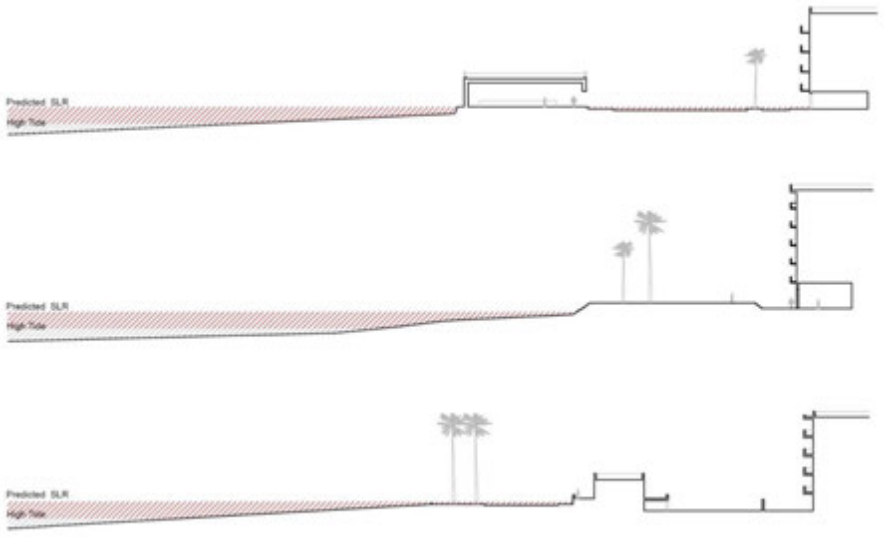

Fig. 6: Quarteira: Urban Sections + Sea Level Rise Scenario. Data estimated by IDL.Instituto Dom Luiz, Faculdade de Ciências da Universidade de Lisboa. Sea level rise scenarios available at: https://smart.campus.ciencias.ulisboa.pt/portal/apps/MapSeries/index.html?appid=ebee609293804c49abd52ccfb07f4762. Author's editions, 2022.

In 2016, the *Passeio das Dunas*, designed by João Nunes, *PROAP: Landscape Architecture and Design Studio*, was inaugurated, an urban public space designed with the intention of connecting Quarteira with Vilamoura and with the objective of protecting the urban agglomeration from the effects of the rise in the average sea level.

Passeio das Dunas, (seafront promenade), extends for approximately 675 m occupying an area of 52.329,54 square metres (fig. 7).

Fig. 7: Quarteira: Plan, Section and Image of *Proap: Landscape Architecture and Design Studio Project*. Author's editions, 2022.

João Nunes' project was based on the possibility of artificially creating natural conditions for the dune system to settle and develop, as in the natural process, recovering the existing dunes and vegetation. The project planned to work with natural dynamics, such as the movement of the dunes, through the creation of a thickness with blurred boundaries, allowing the continuous transformation of the space over time.

If in the competition phase the *Passeio das Dunas* was conceived as non-linear forms and paths related to working with living and evolving ecological systems such as green and blue

infrastructure, in the realisation phase the same forms were realised through rigid systems that delimited the space with rigid elements that prevented its continuous transformation. Results are sand dunes within which there is a rigid structure that holds the vegetation firm, bordered by a concrete walking surface as in the case of the seashore street to the east of the port.

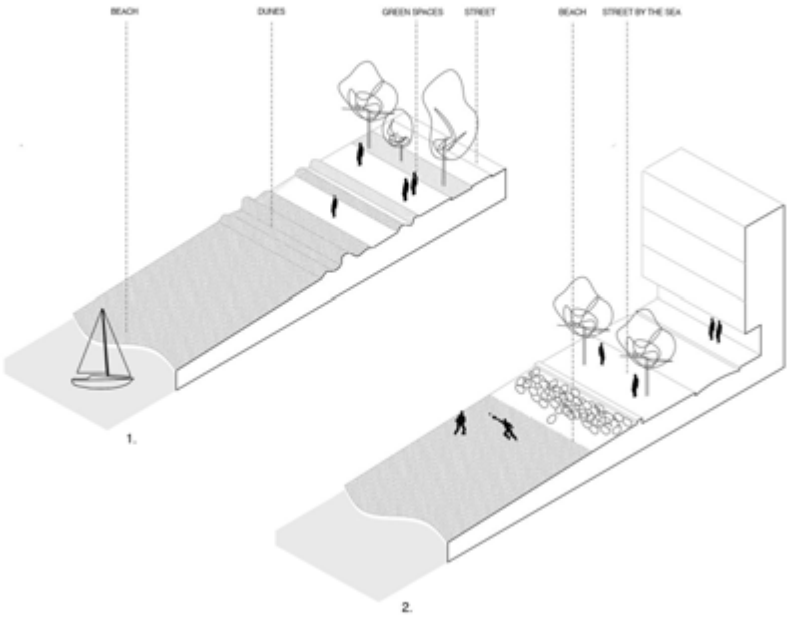

Fig. 8: Quarteira. Author's editions, 2022.

We observe in *Passeio das Dunas* project, João Nunes's design purpose to recognise the transformative process that the marine environment entails and thus propose in the project a dune landscape in continuous transformation.

The alteration of Joao Nunes' project has resulted in the construction of an infrastructure that will have the same problems over time as the fixed infrastructure, indeed, like the seashore streets, it will become a ruin over time due to the effects of extreme weather phenomena: such as erosion and floodings phenomenon.

Water: a territorial project

Water, as a structuring element of places, may guide the design of the form of the city (Proença et al, 2021). As Conceição (1997) affirms, water can structure places through functional, conceptual, symbolic, and geometric relations. Although water is an element with no intrinsic form, it forces us to question and discuss its presence in architectural and urban projects. Examples where the design of public space has taken into account the natural element of water include the Living Breakwaters project, which envisages risk reduction by improving physical resilience along Staten Island's south shore through the use of hard infrastructure, the

breakwaters, and green and blue infrastructure. As is the Climate Ready Boston project, to make the East Boston and Charlestown coastal area resilient through the use of green infrastructure - vegetation - as a protective and adaptive system that accommodates rising mean sea level. As Figueira (2020) argues, the river and the sea are primordial elements in determining urban design, whether during a flood or a high tide, in both cases water is the regulating element (Figueira, 2020, p.33).

Drawing the transformation of the Landscape: a constructed nature

Nowadays, due to the increasing effects of sea level rise, such as erosion and flooding phenomena, there is a political and administrative demand to establish urban adaptation plans and projects for vulnerable areas. As with all environmental frontiers, the shore is an ecosystem with a dynamic and fragile equilibrium, therefore water-related challenges - such as storm surge protection - are often addressed in a separate way through limited procedures and plans. Landscape plans, of European character and national implementation, also identify lines of urban vulnerability, for example, the lack of resilience and doubtful reliability of water defence, collection and transmission systems in the face of extreme climatic events.

To wonder nowadays, to discuss, which is the construction with nature and which is the constructed nature becomes not only an academic exercise but a political act of recognition of the elements that exist in the Landscape and with which to operate compositionally in the architectural and urban process. World Cities Report 2020 by United Nations Human Settlements Programme (UN-Habitat), indeed reports that when nature-based solutions are incorporated into design and management, urban areas can benefit from multiple ecosystem services, including carbon sequestration, local climate regulation, stormwater capture and water and air purification. Landscape architecture, urban design, spatial planning and architecture, must be concerned with consciously shaping the environment (Oudes et al, 2020).

Conclusion

In conclusion, we consider it essential to highlight how the theme of water, in its different conjugations, allows the exercise of recognising the physical characteristics of the territory. Therefore, we can state that climate change, specifically the effects of extreme weather phenomena and rising mean sea level, becomes a pretext, a *conditio sine qua non*, to rethink the elements on the territory, not as belonging to different systems, but as subjects of transformation. We believe that recognising the role of water not only as an integral and constituent part of the landscape, but as a subject enables the drafting of adaptation plans and projects coherent with the the form of the place.

We feel it is important to summarise the main theoretical outcomes derived from the formal comparison of the two projects and the debate on the design choices undertaken, knowing that they are the first step in the development of new research on urban design transformation and adaptation paradigms:

1. Designing under uncertainty, resulting nowadays for the effects of climate change on the urban fabric, to decrease urban vulnerability requires a deep and precise knowledge of the urban landscape, from the macroscale of the territorial planning to the microscale of urban drawing;
2. Comparing different project, design and planning, visions and scales of spatial approach enables the understanding of contemporary criticalities that can be observed in the spaces, object of study, at the margins between the city and the sea;

3. Understanding that in the space between the city and the sea, the implementation of blue-green infrastructural solutions, achieved through working with nature, provides a greater palette of solutions for urban adaptation.

In conclusion, we consider that only by understanding the physical characteristics of two different approaches to public space by the coastline, - one based on the design of rigid layouts with fixed linear infrastructure systems and the other (on non-linear forms and layouts related to the use of living and evolving ecological systems such as green and blue infrastructure - can efficient designs be outlined.

The theoretical reflection carried out so far about the case of Quarteira, composed of two fixed linear infrastructure systems - the seashore streets - and a dune park, the *Passeio das Dunas* (which, as mentioned, was planned to be constituted through ecological system), demonstrates the need for a paradigm shift in the design approach to the transformation and adaptation of coastal cities. Although the *Passeio das Dunas* was not constructed as designed, we consider that it remains an initial starting point for a long theoretical discussion and one of the possible paths on the future formal definition of the vulnerable public space, between the city and the sea, of the effects of climate change.

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Playful Urbanism in Diyarbakır: Dynamics of Power and Play in Public Space Design

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Abstract

Public spaces embody the intricate interplay of power dynamics influenced by governmental, societal, and economic factors, shaping spaces to reflect idealized lifestyles guided by urban management, societal norms, and capitalist economies. However, the emergence of playful actions disrupts these norms, offering fresh perspectives on power structures and public spaces. Activities characterized by playfulness, illuminated by play theory, advocate for innovative approaches to public space design, exploring play's transformative role in nurturing social connections and enriching urban life while reshaping social interactions and landscapes.

Focused on Şeyh Said Square and nearby parks adjacent to the Diyarbakır walls in Turkey, this study employs field research, observations, and surveys. Renowned for its vibrant culture and diverse societal representations, this locale fosters unique connections among users, authorities, and urban designers. Playful actions serve as a catalyst for challenging established power dynamics and fostering greater participation in the design and use of public spaces. Acknowledging play as fundamental in urban design, the research explores alternative narratives, emphasizing social engagement and public space utilization. Through a comprehensive and participatory methodology, it highlights play's significance in promoting participation and shaping urban design.

Keywords: play theory, power dynamics, social interaction, participation, urban design.

Introduction

Public spaces in urban environments are vital for social interaction and community engagement. These areas have evolved into dynamic arenas where power dynamics, conversations, and collective activities converge, deeply influencing the fabric of society (Lefebvre, 1991; Sennett, 2018). As essential components of an open society, public spaces serve as venues for socialization, counterbalancing divisive societal forces. Although they may not directly resolve social and economic challenges, these spaces are fundamental to the effective functioning of democratic societies (Madanipour, 2010).

Play theory offers a unique lens through which to view public spaces, revealing the underlying power dynamics and social interactions that shape them. Embracing play enables individuals to overcome power barriers, establish new social connections, and redefine the essence of public spaces (Stevens, 2007). Beyond mere entertainment, play serves as a mechanism for reclaiming, designing, and transforming existing spaces and urban landscapes (Shaftoe, 2008).

This study aims to apply play theory to specific public spaces, including Şeyh Said Square and the parks surrounding the Diyarbakır Walls in the Sur district of Diyarbakır province. This region, recognized for its rich historical and cultural significance, has long been a site of power struggles and political activity due to its strategic location and historical importance.

The Sur district encompasses remnants from nearly 30 civilizations, including churches, mosques, and bazaars, creating a rich cultural mosaic with a profound historical narrative (Diyarbakır Cultural Inventory, 2011). With its architectural marvels and narrow alleyways, Diyarbakır's historic Sur district reflects the complex interactions among diverse civilizations over time (Aslan, 2013). During bustling commerce and vibrant markets, these areas continue to serve as centres for communal life and social interaction, preserving their traditional charm and cultural heritage (İnce, 2011).

Despite its rich history and diversity, Sur faces challenges from homogenizing urbanization and rent-driven economies. Migration, urban transformation, and urban destruction have gradually eroded the unique character and identity of Sur’s public spaces. However, these challenges also present opportunities for revitalization and renewal through playful urban interventions.

Playful activities, emerging in response to entrenched power structures, offer a dynamic and inclusive approach to urban life. Play serves as a form of participation, allowing residents to engage with and shape their surroundings. This study aims to explore play activities within public spaces and investigate residents' expectations for these communal areas. By understanding user preferences, the research seeks to enhance community engagement and empowerment in urban design through play. Additionally, the study examines the complex power dynamics inherent in urban design, aiming to dismantle traditional hierarchies and promote a more collaborative approach to urban development.

2. Theoretical Framework: Play, Power Relations, and Public Space

Understanding the intricate relationship between power dynamics and the use of public spaces is crucial for navigating the complexities of urban life. These spaces are influenced by a range of factors, including political, military, economic, and social forces, all of which are

interconnected within broader national and international contexts (Mitchell, 2003). Because of power dynamics, public spaces have evolved to become increasingly impersonal and transient, often serving functional or symbolic roles. These ongoing transformations underscore the dynamic nature of public spaces, which are continually shaped by diverse societal, national, and international factors impacting their liveability, sustainability, and user-oriented design in urban environments (Madanipour, 2010).

This section explores the nuanced power dynamics within public spaces, examining how historical contexts, regulatory frameworks, and theoretical perspectives influence the urban social fabric. It also considers the role of play theory, highlighting its impact on public spaces and its potential to influence power relations by promoting inclusive social interactions and challenging traditional hierarchies. By applying this perspective, the study aims to foster a more equitable and engaged urban community.

2.1. Understanding Power Relations in Public Space Use

Public spaces within urban areas are crucial in defining a city's character and identity. These spaces—including parks, plazas, sidewalks, and other communal areas—are managed by authorities to ensure they fulfil their intended functions effectively. Initially, rules governing public spaces were established for practical reasons such as maintaining order, safety, and cleanliness (Carmona, 2010). Over time, these rules have evolved into complex systems of regulations resembling localized legal frameworks. Each public space has its own set of rules tailored to its specific context, reflecting the unique dynamics and priorities of the surrounding community. These regulations shape social behaviour and interactions within public spaces, creating a sense of order and predictability. However, what began as temporary or exceptional rules often become normalized and entrenched in everyday life. Public spaces thus transcend their physical attributes to become symbolic arenas where societal norms and values are expressed and enforced. Understanding the evolution and implications of these regulations is crucial for policymakers, urban planners, and residents as they strive to create inclusive and vibrant public spaces that meet diverse community needs (Stavrides, 2019). Examining these power dynamics is essential for exploring how interventions can reshape public spaces.

In the early 20th century, urban designers and architects did not directly challenge the existing system but sought to impose order on the chaos of modern life and urbanization (Gilloch, 2001). Their focus was on standardizing everyday life and practicality, with less emphasis on entertainment in city planning. Le Corbusier, a prominent figure of this approach, argued that many existing cities could not meet the demands of modern life due to rapid urban development and industrialization. He viewed urbanization as a natural progression and emphasized the need for ideal planning to foster progress. Le Corbusier envisioned cities characterized by organized transportation, clean environments, and strong ethical values, placing importance on working conditions and the layout of business areas. In contrast, Jane Jacobs criticized Le Corbusier's projects, arguing that they prioritized cars over people and promoted functional separation of urban areas, limiting social interaction. Jacobs advocated for diverse, interactive urban spaces such as vibrant streets and sidewalks, which she believed were essential for fostering human connections and enhancing city liveability (Jacobs, 2009). Examining these historical perspectives reveals the evolving relationship between urban design, societal norms, and power dynamics.

Michel Foucault's concept of disciplinary society provides a profound exploration of power dynamics, extending beyond mere coercion to emphasize the systematic organization and

control of individuals. In a disciplinary society, power operates through various mechanisms of discipline—such as surveillance, normalization, and examination—that are embedded within social institutions and practices. These mechanisms regulate behaviour and shape spatial organization. For Foucault, discipline is not just a coercive force but an art of distribution that actively influences individuals' actions within a societal framework (Foucault, 1995). The spatial aspect of this disciplinary order is crucial, as power intervenes to regulate the physical distribution of individuals, turning discipline into a tangible influence on spatial organization (Foucault, 1995). In public spaces, disciplinary power is evident in design and surveillance measures that control behaviour, impacting social interactions and shaping usage patterns (Zukin, 1995). Analysing power dynamics in public spaces provides insight into how disciplinary mechanisms manifest and influence social interactions within urban environments.

In public spaces, power dynamics work to establish order, standardization, and an ideal societal vision. Drawing on Foucault's concept of biopower, which encompasses control over life itself (Foucault, 1978; Foucault, 2003), public spaces become arenas where structures, relations, and practices shape political subjects. These spaces are not merely passive backdrops but are imbued with power mechanisms that regulate and organize human behaviour. Biopower reveals how political subjects are constituted and deployed through regulation and surveillance of various life aspects, including time and bodies (Cisney & Morar, 2016). This lens highlights how the management of public spaces involves asserting authority over populations, shaping behaviours, interactions, and collective dynamics (Agamben, 1998). The regulation and surveillance in public spaces extend beyond individual bodies to broader population dynamics, reflecting a biopolitical approach to community life (Negri, 2016). Thus, the design and management of public spaces are intertwined with power dynamics aimed at creating standardized, organized environments conducive to an ideal societal vision (Boano & Talocci, 2014). Exploring these dynamics opens opportunities to apply play theory, paving the way for innovative approaches to challenge and reshape entrenched power structures.

2.2. Utilizing Play Theory to Reshape Power Dynamics in Public Space

Play theory can be applied to public spaces to empower communities and transform power dynamics. It involves the actions of individuals, their use of space, and their engagement, either individually or collectively. Play theory holds the potential to rejuvenate existing power structures and foster new social connections. In everyday life, people often unconsciously replicate societal norms and behaviours through playful interactions, creating their own set of rules, rhythms, and social orders within the context of play (Lefebvre, 1991). To fully comprehend play theory in public space design, it is necessary to explore the concept of play itself and its impact on power relations within public spaces.

Play is frequently perceived as a creative and productive activity that fosters innovative potential. However, it is not confined to just children; rather, it is a voluntary engagement that individuals undertake throughout their lives in various spaces and times. The foundational work on play comes from the Dutch historian Johan Huizinga, who introduced his work "Homo Ludens" in 1938. Huizinga explores the historical significance of play, asserting that it played a crucial role in the emergence of culture. He conceptualizes human beings as "Homo Ludens" or playing humans, suggesting that actions performed in social life serve to produce the essential needs and requirements of life. Huizinga characterizes early human societies' life-sustaining activities, such as building shelters, hunting, and gathering, as acts of play. As human beings started creating their reality, they initially shaped everything in rhythm, arrangement,

and repetition. In essence, reality emerges as a product of playful social interactions (Huizinga, 1995).

Agamben provides a profound insight into the concept of play, defining it as the act of liberating things, actions, or events from the confines of the sacred realm, thereby enabling individuals to interact with them without the constraints imposed by sacred conventions. The contemporary manifestations of the sacred are diverse and complex, encompassing phenomena such as militarized security institutions, military urbanism, and the capitalist process of dispossession. Agamben's concept of profanation involves returning sacred objects or spaces to the free use of humanity, thereby subverting the control imposed by governmental mechanisms and neoliberal ideologies. Play, through its transformative power, empowers citizens to reshape urban environments, while profanation disrupts dominant narratives by reclaiming sacred spaces for common use (Boano & Talocci, 2014). By encompassing all human activities that transcend the limitations imposed by the sacred, play serves as a potent tool for challenging established norms and practices dictated by sacred tradition. Particularly evident in children's play is the transformative nature of ordinary objects, as items like cars, toy guns, or even electric stoves assume new roles and meanings through imaginative exploration. Through play, children freely navigate social conventions and expectations, unleashing their creativity and expressing their unique perspectives (Agamben, 2007).

Play activities in public spaces emerge as a means to challenge the stability and rationality of modern life. Shaped by the intricate social and cultural norms of the city, these activities do not always occur spontaneously but possess creative potential, offering new perspectives on the world. French sociologist Pierre Bourdieu conceptualizes play activities as a form of habitus, constituting a set of beliefs, values, and practices evolving through daily experiences. Play becomes a tool for personal and social transformation, enabling individuals to surpass their customary ways of thinking and behaving (Bourdieu 2000).

According to Sennett (1974), the playful theatricality of roles and masks in urban encounters goes beyond traditional responsibilities, reshaping the rules of social participation. Play in public spaces prompts individuals to discover new needs and develop fresh forms of social life and space, offering a lived critique of instrumental rationality and challenging conventional definitions of function. Playful behaviour, marked by sudden, unplanned, and unpredictable social encounters, takes on a spontaneous and creative dimension. Each urban period introduces new roles and potentials, inducing corresponding changes in laws, etiquette, and the overall transformation of the city (Stevens, 2007).

Public spaces, whether among friends or strangers, serve as environments where individuals engage in various modes, acting as both spectators and performers. Participation in these areas fosters a shared understanding that others, like oneself, possess a rich repertoire of social behaviours, reinforcing the joyful and pleasurable aspects of social interaction (Lennard & Lennard, 1984). This learning extends beyond public space, influencing structured relationships and other environments. The organization of people's activities in and around public spaces contributes to its theatrical quality by providing a wide range of potential actors and framing their interactions (Stevens, 2007). In these dynamic environments, individuals, whether friends or strangers, collectively realize that they share a broad spectrum of social behaviours through play, leading to the creation of new spaces (Lennard & Lennard, 1984). These evolving interactions weave into Sur's Story, illustrating how historical events and urban realities shape and are shaped by the dynamic nature of public spaces.

3. Contextual Background: Sur's Story: A Tapestry of Historical Events and Urban Realities

Understanding the historical narrative and demographic shifts of Sur is essential for contextualizing the complex interplay of power dynamics and urban development in the region. Before delving into the study area, it is crucial to explore the events that have shaped Sur's rich historical legacy and ongoing socio-political changes, as public spaces derive significance from these structural, demographic, and political contexts.

Sur, originally a diverse settlement embracing various ethnic and religious groups, has undergone profound transformations over time. Historical events such as the mass deportation of non-Muslim populations in 1915 and the suppression of Kurdish uprisings in 1925 have significantly influenced the city's collective identity (Gambetti, 2009). However, the most impactful event reshaping Sur's demography was the conflict between Turkish state forces and the PKK (Kurdistan Workers' Party) in the 1990s. This conflict led to the forced migration of numerous residents from rural areas to Sur, further altering the city's demographic landscape and contributing to its evolving identity (Ayata & Yükseker, 2005; Çelik, 2005).

The intense clashes between state forces and Kurdish fighters from 2015 to 2016 represent another critical chapter in Sur's history. The Kurdish issue and demands for rights, longstanding since Turkey's establishment, gained prominence in 2013 with peace negotiations, only to end abruptly in 2015. Subsequently, conflicts erupted as Kurdish militants declared self-governance and autonomy, resulting in widespread violence and destruction, particularly in Sur. The aftermath of these conflicts witnessed urban transformation projects, leading to the demolition of buildings within the Sur region and significant changes to the cityscape (Kibar, 2017).

The urban transformation has sparked debates about preserving Sur's historical and cultural heritage, particularly as new developments often clash with the city's historical fabric. Criticisms have been raised regarding the construction of concrete structures and widened roads, which deviate from the old ambiance and contribute to the displacement of residents, turning parts of Sur into ghost towns (Eşin, 2018).

These intricate social and urban transformations underscore the complex interplay of political, economic, and ideological factors shaping Sur's urban landscape. As Sur continues to evolve, research into its past and present becomes indispensable for understanding urban spaces and broader societal dynamics. When examining these events within the city walls, it becomes imperative to reconsider the roles of decision-makers and power dynamics within the city and how these dynamics will be influenced by the unfolding events.

4. Study Areas: Şeyh Said Square and parks around Diyarbakır Walls

This study focuses on Şeyh Said Square and the surrounding parks near the Diyarbakır Walls, areas of profound historical and cultural significance. These locations offer valuable insights into the dynamics of power and playful interactions within public spaces.

Diyarbakır's city centre, with origins dating back to approximately the 6th millennium BC, flourished under the protection of the Diyarbakır Walls. The walls, constructed during the Roman era, include both inner and outer fortifications, symbolizing Diyarbakır's enduring heritage. Designated as a UNESCO World Cultural Heritage site in 2015, the walls extend over 5.5 kilometres. They feature bastions that rise 10 to 12 meters high and possess a thickness of

3 to 4 meters, significantly contributing to Diyarbakır's distinctive urban landscape (Diyarbakır Cultural Inventory, 2011). The parks that surround these walls further enhance the study area, offering additional context regarding the region's historical and social fabric.

Şeyh Said Square, formerly known as Dağkapı Square, was renamed in 2014 in honour of Şeyh Said, a notable Kurdish figure who was executed by the Turkish government in 1925. In 2019, the Turkish government appointed trustees to the Kurdish-majority area and declared a state of emergency (Kibar,2017). Despite the ongoing uncertainty regarding the square's official name, the local community continues to refer to it as Şeyh Said Square, underscoring its enduring significance and the lasting legacy of Şeyh Said.

The square has undergone significant transformations over time. The most notable changes began in the 1930s, when the demolition of the Sur walls was carried out to improve airflow and reduce heat. This demolition led to the reconfiguration of the square and the surrounding roads (Gambetti, 2009). These modifications were part of a broader effort during the early Republican era to establish a uniform and modern society, as reflected in the development of contemporary urban spaces (Bozdoğan, 2002). At that time, the area surrounding Dağkapı Square was developed with a focus on military infrastructure, shaping its initial landscape (Gambetti, 2009). Today, Şeyh Said Square functions as a bustling transit hub, as shown in the function map (Figure 1). It is surrounded by large, dynamic traffic roads, medical facilities, hotels, restaurants, retail shops, and remnants of its military history.

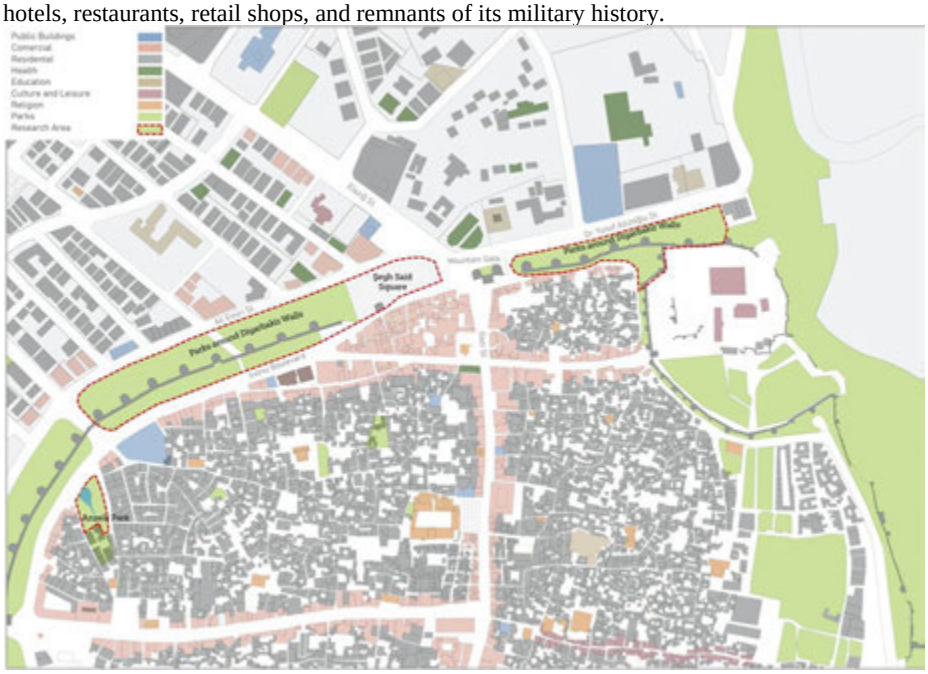

Figure 1. Map of research areas: Şeyh Said Square and Parks around Diyarbakır Walls

5. Methodology

This research employs two primary methodologies: observational study and structured questionnaire survey. Together, these approaches aim to provide a comprehensive

understanding of public space utilization, socio-cultural influences, and individual perceptions within Diyarbakır.

Observational research was conducted to investigate the use of public spaces in Şeyh Said Square and the neighbouring parks beside the historic Diyarbakır Walls. Observations were carried out primarily in the afternoon, between 16:00 and 17:00, during March and April to capture peak activity periods under favourable weather conditions. Following principles from urban ethnography (Whyte, 1980), the observations focused on documenting interactions between individuals and their physical environment, particularly playful activities, and social behaviours. This included monitoring movement patterns, social interactions, and prevalent activities within the selected public spaces. Data were recorded through detailed notetaking and photography to capture insights into space utilization and the nature of activities.

A structured questionnaire survey was utilized to gather quantitative data from 227 residents of Diyarbakır. The questionnaire was carefully designed to capture participants' descriptions and perceptions of public spaces, as well as their engagement with playful elements. According to Taherdoost (2022), questionnaires are essential for collecting standardized and comparable data, ensuring a rigorous approach to data collection. The questionnaire followed a structured format, with sequential questions designed to guide participants through the survey systematically. This approach aligns with the methodological principles outlined by Burgess (2001), from defining the research objectives to analysing the collected data. By adhering to these methodological standards, the study aims to offer a thorough analysis of the perceptions and activities of individuals within Diyarbakır's public spaces.

6. Case Study: Şeyh Said Square and Parks around Diyarbakır Walls

Şeyh Said Square predominantly hosts similar types of activities, reflecting its role as a communal space. In the afternoon, people often gather to socialize, sitting on small stools while enjoying cups of tea (Figure 2). It is a popular spot for chatting with friends, watching people go by, and soaking in the atmosphere. The square features two open-air tea houses on opposite corners, which are mostly frequented by older men. Nearby, children aged 7 to 15 play football, turning parts of the square into a playful area (Figure 3). They are quite agile and can organize games in any available space better than adults.

Figure 2. Tea drinkers on small stools

Figure 3. Children playing football.

The square is primarily used by pedestrians, with people moving at varying rhythms and speeds. As observed in Figure 4, the fountain pools are typically empty, and some benches are occupied

by individuals waiting for friends. In the centre of the square, a clock tower stands above a closed market. Most of the market stalls are vacant, except for one music studio. The lower market area is transient, particularly for young people visiting the studio. Beyond the clock tower, the square is mostly empty, with some scattered seating. Figure 5 illustrates the evening ambiance as clothing stalls begin to appear around the square, sometimes even within it, displayed on hanger racks. While informal sellers can occasionally change, this gives a basic identity of the square during the afternoon and evening times.

Figure 4. People sitting on benches and walking

Figure 5. laid out on hanger racks.

In the parks around the city walls, you'll find mobile liver kebab carts positioned near the entrance gates (Figure 6). Although some people complain about the smoke and smell from these carts, many still choose to sit on stools and enjoy the liver kebabs. Picnicking used to be more common, but it has decreased due to past conflicts and changes in the area. Outside of tourist activities like taking photos of the walls, the connection between people and the city walls tends to be more passive.

Anzele Park, as shown in Figure 7, offers a playful approach within a historical context. Located near the Diyarbakır Walls, but separated by a busy road with heavy traffic, the park features a vibrant and playful environment. The pool area next to the old historical fountain serves as a space for children to learn swimming. Currently frequented by residents who have remained despite urban transformation, the park functions as a vibrant public space where activities such as swimming, watching children, chatting, and enjoying tea take place.

Figure 6. Mobile liver kebab carts

Figure 7. Children are swimming.

Şeyh Said Square primarily functions as a waiting and transition space, with occasional events like festivals managed exclusively by governmental organizations. Similarly, parks in non-tourist areas often serve as brief waiting spots but lack significant user engagement despite their inherent potential. Anzele Park stands out with its numerous playful dynamics, whereas other parks around Diyarbakır generally exhibit less vibrancy.

The connection between the city walls and their users remains largely passive. Even though these walls provide shaded areas crucial for the hot climate, people use the parks infrequently. Activities such as eating liver kebabs or drinking tea around the Sur area contribute to the unique character of these spaces. However, due to urban transformation projects and migration, parks experience minimal user participation. Promoting more playful activities could potentially alter this dynamic, enhancing user empowerment and fostering greater involvement in the design process. To further understand these dynamics and the underlying reasons for limited engagement, the subsequent analysis of the questionnaire data provides valuable insights into user perceptions and preferences regarding public spaces in Diyarbakır.

7. Analysing Public Space Perceptions and Urban Design Participation: Insights from Şeyh Said Square and Diyarbakır Walls

To understand users' perceptions of play activities and public space, as well as their participation, the results of the questionnaire were analysed. Responses were gathered from a diverse pool of 217 participants, providing perspectives and preferences regarding public spaces, particularly Şeyh Said Square and parks in the Sur surroundings. Among the respondents, 54% identified as male, 45% as female, and 0.50% as other. Regarding age demographics, the participants were distributed as follows: 2.80% were under 18, 20.20% were aged 18-24, 30% were aged 25-34, 27.20% were aged 35-44, 15% were aged 45-54, and 5.20% were 55 and above. In terms of educational attainment, most respondents held a bachelor’s degree (70.00%), followed by those with a master’s degree (18%), individuals with a high school diploma or lower (9.00%), and a small proportion with a doctoral degree (2.80%). These responses were not only from the residents of the Sur District but also included participants from other neighbourhoods, reflecting the area's appeal beyond its immediate vicinity. The aim was to gain insights into participants' perceptions of public spaces, understand how these spaces are utilized, and explore views on play activities within these environments.

The representation of public spaces plays a crucial role in defining their function and impact on the community, as it shapes how individuals perceive and interact with these environments

(Lefebvre, 1991). Participants offered varied definitions of public space, with a majority emphasizing its pivotal role as accessible areas for diverse segments of society to converge and interact. As illustrated in Figure 8, public spaces are regarded as common areas for social interaction and fostering a sense of community, with an emphasis on the importance of civil participation. Conversely, a smaller segment of participants considers public spaces as dynamic environments meant to break away from daily routines and encourage spontaneous, unpredictable interactions. This limited acceptance suggests that people may be less open to encountering new and diverse experiences within these spaces, reflecting a reluctance to embrace risk and novelty. This hesitation aligns with Stevens' observations on the difficulties of integrating playful and unpredictable elements into public spaces (Stevens, 2007).

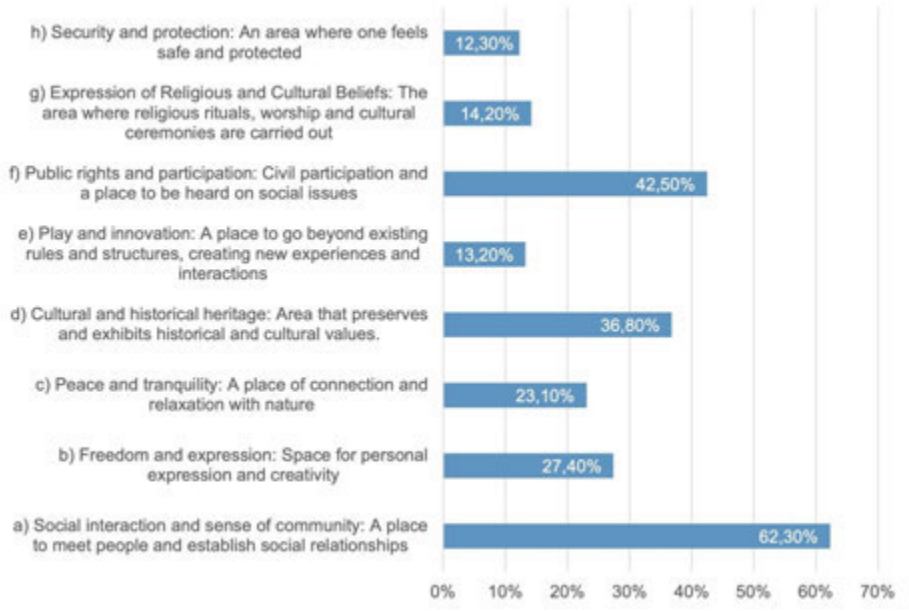

Figure 8." Which of the following do public spaces represent to you?" (np:227)

The survey results reveal a broad spectrum of activities that people associate with play in public spaces, highlighting varying preferences and perceptions. Figure 9 illustrates that socializing and meeting with friends is the most favoured activity, reflecting the importance of public spaces as venues for social interaction and community engagement (Shaftoe, 2008; Whyte, 1980). This underscores the role of play these spaces in facilitating informal social gatherings and connections. Children's games, while significant, are viewed as a more traditional aspect of play, illustrating a common perception that play is primarily for younger individuals (Huizinga, 1955). This perspective is supported by the popularity of sports and games, which are seen as organized and regulated forms of play in modern contexts. Additionally, creative, or artistic activities and social and political activities also receive notable support, indicating that respondents view play in public spaces as encompassing opportunities for creative expression and civic engagement. This reflects a broader and more inclusive understanding of play, highlighting the evolving nature of these activities beyond traditional recreational pursuits (Huizinga, 1955).

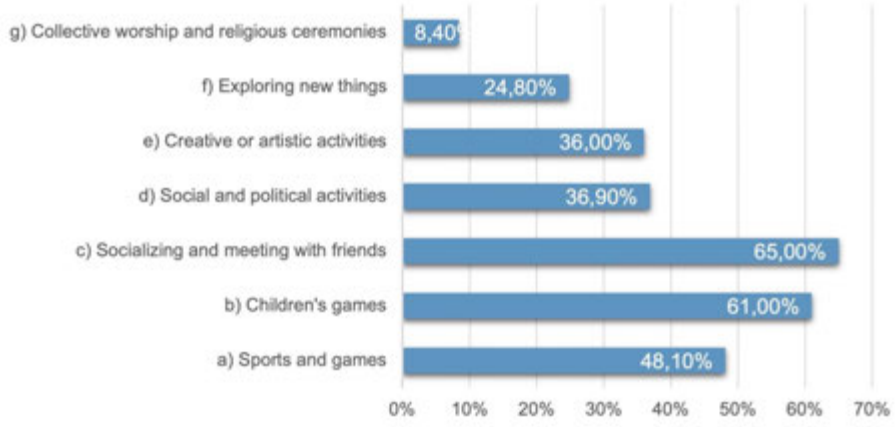

Figure 9." What types of activities do you consider as play in public spaces?" (np:227)

The range of activities that people currently engage in or plan to pursue at Şeyh Said Square underscores its multifaceted role within the community. According to Figure 10, sitting, resting, and chatting are the most common activities, highlighting the square's function as a space for relaxation and informal social interaction. This underscores the need for comfortable and inviting areas that foster leisure and social connections. Additionally, there is significant interest in participating in events that enhance the square's aesthetic appeal, such as art installations and festivals, indicating a desire for a visually and culturally enriched environment. Activities related to social, political, or environmental causes, such as protests and rallies, also play a notable role, underscoring the square's importance as a venue for civic engagement and community activism. Cultural activities, including street performances and outdoor theatres, as well as support for local businesses through markets and fairs, are also valued, reflecting a preference for diverse public programming. In contrast, outdoor sports, yoga sessions, and fitness classes are less emphasized, suggesting these activities are not central to the square's current usage.

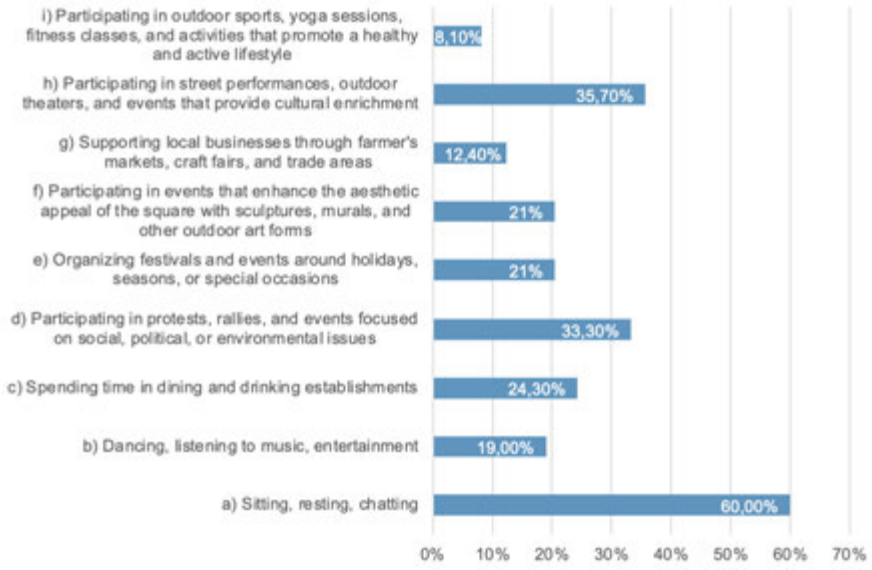

Figure 10. "What activities currently or intend to engage in at Şeyh Said Square?" (np:227)

The survey explores the participation of various stakeholders in the design process and their respective roles. Most respondents believe that users should be directly involved in the design of public spaces, reflecting a strong desire for public engagement and input in shaping their environments (Shaftoe, 2008). This perspective suggests that incorporating user feedback can lead to more responsive and inclusive designs that better meet the community's needs and preferences. Figure 11 highlights the decision-making responsibilities, with architects, urban planners, and environmental experts seen as the most crucial contributors to public space planning. This underscores the value of professional expertise in creating well-designed and functional spaces (Lefaivre & Döll, 2007). Local governments also play a significant role, emphasizing the importance of municipal involvement in managing and maintaining public spaces. Moreover, there is substantial support for involving users, non-governmental organizations, and local communities, indicating a recognition of the importance of diverse perspectives and grassroots input in the decision-making process (Boano & Talocci, 2014).

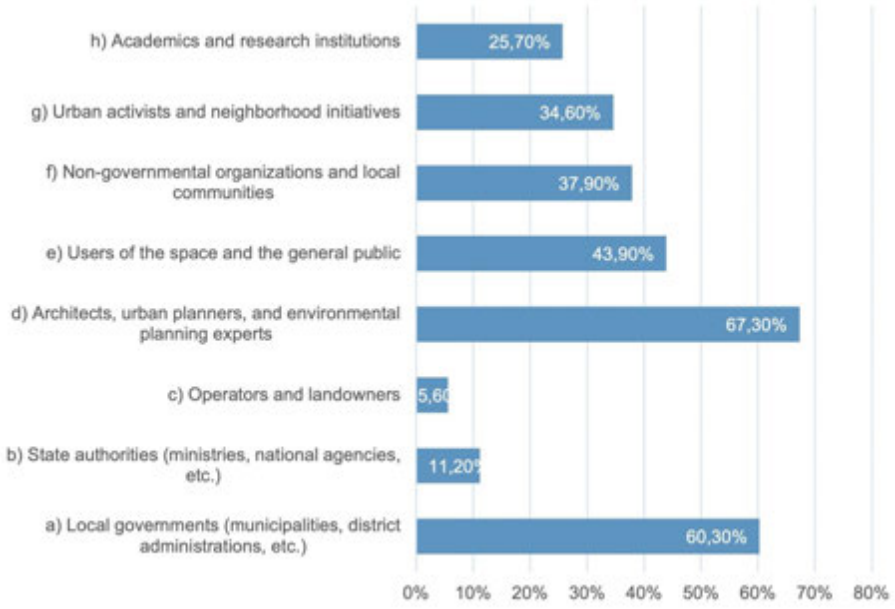

Figure 11. " Preferred Decision-Makers in Public Space Planning and Management?" (np:227)

The findings underscore the multifaceted nature of public spaces and emphasize the importance of incorporating diverse perspectives and user engagement in their design. These insights will serve as a foundational basis for future initiatives aimed at enhancing public spaces in Şeyh Said Square, parks in the Sur surroundings, and beyond, ultimately fostering social cohesion, cultural vibrancy, and community well-being. This emphasis on participation and play highlights the importance of giving users the power to shape their environments and make decisions that reflect their needs and preferences. It is imperative to recognize that participation and play are not only integral components of vibrant public spaces but also mechanisms for empowering individuals and communities to actively engage in the process of urban design and decision-making.

8. Discussion: Playful Participation in Urban Design to Play with Power Relations: Towards Inclusive Public Spaces

Observing the events shaping the history of the Sur district reveals that life within Şeyh Said Square and its surrounding parks is significantly influenced by power dynamics, particularly urban transformations driven by state interventions and economic factors. Social life, characterized by group activities and male-dominated gender dynamics, also plays a major role in these power dynamics. Despite these challenges, a closer examination of how people navigate their everyday lives reveals new ways of utilizing the space. In these instances, playful engagements have the potential to shift power dynamics, granting individuals greater autonomy within the spatial realm. Playful interventions can disrupt dominant narratives, subvert spatial hierarchies, and create opportunities for collective empowerment and expression (Boano & Talocci, 2014). In urban public settings, play often arises in response to the uncertainties and

tensions inherent in everyday life. Play within public spaces promotes interactive engagement and heightened awareness of others participating in the same activity (Stevens, 2007). This participation and its benefits produce new powers and spaces. Play serves as a communication network, actively engaging people within these dynamics (Sennett, 2018).

Understanding the diverse needs, preferences, and behaviours within the community is essential (Madanipour, 1996). Play theory suggests that the introduction of playful elements into public spaces can facilitate new forms of usage by encouraging risk-taking and spontaneous behaviours (Stevens, 2007). In Şeyh Said Square and the surrounding parks, functions such as eating and drinking areas are identified with the area and contribute to the spatial distinctiveness of these locations. The music workshop situated in the unused covered bazaar beneath the public space could potentially spill over into the square, adding to its vibrancy with playful activities. Additionally, the questionnaire responses indicate a broad and diverse perception of play among the participants, highlighting the multifaceted nature of playful interactions within these spaces. Specifically, play facilitates social interaction and integration with nature, bringing new possibilities for rhythms of behaviour and new communication systems (Lefebvre, 2004).

The interplay between the city walls and local activities can make play activities unique to a specific place. In play theory, adopting a historical perspective is crucial for evaluating a location based on its history. The embedded stories and memories within the urban fabric enrich our understanding of the place's identity (Boano & Talocci, 2014). The city walls of Diyarbakır, often seen merely as a backdrop, reveal deeper historical significance upon closer examination. Locals refer to the city walls as the 'body,' a term that holds substantial meaning and plays a distinct role in everyday life. Historically, street fighters would challenge each other in the areas near the walls, which were referred to as the "body," and social gatherings would often take place in these spaces (Diken, 2002). This term embodies a form of spatial ownership and identity, where play functions as a mediator in this ownership process (Boano & Talocci, 2014).

The character of playful activities is significantly influenced by the surrounding urban structures and the overall urbanization of the area. One major factor that restricts the playfulness of this space is the high density of vehicular traffic and the designated use of these areas for vehicles only (Shaftoe, 2008). Roads around Şeyh Said Square and nearby parks are heavily trafficked, and the rise of automobile-dependent transportation has further diminished opportunities for outdoor interaction. Consequently, public spaces have been reduced to main roads and isolated gardens. Modern design principles for public spaces should focus on human-centred planning. This approach should foster environments that promote social interaction, spontaneous play, and community engagement, while also integrating elements of nature to enhance liveliness and strengthen the connection between people and their surroundings (Gehl, 2011; Gómez-Baggethun et al., 2013; Beatley, 2011).

Participatory design workshops, interactive installations, and collaborative activities that invite residents to contribute their ideas and wishes are essential for creating playful public spaces (Boano & Talocci, 2014). Actively involving the community in the design and planning of these areas ensures that they reflect the desires and aspirations of their users. This participatory approach leads to urban environments that are more inclusive, user-friendly, and vibrant—a concept that aligns with play theory, which emphasizes the interactive and participatory dimensions of play within societal norms (Bateson, 1987). Findings from the questionnaire reveal a strong desire among people for greater involvement in the public space design process, indicating a wish to have more control over their surroundings. Residents of Sur, in particular,

have expressed a desire to engage in discussions about the city with designers, supported by contributions from local administration. This call for empowerment reflects a broader aspiration for community-driven urban development, where residents actively shape the environments, they inhabit.

The insights presented in Table 1 highlight the importance of integrating playful interventions, active participation, and historical exploration into urban design. Such approaches contribute to the creation of inclusive, vibrant, and nature-oriented public spaces.

Table 1: Insights into Urban Design Approaches through Play Theory

Urban Design Approach	Key Insights	References
Empowerment to Users	Playful interventions can disrupt dominant narratives and challenge the sacredness of, thus dismantling power dynamics embedded within urban spaces.	(Stevens, 2007), (Shaftoe, 2008), (Whyte, 1980)
Creating New Actions	Playful design encourages the creation of new actions and interactions within public spaces, fostering a sense of ownership and empowerment among individuals in reshaping their environments.	(Stevens, 2007), (Shaftoe, 2008), (Whyte, 1980)
Active Participation	Actively involving the community in playful design processes empowers individuals by giving them a voice in shaping their surroundings, leading to more inclusive and user-centric urban spaces.	(Boano & Talocci, 2014), (Shaftoe, 2008), (Carmona, 2010)
Historical and Cultural Exploration	Exploring the history and culture of public spaces through a playful lens enriches the understanding of place identity and encourages meaningful interactions between users and their urban environment.	(Huizinga, 1995), (Boano & Talocci, 2014), (Jacobs, 1961)
Connectivity and Accessibility	The proliferation of playful spaces is facilitated by the interconnectedness of public spaces	(Shaftoe, 2008), (Whyte, 1980)
Varied and Stimulating Environments	Public spaces gain meaning through the functions and life surrounding them.	Lefaivre & Döll (2007); Whyte,(1980)
Lively and Nature-oriented	Incorporating nature elements and promoting vibrant activities enhances the vitality and connection to the environment in public spaces.	(Gómez-Baggethun et al., 2013), (Beatley, 2011), (Francis, 1987)

9. Conclusion

Active participation in the design and planning of public spaces is pivotal in shaping environments that foster inclusive and empowering experiences. By involving the community in these processes, public spaces can be transformed into dynamic arenas where individuals not only participate but also shape their surroundings according to their needs and aspirations. This approach challenges existing power dynamics inherent in urban transformations and state interventions, offering an opportunity to democratize spatial experiences. Through playful interventions, individuals gain agency within the spatial realm, disrupting dominant narratives

and subverting spatial hierarchies (Boano & Talocci, 2014). Promoting interactive engagement and heightened awareness of others, play creates opportunities for collective empowerment and expression, ultimately sharing power equally and fairly among users (Sennett, 1977). Prioritizing human-centric design principles and facilitating active community involvement in creating public spaces are essential steps toward building vibrant, inclusive, and socially connected urban environments where the transformative potential of play can be fully realized (Shaftoe, 2008).

In examining Şeyh Said Square and the neighboring parks in Sur, an ongoing urban change is evident, affecting residents, often without their realization. However, through observing playful activities and engaging with people about their desires, these places can become lively through active involvement. Even when power dynamics are influenced by the conservative values of the state, economy, or society, play always introduces a new way of exerting influence. According to Agamben, play empowers citizens by involving them in the design process and allowing them to reshape their environment based on their aspirations and everyday needs. The act of play is explored as a means of opening up the fence and unlocking new uses and modes of politics within urban design processes (Boano & Talocci, 2014). Play theory offers a framework for understanding the aesthetic and political dimensions of urban design. Designers can challenge established norms and power structures, opening possibilities for alternative forms of social and spatial organization (Sennett, 1970; 1972).

Concluding the exploration of the importance of play by delving into Nietzsche's philosophy, his character Zarathustra famously declares, "*I will believe in only one god, a god who dances!*" (Nietzsche, 1995). In Nietzsche's philosophy, dance symbolizes the affirmation of bodily pleasures and the celebration of life. Rejecting dogmatic truth claims, Nietzsche advocates for a philosophy that embraces the richness of life and celebrates free thought. He emphasizes activities like dance and music that transcend intellectual constraints, offering avenues for self-expression and empowerment. Thus, the prevalence of play activities in space signals a community actively engaged in shaping their existence, embodying Nietzsche's vision of personal autonomy and creativity (Hinman, 1975). In conclusion, integrating play theory into the collaborative design process empowers individuals to actively shape the evolution of public spaces, fostering a spirit of playfulness, encouraging social interaction, and deepening the sense of place (Whyte, 1980; Shaftoe, 2008). Embracing play as a vital force in urban design leads toward establishing lively and adaptable cities that reflect the rich tapestry of experiences inherent in diverse communities.

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Exploring User Preferences and Place Attachment in Urban (Public) Spaces: A Case Study of Kadıköy Historical City Centre, Istanbul, Türkiye

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Abstract
This study aims to explore the preferences of different user groups for urban (public) spaces and their selective behaviours within them. The study centres on the Kadıköy Historical City Centre (KHCC) in Istanbul, Türkiye. A public online survey was conducted with 473 participants representing residents, workers, and visitors. Survey data were analysed using mixed methods techniques, including descriptive statistics, discourse analysis, and mapping. It was found that there were notable differences in terms of urban space preferences among locals and visitors, and that the place attachment different user groups developed with the space were diversified and differentiated. The study underscores the need for inclusive urban spaces that cater to the needs and demands of all user groups, given the transformation of KHCC.
Keywords: urban (public) space; user preferences; place attachment

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1. Introduction: Urban Users and Place Attachment

Different user groups perceive urban (public) spaces and interact with them in unique ways. This experience is shaped by intricate connections between cultural, economic, environmental, geographical, political, social, and technological factors. These encounters shape the attachment individuals develop to these spaces, which is rooted in both direct and indirect physical and social engagements in their daily routines.

Different from place identity and sense of place, place attachment specifically refers to "the cognitive-emotional bond to a meaningful setting […] observed across cultures, place types, and eras" (Scannell and Gifford, 2017, p. 256). It is "an emotion experienced toward a given place, knowledge and beliefs about the place, and behaviour and activities in the place" (Altman and Low, 1992, in Wohl and Blit Cohen, 2024, p. 2). Therefore, it has three main dimensions: personal, psychological, and spatial (Scannell and Gifford, 2010). The personal dimension refers to the individual and collective meanings that people ascribe to a place, whereas the psychological dimension includes feelings, thoughts, and behaviours that are a result of the attachment process. The spatial dimension, on the other hand, stresses the physical and social qualities of a place, like its uniqueness, interpersonal connections, and the built and natural environments.

According to Lewicka (2011), the majority of place attachment research takes neighbourhoods as the place type, whereas the other types are either neglected or have little body of research. Therefore, there is a high need for research in different place types and in different socio-geographical locations to better understand how place attachment is developed and can be sustained so as to instrumentalise it for the betterment of societies and future cities. Especially in the case of deteriorating city centres, place attachment can be used as a mediator for the revitalisation of vivid city life.

In this context, this study aims to explore the preferences of different user groups for urban (public) spaces, as well as their selective behaviours within these spaces, by analysing and comparing the place attachment these groups develop with them. The study centres on the

Kadıköy Historical City Centre (KHCC) in Istanbul, Türkiye, as it accommodates multiple user groups from different socio-cultural and socio-economic backgrounds and has been one of the most important sub-centres of the Istanbul Metropolitan Region since the 19th century. A public online survey was conducted with different user groups (residents, employees, and visitors). A total of 473 participants took part in this study. Survey results were analysed by means of mixed methods techniques, including descriptive statistics, discourse analysis, and mapping.

2. Case Study Area: Kadıköy Historical City Centre (KHCC), Istanbul, Türkiye

Kadıköy Historical City Centre (KHCC) is located on the Anatolian Side of Istanbul Metropolitan Region (see Figure 1). It is one of the oldest settlements dating to 675 B.C. (T.C. Kadıköy Kaymakamlığı, n.d.). Until 1882, it was known for its summerhouses and excursion spots, as well as its agricultural lands, vineyards and Turkish gardens (Ayvazoğlu, 2011; Ekdal, 1997; Kütükçü, 2014) (see Figure 2). Starting with the very first systematized urbanization movements at this time, these places began leaving their spaces to a densely concentrated commercial activity – a city centre – on the coastline and to residential areas in the inner sides of the area (Ulubaş Hamurcu and Terzi, 2021). Beginning with the 20th century, KHCC hosted a vast variety of ethnic and religious groups including Armenians, Bulgarians, Greeks, Jews, Levantines, Roman Catholics and Protestants, and Turks (Kütükçü, 2014). The most dramatic change in KHCC dates to the mid-1900s (Ulubaş Hamurcu and Terzi, 2021). Along with the modernism movement, the existing housing stock was merely replaced by apartment blocks. Following the incidents in 1955 and 1964, the social conjuncture of the area changed drastically (Kavukçuoğlu, 2010).

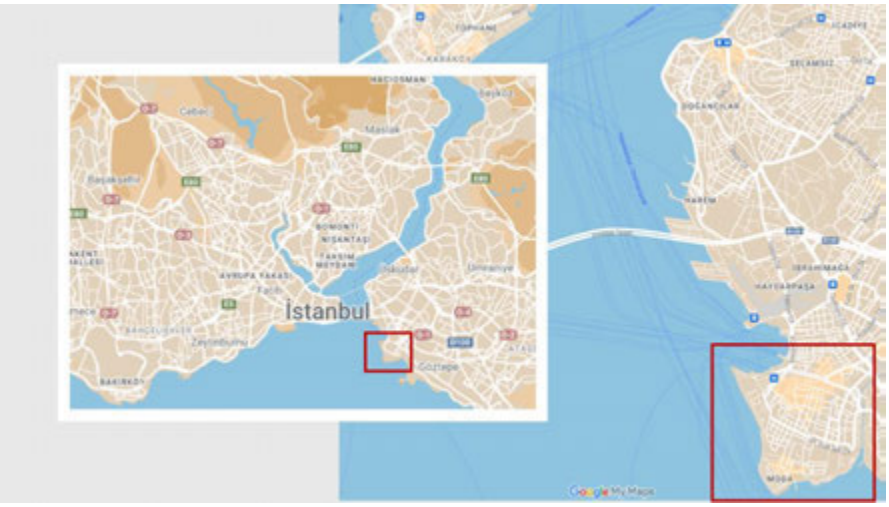


Figure.1 Location of KHCC (prepared by the authors)

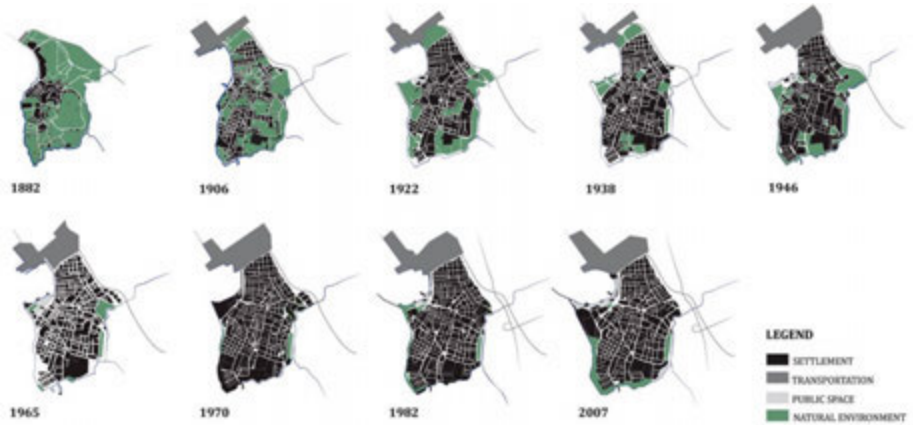


Figure.2 Urban pattern change in KHCC between 1882 and 2007 (Ulubaş Hamurcu and Terzi, 2021, p. 14)

Large-scale urban transportation projects at the beginning of the 2000s resulted in KHCC becoming an important transfer centre for daily mobility and an attraction point for local and foreign visitors (ÇEKÜL, 2014). Along with the renewal projects, it also started housing young white-collar workers, (exchange) students, and professionals from different sectors.

Today, KHCC hosts a variety of users from different economic, educational and social backgrounds (Ulubaş Hamurcu and Terzi, 2021). The diversity and vibrancy brought about by these developments have changed KHCC's appeal, affecting a sense of belonging and attachment among its residents and frequent visitors. This place attachment is further influenced by user preferences that dictate the amenities and social spaces they frequently use within KHCC, shaping their daily interactions and experiences.

3. Data and Methodology

A public online survey was conducted with different user groups (residents, employees, and visitors) before the breakout of the COVID-19 pandemic, between April 29, 2019, and December 18, 2019. A total number of 498 participants was reached. Nevertheless, 25 answers were excluded due to misuses and misunderstandings faced in the answers which resulted in a total of 473 participants.

Among these, 71% are visitors, 22% live and 7% work in the area. A detailed analysis revealed that 55% of participants come to KHCC for leisure activities, 10% for transportation, 5% for shopping, and 3% for other purposes. It was also discovered that 3% of the participants both live and work here.

Participants were asked to: (1) list the first three things that come to their mind when Kadıköy is mentioned; (2) choose among the list of regions of KHCC which they think they mostly use; (3) list where they specifically spend most of their time in KHCC; (4) and choose among the listed publicly owned places which they think they know. By asking these, it was aimed to understand how the participants related themselves to the existing physical environment (in this case, KHCC) and what type of meaning they attribute to it.

Thus, survey data were analysed using mixed methods techniques, including descriptive statistics, discourse analysis, and mapping. Descriptive statistics are used to frame the user profiles of different sub-groups whereas discourse analysis is used to reveal the level of place attachment to KHCC in relevant sub-groups. Mapping is done for visualising the selective behaviours of sub-groups within these spaces. The results are given space based on the representativeness of the sub-groups within the sample one-by-one.

4. Findings and Discussion: User Profiles and Preferences of Urban (Public) Spaces of KHCC

In this section, the results of the study are delivered based on the representativeness of the sub-groups within the sample one-by-one and a thorough discussion is held.

4.1. Visitors

A vast majority of the participants are visitors. A total of 323 attendees come to KHCC for transfer (= 43 people), shopping (= 20 people) and leisure purposes (= 260 people). Among these 69% are women and 31% are men. The general profile of the visitors might be categorised under two: (1) 18-24-year-old university students and (2) full-time workers with at least bachelor's degrees. 84% are single, 15% married and 1% have another marital status. 61% are tenants of which 66% live with full rent, 32% share their accommodation and 2% sub-rent it. 71% know their neighbours. Most of them use rail transit and ferries to come to KHCC.

The answers given to the question about the three things that come to one's mind when Kadıköy is mentioned are cumulated around the physical attributes of the site. These can be listed as Moda (*a neighbourhood*), Boğa (*a bull statue in the middle of a roundabout*), Rıhtım (*coastline where the jetties are located*), Moda Sahil (*coastline where the open public green spaces are located*), ferry, Fenerbahçe, and beer. Among the frequently used words listed, only two have direct emotional connotations, which are 'crowded' and 'fun' whereas 'Fenerbahçe' as a football club also has emotional connotations (see Figure 3).

Figure.3 Three things about KHCC – Visitors (prepared by the authors using Word Clouds)

Visitors state that they spend most of their time in Moda. Following Moda, they spend time in Bahariye, Caferağa, Çarşı (*bazaar*), and Moda Sahil. These regions are closely located to each other creating an axis which begins with Çarşı (*the commercial centre*) till Moda Sahil (see Figure 4 – left).

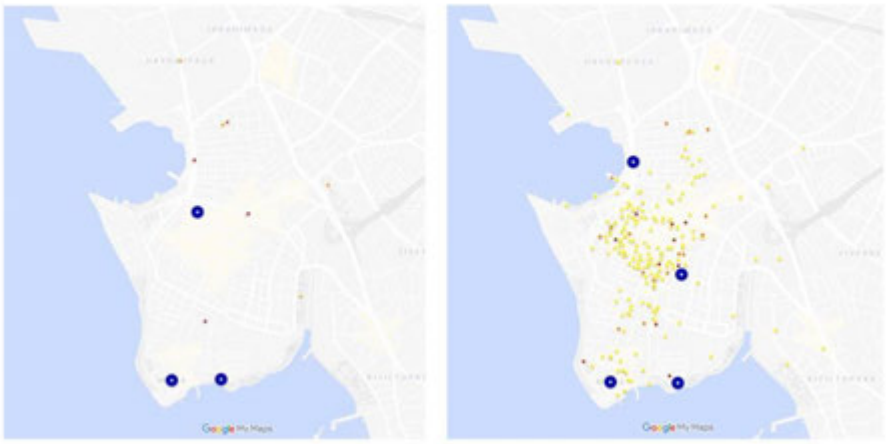


Figure.4 Top districts accommodated by visitors (left); Frequently visited places (right) (prepared by the authors)

Participants are also allowed to give detailed answers to the places where they go frequently. Again, Moda, Moda Sahil, Bahariye, Rıhtım and Çarşı (Bazaar) come to the forefront. In addition to these districts, they also go to Starbucks, Moda Aile Çay Bahçesi (*tea garden*), Akmar (*a building where second-hand bookstores are located*), Asuman (*chocolatier*) and cafes (see Figure 4 – right).

On behalf of publicly owned spaces, Nazım Hikmet Kültür Merkezi, Süreyya Operası and Barış Manço Evi are well known, whereas the rest of the spaces have equal significance. These publicly owned spaces also exist on the same axis beginning with the Çarşı to Moda Sahil.

4.1.1. Visits for leisure time activities

55% of the participants (=260 people) come to KHCC for leisure time activities. Among these 68% are women and 32% are men. The profile of the visitors with leisure purposes is similar to the general profile of the visitors which is 18-24-year-old university students and full-time workers with at least bachelor's degrees. 85% are single, 14% are married and 1% have another marital status. 65% are tenants of which 66% live with full rent, 31% share their accommodation and 3% sub-rent it. 69% know their neighbours. Most of them use the ferry to come to KHCC along with wide ranging ways of transport including minibus, rail transit, car, metrobus, bus, bicycle and walking. A small group uses taxis to come to KHCC.

The answers given to the question about the three things that come to one's mind when Kadıköy is mentioned are cumulated around the physical attributes of the site. These can be listed as Rıhtım, ferry, Moda, Boğa, Moda Sahil, beer and Fenerbahçe. In terms of emotional connotations, 'crowded' and 'fun' comes to the forefront, whereas 'Fenerbahçe' as a football club also has emotional connotations (see Figure 5).

Figure.5 Three things about KHCC – Visits for leisure time activities (prepared by the authors using Word Clouds)

Visitors with leisure purposes state that they spend most of their time in Çarşı, Moda and Moda Sahil. Haydarpaşa and Rasimpaşa are the least preferred regions by them (see Figure 6 – left).

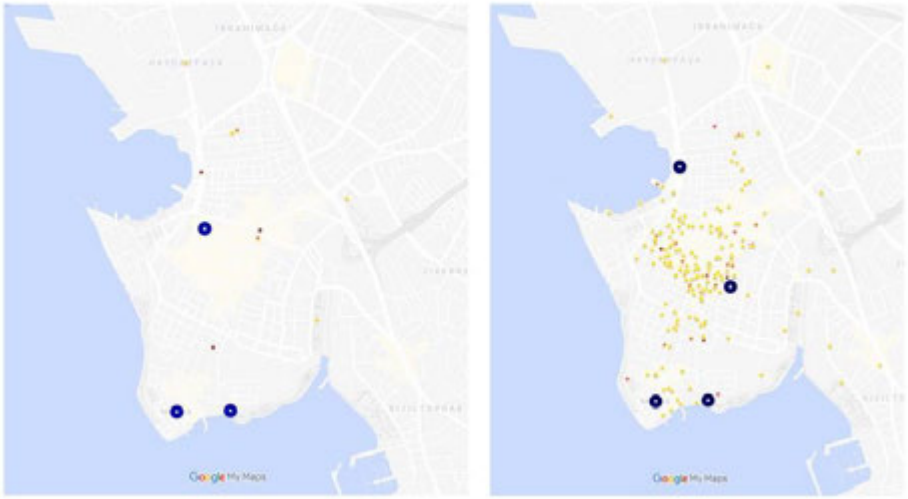


Figure.6 Top districts accommodated by visitors with leisure purposes (left); Frequently visited places (right) (prepared by the authors)

Participants are also allowed to give detailed answers to the places where they go frequently. Bahariye, Moda, Bazaar, Moda Sahil, and Rıhtım come to the forefront. In addition to these districts, they also go to Starbucks, Asuman, Akmar, Barlar Sokağı (*a street where bars and pubs are dominantly located*), Moda Aile Çay Bahçesi, and IDEA Kadıköy (*public working space and initiative*) (see Figure 6 – right).

On behalf of publicly owned spaces, Barış Manço Evi, Süreyya Operası and Barış Manço Kültür Merkezi are well known, whereas the rest of the spaces have equal significance. As aforementioned, these publicly owned spaces are located near these most used and preferred places and regions.

4.1.2. Visits for transfer

10% of the participants (=43 people) come to KHCC for transfer purposes. Among these 72% are women and 28% are men. The profile of the visitors with transfer purposes is similar to the general profile of the visitors which is 18-24-year-old university students and full-time workers with at least bachelor's degrees. 76% are single and 24% are married. 54% are tenants of which 70% live with full rent and 32% share their accommodation. 77% know their neighbours. Most of them use ferries to come to KHCC. This is followed by rail transit, minibus, metrobus, bus, taxi, and on foot. A small group also uses bicycles to come to KHCC.

The answers given to the question about the three things that come to one's mind when Kadıköy is mentioned are cumulated around the physical attributes of the site. These can be listed as Moda, Boğa, Rıhtım, ferry, Haydarpaşa, bars, beer, shopping and İskele (*jetty*). Among the frequently used words listed, only two have emotional connotations, which are 'crowded' and 'fun' (see Figure 7).

Figure.7 Three things about KHCC – Visits for transfer (prepared by the authors using Word Clouds)

Visitors with transfer purposes state that they spend most of their time in Moda, Moda Sahil and Çarşı whereas Haydarpaşa is the least preferred region by them (see Figure 8 – left).

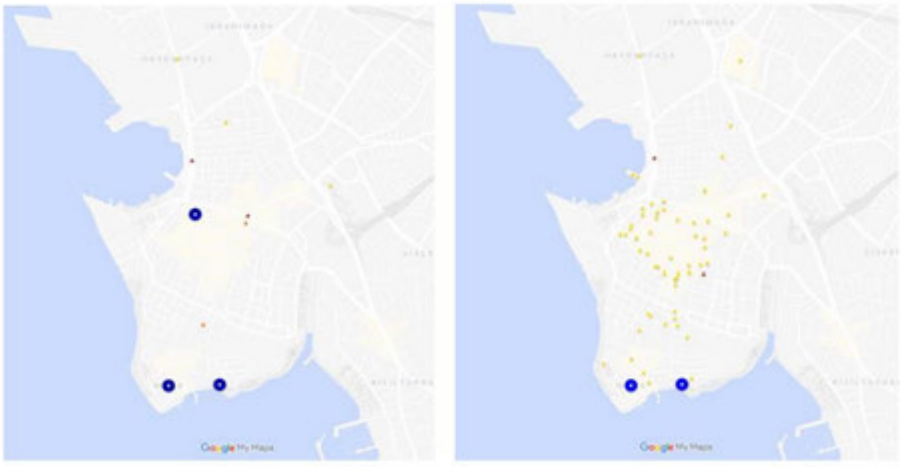


Figure.8 Top districts accommodated by visitors with transfer purposes (left); Frequently visited places (right) (prepared by the authors)

Participants are also allowed to give detailed answers to the places where they go frequently. Again, Moda and Moda Sahil come to the forefront. In addition to these districts, they also go to Starbucks, Rıhtım, Akmar, and cafes (see Figure 8 – right).

On behalf of publicly owned spaces, Nazım Hikmet Kültür Merkezi, Süreyya Operası and Barış Manço Evi are well known. Surprisingly, though Tarih Edebiyat Sanat Kütüphanesi (TESAK) is located on the coastline right behind the Beşiktaş-Adalar jetty and IDO terminal, and next to the first-final stop of Moda tram and Kadıköy-Bostancı minibus terminal, and at the back of bus stops, it is the least known by the visitors with transfer purposes.

4.1.3. Visits for shopping

5% of the participants (=20 people) come to KHCC for shopping purposes. Among these 70% are women and 30% are men. The profile of the visitors with shopping purposes is similar to the general profile of the visitors which is 18-24-year-old university students and full-time workers with at least bachelor's degrees. 76% are single and 24% are married. 30% are tenants of which 50% live with full rent and 50% share their accommodation. 85% know their neighbours. Most of them use bus, minibus, rail transit, ferries, and car to come to KHCC. A small group also uses taxis and metrobus to come to KHCC.

The answers given to the question about the three things that come to one's mind when Kadıköy is mentioned are cumulated around the physical attributes of the site. These can be listed as Moda, Boğa, shopping, ferry, sea, Bazaar, Haydarpaşa, Rexx, beer, fish and cafes. Among the frequently used words listed, 'crowded', 'culture', 'arts', and 'ease' come to the forefront with emotional connotations (see Figure 9).

Figure.9 Three things about KHCC – Visits for shopping (prepared by the authors using Word Clouds)

Visitors with shopping purposes state that they spend most of their time in Moda and Çarşı whereas Haydarpaşa is the least preferred region by them (see Figure 10 – left).

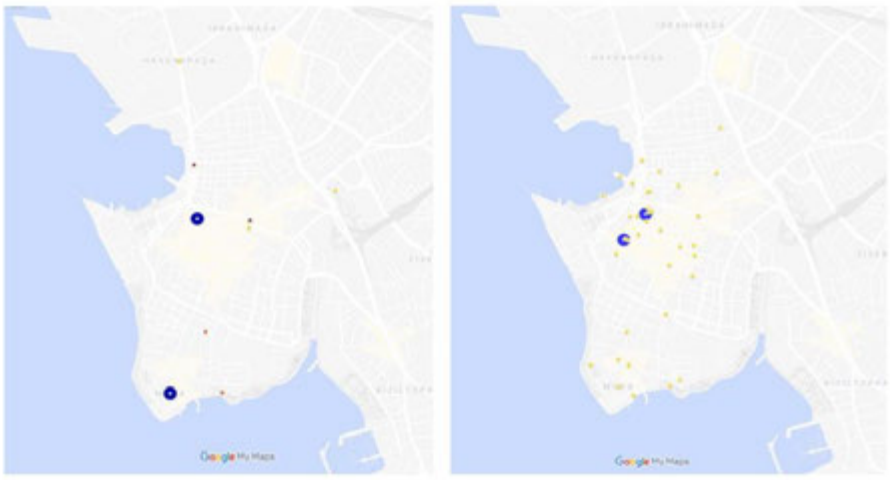


Figure.10 Top districts accommodated by visitors with shopping purposes (left); Frequently visited places (right) (prepared by the authors)

Participants are also allowed to give detailed answers to the places where they go frequently. Boğa, Bazaar, Moda and Moda Sahil come to the forefront. In addition to these districts, they also go to Starbucks, Mephisto (*bookstore*), Baylan (*patisserie*), Rexx (*bar*) and second-hand bookstores (see Figure 10 – right).

On behalf of publicly owned spaces, Yeldeğirmeni Don Kişot Evi, Karikatür Evi, Yeldeğirmeni Sanat and Tarih Edebiyat ve Sanat Kütüphanesi (TESAK) are the least known whereas the rest of the spaces have equal significance.

4.2. Locals

Locals consists of residents, workers, and people who both live and work in KHCC.

4.2.1. Residents

22% of the participants (=105 people) live in KHCC. Among these 54% are women and 46% are men. The general profile of the residents is 25-45-year-old full-time workers with at least bachelor's degrees. 62% are single, 35% are married and 3% have another marital status. 63% are tenants of which 79% live with full rent and 21% share their accommodation. 77% know their neighbours.

The answers given to the question about the three things that come to one's mind when Kadıköy is mentioned are cumulated around the emotional connotations of the site. These can be listed as 'home', 'ease', 'crowded', and 'fun'. These are followed by 'freedom', 'civilization', 'safety', 'friends', 'arts', 'life', 'history', and 'social environment'. Among the frequently used words listed, only a few refer to the physical environment. These are Bazaar, Boğa, Moda, and Moda Sahil. Sea, ferry, Yeldeğirmeni and Haydarpaşa are also among frequently referred physical attributes of KHCC (see Figure 11).

Figure.11 Three things about KHCC – Residents (prepared by the authors using Word Clouds)

Residents state that they spend most of their time in Moda, Moda Sahil and Bahariye whereas Haydarpaşa is the least preferred region by them. Yeldeğirmeni and Caferağa are also among the frequently preferred regions of KHCC (see Figure 12 – left).

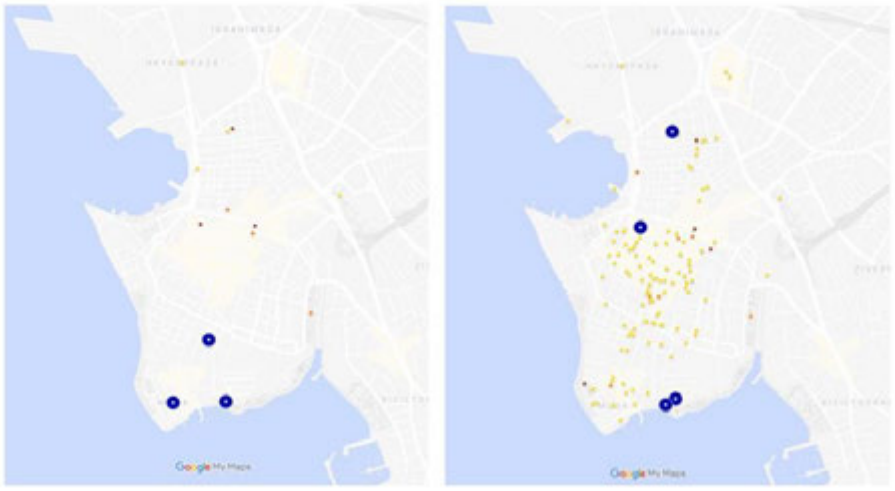


Figure.12 Top districts accommodated by residents (left); Frequently visited places (right) (prepared by the authors)

Participants are also allowed to give detailed answers to the places where they go frequently. Again, Moda and Moda Sahil come to the forefront. In addition to these districts, they also go to Yeldeğirmeni, Çarşı, and Bahariye. It is also observed that they visit Moda Aile Çay Bahçesi, IDEA Kadıköy, Küff (*pub*), and Nazım Hikmet Kültür Merkezi (see Figure 12 – right).

On behalf of publicly owned spaces, Nazım Hikmet Kültür Merkezi, Süreyya Operası and Barış Manço Evi are well known by residents. The rest are also known by the residents of KHCC.

4.2.2. Workers

7% of the participants (=33 people) work in KHCC. Among these 30% are women and 70% are men. The general profile of the workers is 25-45-year-old full-time workers with at least bachelor's degrees. 61% are single, 33% are married and 6% have another marital status. 58% are tenants of which 89% live with full rent and 11% share their accommodation. 79% know their neighbours. Only a small group uses taxis to come to KHCC whereas the rest of ways of transport are preferred by a general audience. However, metrobus is not preferred by any of the participants, who are workers, for coming to KHCC.

The answers given to the question about the three things that come to one's mind when Kadıköy is mentioned are cumulated around the emotional connotations of the site. These can be listed as 'ease', 'crowded', and 'home'. These are followed by 'civilisation', 'noise', 'fun', 'night life', 'freedom', and 'Fenerbahçe'. Among the frequently used words listed, only a few refer to the physical environment. These are Moda Sahil, Moda, Boğa, Rıhtım, ferry, beer, theatres, and Yeldeğirmeni. Work and Fenerbahçe can be also included in both categories (see Figure 13).

Figure.13 Three things about KHCC – Workers (prepared by the authors using Word Clouds)

Workers state that they spend most of their time in Moda and Bahariye whereas Haydarpaşa is the least preferred region (see Figure 14 – left).

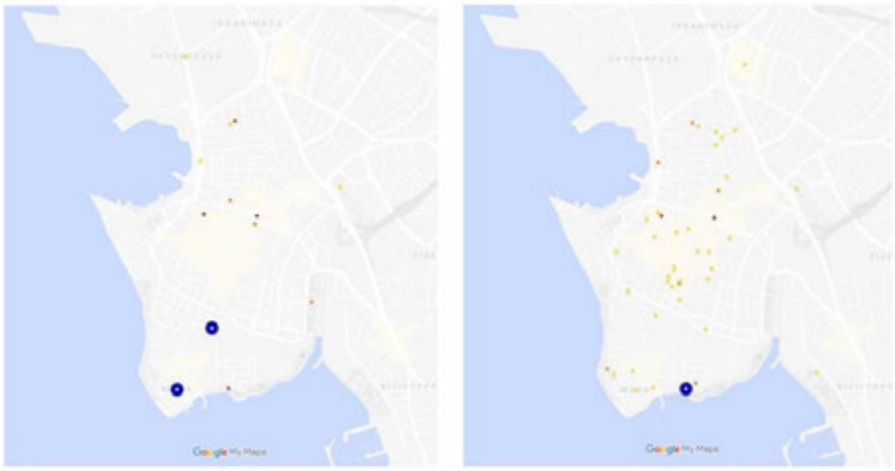


Figure.14 Top districts accommodated by workers (left); Frequently visited places (right) (prepared by the authors)

Participants are also allowed to give detailed answers to the places where they go frequently. Again, Moda Sahil come to the forefront. In addition to Moda Sahil, workers also go to Bahariye, Moda Aile Çay Bahçesi, IDEA Kadıköy, and Rıhtım (see Figure 14 – right).

On behalf of publicly owned spaces, Barış Manço Kültür Merkezi, Süreyya Operası and Barış Manço Evi are well known. The rest are also known by the workers of KHCC.

4.2.3. Both

3% of the participants (=13 people) both live and work in KHCC. Among these 23% are women and 77% are men. The general profile of the workers is 25-45-year-old full-time, freelance and multiple job workers with at least bachelor's degrees. 46% are single, 39% are married and 15% have another marital status. 85% are tenants of which 29% live with full rent and 18% share their accommodation. 77% know their neighbours.

The answers given to the question about the three things that come to one's mind when Kadıköy is mentioned are cumulated around the emotional connotations of the site. These can be listed as 'noise', 'ease', 'home', and 'crowded'. Among the frequently used words listed, only Moda Sahil comes to the forefront on behalf of physical attributes of the site. Different than that of other user profiles, this group also refer to a list of words which consists of the following: 'neighbourhood', 'neighbourhood culture', 'streets', 'my youth', 'my life', and 'motherland' (see Figure 15).

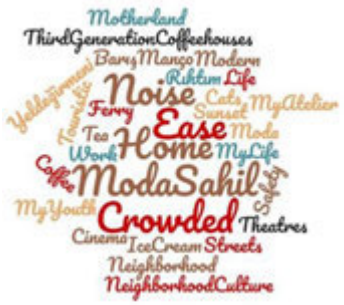


Figure.15 Three things about KHCC – Both (prepared by the authors using Word Clouds)

Participants who both live and work in KHCC state that they spend most of their time in Moda and Bahariye. Rasimpaşa, Altıyol/Boğa and Rıhtım are the least preferred regions (see Figure 16 – left).

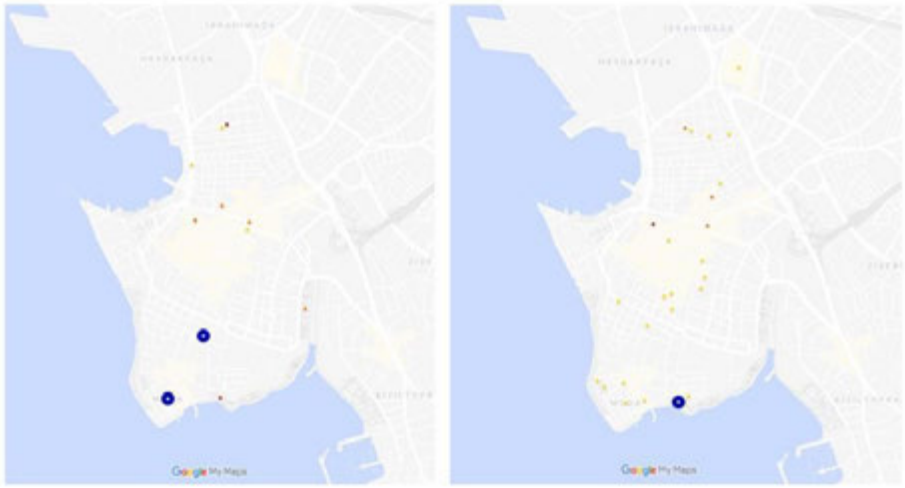


Figure.16 Top districts accommodated by both residents and workers (left); Frequently visited places (right) (prepared by the authors)

Participants are also allowed to give detailed answers to the places where they go frequently. Again, Moda Sahil and Bahariye come to the forefront. In addition to these places, they also go to Yeldeğirmeni and Çarşı (see Figure 16 – right).

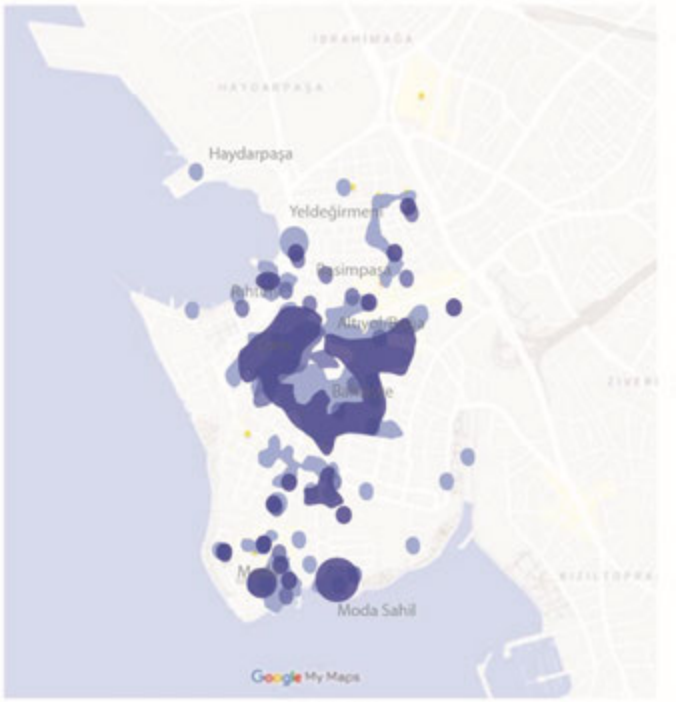
On behalf of publicly owned spaces, IDEA Kadıköy, Süreyya Operası and Barış Manço Evi are well known. The rest are also known by the participants who both live and work in KHCC.

4.3. Discussion

Based on the discourse analysis, two major groups of participants are revealed. These are visitors and locals. Both groups stand on the opposite sides of the spectrum as they have different types of place attachment with KHCC. It is obvious that the emotional and social ties of locals with the place were very strong, and the meaning they attribute to the urban space was determined considering these premises, whereas visitors mostly referred to the physical elements of the urban space when describing the KHCC (see Figure 17). On behalf of locals, it is also observed that participants who are both residents and workers in KHCC have a different place attachment when compared to other sub-groups of locals as they also emphasize on a group of words which are ‘neighbourhood’, ‘neighbourhood culture’, ‘streets’, ‘my youth’, ‘my life’, and ‘motherland’. Not only this but also their mentioning only a few physical aspects of KHCC strengthens this premise. This is not surprising as the more the time spent the stronger the place attachment is (Lomas et al., 2024).

Figure.17 Comparison of the physical and emotional connotations by visitors and locals (prepared by the authors)

It was also found that there were notable differences in terms of urban space preferences among locals and visitors (see Figure 18). When a detailed analysis was made by visitor purposes to KHCC, it was determined that there were subdivisions in terms of their spatial preferences, revealing that the different sub-regions of KHCC were intensively used and preferred by different user groups. In other words, different user groups are clustered in different regions of this urban space, interact with different parts of it, and have different spatial experiences. In detail, visitors with shopping purposes reveal a dispersed pattern across the area without any significant clustering, whereas visitors with transfer purposes prefer similar regions with visitors who come to KHCC with leisure purposes showing clustered patterns around Çarşı, Bahariye, Altıyol/Boğa, Moda and Moda Sahil (see Figure 18a). On behalf of locals, workers show a similar behaviour with visitors with shopping purposes as they display a dispersed pattern across the area, whereas residents permeate like an oil stain between Çarşı, Altıyol/Boğa and Bahariye (see Figure 18b). Participants who are both living and working in KHCC are, on the other hand, mobile on a North-South axis between Yeldeğirmeni and Moda Sahil creating sub-clusters. Nevertheless, there are certain regions where all user groups come together. These are Moda and Moda Sahil where the coastline with green areas exists and act as the main common public space for all types of users.



(a) visitors
(light colours=leisure, medium colours=shopping, dark colours=transfer)

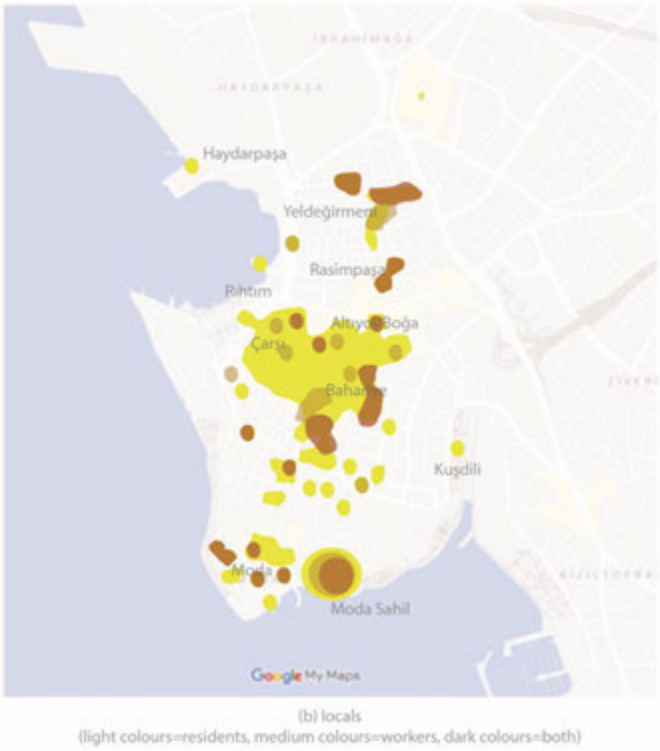


Figure.18 Comparison of the spatial preferences by visitors (a) and locals (b) (prepared by the authors)

5. Conclusion

Considering the transformation that KHCC is currently undergoing, it stands out that there is a high need to design and plan urban (public) spaces that are inclusive of all user groups and respond to their needs and demands. As there is a major differentiation between two different user groups (visitors and locals), the sustainability of the city centre and mixed-use areas depends on how these needs and demands can be faced and how much the place attachment would be developed and made stronger. These findings are also expected to contribute to the international urban planning discourse, emphasizing the importance of socio-cultural diversities in shaping the future of urban spaces and placemaking.

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Ethical Approvals, As this research includes human research participants, ethics approvals from the Istanbul Technical University Social and Human Sciences Human Studies Ethics Committee are taken (Date: November 2, 2018, Number: 99). In place of informed written consent, the web-based survey included two mandatory checkboxes to start the survey and to participate in the research: (1) participants confirm that they are over 18 years old; and (2) they accept voluntary participation in the survey on the condition that they can leave it at any time before submitting their answers if they do not want to continue it. In addition to these, detailed information about how and where this data will be used was included above these checkboxes.

How social media influences rural spatial practice and place identity: A case study of Fuling Village

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Abstract: Social media have opened up new growth opportunities for the development of tourism in traditional villages. It can not only attract the attention and sustainable development of villages, but also make villages dependent on the outside world's imagination of "tradition" and "the gaze of the other" in spatial remodeling. In this paper, we take Fuling Village as a case, and explore the spatial practice and changes in villagers' local identities triggered by social media in the context of rural tourism. It is found that (1) the village is changing from a local space to an fluid space under the shaping of social media.(2) Social and power relations in the social media space influence there modeling of local space, forming the "production of virtual space".(3) The development of rural tourism affects the community and rebuilds place identity. The development of traditional villages needs to pay more attention to refining and transforming local characteristics, preserving originality and promoting individuals' place identity in order to achieve sustainable development.

Keywords: Place, identity, tourism development, social media, traditional village

1. Introduction

In the context of global digitization, rural China has ushered in new development opportunities, with an increasing number leveraging social media to develop the tourism industry, aiming to drive economic growth(Liu et al., 2024, Su, 2011). Compared to the past when villages were inward-looking, closed-off, and primarily locally significant spaces, they are now not only shifting towards fluid spaces but also becoming objects of spatial production catering to virtual imagination through tourism development, showcasing cultural interactions with "others."(Jay, 1993, Poole, 2005). With the flourishing development of the tourism industry sparked by social media, there has been infiltration into rural areas, triggering the capitalization transformation of traditional spaces, even to the extent of the entertainment-oriented utilization of spaces of faith. This has led to a contestation among diverse entities for space and the weakening and reconstruction of spatial and place meaning(Guo, 2020). At the same time, with the rise of cultural heritage tourism and rural tourism, traditional villages like Fuling Village located along the southeast coast of China are actively engaging in tourism practices and community development construction, leveraging their unique natural and cultural resources. Similar to many traditional ancient villages in China, in their process of modernization, the intervention of external forces inevitably changes the original economic, cultural, and social relationships. The originally relatively

stable local significance is continuously deconstructed and reconstructed. This not only leads to drastic changes in the architectural landscape of the villages but also creates confusion among local residents about the "why" of tradition display and concerns about the loss of indigenous cultural heritage.

The theoretical study of place originated in the 1970s, slightly later than the study of space. In the context of modernity, space was initially rationalized as abstract geometry. However, with deeper reflection, the concept of place gained attention. Particularly, human geographers represented by Yi-Fu Tuan emphasized that the process of endowing space with meaning gives rise to place (Relph, 1976, Tuan, 1977, Wright, 1947, Tuan, 1971). After cultural accumulation and identity formation, a sense of place is established(Crang, 2013). The essence of sense of place lies in the transformation of spatial meanings into new places and the generation of identity. In this process, spatial practices are essential. Without human spatial practices, a place is merely space(Relph, 1976). However, imposing violence or authority on spatial practices can disconnect individuals from their sense of place, leading to the destruction of the meaning and identity of place(Tuan, 2013). In urban design, place identity primarily revolves around the physical appearance and how people perceive it, with less focus on the extent of the bond between people and place or the depth of its significance. Studies in environmental psychology often link place attachment to individuals' sense of self and community identity, as well as their sense of uniqueness(Ujang and Zakariya, 2015).

Tourism has promoted rural geographical imagination and spatial construction, influencing place meanings and identities. Social media has intensified this change. With its extensive marketing capabilities, social media has increased the attention to rural tourism and promoted the development of rural tourism industry(Senyao and Ha, 2020, Harb et al., 2019)。Due to binary definitions(Dymitrow and Brauer, 2018), urban people often view rural areas with curiosity, which is why content with "rural" titles on social media often receives higher click rates. Current research focuses on the motivations behind tourists' viewing and sharing behaviors on social media (Munar and Jacobsen, 2014)， the influence on tourists' expectations and decisions(Narangajavana et al., 2017, Palazzo et al., 2021, Liu et al., 2024), and the impact on tourists' social networks(Meek et al., 2019). However, most studies overlook the importance of social identity. In this process, virtual spaces and real-life spaces are connected through social media, reshaping social and power relations(Senyao and Ha, 2020). The groups of social actors become more complex, not only affecting spatial practices and changing the lifestyle and livelihood (Su et al., 2019) of local villagers but also influencing their sense of place(Guo, 2020). Due to the neglect of local subjects, there is a lack of theoretical and principled guidance in spatial practices, thus further analysis and strengthening of the guidance and control of local spatial practices are necessary. Therefore, this study focuses on three aspects of spatial creation in Fuling Village's tourism development process under the influence of social media as the research object. It specifically analyzes the changes in spatial practices and social identity, posing the following questions: 1) Under the background of tourism development mediated by social media, what kind of changes have three types of public spaces in Fuling Village experienced? What factors have led to these changes? 2) What perceptions and local identities have the changes in public space practices in Fuling Village brought to the villagers? What does this reflect in terms of substantive issues? 3) As a microcosm, what insights does the case of

Fuling Village offer for understanding new development models for villages in the context of rural revitalization in China? How can the significant gap between spatial practices relying on virtual imagination and the obscured real history be bridged? Additionally, how can the misinterpretation of tradition and the pandering to sensationalism be avoided in tourism development? Research and answers to these questions can deepen people's understanding of rural spatial practices and place identity theoretically. In practice, they can provide reference for practical activities in Fuling Village and similar regions.

2. Methods of case study

2.1 Context of the study area

Fuling Village is located in the coastal region of the Xinghua Bay in Fujian Province, China. The site of village is near the Wuhou Mountain and leading to the Taiwan Strait. Fuling Village and Wuhou Mountain are well-known scenic spots along the coast of Putian (Figure 1). The village has a history of around 1000 years and was officially listed in the fourth batch of traditional villages by the Fujian Provincial People's Government in 2021. Currently, the village comprises 232 households with a permanent population of 1580 people, predominantly consisting of three major family surnames: Chen, Xiao, and Xu. Before the 1950s, the village was primarily governed by clan autonomy. After the establishment of the People's Republic of China, the clan system was replaced, but local elders and other respected individuals still oversee the village's political, religious, and daily management affairs. Following the reform and opening-up policies, the closed pattern of the village has been disrupted, with a large number of villagers going out for work or business. Since the beginning of the 21st century, there has been a gradual increase in folk activities, such as the Wuhou Mountain religious and scenic tourism experiences. Traditional ceremonies like the Lantern Festival celebration have started to revive. Since 2010, Fuling Village has primarily experienced a phase of spatial practices characterized by simultaneous tourism development and community reconstruction. Especially in 2019, the village established a tourism development company with a focus on using social media as a means to attract tourists, highlighting the cultural theme of "福" (fortune) to generate additional income for the village and stimulate industrial development.

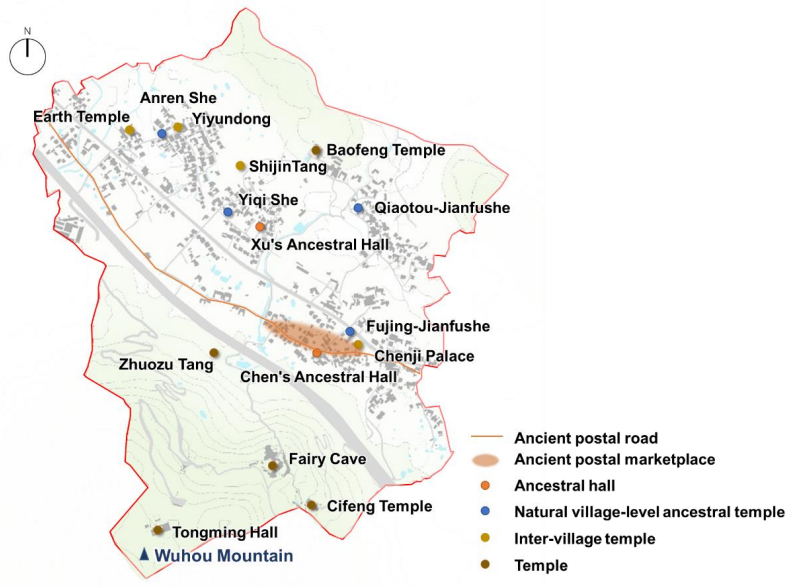


Figure 1. Distribution of public spaces in villages

The selection of Fuling Village and its public space transformation focuses on three case studies: "Religious Belief Space," "Family Ancestral Hall," and "Post Road Marketplace." This choice is based on several reasons. Firstly, Fuling Village, as a traditional coastal village in China, mainly relies on tourism development, making it an ideal place to observe spatial practices influenced by tourism. It heavily relies on social media and social communication to promote its local characteristics, making it a typical destination for technology-mediated tourism. Secondly, the three public spaces in Fuling Village exhibit differences in type and scale. They have clear functional boundaries within the old village and collectively constitute the core public spaces of the village. These spaces have undergone morphological and functional changes under the influence of social media and tourism development, fundamentally altering the usage and perception of daily social life by villagers, leading to changes in local connotations. The interpretation of traditional culture is flattened, and the spiritual foundation based on place identity is shaken. The balance between development and preservation requires urgent consideration and resolution. Thirdly, the spatial practices in Fuling Village are not unique, especially in the context of rural revitalization in China. The challenges it presents have implications and warnings for other regions.

2.2 Data collection and processing

In this research, participant observation and semi-structured interviews were mainly undertaken to study the causes and processes of rural change and the place identity of various villagers in the process.

The research process is mainly divided into two stages: data collection and data analysis. The survey consists of two stages. In February 2023, a village survey was conducted to collect basic data and conduct preliminary investigations. Researchers visited all religious buildings, residential houses, ancestral halls,

and government offices in Fuling Village to gain a preliminary understanding of the overall environment, culture, population, spatial layout, and tourism development situation of the Fuling community. After obtaining basic information about Fuling Village, participatory observation and in-depth interviews were conducted. Researchers entered the case study site multiple times to observe interactions among villagers, tourists, and administrators, as well as changes in lifestyle, recording observations in diary format. In-depth interviews were conducted with 19 respondents as listed in the table below, covering their perceptions of material and cultural changes within the village and their evaluation of village tourism development. In addition, a supplementary questionnaire survey was conducted, targeting individuals who work outside the village but still maintain household registration in the village (and are still involved in village public affairs), with 105 valid questionnaires collected. Subsequently, data analysis and validation were performed. In August 2023, a return visit to the village was made to supplement research and revisit, to understand the situation of tourism development construction and community development. In addition, historical information was supplemented and verified through multiple local chronicles, genealogies, and other historical records.

3. Findings

3.1 Social Media Landscape in Fuling Village

Historically, the development of Fuling Village into a popular tourist destination on social media is closely intertwined with people's use and understanding of social media. The village own several religious destinations, famous for special mountainous coastal landscape and efficacious gods, which attract disciples and tourists. People initially used the photography and video features of social media to document and share the local scenery and activities, aiming to connect people both inside and outside the village. Since the 1980s, many villagers have migrated elsewhere, yet due to difficulties in obtaining urban residency or basic services, they still retain rural household registrations. As a result, they need to participate in certain village collective affairs, necessitating them to stay in touch through mobile phones. Consequently, many important village matters are now disseminated through social media platforms like WeChat. Subsequently, with the rise of short video platforms like Douyin (Tiktok in China), some villagers have uploaded these unique village scenes to platforms with wider audiences, garnering significant attention. Moreover, proud villagers often share the distinctive features of their hometown on social media, leading to an initial understanding of the village's original intentions from outsiders.

After the central government implemented the rural revitalization strategy, government of Fuling village try to show the local scenery online in order to resonate or trigger curiosity with consumers. In 2019, the village was designated as a pilot village for rural revitalization in Fujian Province and established a tourism company in the same year, officially initiating tourism development. It mainly attracted investment through the social capital of villagers and enhanced the village's visibility in Putian City and surrounding areas through marketing and promotion on the Douyin platform. In 2021, Wuhou Mountain was rated as a 2A-level scenic spot, and the village was included in the list of traditional villages in Fujian Province, receiving some special funds, which accelerated its construction.

It does get a lot of attention, according to the search results on the Douyin platform. Douyin (TikTok) is a music and creative short video social networking app. By April 2019, TikTok has gained 200% market-share in a two-year growth period(Lee and Nass, 2005). The app had 51 million ratings on iPhone app store, 19.31million ratings on Google Play, and over 5 hundred million downloads (2024 May).

On Douyin, searchers using keywords such as "Fuling Village, Putian City," and "Fuling Village, Wuhou Mountain" saw a rapid increase in video creation and views in 2021 (Figure 2). The most viewed video had approximately 27 thousand plays. Promotion focused on keywords like "internet celebrity," "check-in spot," "Spring Festival," "night scenery," and "dream prayer holy land," constructing local cultural landscapes and guiding people to understand and imagine the geographical features of Fuling. Local features such as Xianv Cave, Lover's Bridge, and Rainbow Path were amplified and became symbols of promotion, attracting numerous comments and attention, and enhancing on-site experiential perception. Internet users and the village formed a relationship of mutual gaze through the internet, with Douyin serving as a theater for tourism promotion and display.

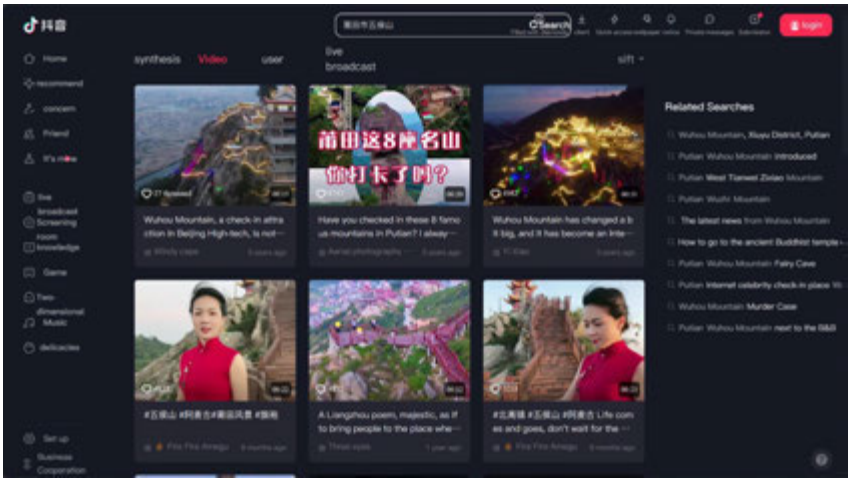


Figure 2. The search results for "Wuhou Mountain in Putian City" on Douyin

3.2 Influence of Social Media on Spatial Practices

3.2.1 Religious belief spaces and tourist attractions

Since the Northern Song Dynasty, ancestors have been building temples in Fuling Village. Due to its unique geographical location in the plain area, Wuhou Mountain serves as a natural "landmark" for the safe passage of boats in and out of Xinghua Bay in Putian and Fujian. In ancient times, people believed that the gods could conquer the forces of nature, and the safe sailing of ships was believed to be blessed by the gods. Over time, this place became a gathering place for guardian gods of fishing boats heading out to sea. During the Northern Song Dynasty, the statesman Cai Xiang supervised the

construction of the "Two-Pavilion Temple" on Wuhou Mountain to enshrine the Jade Emperor. In the early Song Dynasty, a clever girl named Chen Mingzhu in the village ascended to heaven as a fairy after reaching enlightenment here. Later, people built the Fairy Cave and the Ruizhu Palace in her honor. It is believed that the gods here help those in need and bless the villagers, so prayers are constantly answered. The village still preserves nine religious belief spaces, including the Tongming Hall, Qingyun Pavilion, Qingyun Cave and Fairy Cave.

For generations of Fuling villagers, their daily lives are closely intertwined with the religious belief spaces on the mountain, forming an inseparable emotional bond with themselves. Villagers participate in various religious activities throughout the year, over a dozen festivals and ceremonies annually. To facilitate these ceremonies, villagers even invite deities down from the mountain for daily worship, seeking blessings for the villagers. In the construction of their homeland, religious beliefs connect villagers and believers from all directions through various activities, fostering significant emotional ties to the space. In the villagers' perception, religious beliefs symbolize the rich culture and long history of their village, affirming it as a "blessed land" and strengthening collective consciousness. It is evident that religious beliefs shape the worldview and environmental perception of local villagers.

Since 2018, the village has been actively developing rural tourism. The abundant religious belief spaces have become the primary resource for tourism development and are now "spaces under scrutiny." The tourism company, managed and operated by villagers elected for their high social status and economic strength, collaborates with the temple board to discuss development plans. This new organization, as a driver of tourism practices, has initiated a reinterpretation and reconstruction of Fuling Village. These transformations are based on the spatial imagination of potential tourists analyzed by the tourism organization. They observe the "Internet-famous tourist villages" on social media and believe that the social construction of tourists' visual and psychological perceptions, as well as their aesthetic appreciation of the Jade Emperor culture and the Fairy Maiden Cave, should be based on freshness and unique experiences. Therefore, facilities that can become focal points for sightseeing must be redesigned to serve as tourist attractions. Under this concept, religious spaces have encountered modernization erosion, and the tourism development company has expanded and transformed the original spaces. For example, the Golden Dragon, symbolizing the "distinguished status of the Jade Emperor"; the Lover's Bridge, originating from "many people come here to make wishes for love, and the construction of ropes symbolizes climbing together through the trials of love."(Figure 3)

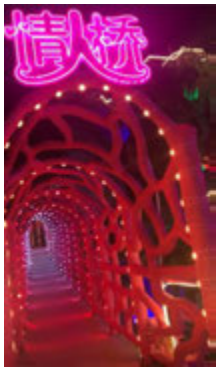
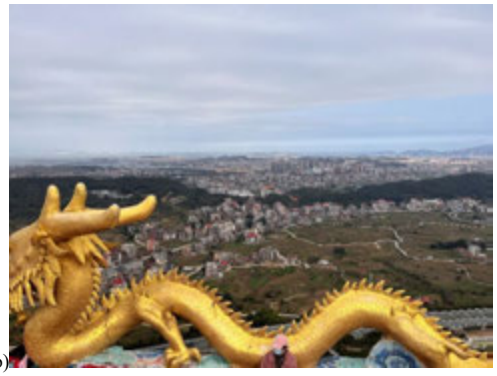
(a)  (b) 

Figure 3. New facilities for religious spaces，(a) "Lover's Bridge," and (b) "Golden Dragon"

It can be seen the fundamentally different logics in spatial connotation between original religious spaces and the tourist attractions in Fuling Village. Although the villagers who built the temples and the members of the tourism development company mainly come from within the village, the subjects with different behavioral purposes have significant differences in the concept of spatial practice. The religious beliefs originated from worship of nature and deities, leading villagers to form a natural-space territorial view in spatial practice, resulting in strong local cognition. However, spatial practices under tourism influence take tourists' spatial imagination and psychological needs as starting points, demanding novelty and popularity, thus creating a large number of symbolic expressions.

3.2.2 Ancestral temples and ritual performance spaces

The four natural villages in Fuling Village are all family lineage clans primarily based on surnames. In ancient China, the lineage was an important organization and responsible for the regulation of rural populations(Chen, 2016). In folk tradition, the ancestral hall is an important public space where clan members engage in daily recreational activities, discussions, ceremonies, and social mobilization(Dean, 2010). Traditional ancestral hall spaces not only host public affairs but also serve as places to maintain emotional connections among villagers of different surnames. The most frequent and fundamental activity is after a day of farming, villagers gather in front of the ancestral hall to chat, share stories, and then light incense inside the hall before returning home. This has been the daily routine for villagers for centuries. Additionally, various clan affairs must be consulted with the ancestral hall's deities, leading to periodic ceremonies. Through these ceremonies, blood ties are emphasized, creating tighter connections among clan members. Within the ancestral hall space, people share emotions, making it a crucial space for local emotional communication. After the establishment of the People's Republic of China and especially during the reform and opening up period, the clan system dissolved. The village's lifestyle was disrupted, clan-based production and life disintegrated, and with the outflow of population, clan ceremonies decreased or ceased altogether, weakening collective consciousness and local spirit.

With the increase in income among some villagers, local spirit and traditional culture have seen a resurgence. Clan culture has been revitalized, and since 2010, villagers have begun rebuilding their

communities. Concurrently, the ancestral halls of various clans have been renovated to restore and promote clan activities. Building upon this foundation, village management proposed integrating the development of rural tourism by packaging major ceremonies such as ancestral worship activities with festivals like Lantern Festival (Figure 4). These events are organized and performed, coupled with promotion on social media platforms like WeChat and TikTok, resulting in widespread sharing among both locals and outsiders, once again boosting attention and visits.

(a) (b)

Figure 4. (a)Chen's Ancestral Hall, (b) Clan rituals

Source: *Chinese Traditional Village Archives Survey Form - Fuling Village*

The transformation of the functional role of ancestral halls fundamentally reflects a shift from utilitarian space to symbolic space. The rebuilding of ceremonies and spaces is diminishing the practical significance for the original users. Meanwhile, tourists, as the target audience for tourism development, are gaining prominence. Although clan ceremonies emphasize identity and belonging to some extent, arousing villagers' attachment to their land, the ambiguous modernity of their multifaceted objectives and villagers' doubts about their own identity are evident. Ultimately, this process represents a form of spatial disciplining in the locality.

3.2.3 Postal marketplace and the "Rainbow Blessing Path"

Besides religious spaces, the primary public activity space in the village is the marketplace developed from the postal station. Ancient Post Road was established by ancient Chinese authorities to meet various governmental, military, and economic requirements, including the dissemination of decrees and official communications, administrative transactions, and the transportation of goods between central and local regions. To ensure the swift delivery of official documents, post stations were strategically placed along the route, equipped with amenities like post buckets, relay horses, and resting facilities for travelers(Kauz, 2005, Wang et al., 2020). The branch line of the Fuxing Post Road system, which was established during the Tang Dynasty (Fuzhou to Xinghua region), passed through Fuling Village. A post station was established at Puochoujing in Fuling Village to accommodate the increasing number of travelers, gradually forming a marketplace. Named Puochou Pu, the post station evolved from a public service facility to a retail business space with the increase in exchanges, offering tea houses, grocery stores, etc., thus forming a small-scale market. Over the nearly one thousand years of existence of the

post road, the prosperity of the post stations continued, where people communicated and cared for each other. Despite being strangers, it became a warm space.

As the 20th century brought the construction of inter-village connecting roads and county highways, and in the early 21st century, the completion of highways passing through villages, car travel became the main mode of transportation for people. As the width of the post roads mainly suited pedestrian and horse-drawn carriage traffic, they were designated as village-level internal roads, resulting in fewer travelers and a decline in vitality. Consequently, street-front shops gradually closed down, and the marketplace lost its vibrant public activities, gradually fading away.

With the rise of tourism development in Wuhou Mountain, village administrators noticed that the tourism industry lacked a long supply chain, with most tourists staying only in the temples for sightseeing experiences, without contributing to the overall development of the villages at the foot of the mountain, thus limiting further consumption. Therefore, a plan was devised to construct the "Rainbow Blessing Path" to connect the foot of the mountain with the village, promoting it as a significant experiential facility in tourism videos. It emphasized guiding people to experience the village on foot rather than leaving directly by car. However, due to the lack of vitality in the village and insufficient tourism experiences and service facilities, it failed to attract tourists to come and experience it, leaving only the "rainbow" waiting quietly (Figure 5).

(a) (b)

Figure 5. (a) Ancient Post Road, (b) "Rainbow" road

Due to the outflow of population and the reduction in community public life, the frequency of use of public spaces has sharply decreased. The original "Post Road," as the main space for village life, remains an emotionally significant "place" for them. Many elderly villagers recalled in interviews the lively and warm atmosphere of life on the "Post Road," saying, "In the days when travel to distant places could only be done on foot, the mutual help between strangers is something we cannot experience today," expressing regret for the loss of close connections between people. Meanwhile, the "Rainbow Path" has become the choice for villagers commuting to work in the fields and for accessing external roads by car.

From the case of the "Rainbow Blessing Path," it can be seen that the post station, as a service facility, is an important source of spatial vitality. It forms a fluid social network through social

interactions, creating emotionally special "places" and fluid "communities." However, after modern facilities disrupt the foundation of the village community, attempts to transplant, imitate, and reconstruct spaces without resonating with the villagers or attracting tourists. This is fundamentally because tourism producers overlook changes in relational connections, leading to differences in social culture and place identity.

4. Discussion and conclusion

4.1Discussions

Social and cultural identity is a socio-psychological phenomenon formed through the spatial-temporal process(Hidalgo and HernÁNdez, 2001), constituting an important spiritual essence for national and local development. The social community of traditional villages, on one hand, sustains organization and perpetuates collective and national momentum, while on the other hand, it is rooted in its subject—the people(Castells, 1997).

From the case of Fuling Village, it can be observed that in traditional societies, local socio-cultural values construct and maintain villagers' unique cultural identity through local religious beliefs, customs, social organization, and ways of life. In traditional spatial practices, people devoutly believe in the protection of religion, deities, and clans, relying on the identity conferred by structural frameworks. Villagers form a negotiated "natural identity" through interaction with nature and society, based on accumulated a priori rules that lead to stable, consistent understandings and beliefs. However, in recent years, the external focus brought about by tourism has led to the inclusion of new actors in spatial practices: tourism development enterprises and their imagined network tourists. Due to the differing interventions of various actors and their divergent understandings and practices of space and place, the roots of identity have undergone changes. Developers aim to gain profits, while tourists seek experiences and exploration. Social media amplifies the audience's curiosity, leading to the rapid production of symbols and differential identification in the crowded network image competition. For the new spatial villagers, they find themselves in an awkward situation where they cannot fully identify, yet they cannot maintain their original identity through reminiscence and reproduction. This case reflects that modern public spatial practices are transitioning villages from sacred spaces to secular spaces, and natural identities are shifting towards mechanical identities collectively constructed by subjects with different backgrounds and cognitions. Local meanings and attachments are in a state of flux.

It can be seen that complexities exists in giving places their identities under the tourism backdrop. Holding on to one’s place meanings may become increasingly challenging as the gap widens between the meaning and the physical characteristics of the setting(Fitchen, 2019). The loss of place meanings and attachment result in the inability to continue to feel, to practice and to recall experiences(Ujang and Zakariya, 2015). Therefore, in the context of fluidity, the future spatial practices of rural areas require respecting local natural identities, orderly developing diverse mechanical identities, avoiding nihilism, and better promoting the healthy development of local socio-cultural through multi-party negotiation.

4.2 Conclusions

The transformation of Fuling Village reflects the powerful impact of modernization intrusion on traditional spaces. While tourism development brings possibilities of economic growth to ordinary rural areas, the new ideologies it brings about lead to the transformation of traditional values and customs. This subjects them to the rapid influx of information, making it difficult to extricate themselves. In the longer term, this may prove to be short-lived and bring about even more severe challenges.

Public spaces play a significant role in the formation of place identity and attachment, but their creation and governance have always been a complex process. In tourism-oriented community development, particular caution should be exercised. Traditional consumption and tourism rely on meaningful places, so it is still necessary to understand and construct what constitutes a place within the new system. This involves identifying social and cultural differences and commonalities among different stakeholders, and re-evaluating space and locality.

It can be observed that the development of the internet society has once again changed the way people travel. People share and obtain information through the internet, forming virtual communities and online identities. This not only affects users' perceptions but also influences specific places and their indigenous inhabitants through their spatial practices. As early as the 20th century, Joshua Meyrowitz proposed that the emergence of new media directly led to the fragmentation, reorganization, and transformation of social situations, affecting people's definition of contexts(Meyrowitz, 1986). In China, there are still many places similar to Fuling Village that are becoming tourist spaces under the focus of mobile networks. The spatial practice case of Fuling Village can provide reference for other places, reminding people that locality is not only a physical space and region, but more importantly, the associations and meanings generated by interactions among subjects. Perhaps in practice, tourism development can expand digital utilization methods, such as reflecting local culture and heritage through digital platforms, to strengthen interaction and negotiation among subjects, and explore the possibility of place identity on the basis of building communities.

Note： Except for the marked ones, the rest of the photos are produced by the author.

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Continuing Community Spirit: Study on the Public Space of "Pu-Jing" Community in the Ancient City of Quanzhou

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Abstract
Exploring and continuing the spiritual connotation of community public space is of great significance to shaping the place identity. "*Pu-Jing*", the grass-roots organisation system of Quanzhou during the Ming and Qing dynasties in China, created the "*Pu-Jing"* community, a governance unit that combined official administration and folk beliefs, and had a profound impact on the community public space system. The purpose of this study is to interpret the spatial characteristics and cultural connotations of public space in *Pu-Jing* community by analysing the spatial carriers and social factors. The research examines the compositions of the community public space, explores their spatial structure, and then summarised the formation logic and building ideas of the public space. The study reveals a public space system with the *Jing* Temple as the core, the streets and alleys as the link, and the belief realm as the unit was formed in *Pu-Jing* community under the combined effect of official management and civil autonomy, creating a stable sense of spatial domain for the residents' ritual and daily activities. The wisdom of place-making implied in the public space of *Pu-Jing* community provide inspiration for contemporary community governance.

Keywords: Community public space; spatial characteristics; place identity

1. Introduction

1.1 Theoretical background

With the emphasis on reviving the spirit and sensibilities of urban construction (Alexander, 1987), there is a growing realisation that shaping identity is key to truly revitalizing a place (Xia, 2020). Only when we learn from existing experiences and promote the conservation of urban spiritual significance can urban structures become life structures, allowing urban identity to emerge naturally (Zhao and Jiang, 2022).

In communities, individuals feel emotionally connected to the community by sharing similar cultural experiences and values with it (Durkheim, 1984), gradually forming a cultural identity with the community (Tajfel and Turner, 1986; McMillan and Chavis, 1986). Thus, community identity becomes a close psychological experience linking individuals and the community. For each individual in the community, mutual promotion of belongingness and identity helps satisfy their need for external dependence to some extent (Wu and Qin, 2022), thereby enhancing their sense of happiness. For the community, reinforcing members' cultural identity contributes to community cohesion and promotes its stability and development. Therefore, community identity becomes the core content of community construction.

As the accumulation of history, culture, traditions and values within a community, community context becomes the common cultural foundation of its members. Consequently, it becomes an important factor in forming a sense of community identity and constitutes the characteristics of the community. Inheriting community context can

help community members feel the continuity of its history and the perpetuation of its culture, thereby establishing their own historical connection and sense of identity with the community.

Public space, as venues for daily activities, interactions and various collective events among community members, is regarded as the core place of community life. Within urban community public spaces, buildings and structures with historical significance, as well as venues for traditional festivals and celebrations, serve as tangible witnesses to historical activities and events, conveying the collective memory of the community and embodying its collective spirit. Community public spaces not only serve as important carriers of community context but also as crucial places for its inheritance and development. Therefore, exploring the historical context and spiritual significance of community public spaces is essential for shaping the cultural identity of the community.

1.2 Overview of the study area

"*Pu-Jing*"(铺境), the grass-roots organisation system of Quanzhou in the Ming and Qing dynasties, created the “*Pu-Jing”* community, a governance unit that combined official administration and folk beliefs. Formed under a specific social background and urban governance, the *Pu-Jing* community responds to the most essential characteristics of the community, and is a special form of traditional Chinese community evolution.

Located in the southeastern coastal region of China, Quanzhou has been an important port city in southern China since the 9th century AD. During the Song and Yuan Dynasties, it was China's world centre of maritime commerce. Maritime trade and fishing life made Mazu, the goddess of the sea, one of the most revered deities of the people of Quanzhou. The geographical advantage facilitated the spread and exchange of different religions such as Buddhism, Taoism, and Islam in the Quanzhou area, making it a region of diverse religious beliefs. People integrated their life needs with religious beliefs, leading to the development of a thriving folk belief system, which has had a far-reaching impact on the Quanzhou community.

After the prosperity of the Song and Yuan dynasties, Quanzhou's economy declined and its status as a regional centre fell away due to the strict restrictions and controls on trading activities overseas and the frequent occurrence of wars during the Ming and Qing dynasties, but the folk beliefs remained vibrant. In the context of the maritime prohibition and external defense, the government's control over the grassroots society was greatly consolidated, which directly led to the creation of the *Pu-Jing* system (Lin, 2007).

The *Pu-Jing* system is "a comprehensive urban social spatial classification system implemented in Quanzhou during the Ming and Qing dynasties" (Wang, 2003). The concept of "*Pu*" (铺) points to urban governance and refers to an administrative spatial unit promoted by the authorities (Chen, 2009, pp. 103). According to the "Political Records", there is a strict population control system implemented within the *Pu* unit[1].The affairs of household management, taxation, public security and education in it are subject to official management (ibid.). "*Jing*" (境) is the next level of the "*Pu*". It refers to local beliefs, which denotes the jurisdiction of a temple, as well as the scope

of the "parade around the realm" when the folk welcome deities (Wang, 2022). The people of a *Jing* unit share a common belief in the sacred. According to the Qianlong edition of Jinjiang County Annals, the city of Quanzhou in the Qing Dynasty was divided into 36 *Pu* units and 72 *Jing* units. The assemblage of the *Pu* and *Jing* units is to some extent equivalent to today's neighborhoods.

The people of Quanzhou, based on their spiritual needs, have integrated belief systems carried by the "*Jing*" into the official framework of control organised by the "*Pu*". With the harmonisation of the two, a governance unit combining official administration and folk beliefs was formed in Quanzhou. The local significance of the *Pu-Jing* community was gradually strengthened by its role as a spiritual support for the people. Even today, the people of Quanzhou still attach great importance to the concept of “*Pu-Jing*”. One can still hear Quanzhou residents narrate stories about their origins from a particular *Pu* or *Jing* unit, and which deity they believe in. When overseas Chinese write letters to their home countries and when Taiwan compatriots return to their hometowns to recognise their ancestors, they use a certain “*Pu*” and “*Jing*” as their address (Chen and Lin, 1990, pp. 2).

The local characteristics of Quanzhou's *Pu-Jing* community are prominently reflected in the public spaces consisting of facilities that support the belief system and daily life. Based on this, this study starts from the perspective of community public spaces to investigate their spatial features and social significance, explore how they contribute to shaping a sense of belonging, and summarise their spiritual connotations, hoping to provide insights into the continuity of cultural context in contemporary urban development.

2. Methodology

This paper takes the public space of the *Pu-Jing* community as the study object, focusing on its physical characteristics and cultural connotations. The study is based on the “Map of Quanzhou City”, which was surveyed and mapped by the Quanzhou Public Works Bureau in 1922. This historical map was calibrated based on the historical nodes of the current satellite map on the GIS platform. And then we overlay the calibrated “Map of *Pu-Jing* in Quanzhou City” (Chen and Lin, 1990) on the “Map of Quanzhou City” to identify the 31 *Pu* units and the *Jing* temples in the 79 *Jing* units within the ancient city of Quanzhou. The exact boundaries of the *Jing* units cannot be examined at present, but its coverage can be roughly inferred from the accounts of its internal streets and alleys documented by Chen and Lin (ibid.).

Based on the above materials, we extracted the data of the public space elements of the *Pu-Jing* community, and analyzed the spatial characteristics with digital methods. The *Jing* temples, streets and the boundaries of the *Pu* and *Jing* were redrawn by using ArcGIS. The distribution of *Jing* temples was identified by Kernel Density, and the local integration of streets was identified by Space Syntax. Local integration is used to indirectly account for the accessibility of a space to other spaces within a given spatial radius. On this basis, the location characteristics and service coverage of *Jing* temples, the relationship between streets and *Jing* temples, and the urban public space system could be explored. Further, the building ideas of public space were discussed.

3. Spatial composition and structure of the public space in *Pu-Jing* community

The analysis shows that the public spaces of Quanzhou's *Pu-Jing* community comprise three constituent elements: the unit, the core and the link.

3.1 Unit: *Pu* and *Jing* realms related to spiritual beliefs

“*Pu*” and “*Jing*” are the two hierarchical organisational units of Quanzhou's *Pu-Jing* system, each with its specific physical spatial domain. The demarcation of their domains adopts a unique local method, where psychological factors play a significant role.

As a management unit, the delineation of the "*Pu*" took into account both administrative management and mental identity. According to the "Map of *Pu-Jing* in Quanzhou City", the boundaries of the “*Pu*” were not strictly divided along the streets and lanes, but were irregularly shaped (Figure 1). This is a psychological boundary formed through the construction of locality based on psychological identity(Cai, 2022), which is constructed based on the common worship of deities and ritual ceremonies among the residents within the boundary, and forms the foundation of the local identity network (Chen, Guan and Lin, 2011). The scales of these *Pu* units vary. By comparing the scope of the *Pu* units with the urban construction area, it can be observed that the its demarcation is related to the distribution of the population's residence in the ancient

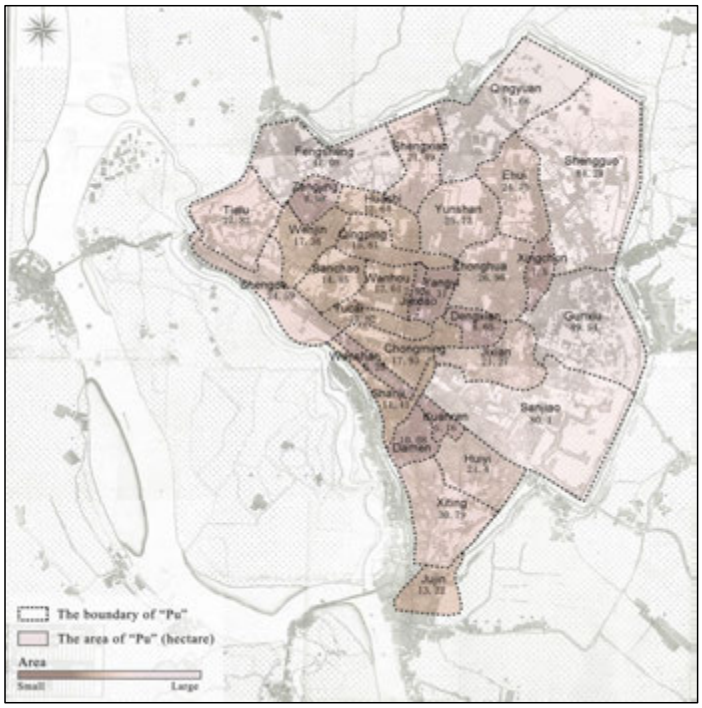

Figure 1 The boundary and area of *Pu* units.
Source: Drawn by the authors based on the “Map of Quanzhou City”. Quanzhou Public Works Bureau, 1922.

city of Quanzhou. In areas where the residential areas are dense, the scale of the *Pu* units is often smaller, with the smallest being about 3 hectares, while in the areas close to the edges of the city walls, the size of the *Pu* units is larger, with the largest reaching up to 80 hectares. The number of *Jing* units divided within different *Pu* units also varies. Within a single *Pu* unit, there are usually 2-5 *Jing* units, with the most having up to 9.

As a belief unit, the realm of the *Jing* is recognised through a twice-yearly ceremony of stabilizing boundary (Wu, 1985, pp.98). Like the *Pu* unit, the scope of the Jing unit is also usually related to the built-up area scale in order to ensure a balanced population size within the realm. Taking *Sanjiao Pu* as an example, the scale of its nine *Jing* units ranges from 1.69 hectares to 12.43 hectares. The built-up areas and distribution of people in *Yichun Jing* and *Wenxing Jing* are relatively centralised, so they are smaller in scope; the sites in *Longgong Jing* and *Fengchi Jing* are fragmented, so their scope is larger. On this basis, the residents further define the boundaries of the *Jing* units through the ritual activity of "parading the *Jing*'s realm". The activities include the rituals of " greeting the deity" and "seeing off the deity". Usually, the residents of the *Jing* unit carry the Main Deity of the *Pu* or *Jing* along the streets to patrol the area under their jurisdiction in order to strengthen the boundaries of the realm. However, when the members of one *Jing* realm invades the territory of a *Jing* realm belonging to an opposing power during a ritual parade, it can result in conflict between the two *Jing* units (ibid.). Boundaries formed by consensus among different *Jing* units ensure harmonious coexistence. The immaterial elements of religious rituals, together with the physical space, define the realm of the *Jing* units, shaping in the consciousness of the inhabitants an organisational unit that is closely related to their own experience of spiritual life.

From the perspective of the entire city, the scale of a *Jing* unit generally remains within a certain range. Nearly 90% of the *Pu* areas have an average *Jing* scale ranging from 3 to 12 hectares. Compared to the ideal community scale today, which covers a range within a 300m walking distance (8-18 hectares), this is slightly smaller. It seems to have achieved a belief unit scale suitable for the social environment of that time and place.

3.2 Core: *Jing* temples as a place of spiritual cohesion

3.2.1 Functions of the *Jing* temples

In the system where *Jing* serves as the belief unit, each *Jing* unit is equipped with a *Jing* temple, which undertakes daily worship, large-scale rituals, and grassroots management functions. The founding years of these *Jing* temples span a wide range, from the Tang Dynasty to the Ming and Qing Dynasties. With the establishment of the *Pu-Jing* system, they have continued to exist as the spatial carriers of the system, and undergone changes to adapt to social needs under the amalgamation of official governance and folk beliefs.

Each *Jing* temple enshrines the respective protective deities of each belief unit, and the variety of deities worshipped reflects the coordination between folk spontaneity and official authority. The number of deities that are mainly worshipped amounts to more than 30. With the exception of Buddhist and Taoist deities such as Guanyin, Guandi, Mazu, Erlangshen, and Xuantian Emperor, which are included in the national

sacrificial system, the folk deities worshipped in the *Jing* temples are generally those closely related to local history, culture and legends. One type is deities highly associated with life services, such as the theater deity "Xianggongye," the medical deity "Baosheng Dadi," and the childbirth protector "Pingtian Shengmu". The other type is local protective deities established based on the worship of historical figures.

The identification of these ritual deities was often the result of dual interaction between the folk and the authorities. On the one hand, the official authorities of the Ming and Qing dynasties continuously absorbed symbols deemed practical from the folk, such as eminent scholars, righteous individuals, and heroes, and exalted them as deities to establish role models for governance and personal conduct (Wang, 2017, pp. 248-249). On the other hand, the people needed to obtain official recognition for the deities they worshipped in order to keep their own deities from being abolished by the authorities. This is often done by giving the local deity the name of an officially recognised historical figure with the same surname, thus transforming the community's protective deity into a famous historical figure.

Besides daily worship, the *Jing* temple also undertakes more solemn festival ceremonies, and gradually becomes an important venue for the city's periodic celebrations. In the aforementioned custom of "parading the *Jing*'s realm", the *Jing* temple is the key node for the entire event, serving as both the starting point and the end point. City-wide "*Pudu*"[2] activities are also held alternately in the *Jing* temples of various units (Wang, 2017, pp. 292-295). Additionally, due to the diversity of deity worship, Quanzhou hosts deity birthday celebrations every month, with such events spanning over 100 days within a year (Chen and Lin, 1990, pp. 98-101). These activities all rely on the *Jing* temples to be carried out.

Due to official administrative intervention, the *Jing* temple also undertake the function of "*Yuesuo*" (covenant house)[3]. According to records in the "Political Treatise," the formulation and implementation of township covenants often rely on existing temple spaces. The purpose is to utilise the religious and public attributes of temples and the deterrent effect of local deities to strengthen the moral education role of the township covenants, and thus to guide the grass-roots administrative affairs. In the ancient city of Quanzhou, the *Jing* temple called "*Yuesou*" in *Qingyuan Pu* used to be the place where township covenants were made and local civil disputes were dealt with (Wang, 2017 pp. 284). The *Jing* temple such as *Fengsheng* Temple and *Shangdi* Temple also have relevant records as the covenant house.

The *Jing* temple, as a public building for folkloric enshrinement of deities and rituals for blessings, has become a core place where the urban governance system integrates with the local belief system, with the superimposition of official control and supervision functions.

3.2.2 Distribution of the *Jing* temples

Within the *Jing* realm, the *Jing* temple are often located closely adjacent to residential buildings, establishing a tight relationship with them (Figure 2). Influenced by the high-density built environment of the ancient city, most of the *Jing* temples are of the single-hall type, with a narrow internal space, where the deity statue and the offering table are located at the entrance, which can only provide space for the basic

worship activities. In contrast, the *Jing* temples in the urban fringe present larger and more complex architectural styles, such as *Tongtian* Temple with three halls and three openings, *Fumei* Temple with two halls and three openings, and *Xiling* Temple, which consists of a combination of two single-hall temples side-by-side.

Figure 3 Photographs of the *Jing* temple and its relationship with the surrounding area. Source: Quanzhou Culture and Tourism. (2023). *Explore the lesser-known Jing Temples in the south of the city.* Available at: https://mp.weixin.qq.com/s/pb44AgMzeS440H089IWZbw (Accessed: 6 May 2024).

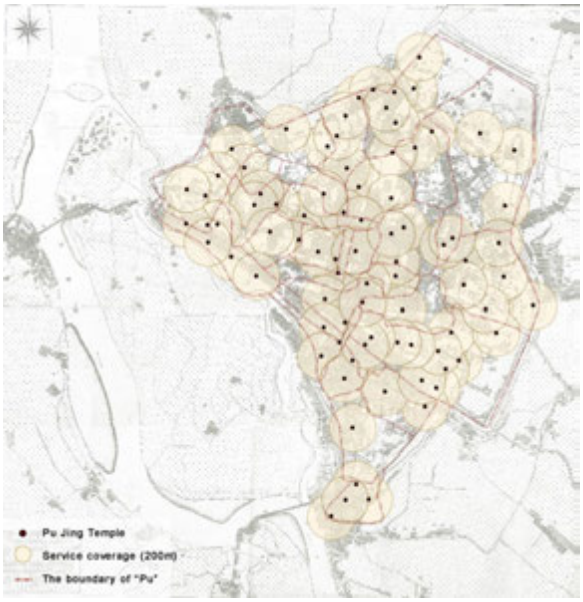

Figure 2 The service range of the *Jing* temples
Source: Drawn by the authors based on the "Map of Quanzhou City". Quanzhou Public Works Bureau, 1922.

At the urban level, *Jing* temples are widely distributed throughout the entire city. The service range of the *Jing* temples essentially covers residential areas within the city if measured at a radius of 200m (Figure 3). The *Jing* temples, as

community-level public buildings serving the basic units of the city, have achieved a grid-like distribution as if following today's standards for the layout of public service facilities.

3.3 Link: Streets and alleys connecting the individual and collective spaces

3.3.1 Roles of the streets and alleys

As transportation passages for people, streets and alleys form the basic skeleton of the community's public space. The distribution of *Jing* temples is based on this historically established and stable spatial foundation. Streets and alleys, as important venues for the daily life of Quanzhou residents, are closely related to their collective life. Residents gather here to exchange information, host community gatherings, and participate in festive events. The streets and alleys reflect the life trajectory and psychological experience of residents. The values of comity, filial piety and positive enterprising embodied in the historical alleys such as Comity Alley, Filial Piety Alley, and Taikui Alley, reflect the deep historical memories and cultural spirit of residents. Due to the prosperity of folk beliefs, the streets and alleys not only assume administrative and daily life service function, but also become important places for religious activities.

Firstly, the streets and alleys link up the *Jing* temples, serving as the essential passageways for pilgrimage, prayers and religious ceremonies, connecting the daily life of the residents with their spiritual beliefs. The streets and alleys link the public spaces in front of the *Jing* temples, the public spaces shared by several families and the public spaces in front of each house. They connect the individual lives with public social activities.

Secondly, streets and alleys serve as routes for ceremonial activities and the important places for local residents to worship deities. During the rituals such as “greeting the celestial troops” in the spring, “offering incense” in the summer, and “seeing off the celestial troops” in the winter, the residents of the *Jing* units carry the Main Deity of *Pu* or *Jing* along the alleys, and the deities will be enshrined by each family.

Thirdly, the alleys serve as stages for performances during religious festivals and celebrations. In the first month of the lunar calendar, the “makeup people” would parade along the alleys and make a variety of folklore performances such as Lantern Show, Parade floats and Gaojia Opera. The alleys around the *Jing* temples are usually responsible for more public activities. The stage of *Tongjing* Temple in *Ciji Pu* is erected above alley and water system. Residents built a stage out of wooden boards that were usually kept in the *Tongjing* Temple, and then they could gather in the alley in front of it to watch the play (Wang et al., 2022). The alleys closely connect the religious activities with community life and become a space that bridge the gap between people and the deities.

The *Pu-Jing* system in Quanzhou integrates the administrative, religious, and daily living functions, with the streets and alleys playing a role in connecting and coordinating these functions. While not directly stemming from the *Pu-Jing* system, the streets and alleys build an important support system for it.

3.3.2 The relationship between the streets and *Jing* temples

The analysis results show that the majority of temples have high accessibility relative to their surrounding areas. By examining the distribution of *Jing* temples and the local integration of streets and alleys, it is observed that the areas with a high concentration of *Jing* temples coincide with the areas where the local integration of streets and alleys is higher (Figure 4). It can be seen that from the perspective of the entire city, temples are mostly distributed in areas with high road accessibility within a small range, and their main service area is within a certain range around them.

Figure 4 The distribution of Jing temples and the local integration of streets and alleys. Source: the authors.

Furthermore, the temples are closely associated with the streets, resulting in three types of "temple-street" layout forms. (1) The *Jing* temple is located on the corner of street. This is the most common layout form (Figure 5(a)). (2) The Jing temple is located on the T-shaped junction. Accessibility of the *Jing* temple is greatly enhanced by the location of transportation node and focal point (Figure 5(b)). (3) The Jing temple is located on one side of the street. Compared with other forms, the *Jing* temple is more difficult to be noticed, but the combination of *Jing* temple and public space can increase the publicness of the *Jing* temple (Figure 5(c)). The public space system linked by streets and alleys further emphasises the centrality of the *Jing* temple.

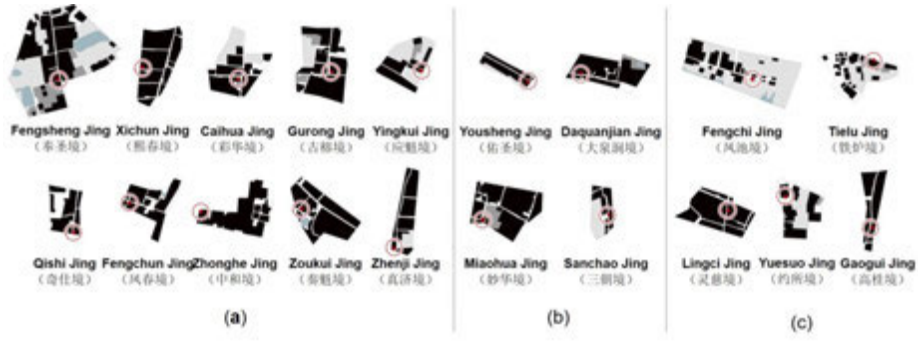

Figure 5 Three types of "temple- street" layout forms. Source: the authors.

4. Characteristics of public space in typical community - *Sanjiao Pu*

"*Sanjiao Pu*" is a typical representative of the *Pu-Jing* community in Quanzhou, which is large in scale and rich in elements. The area of *Sanjiao Pu* is 80.10 hectares, surrounded by the city centre to the west and the suburbs to the east. It enshrines the deities of Confucianism, Taoism and Buddhism, and includes the Confucian Temple, Guandi Temple and Tongfo Temple. Historically, it was a sacred place where the beliefs of the deities were gathered, and it was also the centre of official administration. The *Sanjiao Pu* is divided into nine *Jing* units: *Wenxing Jing*, *Houcheng Jing*, *Baiyuan Jing*, *Longgong Jing*, *Guangxiao Jing*, *Yichun Jing*, *Yuxiao Jing*, *Shangdi Jing*, *Fengchi Jing* (Figure 6).

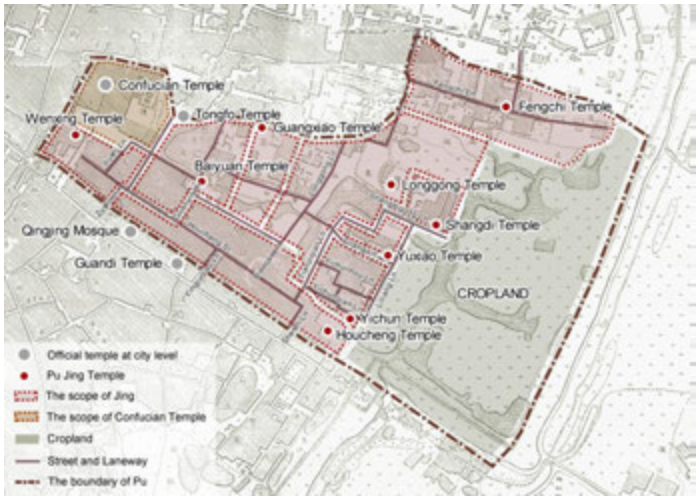

Figure 6 The Pu-Jing system in "Sanjiao Pu".
Source: Drawn by the authors based on the “Map of Quanzhou City”. Quanzhou Public Works Bureau, 1922.

The *Sanjiao Pu* exhibits a structural characteristic in its public space organisation, forming a spatial pattern centred around the *Jing* temple, connected by streets and alleys, and organised into units based on folk beliefs. As stable spatial elements in the history of urban development, the alleys such as *Longgong* Alley, *Shangdigong* Alley, and Comity Alley, have constructed the spatial framework of the community and partly serving as boundaries of the *Jing* realm. Each of the nine *Jing* units has a *Jing* temple with the same name as it. The *Jing* temple serves as a core and is located on the main alleys, serving as a spatial and visual focal point. For example, *Shangdi* Temple is located along the alley and orients to the main alley, which strengthens its recognizability and accessibility; *Yuxiao* Temple is located on the corner of the alley, facing Comity Alley, greatly improving the degree of perceptibility; *Yichun* Temple faces the water, which forms a good fengshui node. At the same time, the Jing temples are closely related to residential buildings, and their volumes harmonise with each other. For example, the *Shangdi* Temple has a street frontage of only four meters, but a depth of sixteen meters, with very little interval to the left and right, and is close to the buildings behind it.

What’s more, the public space system becomes an important spatial carrier for social activities and cultural connotation. In the term of social activities, the *Sanjiao Pu* are responsible for the *Pudu* activities and Deities’ Birthday ceremonies like other *Pu-Jing* communities in Quanzhou. The *Pudu* activities are held at different *Jing* temples on the first day (*Baiyuan Jing*, *Longgong Jing*), second day(*Houcheng Jing*) and nineteenth day(*Fengchi Jing*, *Yichun Jing*) of the seventh month of the lunar calendar every year (Wang, 2017, pp. 292-295). And the activities such as the street-based “parading the *Jing*’s realm” strengthen the sense of community. *Fengchi Jing* even had disputes with the others during the activity of “parading the realm”. This conflict based on the different beliefs of each Jing units, usually arises when the residents of one Jing unit intrude into the other *Jing* unit during the parading along the streets and alleys. This shows that, the belief system of the *Jing* unit and its “spiritual boundaries” are inviolable in the residents' mindset.

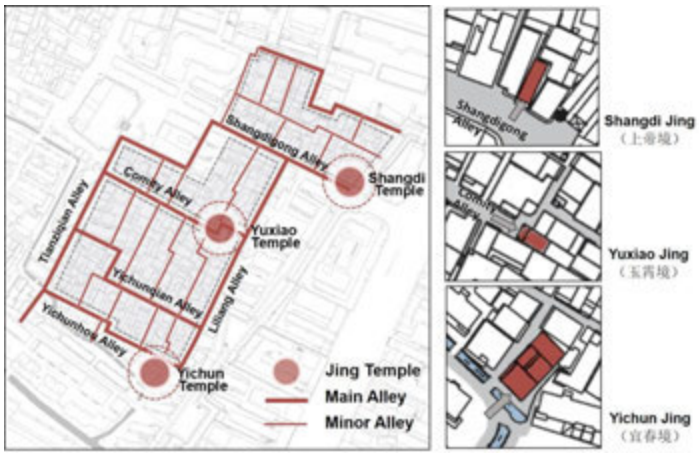

Figure 7 The public space system in "Sanjiao Pu".
Source: the authors.

In the term of cultural connotation, as the spatial carrier of community spirit, the alleys reflect historical memories and collective spirit that further strengthen the sense of community attachment. In the *Sanjiao Pu*, the names “*Shangdigong* Alley”, “*Longgong* Alley” and “*Fengchi* Alley” were all named by the name of *Jing* temples, which reflects the influence of the deities in the *Pu-Jing* communities. The name “*Houcheng Jing*” is derived from “*Houcheng* Street”, which emphasises the meaning of loyalty and honesty, and has greatly influenced the family rules of the residents in this area. The name “Comity Alley” originated from a story about comity. In the early years, when the residents of the Comity Alley built new houses, they would take the initiative to set back a bit of space, so that a public space was formed at the entrance of each house. All of these form the spiritual core of the community.

5. Discussion and Conclusion

Through the analysis of the public space composition and the spatial structure of the *Pu-Jing* community in the old city of Quanzhou, it is found that a well-defined and structurally stable public space system was developed in the *Pu-Jing* communities

during the Ming and Qing dynasties. Through even coverage and relatively high accessibility, a systematic distribution of *Jing* temples has been realised. The public space system with the *Jing* Temple as the core, the streets and alleys as the link, and the belief realm as the unit was formed throughout the city. This grid-based public service system supports traditional beliefs and grassroots governance systems.

Through this public space system, we can further understand the space formation logic and building wisdom reflected in it. On the one hand, the public space has gradually developed a specific structure and a stable pattern, which supports folk beliefs and grass-roots management to be carried out in a long-term and orderly manner. The pattern of public space of Quanzhou's *Pu-Jing* community has the following three main elements. (1) Units of appropriate scope: Folk belief units are further subdivided within the framework established by the authorities. Their scale is determined by population size and the level of social development and their boundaries are delineated by both material and psychological factors, which fosters the formation of a sense of community spatial domain. (2) Universally recognised core: Within each unit, there are *Jing* temples where collective beliefs and public affairs activities are held, serving as a place of spiritual cohesion among residents. Their intentional placement enhances their recognizability and accessibility. The main body of these *Jing* temples (sometimes combined with surrounding areas) typically forms the most influential public space within the community. (3) Stable connecting structure: Relying on the basic organisational elements of the community, streets and alleys connect individual private dwellings to the public centre. Through this spatial pattern, favorable conditions are created for the continuation of social activities and a strong link is established between the secular and spiritual activities of people and specific places. The public space of *Pu-Jing* community has long played an important role in maintaining neighborhood relations and supporting social activities, and thus serves as a vital connection between individuals and their surroundings, allowing the residents to gain a sense of belonging.

On the other hand, the public space system reflects the ability of the civil society to develop autonomously in response to and in coordination with the official management and its relentless pursuit for spiritual meaning-making. The social relations constructed by the bond of common beliefs are fully reflected in the public space system. Folk belief activities, daily life, and administrative affairs are accommodated and integrated within this public space system. The construction process of communities under the *Pu-Jing* system transcends the guidance and management of the authorities, reflecting the practical embodiment of residents' adaptation of daily living spaces to their mental needs. The public and government departments have established a relationship of mutual recognition and influence that works together at the social and spatial levels thereby contributing to the shaping and development of the community. In a stable faith-based social and spatial structure, people perpetuate spiritual activities deep in their memories, and the constant consolidation of their beliefs also allows for the conservation and continuation of the community's collective memory. Today, folk festivals and belief rituals are still active in Quanzhou, and the public space system remains strong and continues to play a promoting role in community identity. The community public space system has become an important carrier of the historical and cultural values and spiritual connotations of the *Pu-Jing* community.

The *Pu-Jing* community has explored a certain degree of autonomous development under official control, and realised the shaping of sense of place. The wisdom of place-making implied in the public space of *Pu-Jing* community provide inspiration for contemporary community governance. The social structure and activities supported by the public space of the *Pu-Jing* community are the core social characteristics of this distinctive community form. This is precisely what modern communities lack— in contemporary community building, the serious homogenisation and economic orientation gradually erode the cultural and social relationships within the community. As a critical entry point for community governance, the planning of public space has become an important means of creating a sense of belonging to the community. When planning public spaces, it's crucial to preserve and perpetuate stable spatial patterns that have been formed over a long period of time to maintain social relationships. We should strive to preserve indigenous populations and their social networks as much as possible while pursuing development, so that the original spirit of the community can be continued over time.

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Conflicts of Interest: The authors declare no conflict of interest.

Notes

1. According to the "Political Records", one headman is appointed for each "*Pu*", along with one assistant headman, one constable, and one deputy constable. The headman and the constable respectively manage the "*Pu*" records, and constabulary records. The "*Pu*" records are mainly related to public security and labor duties, specifying the daily duties of watchmen and miscellaneous laborers. The constabulary records mainly address local emergencies, recording the number of watchmen each household under each "*Pu*" should provide.
2. In Quanzhou, the term "普度" (*Pudu*) refers to a traditional Buddhist ritual known as the Ghost Festival or the Hungry Ghost Festival, which is part of Chinese folk religion and also observed in the Buddhist tradition. The purpose of this festival is to release the suffering of the deceased, particularly those who have become "hungry ghosts" due to unfulfilled desires or neglect by their descendants. By the end of the Ming and the beginning of the Qing dynasty, it had developed into a city-wide "rotation" system. Each communities takes turns hosting the *Pudu* festival on specific dates, usually from the fifth to eighth lunar month.
3. The "covenant house" is the place where the grassroots society promotes and formulates the "township covenant" to restrain the townspeople. The "township covenant" combines indoctrination and administrative attributes, and is an extension of the administrative management system at the grassroots level (Kang & Wang, 2022).

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The Impact of Online Social Activities on Public Spaces in the Digital era - A Case Study of Guochuang Park in Nanjing

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Abstract

In the digital era, public spaces are not only significant venues for daily recreational experiences in the physical world but also the focus of online social platforms. This study, using Guochuang Park in Nanjing, China, as a case study, to explore how online social activities influence the production of virtual spaces on social media platforms and the vitality and landscape of physical public spaces. The research indicates that users on the platform establish new social relationships and virtual spaces through online social activities. Additionally, platform activities can inject vitality into physical spaces but may also lead to some social and spatial issues. Consequently, this study advocates for urban planning to accommodate digital activities while preserving the significance of physical spaces.

Key words

Social Media Platform, Online Social Activities, Public Space Vitality, Production of Space, Local Culture

1.Introduction

With the increasing integration of digital platforms into urban life, numerous urban experiences are being mediated through digital technologies, enhancing the complexity of place experiences and activities. According to a new survey report released by Meltwater and We Are Social, the global social media user population has surpassed 5 billion, accounting for 62.3 percent of the world's population (CNMO Mobile China, 2024). Meanwhile, as indicated by the 52nd Statistical Report on Internet Development in China, as of June 2023, China's internet users have reached 1.076 billion, with 1.03 billion being social media users (CNNIC, 2023). Social media has unprecedentedly permeated into our daily lives, influencing people's perception of the real world and altering public demands (Hyun et al., 2018; Van der Hoeven, 2019). It has become a medium for the public to understand localities and cultures, playing a significant role in exploring, selecting, and experiencing cities. At the same time, people's activities on social media cannot be separated from urban spaces. From text to images and videos, urban spaces are acquired, edited, disseminated, and constructed on the internet by social media platform users, forming a "media landscape" characterised by visual symbols.

More and more scholars are paying attention to the role of social media in urban studies, for example, using social media data with coordinates to analyse the vitality of urban space, urban sentiment, public landscape preferences, and so on (Sun, Shao and Chan, 2020; Dorostkar and Najarsadeghi, 2022; Ma, Yang and Jiao, 2021; Tieskens et al., 2018) Most of the studies seem to treat the text and images in social media as simple "information" or data sources. However, from the perspective of the sociology of media space, social media platforms are not only online information spaces in the physical sense, but also complex social spaces built on the multiple values and social meanings of different groups of people. As Rose (2014) suggested, it is important to regard the

social networks constructed through images, short texts, comments, and ‘likes’ as integral components in the construction of urban places and social relationships. Social media platforms encompass various entities such as capital, influencers, and regular users, whose activities reconstruct social relationships and shape new virtual images (Huang et al., 2021). Online social activities, as a means of publicly conveying visual, textual, or physical representations of urban areas (Bronsvoort and Uitermark, 2022), promote the overlap and interweaving between offline physical spaces and online virtual spaces (Zhou, Lu and Wang, 2023). The "media landscape" based on mass aesthetics is gradually becoming a fundamental element of urban space, guiding its development.

In the digital age, public spaces are not only important venues for people's daily leisure experiences in physical spaces but also the focus of social platforms. As vital social spaces in cities, the functions of public communication and cultural dissemination have been continually amplified and diffused on social media platforms. Therefore, it is necessary to study the influence of social media on urban public spaces in the digital age. Consequently, this paper will take Nanjing GuoChuang Park (hereafter referred to as "GuoChuang Park") as an example, employing a combined quantitative and qualitative research approach to explore the construction and mechanism of public spaces on social media and provide new insights into how social media produces and shapes places.

2. Data and method

2.1 Case background

Located in the Qinhuai District of Nanjing City, Guochuang Park occupies a prime geographical location and serves as a significant public space for both citizens and tourists to visit, relax, and engage in activities within the old city area. Previously, Guochuang Park was the headquarters of the Jiangnan Mint Bureau during the Qing Dynasty and later the Nanjing Second Machine Tool Factory during the Republic of China era. Later, it underwent industrial upgrading and was renovated with market capital. The park officially opened to the public in 2012, largely preserving its original spatial layout, including large-scale production equipment, ancient trees, and some industrial buildings. It also established the Jiangnan Modern Industrial Heritage Park, which effectively showcases the style and characteristics of Chinese industrial architecture. Following the regeneration of Guochuang Park, its internal functions initially focused on office spaces, accommodating fashion and art-related enterprises, software development, design decoration, and other cultural and creative industries. In recent years, with the successive opening of cafes, flower shops, art merchandise stores, and the hosting of public events, the park has gained popularity on social media platforms such as RED, Weibo, and Douyin (Chinese TikTok). It has gradually become a trendy destination for young people to visit and capture moments, making it a popular “Wanghong area(refers to a popular area or district where people visit to take photos

and share them on social media)".

Dubbed as the "Chinese Instagram," RED was founded in 2013. As of 2023, its user base has exceeded 350 million, with approximately 100 million daily active users and 260 million monthly active users. Targeting high-spending urban white-collar workers, post-90s, and post-00s young generations, the platform has a remarkably high female user ratio of 87 percent and a 51 percent proportion of high online spending users. It serves as an interactive platform primarily focused on sharing lifestyles and consumption experiences, representing one of China's iconic social media platforms. Compared to other social media platforms, RED emphasises platform "tones" more. This study aims to use RED as an example to explore the image and production process of Guochuang Park on social media platforms, as well as the influence of platform discourse on material space culture, landscapes, and more.

2.2 Data collection

2.2.1 Interviews and Field Surveys

This study conducted in-depth interviews with relevant participants. Initially, ten influencers (with over 1000 followers) and ten regular users (with fewer than 1000 followers) who had captured content at Guochuang Park were invited to participate. This study aimed to understand their processes and motivations behind capturing images and videos, writing captions, commenting, and liking posts. Acknowledging that the majority of regular users on RED are "silent content consumers," whose online posting and commenting behaviors may not fully reflect the audience's attitudes and behaviors (Turri, Smith and Kemp, 2013), the author conducted offline interviews with visitors to Guochuang Park. Among them, platform users attracted to Guochuang Park by RED were selected, and their reasons for visiting Guochuang Park, purposes, and actual experiences were enquired. A total of 6 visitors attracted to Guochuang Park by RED were interviewed. Then, interviews were held with staff responsible for RED's operation and brand promotion to gain insights into the platform's business model and its collaboration patterns with influencers.

2.2.2 Social Media Data Collection and Preprocessing

(1) Data Collection

In this study, a custom Python programme was used to collect data from RED by searching for the keywords "Nanjing Guochuang Park" and "Guochuang Park". A total of 400 image-text notes were comprehensively collected. After filtering out irrelevant or non-primary content related to Guochuang Park, 314 notes remained for analysis. The collected data was then cleaned to remove emojis and irrelevant characters from the note descriptions. The final dataset is presented in Table 1. Metrics such as likes, bookmarks, comments, and shares collectively reflect the popularity of the notes. Note

descriptions consist of textual content describing the user's cognition and experiential information about Guochuang Park, while images represent the visual representations of Guochuang Park by platform users.

Table 1: Sample Data of Note Content

Users Name	Note Title	Number of collections	Number of likes	Number of Comments	Number of Shares	Upload Time
W***Nao	Exploring stores in Nanjing	This supermarket makes You never want to leave	10114	12308	424	6878	2022-10-04 20:25:41
Note Description			Note Tags			Note Images
This new store in Guochuang Park is truly eye-catching, with a distinctive storefront design that makes you stop in your tracks. Inside, they sell a wide variety of imported beverages, alcoholic drinks, snacks, instant noodles, beef... it's so dazzling! The entire store exudes an American retro vibe, it's really amazing! The photos come out beautifully.			#Note inspiration; #Nanjing travel; #Nanjing photography; #Nanjing store exploration; #Discovering a great Nanjing store; #Weekend store exploration; #Nanjing dining and entertainment; #Nanjing vintage store; #Nanjing internet-famous supermarket			Saved in a folder

(2) Text Data Preprocessing:

All note descriptions undergoing preprocessing were imported into the semantic analysis software ROST CM6. Initially, the segmentation function in the functional analysis module was utilised to divide the entire text into vocabulary units. Following this, any special place names or internet buzzwords unrecognised by the software were manually added to the custom segmentation word list, such as "Guochuang Park," "Daka（take photos and upload them to social media）," and "Tandian(visiting or exploring various stores, usually to discover new products, experiences, or places)," The segmented files underwent frequency analysis, where synonymous words, such as "good for photography" and "good photo spots,"were merged, and meaningless words were removed.

(3) Image Data Preprocessing:

Out of the 314 notes obtained, a total of 2852 images were collected. Using custom Python code, the local images were converted into the Base64 format. Next, the images were automatically imported into analysis using the Tencent Cloud image tagging API interface. The output results were then saved in Excel format, identifying 2793 images with an impressive recognition rate of 98 percent. The obtained data (Table 2) retained the top three-level tag

classifications (category1-3) and their confidence levels (confidence: values ranging from 0 to 100, where higher values indicate greater confidence). Subsequently, tags with similar meanings in this study were standardised, such as merging "flowers" and "floral arrangements" into "flowers", "food" and "diet" into "food". The processed data served as the foundation for analyzing the virtual landscape construction of Guochuang Park.

Table 2: Top Five Examples of Image Recognition Labels

Image ID	category 1	con_ 1	category2	con_ 2	category3	con_ 3
image_1	People	63	Advertisement	31	Architectural facade	13
image_2	People	89	Architectural facade	61	Auditorium	23
image_3	Retail	93	Supermarket	74	Architectural facade	67
image_4	Clock	77	People	65	Architectural facade	49
image_5.	Retail	78	Architectural facade	63	Supermarket	60

3. Online Social Activities and the Production of Virtual Space in Guochuang Park District

Online social activities have led to the formation of social relationships and societal significance within virtual spaces. The images and text used by users for interaction on social media platforms serve not only as carriers of encoded information but also as contributors to the creation of virtual spaces through user interaction. This chapter begins by analyzing the actors, processes, and motivations of social media activities based on research and interview findings. It then reveals the landscape representation of Guochuang Park on RED through semantic and frequency analyses. Finally, it draws on spatial production theory to explore the production of virtual space.

3.1 Actors, Motivations, and Processes of Activities in Social Media

Based on interviews with influencers, regular users, and platform operators, this study examines the processes and motivations of activities on social media platforms from three perspectives（Figure 1）.

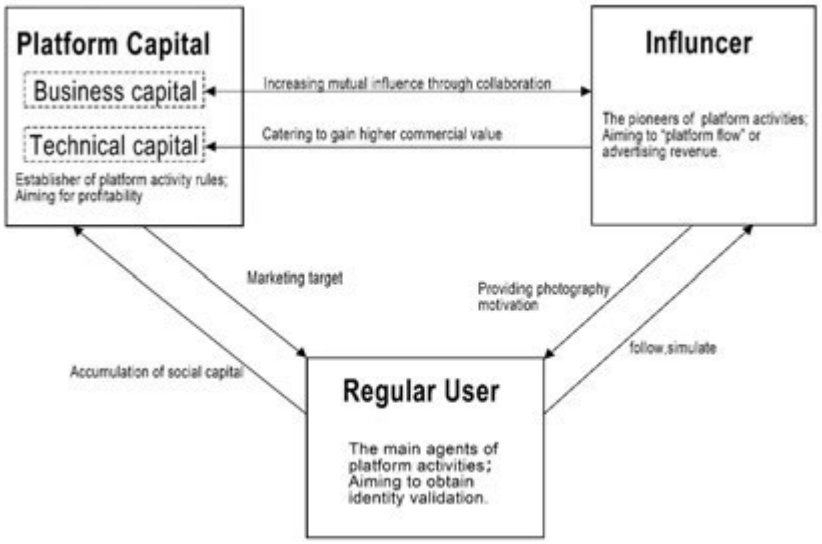

Figure 1. Actors and motivations of social media activity.

3.1.1 Influencers - Pioneers of Platform Activities

Among the 10 influencers interviewed, 4 disclosed that their posts were commissioned advertisements for businesses within Guochuang Park. They stated that before shooting, they would receive specific requirements, and they need to capture images and write captions accordingly, which would then be subject to review and approval before fee settlement. For instance, a promotion for a grocery store required influencers to capture scenes containing crucial marketing elements such as storefronts and brand logos, with the published content needed to incorporate keywords like "American-style" and "retro."

Additionally, the other 6 influencers posted content related to Guochuang Park aiming to "create better content to attract platform flow." As the primary market of RED comprises women and high-end consumers who pursue fashion, influencers tend to select spaces with the potential to create elegant, delicate, and upscale symbolic experiences, using professional cameras and techniques to photograph and produce images. They amplify these aspects through eye-catching titles and exaggerated descriptions to foster identification among regular users. One influencer with 28,000 followers on RED commented:

The backgrounds here are perfect for photography. I brought several sets of clothes to capture photos in different styles for my daily creative content, and the high-end background here naturally attracts attention on RED.

Based on the statistical findings, among the 54 blog posts with popularity levels exceeding 1000 (the sum of likes, comments, saves, and shares), 49 were contributed by influencers, while 5 were from regular users. From this, it can be inferred that influencers with larger online followings occupy significant impact on shaping the discourse during social platform activities and the construction of virtual landscapes.

3.1.2 Platform Users - Followers in Platform Activities

Upon viewing the images and text shared by influencers on RED, regular users are motivated to physically visit the location to obtain embodied experiences. Among the 10 regular users interviewed, all of whom had posted content related to Guochuang Park on RED, 7 indicated that they had "liked" and "saved" photos from influencers for guidance on angles, composition, and poses when taking photos at Guochuang Park. They search for specific angles to capture photos, upload them to RED, and obtain identity recognition through likes, comments, shares, and other interactions, thereby constructing a virtual social circle. One respondent commented:

I refer to photos from other influencers, imitating their poses and backgrounds to take better-looking pictures.

3.1.3 Platform Capital - Establisher of Platform Activity Rules

Based on interviews with official operators and brand promoters of RED, it is evident that RED, as a platform targeting women and high-end consumption, aims to establish a new capital circulation system through commercial spatial strategies. For instance, it aims to generate advertising revenue in industries such as tourism and shopping. The platform releases "influencer recruitment" information through features such us "Dandelion Plaza" or Multi-Channel Network (MCN) agencies, which include details about advertising products, fan requirements, and shooting needs. This facilitates direct interaction between commercial and tourism capitals with influencers. Capital intervention prompts influencers' sharing to be oriented towards capital diffusion, and the purpose is for the audience to see and accept marketing information hidden beneath experience sharing. Furthermore, the platform indirectly influences the activities of both influencers and regular users through "platform flow" (Push mechanism formed by algorithms, the more "platform flow" the more likely to be popular), encouraging users to align with the platform's high-end and sophisticated ideals to the greatest extent possible. Under the “platform flow” mechanism, individuals choose for "premium," "Instagrammable," and "Korean-style" photos as backgrounds to cater to the platform's aesthetics, seeking more exposure and interaction.

3.2 The landscape of Guochuang Park presented by text and images on RED

3.2.1 Landscape Presented by Text

The visualisation results of word frequency are illustrated in Figure 2. Further, verbs, nouns, and adjectives were sorted by frequency, and the top 10 were extracted and summarised in Table 3. Verbs and nouns reflect the social behavioural characteristics of RED users in Guochuang Park, including users' activities and the main purposes of visiting Guochuang Park. Adjectives reflect RED users' subjective perceptions of Guochuang Park. According to the sample results, "taking photos" is the most common activity RED users engage in at Guochuang Park, followed by "strolling," "eating," "Daka (take photos and upload them to social media)," "Tandian (visiting or exploring various stores, usually to discover new products, experiences, or places)," "buy," "city walk," "exhibition viewing," etc. Apart from "Guochuang Park" itself, "Café " "supermarket," "restaurant," and "flower shop" are the main destination points mentioned in the samples, followed by "buyer's store," "factory," "exhibition," "boutique," "museum," etc. RED users consider Guochuang Park to be very photogenic, portraying it as a space characterised by "retro," "American style," "artistic," "niche," "Korean style," "atmospheric," "Wanghongable (a specific place that is highly visible and talked about on social media)," "valuable," and "creative."

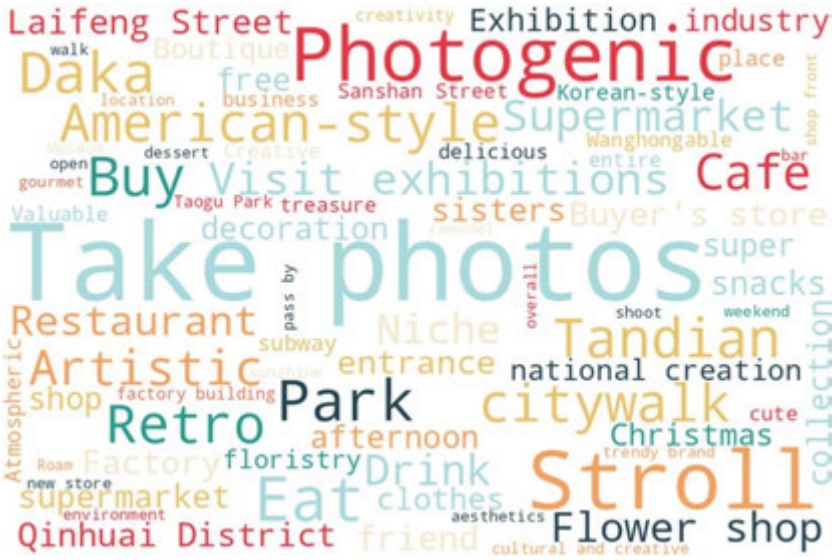

Figure 2. High-frequency word cloud.

Table 3: Frequency Statistics Results

Verb	Frequency	Noun	Frequency	Adjective	Frequency
Take photos	398	Park	99	Photogenic	176
Stroll	207	Café	73	Retro	87
Eat	115	Supermarket	57	American-style	84
“Daka”	98	Flower shop	49	Artistic	72
“Tandian”	90	Restaurant	48	Niche	50

Buy	89	Buyer's store	46	Korean-style	31
citywalk	85	Factory	45	Atmospheric	30
Visit exhibitions	60	Exhibition	40	"Wanghongable"	29
Drink	53	Boutique	32	Valuable	29
Roam	16	Museum	21	Creative	26

3.1.1 Landscape Presented by Image

According to the tag results obtained from sample image recognition, the "person" tag appeared most frequently, occurring 1212 times, accounting for over 40 percent of the total. Among them, 952 instances were in the first-level tags, 155 in the second-level tags, and 105 in the third-level tags. Following closely are scenes such as streets, art, food, flowers, and architectural exteriors, comprising the top 5 percent, as shown in Table 4.

Table 4: Image tag word frequency statistics results

Category Label	Frequency_ category1	Frequency_ category2	Frequency_ category3	Sum
People	952	155	105	1212
Street	25	408	103	536
Art	168	189	138	495
Food	187	108	86	381
Flower	122	138	84	344
Architectural facade	94	108	123	325
Cloth	52	110	128	290
Furniture	79	97	92	268
City	60	81	71	212
Retail	75	69	24	168
Tree	48	48	40	136
Transportation	45	56	27	128
Market	28	39	53	120
Christmas Decoration	38	26	23	87
Restaurant	27	27	30	84

In summary, under the intervention of platform capital and users' pursuit of “platform flow”, Guochuang Park on RED has been constructed as a place predominantly featuring various high-end trendy shops such as cafes, restaurants, and flower shops. It is characterised by its retro, artistic, and niche ambience, suitable for photography, exploring shops, and leisurely city walks, catering to a bourgeois consumption experience.

3.3 Production of Virtual Space in Social Media

Lefebvre's theory of spatial production (Lefebvre, 1991) proposes a triad of space to answer how space is produced: (1) Spatial Practise: the perceived environment involving the concrete shaping and Practises of spatial production and reproduction; (2) Representations of Space: the imagined space controlled and dominated by the will of power and capital, representing the spatial projection of capitalist ideology and imagination; (3) Representational Space: the social relations that emerge from the interaction between users and the environment (Xia, 2019). The theoretical focus on the sociality of space corresponds to the essence of social media platforms—which is the social construction of various social subjects. Therefore, the author will draw on Lefebvre's theory of spatial production to explore the mechanism of constructing virtual landscapes in social media through the three dimensions of "Spatial Practise," "Representations of Space," and "Representational Space."（Figure 3）

3.3.1 Spatial Practise: Concrete Operations and Practises in Constructing Social Media Landscapes

Platform users (including influencers and regular users) are the direct producers of social media landscapes. They select shooting locations in physical spaces, establish local connections, and create media products through text, images, videos, etc., essentially practising place, space, and body. Firstly, based on the audience characteristics of RED, users tend to choose spaces that may create symbolic experiences of delicacy and fashion. Throughout the process of image production and text embellishment, they continuously magnify these aspects, providing imaginative spaces for the audience through mental maps and role symbols (Speake, Kennedy and Love, 2023), thus inducing group identification.

3.3.2 Representations of Space: Capital Intervention and Interference

Platform capital mainly affects the spatial Practises of influencers and regular users in two ways: through direct commercial capital and through platform technical capital—the "platform flow" generated by algorithms—to amplify the imbalance in power relations. Under the influence of advertisements and "platform flow", influencers' activities on the platform are both restricted by commercial cooperation contracts and require catering to platform algorithm to enhance their commercial value (Kaymas and Yakin, 2021). The collaboration between platforms and influencers indirectly influences the decisions and behaviors of regular users. In this process, platform capital amplifies the imbalance in power relations (Söderström and Mermet, 2020) and cleverly reconstructs the spatial Practises and representations of image landscapes in the virtual world by controlling the code and data in virtual network spaces to circumvent regulation in the real world.

3.3.3 Representational Space: Social relationships shaped by platform users

Platform users are also audiences in virtual spaces. After viewing media landscapes on screens, they may visit the places presented in the media in the real world, or explore based on pre-constructed spatial imagination maps, and may discover differences between media landscapes and real landscapes in the process. Moreover, users may imitate others' perspectives in photography for check-ins or engage in new creations, continuously shaping the reproduced space in social media through daily activities. Additionally, through interactions, users form virtual social networks, where metrics such as "followers," "likes," "saves," "comments," etc., seem to visualise the accumulation process of social capital in virtual spaces and construct social relationships within virtual spaces(Speake, Love, and Kennedy, 2023).

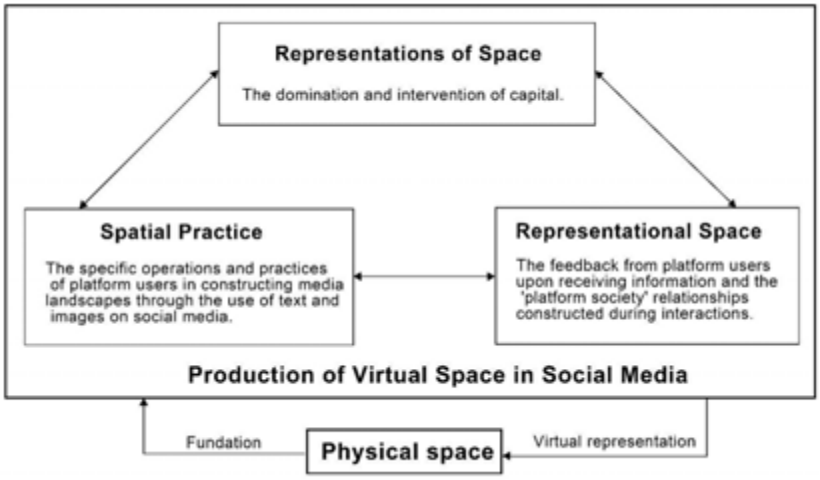

Figure 3. Production of virtual space in social media platforms

4. The Vitality and Landscape of National Innovation Park Blocks Under the Influence of Online Social Activities

4.1. The Conversion of Online-Offline Vitality

Spaces with physical environments can be accessed and experienced both offline and through social media platform, with their popularity online being translated into vitality offline. The positioning of Guochuang Park as "creative" and "artistic" aligns perfectly with the style of RED, and the exposure from RED undoubtedly brings more popularity to Guochuang Park. Influencers and other ordinary platform users seek specific angles to capture photos and upload them on the RED platform, where they gain identity recognition and construct virtual social circles through likes, comments, shares, and other interactions. In this process, platform users utilise the street backgrounds of Guochuang Park to enhance their image in the "platform society" (Walters and Smith,

2024), continuously attracting others and thereby increasing the vitality of public spaces. For instance, one interviewed blogger stated:

Many people tagged their friends in my posts, inviting them to come to Guochuang Park for photos.

Among the 10 randomly interviewed visitors to Guochuang Park, 6 were attracted through RED, 2 through other social media platforms (such as TikTok, WeChat, etc.), and the remaining 2 through other channels. Among the 6 visitors attracted by RED, 4 respondents roughly followed the "play map" from RED's posts, while the other 2 mentioned they just wandered around. Additionally, one respondent mentioned discovering Guochuang Park through RED and finding it different from what was seen online, finding the industrial culture here very appealing:

I came across Guochuang Park on RED. Today, I had no classes, so I came over. Before coming, I didn't know it was an industrial site, but after arriving, I found it more interesting than what I has saw online. I even took a photo in front of the building with the slogan "The helmsman relies on the wind."

Moreover, RED indirectly increases the vitality of physical spaces by enhancing the platform's influence through official offline events. For example, in the "Strolling in the Park Is Serious Business" event initiated by RED in March 2023, four shops in Guochuang Park collaborated with RED, namely, "Some No Some Art Store," "glue," "ETE Supermarket," and "bamboo today cafe." Participants were required to post a note on strolling in parks in Nanjing with the hashtag "#Strolling in the Park Is Serious Business" to receive a free picnic mat from the above-mentioned stores. Many residents and tourists participated in this activity, and Guochuang Park also became their destination for participating in the event. One of the respondents who participated in this activity said:

I saw this event on RED and found that there are several picnic mat pickup points in Guochuang Park. I wanted to check in before, and now I can also get a picnic mat for free.

4.2 The Transformation of Landscape through "Behavior-Space"

UGC on RED, driven by algorithms, influences people's aesthetics and lifestyles. We have ample reason to believe that digital platforms can also have material consequences (Bronsvoort and Uitermark, 2022). Through a series of online-offline activities brought by RED and the interaction among platform users, an increasing number of images capturing the "best angles" are uploaded to social platforms. In the process of mechanical photography, space seems to become a sort of circulating "commodity." Taking photos at "popular spots" is a typical behavior among RED users in Guochuang Park. People seem to be controlled by space and its underlying rules, consciously or

unconsciously engaging in the same behavior, partially losing subjectivity (Li and Wang, 2024). Users seek to obtain "identity inspired by object images" subconsciously and produce the same images continuously, using the symbolic image of a place as proof of a successful visitation (Spierings and Van Houtum, 2008). Subsequently, re-uploading images creates a continuous, repetitive, and widespread dissemination, thus eliciting an aesthetic resonance effect.

The culture and space of Guochuang Park District seem to cater more to the needs of social media dissemination, flattening into backgrounds for photography. Other cultural and creative industry parks, such us Dongxinhe Creative Park in Hangzhou, DEMOHOOD in Ningbo, and N150 Creative Park in Jinan also appear to be shaping images of "niche," "artistic," and "creative" spaces. They promote themselves as trendy popular spots by introducing formats such as cafes, upscale restaurants, galleries, and boutiques to enhance the vitality of the parks. The “Balcony Bowkonts” and the wall-climbing Santa Claus, which started to trend on Wukang Road, and the Rose Waterfall, which has become popular on Summer Palace Road in Nanjing, can also be found in the National Creative Park. Different "creative industry parks" and "Wanghong districts（district which is very popular on social media）" learn from each other, imitating each other's landscape construction methods and development models, resulting in similar evolutionary trends in the presentation of material space landscape, structure, and function, and the unique personality of space is diminishing.

Furthermore, driven by social media, local culture constantly caters to globalised consumerism, often turning spaces into "consumption spaces" with "local culture" as selling points. Dominant cultures oriented towards platform capital and economic development may potentially infringe upon local cultures. For instance, "ETE American-style Supermarket" promotes itself on RED as an "American style" hot spot for photography, while the streets where Glue clothing store and Today shop café are located are also advertised by influencers as "Korean streets." Under the discourse construction of RED, the industrial historical culture in Guochuang Park is marginalised or even dissolved, and external culture and online culture gradually dominate the discourse, creating industrial historical districts as symbolic space landscapes that meet the mass demand for "photo taking." Such uniform constructions may lead to the loss of sustainable development charm in the districts.

5. Conclusion

As our urban imagination increasingly builds upon digital platforms, studying their roles in contemporary cities becomes increasingly significant. In today's society, where social media pervades all aspects of life, Guochuang Park serves not only as an industrial relic but also as a hub for original artistic endeavours, a hotspot for creative industry development, an emerging tourist destination, and a popular spot for photography. Throughout its development, it continually breaks its geographical boundaries, promoting itself in cyberspace, expanding its local influence, and

establishing new local meanings. In this context, researching the virtual construction of Guochuang Park on social media and its impact on physical space is meaningful.

This paper utilises UGC on social media platforms to analyse the activities of platform users in both social media and urban spaces. It argues that pursuing commercial value and obtaining identity recognition are the primary purposes of influencers and regular users respectively. They use physical spaces as the background for photography, engaging in interactions on social platforms, forging new social relationships, and driving the production of virtual spaces. However, their activities are influenced by platform commercial capital, often resulting in virtual space production that aligns with platform commercialisation strategies. While activities on social media platforms can inject vitality into physical spaces, the "platform flow" mechanism and capital may homogenise behavior, flattening space into mere photographic backgrounds, and eroding local culture under the invasion of external culture.

Social media platforms are mobilising user capital, potentially altering users' behaviors, spatial usage patterns, aesthetics, and design standards (Chang and Spierings, 2023). In this process, the construction of platform discourse seems to generate new spatial production modes. Spatial production in social media involves capital using virtual space as a tool to reshape power relations in the real world, aiming for capital diffusion (Senyao and Ha, 2020), which may impact gentrification, community change, spatial aesthetics, local culture, spatial justice, among other aspects (Törnberg and Uitermark, 2022; Duignan et al., 2021; Polson, 2024). The representational power of electronic media cannot be overlooked. It is essential to explore how different types of social media dynamics emerge from urban spaces and feedback into urban changes in future research.

Faced with the strong influence of the silicon-based civilisation, public spaces in various Chinese cities are undergoing extensive updates in social interconnection functions. Therefore, it is necessary to prioritise the needs of digitalisation for physical public spaces in the planning process, integrating online and offline activities into urban scenes to enhance spatial vitality. However, urban spaces should not become mere consumer products on the internet; instead, they should evolve into "carbon-silicon hybrid spaces" that are in line with the development of the times and play a long-term positive and active role in local development and social relations.

Furthermore, effective guidance and control measures should be taken to guide and supervise platform capital, preventing excessive capital in the construction of social media platform discourse, which may lead to the passive dissolution and alienation of locality. It is crucial to prevent material spaces from becoming subservient to digital spaces.

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Enhancing suburban life with Victor Gruen

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Abstract
The essay deals with the theme of the prejudices that prevent us from designing vibrant suburban spaces and argues that we should rediscover Victor Gruen's lesson in doing so. The first part analyzes the consequences determined by the advent of the car and the urban explosion on public spaces. The second section of the essay develops a critical reflection on the way we look at suburban collective spaces and proposes a change of perspective. The concluding section of the essay contains some specific proposals, of a planning and normative kind, to improve the quality of collective suburban spaces.

Keywords: urban explosion; public places; collective spaces; non-places; Victor Gruen

1. The urban explosion and its effects on public places

The urban growth caused by industrialization and urbanization and therefore the subsequent crisis of the historical mobility networks has led to the inevitable abandonment of the traditional way of conceiving and designing public spaces. Much literature has been written on the functional separation brought about by the emergence of the principles promoted by the Modern Movement and urban planning based on zoning and on functional separation. This literature, with its often nostalgic accents, has not been followed by a similar discussion of the implications that the transformations described above have had on the relationship between public space and transport infrastructure and consequently on the character of new suburban public spaces. In fact, the separation of large traffic flows from urban centers entailed the almost complete decoupling of transport infrastructures and urban public spaces. The urban crisis took place at staggered times based on the level of industrialization and motorization of different countries and cities. In large American cities, such as Boston, Chicago and New York, it manifested itself as early as the turn of the 19th and 20th centuries.
The solutions adopted in the different countries were diverse. In the United States the removal of large traffic flows from the Central Business Districts was going to damage huge economic interests, so it was tried to safeguard the accessibility of these through the creation of true urban highways. These entailed huge public works and massive demolitions inside city centers. The case of the Central Artery, built in Boston in the 1950s as the John F. Fitzgerald Expressway, is one of the most emblematic. Funded with $100 million worth of bonds, it involved the destruction of large parts of the city's most central neighborhoods and was met with enormous opposition by residents and businesses that were being harmed (Tsipis, 2001). In the mid-1970s, due to its devastating effects on urban livability, plans were already being made for its undergrounding. At the beginning of the 1980s the first plans were drafted and after seventeen years of work, in 2007, the new underground freeway was inaugurated. This further titanic work of engineering had cost, at current values, the gigantic sum of 24 billion dollars (Moskowitz, 2012). Despite these huge investments, however, the attempt to safeguard the economic and financial interests of the Central Business Districts was doomed to failure. Demographic, financial, commodity and mobility flows would have shifted inexorably to suburban areas, triggering ruinous trajectories of decline and of social and material degradation in the downtown areas. In some cases, these central spaces, once thriving business districts, would never again experience a real recovery process.

In Italy, these phenomena began much later. The rate of motorization began to grow exponentially in the late 1950s. This, in turn, determined a real crisis in the now obsolete historical mobility network. Already in the mid-1960s, the first experiments in pedestrianizing some parts of the historic centers began. At the same time, large-scale programs for the construction of new infrastructures and for functional decentralization were conceived. These projects adopted different planning models. To remain in the Florentine area, the Detti Plan, adopted in 1962, proposed a model of decentralization organized along a major axis connecting Florence to Prato and hosting the main commercial and directional facilities. However, compared to the rapidity with which the 'suburban flight' reconfigured the economic and social geography of large American cities, in Italy the decentralization process took place in a much slower and incomplete manner, reaching a degree of completion only in the last thirty years.

In fact, until a few decades ago the regional system was still urban-centric. Each portion of the urbanized countryside gravitated towards a historic center where all services (commercial, directional, etc.) were located. Today, such a hierarchy has definitely collapsed and historic centers are just nodes, often peripheral, of wider regional systems whose barycenter is in the periphery. The main commercial, service, and directional functions, both public and private, have moved towards the edge of urban areas, close to major arterial routes. New social spaces have arisen in peripheries as well: from outlets to sports facilities, from multi-theaters to gas stations, from entertainment centers to parking lots. These same historic centers are used in very similar ways to shopping malls: you get the car, find parking in a multi-story garage, and plunge into a crowd of consumers. In terms of regional hierarchies we have shifted from a polycentric system to a centrality that is dispersed throughout the entire urbanized territory.

Although suburban studies made considerable progress in recent years, most scholars and politicians are still bound to a pre-modernist idea of the city. They go on conceiving the city and the country as two totally distinct worlds. Metaphors alluding to urban walls (urban boundaries, green walls, etc.) are largely used to symbolically or physically mark boundaries that only exist in our minds. Wachsmuth (2014) pointed out that these conceptions have strong ideological connotations. In most suburban peripheries such boundaries are simply impossible even to imagine. Aside from the fact that a sharp distinction between city and country never existed in the past (Bruegmann, 2005), the problem with this way of conceptualizing the territory is that it obstructs our capacity to solve real problems and to seize the many opportunities that contemporary suburban landscapes offer (Sieverts, 2003; Ingersoll, 2006). New social spaces are assimilated into the non-places of an alienated existence. The corollary of such an absurd postulate is that nobody takes up the task of controlling and guiding the production of these spaces in order to maximize the benefits to society. This is paradoxical even in historical terms: the shopping mall was invented in 1940s by a socialist utopian, Victor Gruen, in order to create a place for public life in the suburbs; in his visionary Broadacre City, Frank Lloyd Wright conceived gas stations as community centers. A paradigm shift is a prerequisite for better-balanced development: the shift consists of recognizing that the periphery has become the center.

2. The rhetoric of 'non-places': a way of looking that obstructs our view.

The concept of non-places, introduced by Marc Augé in his 1994 book of the same name, is often used to describe most of the spaces that characterize the contemporary city. This use is widespread among architects and urban planners, who often qualify as 'non-places' spaces ranging from shopping centres to airports, car parks, service stations, public housing districts, and the suburbs in general. I believe that the concept of the non-place is an ideological device that is both useless and harmful. Its uselessness derives from its inadequacy to describe any

social-spatial system. In fact, by qualifying a space as a non-place, a generic negative connotation is attributed to it and, in fact, its deeper understanding is precluded. The harmfulness of this concept is a direct consequence of its futility. By preventing us from understanding the complexity of the social dynamics that take place in space, the concept of non-place ends up by greatly limiting the design capacity of architects, urban planners, and politicians. This is particularly regrettable, since the spaces considered non-places by dominant urban thinking correspond to much of the contemporary city and its suburbs. Therefore, it stands to reason that the frequent use of this concept would manifest a widespread attitude that is unscientific, ideological and nostalgic to the study and planning of the contemporary city and suburban areas.

What Augé defines as non-places constitute the main social structure of the contemporary city. This social framework has been little studied by academics, and neglected by architects, urban planners and politicians, who have only in a handful of cases been able to plan and design it in a way that is appropriate to its economic and social function. I argue that by challenging Augé's concept of non-places, and proffering a theory that instead elevates and promotes these important spaces, it would be possible to manage and organize them appropriately as well as explore their full potential through architectural and urban design.

For Augé, non-places are the product of what he defines with the neologism 'supermodernity' (surmodernité), that is, the current condition characterized by three main figures of excess: overabundance of events, spatial overabundance, and the individualization of points of reference. For Augé, supermodernity, that is to say the present era characterized by excesses, essentially produces non-places, i.e. spaces without history, identity and social relations[1]. The concept of non-place is defined by Augé in opposition to that of anthropological place. Of variable size, the anthropological place is such insofar as it is an entity invested with meaning. It is also concerned with identity, as a place of birth and of self-identification; relational, as the object of a shared identity as well as support of social relations; and historical, as it is stable over time and it is possible to find in it points of reference that are considered as fixed and immutable. On the contrary "a space which cannot be defined as relational, or historical, or concerned with identity will be a non-place" (Augé, 1995, p. 77-78).

Although the title of Augé's book speaks of the 'anthropology of supermodernity', his definition of non-places – and his repeated classification of their features – is not presented as a research hypothesis to be verified through accurate anthropological work but is a kind of 'ideal type'.[2] It is interesting, therefore, to consider the concept of non-place in light of Max Weber's definition of ideal type: "It is a conceptual construct (Gedankenbild) which is neither historical reality nor even the "true" reality. It is even less fitted to serve as a schema under which a real situation or action is to be subsumed as one instance. It has the significance of a purely ideal limiting concept with which the real situation or action is compared and surveyed for the explication of certain of its significant components." (Weber, 1949, p. 93)

If we assume that Augé's non-place falls into the category of the ideal type described by Weber, what is missing from the work of the French anthropologist is the comparison of this

[1] "[N]on-places are the real measure of our time; one that could be quantified – with the aid of a few conversions between area, volume and distance – by totalling all the air, rail and motorway routes, the mobile cabins called 'means of transport' (aircraft, trains and road vehicles), the airports and railway stations, hotel chains, leisure parks, large retail outlets, and finally the complex skein of cable and wireless networks that mobilize extraterrestrial space for the purposes of a communication so peculiar that it often puts the individual in contact only with another image of himself". Augé (1995, pp. 51-52).

[2] This is somehow recognized by Augé himself when he states: "Place and non-place are rather like opposed polarities: the first is never completely erased, the second never totally completed; they are like palimpsests on which the scrambled game of identity and relations is ceaselessly rewritten" (ibid. p. 79).

concept with the empirical reality of which Weber speaks in the above definition. Spaces that are identified as non-places are never described and studied by him except in a generic, abstract and atopic way. This is the case when he speaks of shopping centres, which he claims are experienced "through gestures, with an abstract, unmediated commerce; [and that are] a world thus surrendered to solitary individuality, to the fleeting, the temporary and ephemeral" (Augé, 1995, p. 78). Similarly, he imagines a hypothetical user of non-places as a "foreigner lost in a country he does not know (a 'passing stranger') [who] can feel at home there only in the anonymity of motorways, service stations, big stores or hotel chains" (p. 106). Also following this model are his descriptions of airports and stations, perhaps the spaces that are closest to the ideal type conceived by Augé.

Now, as we have seen, the non-place is defined as the negation and opposite of the place. The latter is such only if it is historical, identitarian and relational. Even this definition is questionable to say the least. In fact, by prioritizing the characteristics of history and identity, the concept of place thus refers to a narrow and potentially perverse conception of the relationship between space and community, one in which those whose histories and identities are not rooted in the place where they live – who make up a considerable and growing share of the population of every contemporary city – might in theory have no right to claim to belong to that community or territory. In my opinion, the notion of place defined by Augé risks interpretation in this narrow and exclusionary sense.

Being representative of the current era, non-places describe what Henri Lefebvre would have defined, albeit in different words, as the production of abstract space in contemporary capitalist society. Behind the concept of non-place, in fact, there is on the one hand a general criticism of urbanization, and on the other, a yearning for the pre-industrial city. In fact, Augé's book is dominated by a clear nostalgic accent, which can also be discerned in works by many of the great critics of contemporary urbanization, including Lefebvre. It is important to give due attention to the persistent longing for the old city, as it continues to have profound effects on the way space is being produced today.

The notion of non-place developed by Augé in 1992 is part of a broader narrative characterized by nostalgia for the city of the past and by phobia of the contemporary city. Nostalgia for the city and countryside of the previous era has shaped the planning debates in Europe and the United States since their originations (e.g. Secchi, 1984, Boyer 1983). I will focus in particular on Lefebvre, an author who had a strong influence on the urban debate and policies in Europe since the early 1960s. In the Anglo-Saxon context, the scholar who most contributed to what we could call 'suburbs-phobia' is certainly Jane Jacobs (1961). Lefebvre's critique of contemporary urbanization is based on the Marxist concepts of work and product, use value and exchange value. While use value is related to the utility of a good, exchange value refers to its selling price. For Lefebvre, contemporary urban growth has abandoned the traditional urban model in favour of abstract urbanization. Whereas the city of the past was a work (oeuvre) and was socially experienced according to its use value, contemporary urbanization is conceived as a product to be exchanged on the market as any other good. The shift from the traditional city to urbanization, determined by the advent of industrialization, causes the disappearance of community relations typical of pre-industrial societies: in fact, contrasting with today's model, in the past the city was considered a work of art to be used and enjoyed without any consideration for profit.

> *This city is itself oeuvre, a feature which contrasts with the irreversible tendency towards money and commerce, towards exchange and products.*

> *Indeed the oeuvre is use value and the product is exchange value. The eminent use of the city, that is, of its streets and squares, edifices and monuments, is la Fête (a celebration which consumes unproductively, without other advantage but pleasure and prestige and enormous riches in money and objects).* (Lefebvre, 1996, p. 66)

In addition to being poorly supported in terms of historical research, this way of representing the old city is quite idealized. In contrast, the representations of the periphery provided by Lefebvre are strongly dystopian. Also, they have more than one point in common with Augé's descriptions of non-places.[3]

It is not difficult to take a contrasting viewpoint and see how, in many cases, the monumental splendour of historical cities had opposite meanings to the positive ones attributed to them by Lefebvre. For example, many of the old monuments were nothing more than the architectural and urban codification of a deeply hierarchical, unjust and authoritarian social and political order. Not to mention the baroque monumentality of Haussmann's Paris, that was produced by policies of social and spatial purification of the centre of Paris, to the detriment of the lower classes. Correspondingly, it is possible to find numerous positive representations of contemporary mobility as a symbol of freedom and emancipation, both at class and gender levels.

Such a perspective on the contemporary city is deeply rooted in the urban debate in the West, and has significant effects on the way we understand and govern it. In the United States, the condemnation and demonization of sprawl and suburbs commonly perpetuated by scholars (e.g. Davis, 1990; Duany, Plater-Zyberk and Speck, 2001; Silverstone, ed., 1996) and policy-makers prevented them from grasping the complexity and diversity that certainly characterizes the American suburbs, in terms of social and ethnic composition, built environment and lifestyles. Only a small number of more recent studies have attempted to account for this complexity (Nicolaides and Wiese, eds., 2006; Archer , Sandul and Solomonson, eds., 2015).

In Italy and Europe, the myth of the city of the past is even more deeply rooted. In the German context, Thomas Sieverts (2003) argues that the myth of the compact city of the past prevents us from correctly understanding and designing peripheries, i.e. the living space of most people. For this reason, he focuses his attention on the analysis and design of the Zwischenstadt, or in-between city, that is, that hybrid mixture of city and countryside which is one of the main features of most suburban areas. On a similar slant, Rem Koolhaas speaks of the historical centres of the past as symbolically strong apparatuses that are now completely inadequate to support articulated and complex urban systems. And yet, their cultural and symbolic weight prevents the 'new city' from being understood and designed for what it is (1994, pp. 1248-9):

> *Identity centralizes; it insists on an essence, a point. Its tragedy is given in simple geometric terms. As the sphere of influence expands, the area*

[3] "Urban reality, simultaneously amplified and exploded, thus loses the features it inherited from the previous period: organic totality, belonging, an uplifting image, a sense of space that was measured and dominated by monumental splendor. It was populated with signs of the urban within the dissolution of urbanity; it became stipulative, repressive, marked by signals, summary codes for circulation (routes), and signage. It was sometimes read as a rough draft, sometimes as an authoritarian message. It was imperious. But none of these descriptive terms completely describes the historical process of implosion-explosion (a metaphor borrowed from nuclear physics) that occurred: the tremendous concentration (of people, activities, wealth, goods, objects, instruments, means, and thought) of urban reality and the immense explosion, the projection of numerous, disjunct fragments (peripheries, suburbs, vacation homes, satellite towns) into space." (Lefebvre H., 2003, p. 14).

> *characterized by the center becomes larger and larger, hopelessly diluting both the strength and the authority of the core; inevitably the distance between center and circumference increases to the breaking point. In this perspective, the recent, belated discovery of the periphery as a zone of potential value —a kind of pre-historical condition that might finally be worthy of architectural attention— is only a disguised insistence on the priority of and dependency on the center: without center, no periphery; the interest of the first presumably compensates for the emptiness of the latter. Conceptually orphaned, the condition of the periphery is made worse by the fact that its mother is still alive, stealing the show, emphasizing its offspring's inadequacies. The last vibes emanating from the exhausted center preclude the reading of the periphery as a critical mass. Not only is the center by definition too small to perform its assigned obligations, it is also no longer the real center but an overblown mirage on its way to implosion; yet its illusory presence denies the rest of the city its legitimacy.*

In fact, consolidated representations of historical cities and of contemporary suburbs strongly inhibit our ability to interpret and design peripheries. Augé's book certainly belongs to this type of polarized utopian/dystopian representation, and is widely used by architects and planners to describe the contemporary city in opposition to the city of the past. My thesis is that the so-called non-places (i.e. mobility infrastructures, shopping centres, multiplexes, service stations, etc.) that the French scholar speaks about and that are strictly connected to the new mobility networks play the role of 'squares' – understood as the traditional places of urban sociality – of the contemporary city. However, while the debate on the dialectics between the centre and the periphery is now quite consolidated, that on the relationship between traditional public spaces/mobility infrastructures and the new social spaces on the periphery is much less developed.

2. Learning from Victor Gruen: designing 'non-places' as the social infrastructures of the suburbs.

Our inability to understand the role and potential that so-called 'non-places' assume in contemporary society determines a more general incapacity to grasp the demand for sociality that exists in the periphery. What is it that obstructs our gaze and inhibits our planning? According to Sieverts, the persistence of the 'myth' of the old town is responsible. From Europe to the United States, suburbs and suburban areas are generally ostracized, because they do not fit with the traditional and stereotypical image of the city. To be seen in this way, a city must correspond to the urban canons of density, of mixed-use, of a certain relationship between solids and voids. These canons, codified in Jane Jacobs's urban theory and easily found in European and North American cities before the First World War, prevent us from considering as a 'place' whatever does not conform to them. From this perspective, only the square and the street possess full dignity as public spaces. Koolhaas, as we have seen, maintains that the centre, with its symbolic weight, continues to orphan the periphery and prevent us from appreciating its real importance and relative weight in contemporary urban systems. However, his analysis, just like Sieverts's, limits itself to providing an overview of the periphery as a whole without considering its social spaces. This consolidated view of traditional public spaces as the only legitimate social spaces of our cities has strong negative implications for the ways in which contemporary spaces are regulated at a functional, infrastructural and performance level, and designed at an architectural and social level.

Despite the recognized importance of shopping centres in contemporary society these spaces continue to be considered by many the enemies of the retail trade, the ‘bad giants’ who close the shops of the town centre. Polemicists of the 'small shops closing syndrome' do not acknowledge the facts that the majority of the population has been living in the suburbs for some time now, and that many lack the resources to go shopping in the city centre. However, in the United States, this rhetoric has been swept away by the advent of electronic commerce and by the subsequent phenomenon of 'dead malls'. Now that shopping centres are disappearing, their loss is also being lamented. These spaces, after all, have enjoyed considerable importance in the social and cultural history of tens of millions of Americans (Kurutz, 2017). The rapid evolution of e-commerce could quickly make Italian and European shopping centres obsolete as well. The fact remains that these centres have been and still are exclusively regulated as consumption spaces. For example, the legislation in force in Tuscany, drawn up on the basis of the national framework legislation, sets out the number of parking spaces that must be provided in relation to the selling surface. It also limits the number of large shopping centres that can be built. However, it does not give any guidance about the range of public and private functions that should be realized, the accessibility that should be provided for the various modes of transport (cycling, walking, driving, public transit), the necessity of creating some spaces of an exclusively public nature and that of providing adequate urban furnishings (such as seating areas and the like). For this reason we should rediscover today Victor Gruen’s lesson, get rid of our prejudices on the suburban world and on their collective, most often privately owned, facilities. The Austrian-American architect, known as the inventor of the American mall, conceived his commercial suburban outlets as vibrant collective spaces, comfortably usable with their abundant seating, careful and meticulous landscaping, and ample space for collective and social activities (Gruen and Smith, 1960; Hardwick, 2004). Although privately owned and albeit not embedded in the urban fabric of the historic city, Gruen’s commercial centers were real community centers and hosted concerts, festivals, county fairs, political events: they were much better than the anonymous and gloomy non-places imagined by Marc Augé.

Similar considerations, taking into account the difference in scale and the smaller radius of influence, can be made in relation to the planning of petrol stations. Although most of the petrol stations are exclusively technical facilities, some of them may well become, as recent research has demonstrated, small centres for the local community (Giovannoni, 2017). Urban planning and fuel distribution plans should acknowledge this reality and rework their regulations to recognize the difference between facilities providing simple petrol pumps and car washes, and the integrated service stations that could have a wider role in serving local communities. For the latter, functional hybridization with complementary social and commercial activities should be encouraged, and better accessibility from the surrounding residential areas should be ensured.

This reconceptualization should involve a much more varied set of 'types' of new public spaces, which would include outlet villages, airports, multiplex cinemas, service stations, large car parks and sports facilities. Outlet villages could be thought of as gates that connect the highway network along which they are located with the surrounding regions. By integrating commercial functions with tourist and social services, the economic and social benefits of these large magnets could be distributed over wider regions. The airports, usually conceived as negative elements that reduce the real estate values of the surrounding areas, could be transformed into generators of positive externalities, as places of attraction in which

to dine at night while observing the air traffic, to visit exhibitions and commercial spaces, to avail of personal services, and to participate in political and social events.

The transformations I have described above are in part already underway. However, they are almost exclusively led by big economic actors, without any capacity for control and direction by national and local political and administrative bodies. As I have tried to demonstrate, it will only be possible to develop an adequate regulatory framework and reach design potentials once the annihilating and obscuring rhetoric of the non-place has been overcome. This would involve deconstructing the consolidated and dominant narratives on this subject and basing our knowledge of these spaces on accurate socio-anthropological work that would allow us to grasp and appreciate their social relevance and functionality.

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Design climate-adaptive urban green regeneration: Nbs strategies for future-proof streetscapes

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Abstract

In the last two decades, global cities are addressing climate challenges, by transforming their infrastructural spaces through Climate-adaptive Nature-based regeneration, also aiming to cope with local ecological, social and economic asymmetries. Inside a prevailing technical and performance-based approaches, to date design research around Climate-adaptive Nature-based regeneration of urban infrastructure is limited, failing to impact on current transformations and to be implemented beyond larger cities. Taking advantage from a 'research by design' methodology, the research aims to leverage design potential for climate-adaptive green regeneration of infrastructural spaces and mainstream this approach in current practices. With this purpose, an operational Framework is defined, giving both conceptual and operational insight for Climate-adaptive Nature-based Streetscapes that will be tested inside a Southern Europe urban context in the future.

1.Introduction[1]

In the last two decades, cities are addressing simultaneously climate change and its challenges, by transforming their infrastructural spaces through Nature-based regeneration, also aiming to cope with local asymmetries. Within these diverse actions and programs put in place, abandoned, underused or in use infrastructural spaces are transformed into new urban commons and experimental prototypes where cities are testing planning/design strategies and actions to be replicated and upscaled, enhancing spatial quality, liveability and wellbeing for all. Built around a specific idea of society and life standards, infrastructural spaces often reflect the values of society, giving or taking space and time off from social encounters and interaction, regardless of the impact on society at the different scales. Furthermore, on the smaller scale of public and collective spaces, the direct influence between the spatial configuration of these spaces on human activities, pointed out already by sociologists (Debord, 1957), anthropologists (Jacobs, 1961), and architects (Gehl, 2011) still constitutes a means to express a need for the upcoming transitions. In fact, the physical, social, infrastructural, and cultural complexity of grey infrastructures, from local streets to interregional highways, contributes to proactively transforming abandoned, underused or mono-functional pathways into livable and shared public spaces. In this way, by also including Nature-based solutions, they contribute to the urge for climate-adaptability.
By integrating Nature-based solutions, pedestrian-friendly and multi-modal mobility features, accessible public spaces and program through innovative and regenerative design processes into existing mono-functional infrastructural spaces, these spaces are turned into vibrant and multi-purpose streetscapes, providing economic, social and ecological benefits. The green regeneration of infrastructural spaces had been proven to be crucial to support and enact sustainable scenarios and foster environmental consciousness inside the urban environment. In essence, the integration of ecological principles into the social urban fabric underscores the interconnectedness of environmental sustainability and societal well-being, with streetscapes serving as tangible manifestations of this symbiotic relationship. The street, in its various shapes and configurations, (re) claims its central role in the urban morphology (Gregotti, 1989) and acts as a spatial collector of unregulated social practices, and as an urban attractor of time, space and mixité of uses (Andaloro, 2022). New urban natures and aesthetics had emerged, especially from the hermeneutical circle between EU and US, impacting both on our perception of what a climate-adaptive green streetscape is and the way we design it. From the New York City Greenstreet's program (1996) - today part of the City's Green Infrastructure (NY Environmental Protection, 2022)- green regeneration urban initiatives have evolved and multiplied, embracing new challenges, i.e., climate change. Boston, one of the pioneering cities in adaptation to climate change, from its report Climate Ready (2016) has continued its efforts to adapt that resulted also in the elaboration of the Urban Forest Plan (City of Boston, 2022). Los Angeles program for Urban Streets Forest (UFEC, 2021) addresses heat and pluvial flooding extremes from an equity perspective, selecting and re-designing infrastructural spaces that cross low-income, disadvantaged communities where disinvestments are chronic. At the same time, many European countries have developed adaptation plans and projects for cities to prepare to adapt to the worsening of climate changes through Nature-based solutions and Green Infrastructures and, at the same time, contribute to the decarbonisation of the built environment, coherently with the UN directives (United Nation, 2015b). Among the first ones, Danish National Adaptation Plan (NAP), developed after 2008 climate extremes (2008), the Dutch Delta Programme (2010), which informs and leads the national regeneration plan for all the different delta areas, and the Swedish National Adaptation Strategy (NAS) (2019), which also includes concern over the (negative) impacts of extreme weather events on public health, the economy, and the environment. (Sida, 2011). Moreover, and following the Paris Agreement (2015a), several municipalities across the continent have elaborated a Municipal Pact for Climate Action, developing strategic actions at a smaller scale to cope and/or adapt to climate changes. In addition, new geographies

[1] This paper is the result of a shared reflection of the authors, which have together contributed to the drafting version of the paper, under the supervision of Prof. I.Macaione. However, for the sole purpose of competition evaluations: the paragraphs '1. Introduction', '4. Methodology', and '5. Comparing case studies' are attributed to A.Raffa and B.Andaloro; the paragraph '2. Literature review and research questions', and '5.1 Central Alameda District: Central Avenue & 42nd Place, Los Angeles, CA', and '7. Conclusions' are attributed to A.Raffa; the paragraphs '3. Theoretical backgrouns', '5.2 Vief kwartier, a new neighboorhood in the change', '6. Discussion' are attributed to B.Andaloro.

for climate-adaptive nature-based regeneration of streetscapes are emerging. Melbourne, thanks to its Urban Forest Strategy (2012) and its operational plans at the neighborhood scale, had started redesigning its streets and public spaces increasing canopy to adapt and mitigate climate change (City of Melbourne, 2012). The Green Riyadh project (2019) is one of the most ambitious urban forestation plans developed in an arid city, which foresees 6,400 kms of streets and roads shaded by trees and the longest urban green corridor worldwide (Royal Commission for Riyadh City, 2024). Bogota, thanks to its Climate Action Plan (2021), is leading adaptation in the Global South through the implementation of Nature-based Solutions in the urban fabric and simultaneously addressing green inequalities (Bogota Climate Action Plan, 20xx). Nature-based solutions, thanks to pioneering cities pilot projects, are mainstreamed in big cities' streetscape worldwide by providing replicable and up-scalable examples. But a deeper understanding of this ongoing phenomena is lacking from a design perspective, both on a theoretical and operational level.

2.Literature review and research questions

In the last two decades green regeneration of infrastructural spaces had arouse interest also inside the design disciplines, questioning how nature-based design of streetscape can contribute to shape more sustainable scenarios (Im 2019; Rehan 2019). Johansson (2024) discuss the importance of implementing sustainable streetscape at the local scale through the design of Nature-based Solutions. Green regeneration of urban infrastructures via NbS implementation provides many benefits, i.e., economic, social and ecological while also improving space quality and supporting cities in climate change adaptation. The ubiquitous and multi-scalar nature of infrastructural systems provide opportunities, through green regeneration, to balance green open space unequal distribution, working on the quality of spaces where people spent more time daily; but also leverage issue and challenges, as underline by Raffa (2023) concerning climate-resilient nature-based regeneration of streetscapes at the neighborhood scale. In order to explore the present state of the art concerning the entanglements between green regeneration, climate adaptation and Nature-based solutions in terms of spatial quality and from a design perspective, a literature review has been conducted through Scopus and Google Scholar database and also through open-source international organization report and city's authorities plans and planning reports. Compared to other disciplinary fields, the contribution to the topic of design disciplines is quite reduced; among scientific contribution co-authored by multi-disciplinary research team, design disciplines are among the least recurrent. These resulted also in the low spatial quality of spatial visualizations that accompanied experimental works, which are more focused on the implementation of Nature-based solutions and the evaluation of their performance than their spatial implications. The majority of the selected papers develop design guidelines through analytical-comparative approach (Steenberg et. al., 2008; Klaasen 2007) among case studies or through experimental design (Nijhuis & Bobbink, 2012) in specific cities and/or streets typology; or combining both methods. Cabanek et al. (2022) elaborate a Biophilic Design Framework for streets' green regeneration via Nature-based Solutions and apply it to four prototypical streets sections between EU, US and Australia. Klemm et al. (2017) elaborate design guidelines for urban green infrastructure for climate adaptation, working at the city, park and neighborhood street level through a mixed method analysis that integrates micrometeorology and landscape architecture procedures. Furchtlener et al. (2022), inside a landscape design led multi-disciplinary research, provide qualitative-quantitative guidelines for turning Wien streets sustainable and integrating them into the city's green infrastructure, coping with climate change and ecological challenges. Tamminga et al. (2020), arguing that convivial green streets could be source for climate adaptation, extract from ten European case studies Nature-based solutions and devices at the interface between the streets and building. These were implemented in specific street sections, generalized according to the adopted typological criteria and translated into simple visualization to support future community engagement activities. Another consistent group regards experimental design studies, process and outputs, that beside being specific, have a general value. Lotfata et al. (2023), by research through design methodology (Cortesao & Lenzholzer, 2022), developed a conceptual study to test the feasibility of nature-based solutions into different street sections inside an informal neighborhood in Cairo. Moscatelli et al. (2023) through design-driven research explore the interconnection between neighborhood streetscape green regeneration, energy transition and climate change through Nature-based solutions design in arid climate. Hagen et al. (2021), inside an interdisciplinary project and

through a Living Lab approach, introduce processes and actions for the co-design of greener and climate-adaptive regeneration of streetscapes in a dense neighborhood in Wien. Through a collaborative process replicable design solutions were elaborated, and tactical urbanism action take place as a means for raise awareness among neighbors.

Parallelly to our main objective of the literature review other considerations arose that had informed the present research. (i) Geographical asymmetries. Beside specific urban contexts that are at the forefront in tackling contemporary challenges - which are recognizing the urban relevance of infrastructural spaces to reinforce urban green infrastructure and the city's adaptive capacity- US a Northern and Central Europe are leading in the design research and urban experiments for the regeneration of infrastructural spaces into vibrant and adaptive streetscapes through NbSs implementation. Design research and implementation is to date limited in Southern Europe and in Mediterranean urban areas. Studies that deal with these geographical, climatic and socio-cultural contexts are lacking, although its urban areas are already starting experiencing the strong effects of climate change extremes and stresses. (ii) Urban environments' size. Large urban areas are pioneering the implementation of climate-adaptive Nature-based regeneration, worldwide. Medium and small size cities and urban environments, due to structural gaps, seem to be aside from this global tendency of regenerating infrastructural spaces into climate-adaptive nature-based streetscapes, not taking advantage from its potentials. Both these asymmetries are evident inside Italy, between North and South part of the country and among major and medium/small urban areas.

From the literature review, a three-folded problem appears. First, the possibilities derived from infrastructural spaces' nature-based regeneration is quite underestimated in current design strategies and actions which address urban climate adaptation and green infrastructure. Beside the asymmetrical conditions between pioneering cities and medium and small urban settlements there is a spread lack of consciousness about infrastructural spaces' transformation and their ecological, social and economic opportunities. Secondly, the role of design research for infrastructural space climate-adaptive nature-based regeneration is poorly explored in the current practices, which are still functionalist and sectoral. The hypothesis this research support is that the transdisciplinary dimension of architecture and design-related disciplines could contribute to deal with the complexity the topic requires and provide effective solutions that could innovate current approaches and practices and, at the same time, improve space quality and urban spaces' livability. There is a lack of knowledge concerning design principles and procedures to operationalize regenerative potentials of infrastructural spaces's climate-adaptive nature-based regenerations.

Thirdly, concerning the design, although the research has limited impacts in innovating current practices, it can guide and influence the practice, in a learning loop of knowledge. Understanding proper design procedures and tools is essential to mainstream climate-adaptive nature-based regeneration of infrastructural spaces, especially inside those geographical contexts and urban environments where is mostly lacking. There is the need to bridge design research and real-life outputs, through experimental design study as a bridging point between design research and urban effective transformation. Design as a form of transformational knowledge employs also methods and tools that can contribute to raise awareness, understanding and make shared choices among stakeholders.

Inside this problematic framework, the following research questions emerged: (i) How to leverage, from a design perspective, green regeneration for infrastructural spaces, turning them into climate-adaptive nature-based streetscapes? (ii) Which design procedures and tools can be displayed to enact, at a neighborhood level, streetscapes' potential to support also middle and small cities adaptation while reinforcing their green infrastructure? (iii) How this could work inside a Mediterranean, and in particular, Southern Italian (urban) context?

3. Theoretical background

Aiming at exploring climate-adaptive and nature-based approaches for streetscapes through a design-oriented research, it is relevant to position the research with the key concepts it is built on. The large overlapping of meanings and (design) approaches related to concepts such as climate, nature-based solutions, streetscapes, and adaptation, often related to a particular appropriation by a specific knowledge field, can in fact easily cause misinterpretation of these phenomena, their potentialities and vulnerabilities.

While we know from the recent regulations that climate acts and programmes are required to the municipalities, in order to alleviate the central governmental burden and to ensure a targeted approach to local specificities (as for example the Mayor Act), it is useful to point out the meanings and the implications of 'adaptation', especially on the physical space.
The idea of 'adaptation' to climate change is strictly interconnected to the process of 'mitigation', which constitutes an alternative approach to the climate issues, especially for specific sectors of production and consumerism (Klein at al, 2007). Mitigation is, in fact, defined as "an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases" (IPCC, 2001, 990), developed in order to implement policies for the progressive reduction of greenhouse gas emissions, which should not exceed 2°, as agreed in the Paris Agreement (2015a). While mitigation acts mostly on the causes of climate change, adaptation influences and focuses on its effects, through the definition of preventive or reactive actions (Manigrasso, 2019). The IPPC defines adaptation as an "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPPC, 2001, 982). This difference helps understanding the impact of these phenomena, which are more a-spatial in the case of the mitigation acts, as they refer to broader systems, such as production, or energy consumptions. Furthermore, adaptation actions can be earlier applied and shaped to the territories, at their different scales, so as to answer specific (local) needs. Additionally, the definition includes that "various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation" (IPPC, 2001, 982). In this addition we can notice the predisposition to an uncertain and indefinite contest, as a new state of art in the near future. This clarification therefore plays a crucial role in understanding the role of the spatial design, which is confronted with an unpredictable and uncertain reality, in which the possibility of change (at different scales and relative to different elements), becomes a new invariant element of the contemporary. The core of adaptation to support different types of policies and (governmental, social, cultural, spatial) tools, has contributed to the large diffusion of the term among the different knowledge fields, which has resulted in several different interpretation. Despite this, we can recognise a common shift in the paradigm: instead of acting (or designing) against the climate, we need to acting (or designing) with the climate.
In this respect, despite a ten-year development, as from the 'Urban Adaptation in Europe' (2024), the most recent EEA report, it has been highlighted how adaptation must (still) span all sectors and governance levels, addressing current and future climate risks. Additionally, the report underscores the need for concrete targets to measure progress, as only a small fraction of indicators in local adaptation plans are presently linked to specific goals. However, in the broad context presented by the EEA report, it is pointed out the growing focus on the adoption of nature-based solutions (NbS), which feature prominently in 91% of local adaptation plans there considered.
The spread of the culture of Nature-based solutions among different knowledge and research fields has recently contributed to focus on greenery as a crucial element of the spatial project. Firstly defined in 2008 (World Bank), in the frame of a research on the management of natural systems by benefitting both nature and society, NbSs have also contributed to the definition of a different approach about Nature: not against it, but rather with it (European Commission, 2021b). Lately, the attention for Nature-based solutions has also risen from different field, engaging different aspects and leaving considerable space for ambiguities and uncertainties derived by the inter-disciplinarity of this issue (European commission et al., 2020). Some of the definitions include "actions ad- dress environmental, social and economic challenges simultaneously by maximizing the benefits provided by nature (…) inspired by, supported by, or copied from nature" as from the EU initial document (European Commission, 2015c); or "actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits", as by International Union for Conservation of Nature (IUCN, 2020); finally as "concept of nature-based solutions embodies new ways to approach socio-ecological adaptation and resilience, with equal reliance upon social, environmental and economic domains" (European Commission, 2021a). The heterogenity of the fields here involved, as stated by IUCN (2020), contributes to claim a more structured way to identify NbS as, for example, through eight criteria, such as (a) address societal challenges, (b) landscape scale of intervention, (c) biodiversity gain, (d) economic viability, (e) governance capability, (f) equitably balance trade-offs, (g) adaptive management, and (h) mainstreamed within an appropriate jurisdictional context. The impact of these solutions on the built and natural environment is broad and

can also lead to a multi-functionality of NbS, or to their capacity to simultaneously address multiple societal challenges (Raymond et al., 2017; European Commission, 2021a; Sowińska-Świerkosz et al., 2021).
In addition to the multi-purpose aspect of involving NbS into a regeneration project, it is also crucial to consider the possible overlapping in the definition between NbSs and green (and blue) infrastructure (Albert, et al, 2019), as both terms refer to a not better specified infrastructure, which takes into account green elements as their main core. Nonetheless, as stated by IUCN (2020), the presence of blue-green elements as part of engineered solutions is a key criterion of Nature-based Solutions. The difference between Nature-based solutions and Green Infrastructure can lead to different interpretation. According to the definition provided by the European Commission (2013), which refers to Green (urban) Infrastructures as different kinds of natural and semi-natural assets that are strategically planned as a network of interlinked elements, they would enhance and synergize benefits provided by nature, in contrast to monofunctionally planned "grey" infrastructure (Hansen et al., 2014; Karsten, 2019). Finally, the Environmental and Energy Study Institute (EESI, 2019) attempts to define a difference among the terms by considering NbS as "solutions often result in environmental, economic, and social co-benefits" which "includes both green and natural infrastructure", and Green Infrastructures as "Projects that combine gray infrastructure with nature-based solutions to create hybrid systems that improve resilience to climate impacts, while also often resulting in environmental, economic, and social co-benefits".
The combination of Green Infrastructures and Nature-based solution contributes thus to exploring climate-adaptation in the physical space of collective (grey) infrastructures, investigating their (multi-purpose) potential in urban regeneration. In order to do so, the research focuses on the concept of streetscapes, meant as "the natural and built fabric of the street, defined as the design quality of the street and its visual effect" (Rehan, 2013), including horizontal and vertical surfaces which define its edges, as well as the facilities related. By considering the entire three-dimensionality of the streets, and by considering it not only as an infrastructural device, rather as a social, environmental, cultural, and also economic element of the built environment, it is possible to exploit its potential in boosting climate-adaptive nature-based design approaches for urban regeneration. The relationship between streets and public spaces and climate-adaptive approaches is also being explored in the last decade through the elaboration of (design) tool to help supporting a multi-disciplinary research or design approach. Among them, Raymond et al. (2017) shows that streets scale nature-based intervention addresses climate mitigation and adaptation to a much greater extent than building scale interventions. Moreover, Furchtlehner et al. (2022) questions how streets can be re-thought as green living spaces and provide recommendations for future-proof and sustainable streetscapes.
In conclusion, exploiting Nature-based solutions as learning devices for informing climate-adaptive and nature-based streetscapes, supports a design-based methodology able to deal with the urgent transitions of the physical space, thus also providing benefits on social, environmental and economic aspects.

4. Methodology

To deal with the uncertainty of the future, in the attempt to enrich design and research processes with new and unpredictive knowledge, requires defining a positioning between research and design. As for the field of Architecture (at its different scale, from building, to landscape, to urban studies), design constitutes both a means of exploration of theoretical questions, and of testing of practical matters. Moreover, while considering (re)new(ed) complex environmental challenges for the future, it is also important to support and focus on a reflexive approach with multiple feedback loops (Beck, 1994), as well as thriving for an answer which can no longer be certain (Rittel, 1973). Looking at the definition of research and design methodology through time, and looking at the categories defined by Frayling (1993), Hauberg (2011) and Schreurs (2005; Bruns, 2010), we have identified a three-phases methodology, divided into: (1) Research about (into) design, which examines models from which it derives its rules and procedures. This phase, as also intended by Findeli (2004) documents objects, phenomena and history of design, contributing to a scientific discipline studying design (Godin & Zahedi, 2014); (2) Research by or through design, a more explorative phase in which design (in its different forms and meanings) is shaped, in order to produce a new level of shared knowledge. For those who follows a RtD approach, this means to relate to material-based research, development works and

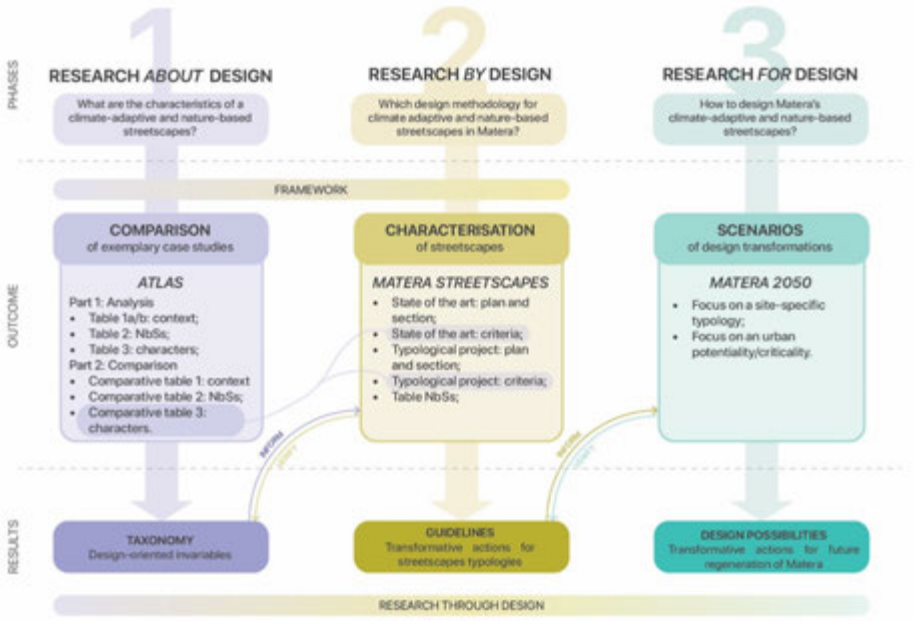
action research, through practical experiments in laboratories. These would result in reports (Hauberg, 2011), with the intended goal of societal change (Binder et al, 2006; Swann, 2002; Zimmerman et al., 2010). Also, RtD supports a (artifact) design process based on trial and error, to better tackle complex design problems (Toeters, et al., 2013). On the other side, in Research-by-design "concordance is sought between the methods of research and a form-giving, experimental design practice" (Hauberg, 2011): the approach produces knowledge through the design's tool and methods, in a direct relationship between analysing and proposing solutions. (3) Research for design, which explores a development phase, whose end product is an artefact, where the thinking is embodied in the artefact and the goal is not primarily communicable knowledge in the sense of verbal communication (Roggema, 2016)

Based on this structure, the research here discussed[2] is structured into these three phases, each one exploring a section of the research question, and informing and verifying the others in a continuous feedback loop. The first phase of 'Research about Design' aims at investigating the invariant characteristics of a climate-adaptive and nature-based streetscapes, aiming at desining a taxonomy of invariable design features.

The second phase of 'Research by Design' takes into account the lessons learned by the first phase, as to resonate on the possibility of defining a characterisation of streetscapes for the city of Matera, which will later be the application case of the research. In this phase, design and research will be highly interconnected to produce knowledge through the act of designing itself. As stated by De Jong (1992), this phase aims to generate desirable, perhaps unexpected, urban perspectives in place of probable, but less desirable, urban developments. By combination of the first and second phase, a Framework for Climate-adaptive Nature-based Regenerative Streetscapes is then defined, giving both conceptual and operational insight for designing for streescapes. Finally, the Guidelines will then inform and be verified by resulting from the final third phase of 'Research for Design', which will explore urban transformation scenarios for the future of Matera through a design-driven approach.

In the following paragraph, the paper will discuss in more details the first phase of the methodology, through ongoing insights of the research, focusing on its role in contributing to the definition of the design Framework.

[2] The paper refers also to the researches conducted in the frames of (1) Urban Green Shape (2021-2023) "Axis IV-Education and Research for recovery – REACT-EU", Action IV.6 "Actions for research contracts on innovation and green topics", funded by PON R&I and FSE REACT EU, carried out by Alessandro Raffa, Scientific Resp.Prof. Ina Macaione (NatureCityLAB_DiCEM, Unibas) and (2) project Tech4You Technologies for climate change adaptation and quality of life improvement, 4.3.1 Azione 1, Fellow Researcher grant "Mitigation and Adaptation to Climate Change in Urban Areas: Green and Blue Infrastructures for the Resilient City", carried out by Bianca Andaloro, Scientific Resp. Prof. Ina Macaione (NatureCityLAB_DiCEM, Unibas).



4.1 Research about design, and the structure of the Framework

Within the first phase of 'Research about Design' we explore the complexity of the concepts which have defined the research question, investigating how practitioners, architecture firm and municipalities have tackled climate-adaptive nature-based design. Specifically, we explore how they have embedded NbSs into their projects though an Atlas of exemplary case studies, which showcases transformation processes. Although still in the making, the Atlas counts about sixty projects, designed and/or built in the last twenty years between Europe and United States[3] which contribute to the elaboration of the Framework for Climate-adaptive Nature-based Regenerative Streetscapes. The Framework, which explores both conceptual and operational approaches, aims to understand how to de-structure and de-compose nature-based, climate-adaptive projects, in order to extract and define applicable design principles and procedures. Its design-oriented nature contributes then to support a multi-scalar research process which could later be applied both for deductive and inductive approaches.
The Framework supports then a critical reflection on similar climate-adaptive and Nature-based regenerative projects: it is devised as a comprehensive design tool for architectural designers keen on exploring the spatial potentials offered by Nature-based Solutions (NbSs), and it aims to furnish multidisciplinary insights into the broad implications of these relatively recent solutions, evaluating the emergence of new typological and morphological categories in architectural composition. Therefore, the Framework integrates both qualitative and quantitative information and data to describe and analyse the projects chosen upon selection (Macaione, 2024). For the variety of information gathered and elaborated, the Framework can also relate to different stages of project development, involving realized, unrealized, and ongoing projects, thus providing nuanced but relevant interpretations. Moreover, it facilitates the examination of projects at different scales, from urban to building, encompassing public spaces and infrastructural elements.

[3] The projects considered by the research are mainly designed, developed and/or built from the years 2000, so as to show a declared interest towards the climatic issues. They all relate to the transformation of grey infrastructures at the different scales, analysing a multitude of typologies and the related transformation scenarios suggested by architecture and landscape recognized studios.

In addition to an initial section, related to the selection criteria of the projects involved, the Framework can be divided into two sections: Section1 is about the analyse of the selected case studies; section 2 is about the comparison of the analysed case studies.
Therefore, the first section ('Analyse') relates to the first level of understanding and de-composition of the cases and is divided into[4]:

- Part 1 delves into the contextual analysis of the projects, focusing on climatic, social, economic, and infrastructural aspects.
- Part 2 scrutinizes the specific climate-adaptive strategies and Nature-based solutions implemented in the projects, assessing their role in the design process and their impact on the site's social, environmental, and economic dimensions.
- Part 3 elucidates the intrinsic characteristics of each project, considering aspects such as time, space, and scale.

This initial phase of analysis leads then to the second section, 'Comparison', in which the projects are progressively put in relation with each others. In order to do so, a three-part comparison is developed:

- Part (a) compares contextual information about the projects, in order to point out initial insight about the relationship between geographical and climatic placement, as shown in Table 1 and 2;
- Part (b) shows the frequency and the details of the Nature-based solutions recognizable in the project involved. This would contribute to understand, in relation with the previous comparison, which solutions are …
- Part (c) aims to deeply explore the implication of the design invariants both in the process and in the projects, as to understand the common elements that fuel climate-adaptive and nature-based projects for streetscape.

5. Comparing case studies

The Catalogue of projects which feeds and inform the Framework includes projects related to different scales and in specific geographies, which explore the theme of urban regeneration through climate-adaptive and nature-based solutions. By collecting and analysing these exemplary case studies, we aims identifying design principles and procedures that facilitate the integration of climate resilience considerations into streetscapes' regenerative processes through Nature-based Solutions (NbSs). While the following paragraphs will contribute with more detailed information about two cases chosen from two different geographical areas, and the related analysis, the Tables 1 and 2 provide a first insight on the comparison of forty projects. Chosen between the US and Northern Europe, these projects highlight their potential in dealing with climate hazards, mainly with heath stress and flooding[5] in different types of grey infrastructures[6], regardless of the climatic types[7], or morphology[8].
The majority of these projects are also related to the development of research and development (R&D) processes conduced together with professionals, municipalities, community-based organisations, research centers and universities, which have often lead to the publication of operational documents, design-oriented guidelines and report, aiming to inform a wide public, including also planners and designers. The general approach of these documents is more technical and performance-oriented and, in the majority of cases, are less focused of streetscape spatial implications. Against this backdrop, two experiences, by using logics and tools proper of the 'designerly way of knowing' can contribute also to inform possible design modes of inquiry and procedures for enacting climate-adaptive and nature-based streetscapes. The case studies which will be deepen in the following paragraphs are framed inside these

[4] Regarding the two case studies discussed in this paper, the related tables of Section 1 'Analyse' can be found among the Annexes.
[5] As from the tables, six cases are related to only one climatic hazard, twenty cases to two climatic hazards, eleven to three climatic hazards, and three to four climatic hazards.
[6] As from the tables, fifteen cases refer to the Linear type, six cases refer to the Network type, four cases refer to the Radial type, and fourteen cases refer to the Grid type.
[7] As from the tables, two cases refer to the type A (tropical), three cases refer to the type B (arid), thirty-one cases refer to the type C (temperate), four cases refer to the type D (continental), according to the Koppen classification.
[8] As from the tables, six cases refer to the Costal type of city, twelve cases refer to the Delta type of city, fifteen cases refer to the River type of city, zero cases refer to the Mountain type of city, seven cases refer to the Flatland type of city.

experimental design guidelines, which had been developed in collaboration with two globally-relevant design firms.
The first experience regards Los Angeles streets' network has been developed by an interdisciplinary consortium, the Urban Forest Equity Collective (UFEC), which has landscape firm STOSS Landscape Urbanism among its consultants. The efforts of UFEC resulted into *LA Urban Forest Equity Street Guidebook* (UFEC, 2021) and other documents which address specific LA neighborhoods. Streets are envisioned as space of possibility to tackle climate change and the structural asymmetric distribution of green spaces which affects especially the most vulnerable neighborhood. Recognizing that each street, neighborhood, and community in Los Angeles embodies a unique set of social, economic, environmental, ecological, and infrastructural dynamics, the guidebook built up a multilevel and multi temporal model able to provide a straightforward and adaptable framework for prioritizing interventions and devising a street-space reforestation strategy which encompass both the neighborhood and the city scale. Central Alameda is then a pilot-project which tries to implement site-specific, climate-adaptive NbS and actions into underused, degraded streets spaces. Through a community design process, STOSS Landscape Urbanism, together with a multidisciplinary consortium, tries to operationalize the Urban Forest Equity strategy the city of Los Angeles has been developing.

The second one is *New Space For Living. Design guideline for public space (Felixx, 2021),* by the landscape firm FELIXX for the City of Groningen (the Netherlands), where the urban infrastructural system is decomposed through a typological approach. Nature-based solutions are implemented also with a spatial quality purpose according streets's context-specific conditions and constrains and visualized through sections. Climate-adaptive nature-based regenerative efforts is evaluated according to a set of parameters (mobility, safety, accessibility, health, social, economy, experience, ecology, climate adaptation and identity), before and after the foreseen implementation (visualised through scenario-based sections) also through a design approach based on phases. In the last part of the guidelines envisioned streets solutions are recombined and tested inside three Groningen's neighborhoods to tackle urban complexity with a site-specific approach. Within this context, Vief kwartier, is a development plan designed in collaboration between the Municipality of Groningen and renown architectural and landscape firms. As part of a broader urban project over the Europark area, the architects aim to transform a wide semi-abandoned parking lot area into a new, sustainable and climate-adaptive neighborhood, which implements a multiplicity of NbS into its streets and public spaces.

Project	City	Type of city					Climate type					Type of G.I.				Climate hazard				Design Firm
		C	D	R	M	F	A	B	C	D	E	L	N	R	G	H	F	D	W	
The Underline	Miami	●					●					●				●	●	●	●	JCFO
Lafitte Greenway	New Orleans	●							●			●				●	●	●	●	Design Works hop
Town Branch Commons	Lexington, Kentucky			●					●			●				●	●		●	SCAPE
RiNO Streetscape Design	Denver, Colorado			●					●						●	●	●			SASA KI
P Street Corridor	Lincoln, Nebraska			●						●		●				●	●			Design Works hop
Brickline Greenway	St. Louis, Missouri			●					●					●		●	●			STOSS
Englewood +AgroEco District	Chicago, Illinois		●							●		●				●	●			Gensler
Green Alleyways	Los Angeles			●				●							●	●	●	●		SALT
El Punto	Salem, Massachusets	●							●						●	●	●			SCAPE
Argyle Shared Street	Chicago, Illinois		●							●		●				●	●			Site Design Group

Pompano Beach Bvld Streetscape	Pompano Beach, Florida	●					●					●				●	●	●	●	EDSA
Central Alameda District	Los Angeles,			●				●				●				●	●	●		STOSS
Paramount Blvd Streetscape	Paramount City, California			●					●			●				●	●	●		Studio One Eleven
Gowanus Green	Brooklyn, New York			●					●						●	●	●			SCAPE
Culver Blvd Medians Park	Culver City, California					●			●			●				●	●	●		SWA
Milton Street Park	Los Angeles,			●				●				●				●	●	●		SWA
Hudson Square Streetscape	New York	●							●						●	●	●			MNLA
Binney/Galileo/Broadway Streetscape	Cambridge			●						●				●		●	●			Alta Planning +Design
West Florissant Avenue Great Street	St.Louis County, Missouri			●					●			●				●	●			SWT Deign
Niagara Medical Campus	Buffalo, New York					●			●			●				●	●			SCAPE

Table 1: Table 1 shows the comparison between the US case studies, as in Section 2 'Comparison', Part (a).

Project	City	Type of city					Climate type					Type of G.I.				Climate hazard				Design Firm
		C	D	R	M	F	A	B	C	D	E	L	N	R	G	H	F	D	W	
Centrumkwadraat	Enschede					●			●						●	●	●			De Urbanisten
Watersquare Benthemplein	Rotterdam		●						●				●			●	●	●		De Urbanisten
Hofbogenpark	Rotterdam		●						●			●				●		●		De Urbanisten
Zomerhofkwarter	Rotterdam		●						●				●			●	●			De Urbanisten
Tiel Watersquare	Rotterdam		●						●				●			●	●	●		De Urbanisten
Tidal Park Keilhave	Rotterdam		●						●						●	●	●			De Urbanisten
Karakter	Zoetermeer					●			●					●		●		●		De Urbanisten
Ringpark Het Schijn	Antwerp		●						●			●					●			De Urbanisten
Beatrixplein	Haarlem			●					●						●	●				De Urbanisten
Kettingplein	Gent					●			●				●				●			De Urbanisten
De Wapper	Rotterdam		●						●						●	●	●	●		De Urbanisten
Vief kwartier	Groningen					●			●						●		●	●		Felixx
Europaweg	Haarlem			●					●				●			●				Felixx
Barendrecht Vrouwenpolder	Barendrecht			●					●						●	●				Felixx
Cobercokwartier	Arnhem			●					●				●			●	●	●		DELVA
Groenklimatassen	Gent					●			●					●		●	●	●		DELVA
Buiksloterham	Amsterdam		●						●						●	●	●			DELVA

Holenkwartier Hoorn	Hoorn	•						•						•	•				DELVA
Ruimtelijk Raamwerk Buiksloterham	Amsterdam		•					•						•	•	•			DELVA
Schoonschip	Amsterdam		•					•						•	•	•			Space&Matter

Table 2: Table 1 shows the comparison between the North European case studies, as in Section 2 'Comparison', Part (a).

5.1 Central Alameda District: Central Avenue & 42nd Place, Los Angeles, CA

Over the past decades, the City of Los Angeles has undertaken a series of green urban regeneration initiatives that look at street spaces as opportunities to address the challenge of climate change, particularly urban heat, through an approach inspired by the concepts of equity and resilience. As part of the LA County 2045 Climate Action Plan (LA County, 2023), the City's Green New Deal. Sustainable City Plan (LA County, 2019) and the LA Countywide Sustainable Plan (LA County, 2019b) but also actions urged by local communities, the city has become a laboratory for green and climate adaptive urban regeneration of streetscapes. With the objectives of adapt to climate change, in particular heat stress, and simultaneously cope with the chronic asymmetries in green spaces distribution [9] which particularly affects the most vulnerable neighborhoods, the city has undertaken a process to explore design and planning opportunities coming from the interconnection between climate adaptation, equity and Nature-based regeneration and provide replicable and up-scalable solutions. With this objective was established the Urban Forest Equity Collective (UFEC), a consortium of designers and planners, forestry experts, researchers, Los Angeles City staff and community-based organization to create holistic, integrative and multifunctional strategies to support urban forest equity, adapt to climate change and improve space quality. Inside the LA Urban Forest Equity Street Guidebook (Shandas , 2022), streetscapes, and their multi-scalar ecological, social and economic entanglements with surrounding neighborhoods and communities, are envisioned as spaces of possibilities to pursue a more equitable, climate-adaptive and resilient urban environment through the implementation of NbS. This strategic document also tries to answer the question on how to operationalize urban forest and to assure an impactful and lasting implementation at a neighborhood scale. The UEFC worked on a framework that provided practical tools to prioritize and plan for the increased presence of green spaces and NbS in urban areas, and offer decision making support, community engagement strategies and visions for LA neighborhoods, demonstrating a powerful and achievable vision for a greener future. This framework adopts a three-tiers approach (Shandas, 2022): the green spaces and tree canopy implementation in the streetscape is described across three levels of intervention which have different intensity, i.e., low [10], medium, and high. Through these tiers, it becomes possible to assess the necessary investments, constraints, and opportunities to address historical inequalities in green spaces distribution. Recognizing that each street, neighborhood, and community in Los Angeles embodies a unique set of social, economic, environmental, ecological, and infrastructural dynamics, this multilevel model provides a straightforward and adaptable framework for devising a street-space reforestation strategy on a neighborhood and urban scale. In order to select pilot neighborhood and prioritize interventions a set of quantitative-qualitative parameters has been defined and organized in four steps which address both vulnerabilities and opportunities: (i) Step 1: Physical and economic needs (i.e. lack of tree canopy, high distribution of impervious surfaces, below average household income); (ii) Step 2: Environmental exposure (i.e. upper 50% for days projected over 90F, for PM2.5 and Diesel PM); (iii) Step 3: Socio-demographic conditions (i.e. poverty, level of education, population density, non-white and non-English speakers distribution, housing conditions, and areas previously redlined); (iv) Step 4: Feasibility and community readiness (i.e. partner activity, area utilization, presence of sites, community interest)

[9] Historical disparities in urban forest distribution that, in conjunction with present and future climate change patterns, can expose Los Angeles communities, in particular those that are already vulnerable, to increasing risks. Past race-based urban policies and planning, i.e. redlining, and structural disinvestments has resulted in urban forest unequal distribution across the city, affecting in particular low-income and black communities. Their impossibility to access to 'ecosystem services' provided by green spaces will exacerbate their vulnerabilities in the context of a changing climate, i.e. extreme urban heat, degraded air quality and heightened levels of flooding.
[10] In the case of level 1 (low complexity), community engagement and involvement of local associations in reforestation activities can be pursued.

(Shandas, 2022). After this investigation, Central Alameda (Gilliam et al., 2024) and Sylmar (Gibson et al., 2024) neighborhood had been selected and specific streetscapes pilot-projects had been identified in it. In the Central Alameda neighborhood, Central Avenue & 42nd Place and other streetscapes have been selected as test beds to apply the three-tier approach and implement NbS. STOSS Landscape Urbanism integrated community inputs throughout the design process (Gilliam et al., 2024). This collaborative approach involved multiple iterations of discussion, enabling the refinement of ideas and concepts. As a result, the design evolved through several rounds of feedback and led to the creation of diagrams and sections (Gilliam et al., 2024). This iterative process not only ensured that the final design resonated with the needs and aspirations of the community but also enriched the project with diverse perspectives, ultimately yielding a more comprehensive and inclusive outcome.

5.2 Vief kwartier, a new neighbourhood in the change

In the frame of a broad development project carried out in the last ten years by the Municipality of Groningen for the Europapark area (Gementee Groningen, 2024), the site 'Vief kwartier' is one of the nine plots destined to be redesigned and transformed. The area is relatively close to the city center of the capital of the Groningen region, and known for the FC Groningen's Euroborg football stadium. It is well connected to the national highway (N7, N37), and a few public transport stops can be found. Moreover, 'Vief kwartier' takes its name from the former Helpman Centrale gas power station and its five towering chimneys. Although it was demolished in 1998, the foundations of the gas power station are still in the area, willing to be involved in the future development plan. The project of the 'Vief kwartier', of which only the Masterplan has been released so far, presents the transformation of the whole area, now used as a parking lot. The project, promoted by the Dutch-based real estate companyABC Vastgoed and designed by a consortium comprising EFFEKT, vector-I, and Felixx landscape architects, embarks on the ambitious endeavor of developing a mixed-use, energy positive and climate-adaptive neighborhood. Moreover, it is based on the "New Space – Design Guideline Liveability of Public Space" developed in 2021 by the Dutch architectural firm Felixx and the Municipality of Groningen, for the transformation of public spaces, thus promoting five quality of life values, among which public space, sports and health, connection, and mobility, mixed-use and sustainability (Felixx et al., 2021). This research work, developed also in collaboration with the University of Amsterdam, points out several transformation scenarios for the different typologies of public spaces, and more specifically, of streets (Figure 4).
In order to build on the former foundations of the gas station (5.000-plus existing concrete piles and blockwork), the new 315 residential units will be entirely constructed using lightweight hybrid timber system, aiming for a energy positive design able to sequester carbon and integrate spatial devices able to harvest rainfalls and mitigate flooding. Four different plots are defined with different typologies and heights, creating a higher external edge and a progressive smaller terraced skyline toward the park. In the four block, the project envisions also courtyards for natural light and cross-ventilation (Table 4). The approved preliminary Masterplan introduces different nature-based solutions and nature-inclusive areas in the district, such as green avenues, and green shades (especially on the edge of the site), but also natural parks and playgrounds in the middle of the site, defining a core place for collective social activities for the surrounding communities. In addition, the project envisions smaller poket-parks where to engage in social activities.
The ongoing development of the Vief kwartier shows the Interest of the Municipality of Groningen to develop a system of spatial transformations which will take into strong consideration the natural components of the urban landscape, thus allowing green and blue infrastructure to settle. Furthermore, as foreseen in the "New Space – Design Guideline Liveability of Public Space", the transformation is envisioned to happen during different periods of time, allowing the neighborhood and the city to adapt to the changes.

6. Discussion

In the last part of the Analyse section[11] the two case studies are compared according to the main design principles: (i) Multi-scalarity, (ii) Multi-temporality, (iii) Multi-Functionality, (iv) Replicability and up-Scaling; (v) Multi-stakeholder collaboration [12]. These design principles had been previously deduced from the intersection between literature review's findings and from a wider comparison among the research's taxonomy of case studies . Both projects show how the integration of climate adaptation into urban green regeneration requires an holistic, integrative approach grounded on multi-disciplinary collaboration. Both projects address (i) Multi-scalarity (City, Neighborhood and Building) and, in particular, in Vief kwartier NbS are also embedded into the buildings. (ii) Multi-temporality is addressed differently in the two projects and in particular, in Central Alameda street project temporality shapes also an implementation logic. (iii) Multi-functionality is also strategic: in the US case study multi-functionality is explored on a street level while in the EU project through the integration between built and unbuilt space. (iv) Replicability and up-Scaling is addressed in both projects. Central Avenue & 42nd Place and its neighborhood is envisioned as a pilot project with an urban and metropolitan relevance. In the Dutch case, instead, Vief kwartier is a pilot project of a broader development project for the whole Europark area. (v) Multi-stakeholder collaboration is operationalized in both cases through a consortium that integrates public and private institutions, researchers, no-profit and community-based organizations and urban designers. Both projects show the synthetic dimension of the design process, through which bridging together different disciplines, objectives and aspirations, supporting adaptation and improving space quality, public health and resilience.
By combining the analyses of the design cases and of some recent design catalogues, and guidelines for the development of public, collective and open-air spaces in the urban fabric (World Bank, 2021; Felix et al., 2021), some design features are recurrent and support the contemporary search for flexibility in use, time and space. First, what seems the most relevant feature, is the necessity of a vision of transformation which guides the development of the project through all its phases, thus emphasizing the need for the project to focus on the quality of living space. Then, the aforementioned introduction of green matters among the architectural ones, for example, not only shows their recurrence, but claims for a deeper understanding of their role in spatial design. Furthermore, it is possible to notice that the developed process supporting the project has a strong component of multi-scalarity, providing solutions which work at the intersection of urban, neighbourhood and building scales. Finally, the regeneration of grey infrastructures into liveable, sustainable and climate-adaptive public streetscapes underlines the necessity and the possibilities envisioned by phase-based planning, ensuring the feasibility and economic viability of the project, allowing the ecosystems involved to integrate in a renewed balance.
As emerged by the analysis of case studies, the emphasis posed to the multi-functionality of NbS, in most cases, is today dominant and preventing form a space-based reflection that could improve spatial quality, together with economic, ecologic, and social benefits.

7. Conclusions

In a renewed approach on the relationship between Architecture, Nature and Climate Change, pioneering cities worldwide are experimenting on grey and mono-functional infrastructural spaces, turning them into climate-adaptative Nature-based streetscapes to date, this trend reveals also asymmetries in the geography and size of cities.
Through the climate-adaptive Nature-based regeneration of infrastructural systems, new ecologies and aesthetics are emerging, but their spatial implications are currently under-investigated. Despite the emerging role of infrastructural spaces green regeneration to tackle climate challenge the role of design, both as a mode of research and practice, is underestimated and poorly-explored in this specific field, both in literature and practice. In addition, a strong disconnection between design research and practice

[11] The corresponding Tables can be consulted as Annexes of this paper. Specifically, here we refer to Table 3..
[12] Multi-scalarity, or the capability to a project to integrate design approaches which intertwine different scales; Multi-temporality: or the capability of the project to adapt and change over time, in relation to different moments of days, season and years, or scenarios; Multi-functionality, or the capability of the project to support different activities and functions in the private, public and collective spaces; Replicability and up-scaling, or the capability of the project to be applied, scaled up or down in analogous (climatic) condition; Multi-stakeholder collaboration, or the peculiarity of the project to be developed by a multidisciplinary group of direct, indirect, public, and private actors which represent diverse needs (Macaione et al., 2024).

still exists. More research is needed to go beyond current sectoral, technical and performance-based approaches and to leverage the potential of urban and architectural design inside this emerging field. A design-based approach can help to address the streetscape's climate-adaptive nature-based regenerative design in a more complex, integrative, and holistic manner. In order to overcome present limitations, the research, through the elaboration of the Framework for Climate-adaptive Nature-based Regenerative Streetscapes, aims to leverage the spatial dimension for streetscape's transformation and pursues operative outcomes. Future advances inside the ongoing research will involve completing the Framework by identifying design procedures and operational guidelines. Operational principles and procedures previously deducted, will be tested inside a medium size city and its neighbourhoods in the Mediterranean region, according to the third phase of the research methodology,
Once completed, the Framework would support the realisation of a design-oriented guidebook, providing a design methodology capable of tackling urgent inter-disciplinary spatial issues through the many facets of design, providing operational tools for future-proof resilient streetscapes, also for cities that are to date not tacking advantage from this opportunity.

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Annexes

		Central Alameda District/ Central Avenue & 42nd Place	**Vief kwartier**
Design firm		STOSS, LA Urban Forest Equity Collective	Felixx, EFFEKT, vector-I
City		Los Angeles, US	Groningen, the Netherlands
Type of city		Flatland	Flatland
Year and status		2021-ongoing	2022-2023
Type of grey infrastructure		Linear/Grid	Urban grid
Extension of grey infrastructure		2.18 square miles	0,24 square miles
Shape of grey infrastructure		Linear/Grid	Grid
Climate type		BSh Semiarid Low Latitude	Cfb Temperate, no dry season, hot summer
Climate hazard	H	X	
	F	X	X
	D	X	X
	W		
Implementation phases		• LA Urban Forest Equity Collective was created; • Phase 1: • Los Angeles Urban Forest Equity (LAUFE) Streets Assessment Report (2021); • LAUFE Streets Guidebook (2021); • Phase 2: • LAUFE Design Guidebook (2024) • LAUFE Neighborhood Strategy (2024) • LAUFE Neighborhood Strategy Central Alameda (2024) • Urban Forest Equity Community Action Toolkit (2024)	• ABC Vastgoed (Dutch-based real estate company) acquired the site from the municipality of Groningen • ABC Vastgoed comprises a consortium of international designers: architects EFFEKT Architects, vector-i (local), Felixx landscape architects (landscape); • Approval of Felixx's "New Space - Design Guideline Liveability of Public Space, Groningen" (2021); • ABC Vastgoed and Municipality of Groningen sign a cooperation agreement for the development of Vief kwartier at the event Let's Gro(2023) • Feasibility studio approved

Table 3: Table 1A compares the U.S. and EU projects from a contextual point of view, giving a first insight on the typology of (grey) infrastructure which the project aims to transform, and the main climate issues of the related areas (elaborated by A.Raffa and B.Andaloro).

	Central Alameda District/ Central Avenue & 42nd Place	Vief kwarter
Vulnerabilities	Climate LA hardest-hit neighborhoods; Difficulties in managing flooding; Ecological Lack of tree canopy and green open spaces; Degraded green spaces; Lack of biodiversity and proliferation of invasive species; Low quality of natural resources, i.e. soil and water and noise pollution Infrastructure Mobility Car-centric mobility infrastructure; Lack of slow mobility; Lack of multimodality; Grey infrastructure Underutilized vehicular lane; Abundance of parking areas; Abundance of Impervious surfaces (more than 60%); Obsolescent water management gray infrastructure Utilities Overhead utilities limit sizes of existing trees Commons Lack of public space for social interactions; Lack of of public spaces, also green, for passive and active recreation; Lack of urban furnishing; Structural lack of investments on urban spaces, also as a result of 'redlining' Housing & Public Health Poverty; Low level of education; Cultural and linguistic divide; Cost burden renters and households; Household income lower than city average Lack of home internet and digital divide; Unhealthy habits of neighbors	Climate Difficulties in harvesting rainwater Difficulties in managing flooding Difficulties in saving energy Ecological The area destined for the new neighbourhood was a former industrial area In the proximity of the area there are small, disconnected green spaces; In the surrounding are there is the Helperpark; Lack of biodiversity ; The area is closed to a canal; The soil consists of a relatively poor quality of terrain with soft banks, grassland, shrubs and trees. Infrastructure Mobility Car-driven area; The area is in the proximity of a national highway (N7; N37); The area is served with train and bus stations; In the surroundings of the area there are a few disconnected bike lanes. Grey infrastructure The site is a parking lot; The area is paved with spontaneous grass and asphalt; The site is surrounded by a dense grid of driveways; Proximity of a medium-size connecting roadway; Commons The plot hosted the former plot of Helpman Centrale power station ('Vief piepen'), demolished n 1998; The site is currently used as parking spot for FC Groningen's Euroborg football stadium; The site contains the original power factory's foundations; The surrounding area has few services The surrounding area is manly residential; In the proximity is the FC Groningen Euroborg football stadium. Housing & Public Health Groningen's population is rapidly increasing; Groningen is suffering from a housing shortage;
Climate-related hazardous events	Flooding Climate change is heightening the likelihood of inland and coastal flooding through rising sea levels and increased occurrences of intense rainfall. Heat Rising average temperatures are leading to more frequent occurrences of dangerously hot days and heatwaves. Over the next three decades, Los Angeles is projected to endure 21 days with	Flooding 1) High emissions scenario: sea levels rises by up to 1.2 m by 2100, and possibly up to 2 m if the Antarctic ice sheet melts faster. 2) Lower emissions scenario: the rise could be between 26-73 cm by the end of the century. Temperature Increases Future projections suggest a further increase in temperature, ranging from 1.4 to 5°C higher by the end of

	temperatures exceeding 93ºF. Extreme heat stands as the primary climate hazard in the city, resulting in a considerable number of climate-related fatalities and hospitalizations. Additionally, the urban heat island effect is amplifying urban temperatures significantly. Extreme Weather Events The combined effects of climate change are amplifying the severity and frequency of extreme weather events, with drought, wildfires, and flooding emerging as particularly acute challenges. Projections suggest an intensification of these risks in the coming years	the century compared to the reference period (1995-2014). Extreme Weather Events The Netherlands is expected to experience more frequent and intense heatwaves, regardless of the emission scenario. By 2050, the number of tropical days (above 30°C) could increase significantly, with a possibility of temperatures reaching 40°C annually by the end of the century in a high emissions scenario. Additionally, the country is likely to face more extreme storms and an increased risk of drought, particularly in spring and summer.
Climate-related planning frameworks	LA Heat Action Plan (ongoing, expected 2024) LA County 2045 Climate Action Plan (2023); Green New Deal (2019); Complete Streets Design Guide for LA (2015) LA Countywide Sustainable Plan (2019); Stormwater Capture Master Plan (2015)	Europapark plan (2013; 2015; 2019, Gronigen Gementee); New Space - Design Guideline Liveability of Public Space, Groningen (Felixx, 2021);

Table 4: Table 1B analyses the two projects from a contextual, more specific point of view, pointing out the climatic, ecological, social, economic vulnerabilities from a spatial perspective, as well as climate related risks and the associated policy and planning framework (elaborated by A.Raffa and B.Andaloro).

Central Alameda District/ Central Avenue & 42nd Place				
Climate-adaptive spatial regeneration strategies	• Reinforce ecological connectivity; • Preserve existing vegetation and increase tree canopy; • Increase biodiversity, by introducing native species and make diverse habitat for other species; • Enhance quality for air and water; • Increase Multimodality and make space for safe, accessible and inclusive slow mobility (i.e. pedestrians and cyclist) across scale; • Stimulate local economies and investments in the surrounding areas; • Integrate bleu-green infrastructure for flood management with existing grey infrastructure;			
Nature-based Solutions			**Spatial actions**	**Spatial devices**
Typologies	**Benefits**	**Techniques**		
Open Green spaces	Climate: Reduce Heat Stress; Reduce Pluvial Flooding risk; Carbon Storage and sequestration; Ecological: Increase Biodiversity; Enhance soil and water quality; Social: Improve interaction; Improve physical, emotional and mental health; Provide opportunities for active recreation and tourism; provide educational opportunities;	Pocket Park	Distribute	Room
		Natural Playgrounds	Re-Connect	Room
Green Corridors	Climate: Reduce Heat Stress; Reduce Pluvial Flooding risk; Carbon Storage and sequestration; Ecological: Enhance ecological connectivity; increase Biodiversity; enhance soil, water and air quality; reduce noise pollution; Social: improve interaction; improve physical, emotional and mental health; provide opportunities for active recreation; Economic: Increase value; Create green jobs; Reduce healthcare costs; Reduce energy consumption;	Street Tree Canopy	Cover	Diaphragm
		Green Avenues	Connect	Threshold
		Urban Green Corridor	Connect	Pathway
Bioretention Areas	Climate: Reduce Pluvial Flooding risk; Carbon Storage and sequestration; Ecological: Enhance ecological connectivity; increase Biodiversity; enhance water quality; Social: improve interaction; improve physical, emotional and mental health; provide opportunities for active recreation; Economic: stimulate local economies and job creation;	Bioswale and Rain Garden	Gather	Threshold
		Permeable pavements	Clad	Surface

Table 5: Table 2 analyzes the Central Alameda District/Central Avenue &42nd Place project from a contextual point of view, giving a first insight on the typologyf (gray) infrastructure which the project aims to transform, and the main climate issues of the related areas (elaborated by A.Raffa).

Vief kwartier				
Climate-adaptive spatial regeneration strategies	• Promote five quality of life values: public space, sport and health, connection and mobility, mixed-use and sustainability; • Boost the importance of public open pedestrianised spaces to improve healthy lifestyles; • Increase availability of public spaces in different meteorological conditions for flood mitigation; • Renaturation of collective spaces; • Promote an innovative timber-hybrid mixed-use development; • Carbon-neutral and energy-positive scheme in existing and new construction; • Minimise carbon emissions; • (Rain)water management, through rainfall harvest;			
	Nature-based Solutions		**Spatial**	**Spatial**
Typologies	**Benefits obtained or expected**	**Technologies**	**actions**	**devices**
Building solutions	Climate: Delay in drainage of rainwater; Pluvial flood regulation; heath regulation; Ecological: Biodiversity increase (i.e.: sensory plants); Seasonal plants; Creation of new habitats for little animals; Noise reduction; Dust absorption; reduce air pollution. Social: Social engagement; social interaction; direct human contact with nature; Economic: Job opportunities for maintenance; (optional) savings for water consumption;	Extensive green roof Ground-based facade	Overlay Overlay	Surface Envelope
Open green spaces	Climate: Management of rainfall; Recycle of rainfall; Water storage; Heath stress reduction; air purifying; cooling effect; Ecological: Biodiversity increase and support; Seasonal plants/landscape; Creation of new habitats for little animals; Food production; removal of pollutants from air, water and soil; Social: Recreational use of garden; community engagement; social inclusion; human direct contact with nature; sensory skills improvement; physical activities encouraged Economic: Create training opportunities; Create Green jobs opportunities.	Climate-proof residential gardens Pocket parks Natural playgrounds	Connect Connect Connect	Filter Horizontal surface Room
Green corridors	Climate: Pluvial flood regulation; water pollution regulaton; heath stress reduction. Ecological: Encourage animal settlement; increase biodiversity in the area; Air quality improvement; carbon storage sequestration; UV ray reduction; Noise buffer. Social: Encourage social encounters and interaction; Shading; Enhancing street quality; Enhancing street identity. Economical: Create training opportunities; Create Green jobs opportunities.	Street tree canopy Green avenues	Connect Edge	Pathway Pathway

Table 6: Table 2 analyses the Vief kwartier project from a contextual point of view, giving a first insight on the typology of (grey) infrastructure which the project aims to transform, and the main climate issues of the related areas (elaborated by B. Andaloro).

	Central Alameda District/ Central Avenue & 42nd Place	Vief kwartier
Multi-scalarity	City • The project is part of a larger development project for equitable urban forest implementation both at a urban and neighborhoods scale; Neighborhood • The project regenerate streets spaces and has been developed at the neighborhood scale, engaging communities, local activities and residents; • Nature-based solutions are embedded into space, according to the local context characteristics; Buildings • the project do not work directly on surrounding buildings but it aims also to improve wellbeing for all, especially for the most vulnerable;	City • The project is part of a larger development project concerning the whole area of Europaparkhas both an infrastructural and proximity scale Neighbourhood • The project is developed at the neighbourhood scale, engaging communities, local activities and residents. • Open-air public spaces are designed as part of the neighbourhood and support community engagement. • Different nature-based and nature-inclusive solutions are embedded into the space, with different scales of deepening. Buildings • The area is divided into four blocks of buildings, the design of which has not been released yet (2024) • Nature-based and/or green solutions are embedded into buildings
Multi-temporality	• The development of the project is at a conceptual phase; • The project will be implemented through a three-tiers framework - according to the different intensity of forseen interventions - that has been defined by the Los Angeles Urban Forest Equity Streets Guidebook (2021);	• The development of the project is following administrative phases, and is now into the deepening of design phase • The project has a vibrant environment with retail, workplace, leisure and community facilities which create activity 18 hours a day, seven days a week in the neighbourhood • Proximity parks, poketparks and green areas are open during day and night
Multi-functionality	• Multi-functionality is promoted in the area, also introducing different type of mobility for pedestrian and bikers; • Nature-based solutions implementation will transform existing streetscape into a multi-functional and diverse space; • Streetscape are re-designed in order to multiplicate public space and activities, also in connection with existing facilities and amenities	• The neighbourhood aims to welcome a variety of uses for the open-air spaces; • Multi-functionality is promoted in the area, also introducing different type of mobility for pedestrian and bikers; • The neighbourhood will have mixed-uses in the buildings which will host residential unts (around 315), together with retail, workplace, leisure and community facilities • Green areas and corridors welcome interaction between species;
Replicability and up-scaling	• The project is one of the two pilot for the implementation of Los Angeles Urban Forest Equity Street Guidebook (2021) at a neighborhood scale and, once completed, to be tested and monitored • As a pilot project, it aims to be replicable and up-scalable, impacting on LA streetscape nature-based regeneration • Nature-based Devices and Solutions adopted address recurrent issues and can pe replicate in similar circumstances	• The project adopts “New Space - Design Guideline Liveability of Public Space, Groningen” (Felixx, 2021) for the (replicable) design of public open-air spaces; • Open-air spaces refer to specific typologies of nature-based devices which can be replicable in similar circumstances; • The built environment envisioned at this stage seems to be made of buildings with modular structure and nature-inclusive solutions integrated into them.
Multi-stakeholders collaboration	• The Urban Forest Equity Collective (UFEC) is a consortium of urban designers and greening experts, City of Los Angeles staff, community-based organizations, researchers, and consultants; • City of Los Angeles: LA Office for Forest Management; LA Bureau of Street Services & Sanitation and Environment; Department of Public works, Water and Power, Recreation & Parks; LA Center for Urban Natural resources Sustainability • University: LA Laskin Center for Innovation (UCLA); University of California Division of Agricolture and Natural Resources; University of Southern California Urban Tree Initiatives; • Organizations: Tree People, City Plants, North East Trees, South LA Tree Coalition; California Climate Action Corps; • Landscape architectural firm: STOSS Lanscape Urbanism • Consultancy for Climate Adaptation planning & analytics: CAPA Strategies	• Municipality of Groningen • The ABC team comprises a consortium of international designers that includes Copenhagen-based international practice, Groningen-based local architectural firm and Rotterdam-based Felixx landscape architects. The design team is supported by advisers and consultants, including integrated design for construction, for sustainability, Spark for mobility, Bouw 21 for realisation and Re:Invest for the co-working design. • Architectural firm(s): EFFEKT Architects, vector-I (local) • Landscape architectural firm(s): Felixx • Consultancy agency for construction: BREED ID • Consultancy agency for sustainability: Traject • Consultancy agency for mobility: Spark • Consultancy agency for building realisation: Bouw 21 • Consultancy agency for co-working design: Re:Invest

	• The project is grounded on community-informed design

Table 7: Table 3 explicates and compares the intrinsic design features of the two projects, specifically in relation to the notions of time, space, and scale (elaborated by A. Raffa and B. Andaloro).

Urban parks through people's new lens: Opportunities behind COVID-19 for public spaces' policies in Costa Rica.

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Abstract
The lockdown and restrictions during the last COVID-19 health crisis confronted the population with an unprecedented situation for urban life. Green areas, mainly large urban parks, become highly valued spaces during and even after the pandemic. This work shows the visitation patterns of users from three large urban parks within the Greater Metropolitan Area of Costa Rica (GAM). The research is based on 8575 in situ surveys carried out between January and August 2023; our team also conducted an exploratory study between 2018 and 2019 (pre-pandemic), which was resumed to compare some aspects before and after the pandemic. The findings allow to explore challenges in public policies to improve access and enjoyment of urban recreational spaces in Costa Rica, replicable in other parts of the world.

Keywords: COVID-19, post-pandemic, Costa Rica, public policies, urban parks.

1. Introduction

Public spaces played a crucial worldwide role during COVID-19; they contributed to meeting social needs and physical activities and positively affected users' health (Lin et al., 2023). However, each country approached its restriction measures during the lockdown differently. In Costa Rica, access to many public open spaces such as beaches, National Parks, squares and urban parks was limited or denied. The access to large urban parks within the Greater Metropolitan Area (GAM) was strongly reduced during 2020 and 2021; sometimes, there was no access at all; others, a visitation schedule was enforced for weekdays, and no visitation was allowed during the weekends.

This study focused on the three large urban parks within the GAM: La Sabana, La Paz and El Este; it aims to analyse users' visitation patterns and place appreciation one year after the government lifted COVID-19 restrictions. Urban residents might have a reappraisal of green

local spaces in the early stages of the pandemic (Alizadehtazi et al., 2020). This research intends to understand if urban park users perceive those places as more valuable today than before the lockdown and to reflect if any change in planning policies must be implemented to embrace that fresh lens.

This research is mainly based on 8575 *in situ* surveys carried out between January and August 2023 in the largest urban parks of the GAM: La Sabana, La Paz, and Parque del Este. The sample included teenagers from 14 years old, adults and people over 65. Additionally, between 2018 and 2019, just months before the spread of COVID-19, our team conducted an exploratory study in the same urban parks to examine visitation patterns and user perceptions with a sample of 491 individuals. In the 2023 survey, we repeated the same questions as the previous study and added specific enquiries regarding visitation and perceptions before and after the pandemic. Therefore, this paper analyses participants' new perspectives while considering views from the same places before the outbreak.

The findings suggest that COVID-19 was a game changer in people's visitation patterns and appreciation of large urban parks within the GAM. The results show that 50% of participants state that they visit the park more often today than before the outbreak; that behaviour was even higher in teenagers, with 56% assured of having increased their visitation frequency. Individuals over 65 years were the group that missed the urban parks the most; 88% mentioned that they missed open spaces or they were looking forward to them being opened. These findings contribute to understanding the effect of COVID-19 in Latin American public spaces.

Although more research is needed, some examples show an increase in visitation patterns in local parks in Brazil after the lockdown (Freires et al., 2022) or a decrease in Puerto Rican parks by 2021 (Luengo-Duque and Crespo, 2022). In Costa Rica, despite the self-reported increase of visitation post-pandemic, planning policies in urban parks face challenges; private cars are the dominant mode of transport to get there, and there are safety concerns, infrastructure, and accessibility issues. Public policies should focus on promoting more accessible and secure urban spaces aiming to ensure a better quality of life for its residents. This paper aims to address public policy challenges according to new post-pandemic visitation patterns.

2. COVID-19 and spatial inequalities

The spread of the COVID-19 pandemic brought crucial challenges to contemporary planning policies. The cities were scenarios of several restrictions in public spaces; each country applied them differently, but common elements such as lockdown, social distance, and limited use of public transport were implemented worldwide. Furthermore, COVID-19 unveiled and aggravated many inequalities related to urbanisation practices; the impact of the lockdown affected disparately for those without access to outdoor spaces and who had a garden or any open space to relax or exercise (Orford, Fan and Hubbard, 2023). The purpose of public policies during the pandemic was focused on stopping the spread; however, suspending routine activities brought devastating effects on mental health (Castillo, 2023).

Beyond the income inequalities, the pandemic also intensified discrimination towards marginalised and stigmatised groups, such as the LGBTQ+ community (Kneale and Bécares, 2020) and older people (Buffel *et al.*, 2023). People over 60 were unreasonably affected by COVID-19; Buffel et al. (2023) highlight that according to the WHO Europe, they represented 95% of deaths in Europe; nonetheless, despite the number of fatalities in residential care (half of them) and older people been identified as the most vulnerable during pandemic, there is a limited amount of public policies to address this population issues. Furthermore, the access to

urban green space reveals spatial inequalities among different age ranges.Buffel et al. (2023) suggest that those circumstances have rarely been transferred to public policies; therefore, 'Age-friendly recovery planning' (p.1472) is required to involve older people in 'designing smart, liveable and resilient cities of the future' (p.1473).

2.1 Planning policies adopted during the COVID-19 pandemic

Measures undertaken to reduce COVID-19 transmission aimed at diminishing crowding; for instance, enhancing online services, reducing face-to-face services and promoting active transport means such as walkability and bike sharing (AbouKorin, Han and Mahran, 2021). However, urban morphology also had a role in the disease spread; AbouKorin, Han and Mahran (2021) carried out research in England, Germany and Italy; they found different infection rates in cities with radial, grid and linear forms; in this respect, radial and grid forms were related to with higher infection rates, mainly because those morphologies allow to concentrate higher densities. Those findings shed light on the planning challenges to keep cities efficiently connected but also resilient to face health emergencies.

Temporary solutions were adopted during the COVID-19 pandemic; many actions were approached through Tactical Urbanism, which allows small-scale interventions with low cost and quick implementation (Vázquez and Berardo, 2023). According to Sáez Reale and Azpiroz de Achával (2022), Tactical Urbanism proved to be a valuable tool during the lockdown; then, when the countries started to lift COVID-19 restrictions, those interventions allowed the create new public spaces in sectors formerly dedicated to cars; also promoted sustainable and safe mobility by expanding footpaths, pedestrianising streets and creating new bike lines.

Within the Latin American region, like many countries worldwide, there were many transformations in public spaces; for instance, in Argentina, they focused on three main strategies: urban mobility, green spaces and open street markets; there was a change in mobility by creating temporary pedestrian areas through the closure of perimeter streets high traffic areas (Vázquez and Berardo, 2023). The expansion of gastronomic public space through platforms dedicated to tables and chairs, commonly known as 'parklets' or 'gastronomic decks' was another tactical intervention with a significant impact on Argentina, as they represent a cost-effective way to reclaim space from cars (Sáez Reale and Azpiroz de Achával, 2022).

Some planning concepts that somehow existed before the pandemic emerged and were further developed, such as 'superblocks', aimed at reducing traffic by closing some streets and dedicating more space to active travel; also, the '15-minute city' (Moreno, 2024), which seeks dwellers can access their essential living needs in less than 15 minutes. Those initiatives search to promote the planning pyramid in favour of public transportation, walking, and cycling (Gesto Rodríguez, 2021)

2.2 Responses post-pandemic

Post-pandemic debates in planning encompass inequality, community participation, green spaces, mobility, and proximity. Shatkin, Mishra and Khristine Alvarez (2023)suggest that post-pandemic informality discourses are framed in three main approaches: the first is 'revanchist' which is based on stigmatisation of informal settlements, often through urban exclusion; the second is 'incrementalist' which is focused on the most immediate contagion threats, and finally a 'reformist' approach which addresses structural causes that foster informality and inequality.

Urban parks play a crucial role in reducing part of spatial inequalities and ensuring equitable access to recreation; however, citizen participation is the first stage in equitable park planning; people want to incorporate their vision in what they wish parks to be, proximity and access are

essential but also quality and sense of belonging (McCormick, 2020). Citizen-led interventions provide balance to city management, and it helps to encourage the use of neighbourhood parks and squares, avoiding long travel distances (GIZ Ecuador, 2020; Bueno Carvajal, 2022). Kyriakidis et al. (2023) found in Athens that the lack of engagement provokes dissatisfaction, and people might feel unfamiliar with the intervention; nevertheless, quick participation interactions through electronic devices such as mobiles (apps) allow people to discuss their community and perceive themselves as empowered.

Some approaches suggest it is not necessary radical city transformations; however, tools for better mediation between citizens and their built environment are required; CAF (2021) recommends four types of public spaces: parks, vegetable gardens, markets and leisure spaces. Furthermore, it is necessary to rethink streets and public spaces for the post-pandemic city; thus, they should prioritise public transit, walking and cycling, more outdoor space, improving the city's environmental conditions, and giving people more space (Barbarossa, 2020). In places such as Italy, the planning policies redefining urban streets for leisure and cultural uses were actions to promote intermodality, traffic data monitoring, tactical urbanism, new parking rules, and an increase in non-polluting means of transport, among others (Barbarossa, 2020).

Lessons that the COVID-19 pandemic left behind suggest the local government should have more quantitative and qualitative information about their parks that help to make medium and long-term decisions about the use and management of public spaces, considering safety and future risks (GIZ Ecuador, 2020); however, this type of information is still limited in places such as Costa Rica (Cruz Zuniga, Centeno Mora and Barrantes Chaves, 2023). Municipalities are the closest institution for citizen participation; therefore, updated data allow them to intervene more quickly than a centralised response through national institutions; local government could encourage a neighbourhood governance model for the organisation of residential communities, recognising their power to transform their local spaces (Fan, Orford and Hubbard, 2023).

3. Costa Rican Context

As in many Latin American countries, the pandemic surprised health authorities and those in charge of public policies. Costa Rica's Minister of Health was trained in epidemiology and led the lockdown policies; however, the main goal was to stop the spread. It was not considered how the adopted measures could affect citizens' right to recreation, leisure, and healthy coexistence.

Even before the pandemic, Costa Rica had a real shortage of spaces dedicated to recreation and sports. The national body in charge of the issue, ICODER (Costa Rican Institute of Sports and Recreation), have had a low budget and many restrictions on its actions. Therefore, the lack of urban planning policies to create green spaces in Costa Rican cities has resulted in historical shortcomings (Cruz Zúñiga, 2002; ProDUS, 2007; Araya-Vega and Quirós-Solano, 2024). For instance, in 2002, Cruz Zúñiga (2002) found sectors of GAM Costa Rica with an average of 2.27 m2/inhabitant of green and recreational areas, against a standard established 12 m2/inhabitant; this flaw has not improved recently; Araya-Vega and Quirós-Solano (2024) found GAM's districts with figures from 1,23 m2/inhabitant to 8,97 m2/inhabitant.

On the other hand, looking back at how the pandemic was experienced in Costa Rica, the focus of attention throughout the first two years was stopping the contagion. Free movement measures were strongly restricted, especially during 2020, mainly focused on all people who could be

fatal victims of the disease, including older adults. During 2020, the parks under study were closed on weekends due to non-compliance with sanitary measures (Peña Nassar, 2021); some areas, such as children's playgrounds, were closed due to being considered places with high human contact. Over the weeks with the highest contagious peaks, these parks were only open for few hours in the mornings (from 5 am to 10 am) to strictly allow outdoor activities and individual sports. The closure of open spaces meant a considerable impact on older people (Barrantes-Chaves, Centeno-Mora and Cruz-Zúñiga, 2023); the Costa Rican population is ageing rapidly (Costa Rica's global fertility rate is ultra-low, 1.31 per woman) (INEC, 2022) and older people choose these spaces for social gatherings and sharing with their peers.

During the lockdown, there was a decrease in traffic on roads, including the park's surroundings. According to previous studies (Barrantes-Chaves, Centeno-Mora and Cruz-Zúñiga, 2023), there has been a strong dependence on private vehicles to visit GAM's urban parks, both before and after the pandemic. In those places, especially on weekends, spaces for private parking are not enough and illegal parking occurs in the park's surroundings, mainly in La Sabana, contributing to the dense local traffic. The economic losses due to heavy traffic within GAM have been estimated at 3.8% of the Gross Domestic Product (GDP) (PEN, 2018).

According to the National Time Use Survey (INEC, 2023), the time per week that Costa Ricans spend in recreational activities has decreased from 2017 to 2022; however, men still prevail as those who dedicate more time to activities such as playing sports or training, while women prefer passive leisure activities. The study infers that before the pandemic, it was more common for both men and women to practice passive leisure activities. However, in 2022 (the last year of the pandemic), these activities reflected a slight shift towards more active routines (it rose on average 1.4% in women and 0.33% in men).

4. Methods

For this study, three main stages were considered. The first involved a thorough exploration and understanding of the different dynamics of the three parks evaluated; the second addressed a literature review on public policies related to public park management; and the last was the fieldwork conducted in the parks. Each of these stages is detailed below.

4.1 Description of the parks considered in this study

The parks considered in this research were all located in San José, the Costa Rican capital, and can be classified as urban parks. Figure 1 presents the location of the three analysed parks: La Sabana, La Paz and El Este, whereas

Table ***1*** summarises their main characteristics relevant to this work.

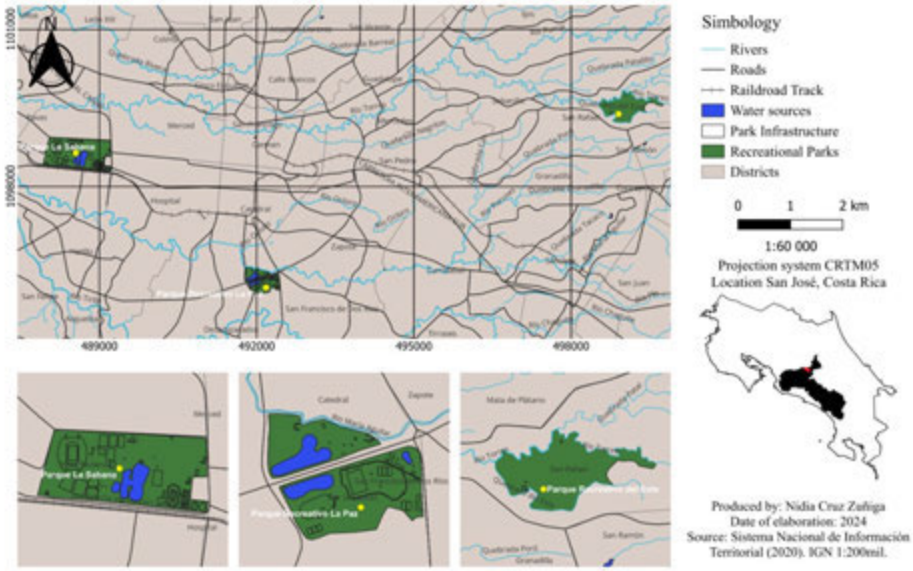

Figure 1. Location of the analysed parks.

Table 1. Main characteristics of each public park

Characteristic	Park		
Park name	Parque Metropolitano de la Sabana	Parque de La Paz	Parque del Este
Location	Canton: San José, District: Mata Redonda	Canton: San José, District: San Sebastián	Canton: Montes de Oca, District: San Rafael
Year of inauguration	1873	1989	1982
Extension (hectares)	72	53	24
Administrative entity	Costa Rican Institute of Sports and Recreation	Costa Rican Institute of Sports and Recreation	Municipality of Montes de Oca
Entry fee	No	No	Yes, approx. US$ 2.0
Opening hours	24/7	24/7	8 am-4 pm
Approx. distance from the centre of San José	3 km	4 km	6 km

4.2 Literature review

A systematic literature review was performed to identify the main published studies worldwide, with more emphasis on Latin America and the Caribbean, about the usage of public parks in the pre-COVID and post-COVID eras.

A protocol was established according to the selection criteria, search terms, and databases. The search was conducted across the academic databases such as Scopus, Web of Science, and Google Scholar, using keywords such as "COVID-19", "public parks", "park usage," "urban parks" and "policy", in English and Spanish. Boolean operators (AND, OR) were employed to refine the search.

Studies were included if they provided empirical data on park usage during or after the COVID-19 pandemic and were published in English or Spanish from 2019 onwards. Exclusion criteria included non-peer-reviewed articles and studies that did not focus on empirical data regarding park usage. After the initial search, titles and abstracts were screened for relevance. Selected articles underwent a full-text review and considered for this article.

4.3 Data collection and analysis

For data collection in this research, 8 575 in situ surveys were conducted across the analysed parks from January to August 2023. The sample included teenagers from the age of 14, adults, and seniors over 65. The surveys were administered by research assistants from the University of Costa Rica, who were previously trained for this task.

Our team undertook a preliminary exploratory study in the same urban parks in a previous publication (Cruz Zuniga, Centeno Mora and Barrantes Chaves, 2023) between 2018 and 2019. This initial research, conducted just months before the COVID-19 pandemic began, aimed to assess visitation patterns and user perceptions with a sample of 491 individuals. It is important to note that during the pandemic, these parks were partially closed following government directives, significantly impacting the usual visitation patterns and park usage. In the new 2023 in situ survey, we not only repeated the questions from the previous study but also introduced specific enquiries designed to understand changes in park visitation and user perceptions before and after the pandemic. This approach allowed a comparison of how perceptions have shifted due to the pandemic and to consider the effects of the partial park closures mandated by the government. To facilitate the processing of field data, an electronic form was created on the Typeforms digital platform, allowing surveyors to enter the information into the platform directly.

Additionally, as a complement to the surveys of 2023, visitation counts were conducted in the parks. For this purpose, in the case of Parque La Sabana and Parque de La Paz, the entire perimeter of the parks was divided into various entry and exit points, and the project assistants were trained to carry out visitation counts, being instructed on how to proceed to avoid duplicating counts. In the case of Parque del Este, being a park with a single entry and exit point where an entrance fee is charged, the counts were conducted only at the park's entrance. These counts were carried out for 5 to 10 hours, repeated over several days of the week, to identify visitation patterns; in total, 38430 people were counted. The data analysis was conducted using Excel (descriptive analysis) and RStudio (descriptive and inferential analysis).

5. Results.

Understanding visitation patterns in large urban parks is essential for developing inclusive planning policies; these findings explore the frequency of visits, transportation means to reach the park, self-reported visitation after the COVID-19 pandemic, and changes in visitation according to data from 2019 and 2023.

5.1 Characterisation of visitors

Visitation patterns of large urban parks within the GAM in Costa Rica have nuances according to age or sex. The age range of the sample is shown in Table 2; it was noticed that users at both ends of the distribution represent the smaller number of participants; which is consistent with the visual counts that were made to triangulate the data and choose the sample size. The figures show that less than 10% of visitors are older people, and a slightly higher number are teenagers.

Table 2. Age range of participants by park (Survey 2023).

	Age range							
Park's name	Under 18 (14-18)	18-30	31-40	41-50	51-64	65 or older	N/A	Grand Total
La Paz	71	632	515	385	329	120	1	2053
El Este	141	945	729	343	207	43		2408
La Sabana	159	1456	1116	815	434	134		4114
Grand Total	371	3033	2360	1543	970	297	1	**8575**

The sex distribution of participants is shown in Table 3; women's participation was around 47%, and men 53% of the sample. Once again, the data closely aligns with the counts; during the counts, 44% of visitors observed were women, and 56% were men. As shown in the Costa Rican National Time Use Survey (INEC, 2023), women spend less time in recreational activities than men; the report shows that women dedicate to sports 4:32 hours a week while men spend 5:12 hours; also, in active leisure women spend 5:10 hours, in contrast with men who use 6:49 hours a week. In this regard, it is expected to find more men than women in both counts and survey applications.

Table 3. Sample by sex and park (Survey 2023)

	Sex			
Park's name	Women	Men	Prefer not to say	Grand Total
La Paz	949	1094	10	2053
El Este	1231	1171	6	2408
La Sabana	1809	2268	37	4114
Grand Total	3989	4533	53	**8575**

The educational level of participants (see Table 4) shows that people with lower qualifications are the minority in the sample. As will be shown, most park users respond that their main transportation means to reach the park is by car. This situation exacerbates inequalities in access to quality public spaces within the GAM (Barrantes-Chaves, Centeno-Mora, and Cruz-Zúñiga, 2023). Therefore, the limited participation of people with a lower educational level could be explained by the challenges they have to face to get there.

Table 4. Educational level of participants (Survey 2023).

	Women	**Men**	**Prefer not to say**
Primary	9%	7%	8%
High school	36%	39%	45%
University (incomplete)	33%	34%	25%
University (complete)	23%	21%	23%
Grand Total	100%	100%	100%

5.2 Visitation Patterns

Participants were asked how they perceived their visitation frequency compared to pre-pandemic times. Figure 2 shows that around 50% of people of all range ages reported that they visit the park more often; this finding concurs with the rise in park visitation after the COVID-19 pandemic in some places from Latin America (Freires *et al.*, 2022). Furthermore, the high increase in teenage frequency visitation (56%) is important because they are not always on the target of planning policies; these data could help local authorities to encourage youth's participation in community park designs. Also, it is essential to highlight that less than 9% of people over 18 years old perceive a reduction in their visitation routine.

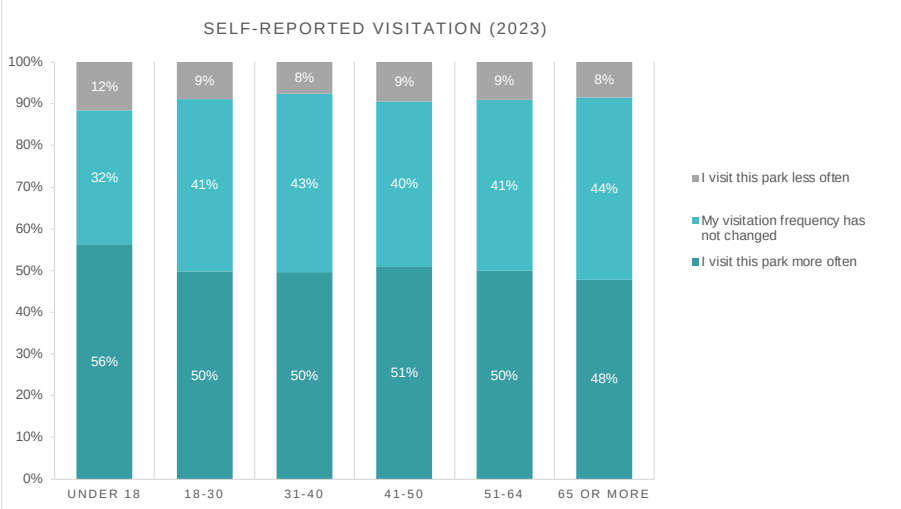

Figure 2. Self-reported visitation after COVID-19 pandemic

Figure 3 shows the visitation frequency in accordance with age. It is noticeable that the visitation frequency of older people (65 years or older) was the highest, with almost half of that age sample visiting the park more than once a week and 16% once a week; research in Atlanta has demonstrated that older people heavy use large scale parks after pandemic due to concerns about contagion and to keep social distance (Liu *et al.*, 2024). This tendency appeared to increase with age, as individuals aged between 51 and 64 also reported more frequent park visits. Other studies have shown the importance of public and open spaces, such as parks, for the well-being of the older population (Xie *et al.*, 2018). Finally, the age group with the lowest visitation frequency is those between 18 and 30; only 31% state that they go to the park at least once a week.

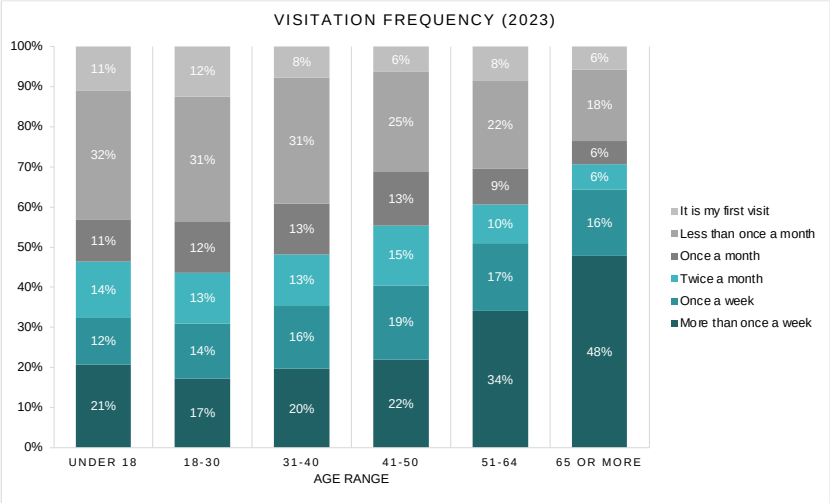

Figure 3. Visitation frequency

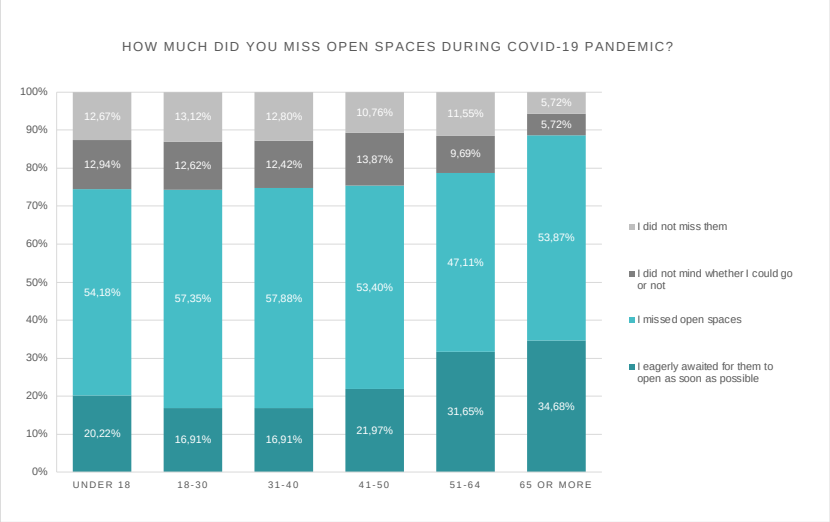

Figure 4. Reports about how people missed the parks during the lockdown.

Users from GAM's parks in San José, as worldwide, had to follow sanitary measures during the pandemic; therefore, all three parks were closed or partially closed during the lockdown. Participants were asked about how much they missed those large open spaces during the COVID-19 lockdown (see Figure 4); the responses show that more than 75% of the sample (N=6484) missed those places or eagerly awaited for them to be open, even those users who reported lower visitation rates admitted to feeling the need to visit these places. The age group that missed parks the most were again those over 65; more than 88% missed or enormously

missed those places. It is noticeable that the eagerness to return to open spaces was highest among the oldest population (over 65) at 34.68% and decreased with age, except for teenagers. Conversely, indifference towards accessing open spaces decreased with age, peaking at 12,94% in the youngest population. The trend of not missing open spaces at all, decreased with age (except for teenagers), with the group between 18-30 expressing the highest indifference (13.12%). These trends suggest a strong affinity for open spaces in older individuals.

Table 5 presents the park visitation for each gender. The visitation patterns show that men generally visit parks more frequently than women; the highest disparity is seen in the "More than once a week" category, suggesting men have a greater tendency for frequent visits. Therefore, 39% of men answered that they visit the park once a week or more, and 36% of women visited those sites under the same conditions. First-time visitors are more likely to be women, perhaps indicating different motivations or opportunities for initial visits between genders. Overall, men's more significant total visit numbers could reflect higher engagement or opportunities to attend the location surveyed.

Table 5. Park visitation variation with gender

Visit frequency	Women	Men	Prefer not to say
More than once a week	21%	23%	21%
Once a week	15%	16%	15%
Twice a month	11%	14%	32%
Once a month	11%	13%	8%
Less than once a month	31%	27%	19%
It is my first visit	11%	8%	6%
	100% (N=3889)	100% (N=4533)	100% (N=53)

As mentioned in the methods section, our team undertook an exploratory study in early 2019 (pre-pandemic) to understand the visitation patterns in those parks from the GAM. As the research used the same survey tool for the post-COVID-19 investigation (2023), it was possible to make an association. Figure 5 displays a comparison between 2019 and 2023; by analysing women and men visitation frequency, it is noticeable that in both samples, 20% of men attend 'more than once a week' to those parks, with a short increase post-pandemic in contrast, women increase their frequency (more than once a week) from 13% in 2019 to 21% in 2023. However, it is worth mentioning that both genders cover a higher range of people who visit the park 'less than once a month'; this figure was lower in 2019. These findings suggest that users of those parks might come more often than before the pandemic, which aligns with the self-reported visitation shown in Figure 2.

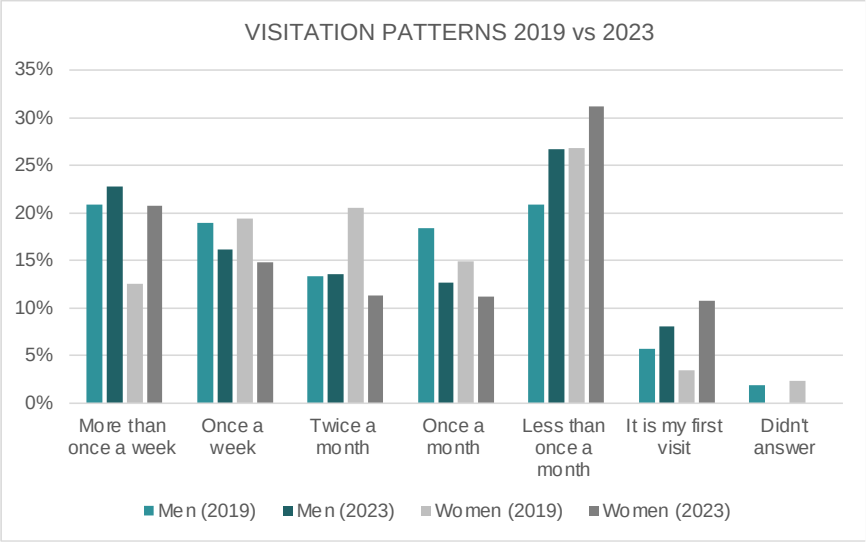

Figure 5. Visitation patterns before and after COVID-19 pandemic

Users from those parks come mainly by car (see Figure 6); despite being urban areas with bus stops nearby, public transport is one of the less popular options to get there. Costa Rica has severe issues with mobility; 34% of the population commutes by bus and 33% by car; 90% of the High Capacity Network does not meet the National Transportation Plan's parameters regarding the number of lanes (PEN, 2018). This means that even a short trip can take a long time. In this regard, more than 40% of large park users prefer to come by car; however, 37% of visitors over 65 come by walking, which is the highest percentage among all age ranges. Less than 25% of park users reach those places by public transport. These findings suggest that large urban parks in Costa Rica's capital might not be easily accessible to people with lower incomes who are not able to afford private transport.

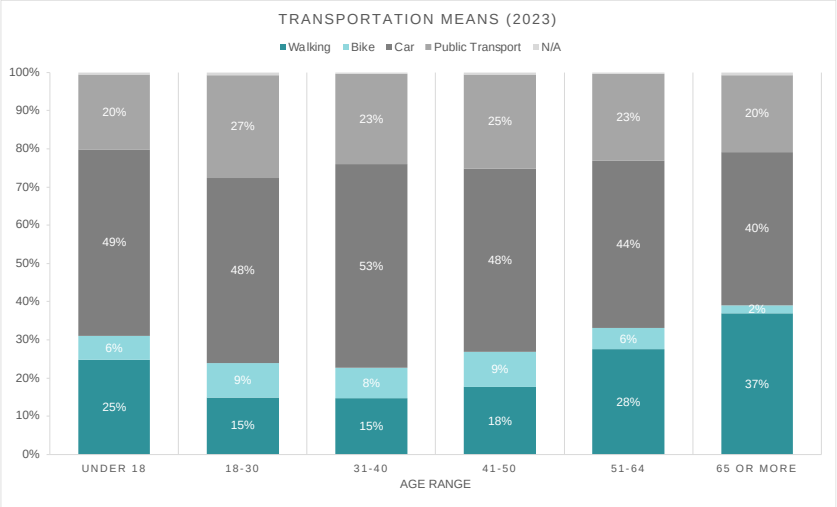

Figure 6. Transportation means after COVID-19 pandemic

By comparing transportation means between 2019 and 2023 (see figure 7), the COVID-19 pandemic seems to have not any incidence in transportation means to reach the parks; in fact, there was a reduction in the use of active ways of transportation such as walking and biking in almost all cases, except for walking in men. In this regard, despite people missing parks and there being an increase in visitation, the mobility conditions have not changed, and public transport has not improved; this situation could lead in the short or middle term to go back to the visitation patterns pre-pandemic as there is not urban policies that foster better macro mobility to urban parks.

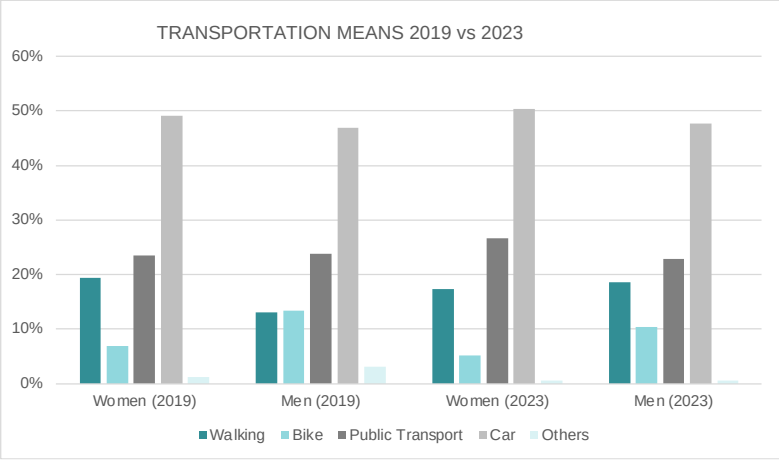

Figure 7. Transportation means before and after the COVID-19 pandemic

6. Discussion

The COVID-19 pandemic brought many lessons to urban planners. The spatial inequalities exacerbated by the pandemic reveal how disparities impact public health in general. Despite park visitation drop during the pandemic in different contexts (Dawwas and Dyson, 2021; Wu *et al.*, 2023), this work reveals that around 50% of visitors reported an increase in their visitation to GAM's parks after the COVID-19 pandemic, which concurs with others context in Latin America (Freires *et al.*, 2022). This research joins a body of literature that demonstrates that after the COVID-19 pandemic, there is a stronger appreciation of parks' contribution to everyday life and recreation (Soares and Brasil, 2020; Wu et al., 2023).

The pandemic has notably changed some behaviours; although an increase in visitation to parks was detected, it remains to be seen if new people's appreciation and preferences will return to pre-pandemic times (Wu *et al.*, 2023). In this regard, authorities in charge of public policies must take advantage of the opportunity to hold that enthusiasm and facilitate better conditions for enjoying those public spaces; for instance, lessons about how flexibility can help to face short to medium-term disruptions (BID, 2022). This new awareness about the importance of green spaces for mental and physical health (Wu *et al.*, 2023) can be approached through new perspectives such as 'Nature-Based Solutions' (NbS) that can offer new possibilities for the public, encompassing integrality, multifunctionality, governance and action orientation (Hernández-García, 2020).

There are also many structural challenges to ensure higher visitation of women in parks; in Costa Rica, women spend less time for leisure than men (INEC, 2023). Although there is still a long way to ensure that men and women equally share responsibilities in domestic and caregiving tasks, some affirmative actions can be taken to facilitate women's access to recreational spaces, such as more versatile infrastructure to meet different needs, and better safety conditions; for instance, minimise blind areas and implement a complete structure with complementary services (Zhang et al., 2022).

This research also shows that older people more frequently visit the GAM's parks; they are willing to come by walking, but their use of public transport is very limited. In this regard, Buffel et al. (2023) recommend an 'age-friendly recovery plan' post-COVID-19, which allows a rethink of which type of urban infrastructure meets older people's needs to support vulnerable populations in order to keep alive informal networks that protect everyday life. Buffel et al. (2023) suggest six principles to secure 'age-friendliness': protect the most vulnerable, mainly when spatial inequality is present, fight against ageism, inclusive post-pandemic city, promote community-based services and infrastructure as well as green areas, develop local partnerships and finally include older people in co-design cities.

The possibility of installing temporary markets would allow nearby communities to interact, sell their products and improve coexistence, which helps the local economy and activation of public spaces, avoiding longer travel times, lower prices from direct producer-to-consumer sales, and natural and fresh products that help maintain a healthy immune system (BID, 2022). Mobility could be the most critical challenge to face; the current transportation system prioritises private vehicles, thus exacerbating inequalities in access to recreational sites.

7. Conclusions

The findings of this work highlight how public policies need to be improved to ensure better access to recreation for Costa Rican citizens. Open spaces were highly valued during the COVID-19 pandemic, and they are necessary and convenient to create a pleasant environment

in the city. The situation experienced during the pandemic left lessons learned about how regional parks are seen with a new lens.

COVID-19 was a game changer in people's visitation frequency in GAM's large urban parks; around 50% of the sample reported increasing their visitation frequency after the COVID-19 pandemic. However, their means of travel have remained the same compared to pre-pandemic times; cars are still dominating the way to get there. Therefore, this momentum could be threatened by growing traffic issues and the need for an efficient public transport system. Biking is not a popular means of transportation; poor infrastructure and heavy traffic make it dangerous. Central and local governments must commit to providing bike lines and pacified streets.

Older people manifested a higher attachment to GAM's large urban parks; it was the age group which missed the most those places during the lockdown; currently, they are the most frequent visitors, and the proportion of senior citizens arriving by walking at the parks is much higher than other age groups. Like many countries worldwide, demographic trends in Costa Rica reveal that the population pyramid has transformed. The proportion of older people has increased; currently, it is 9,6% of the Costa Rican population. The global fertility rate is 1.31 children per woman, considered ultra-low (INEC, 2022), making it necessary to design friendly cities for older adults. Planning policies to encourage better cities for this population are limited; some initiatives are focused on persons with disabilities who are not necessarily older people; for instance, since 1996, Costa Rica has had a law (# 7600) which aims to provide tools for persons from all age with disabilities to achieve their maximum development, social participation, exercise of rights and duties; that includes universal physical accessibility. Costa Rican planning codes could include guidelines to improve the condition of pavements, footpaths, signage, panic buttons, information points, complementary services, and enhance the quality of the walk by planting trees along streets (reducing outdoor temperature). On the other hand, teenagers were the group that reported a higher increase in visitation; thus, the growing interest of teenagers in green spaces and the engagement of older adults might be an invaluable opportunity to promote intergenerational encounters.

Women's visitation frequency was slightly lower than men's, and visual counts showed a higher number of men than women coming to the parks;. However, both genders have similar trends in transportation means to reach the parks; men lightly use more active means such as walking and biking. Affirmative actions could help provide safer pathways for women that could encourage them to try healthier travel methods.

Less than 10% of the sample were people with low educational attainment, which shows how unequal the enjoyment of recreational spaces, even those freely accessible. The poor quality of public transportation and extended times might discourage those people who do not own private vehicles. Outdoor markets stimulate the visitation of people from different economic backgrounds, not only by providing the opportunity to sell products but also by reducing intermediaries and offering fairer prices. As demonstrated in other initiatives worldwide, these spaces might activate public spaces and provide natural surveillance that contributes to the area's security and vitality.

Finally, community participation has been proven to engage people in their familiar environment successfully; therefore, planning policies have to be able to capture citizens' views fairly; data is crucial, not only for authorities but also for citizens to make informed decisions. Planning policies can be addressed to meet people's needs and new visitation patterns after COVID-19. For example, how can we promote a richer intergenerational exchange by taking advantage of teenagers' increase in visitation? Which activities would keep the interest of older

people in those spaces? How can we promote new ways of commuting and reduce access inequalities? How can we provide safer walking and biking routes for women? Public spaces are volatile places (Jacobs,1961); therefore, new users' attitudes also bring new opportunities that must be noticed.

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Heterotopic Pocket Spaces through Intermittent Occupancy

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Abstract

In the contemporary context of a profound crisis of public spaces in general, and the Portuguese context in particular, questions of intensive 'touristification', fast gentrification, and concentrated immigration are reshaping the use and values of traditional urban spaces. The introduction of new public actors, new communities, and associated different social practices, often lead to feelings of estrangement of the public space, as well as to the emergence of different intermittent uses of public space. In this context we aim to discover different formal and social conditions of space especially within 'off-map' places whose use and value are currently being rediscovered and/or shifted.

In this article, we propose a new approach to public space as a threefold notion based on: (1) the idea of Pocket spaces, (2) Foucault's heterotopia and (3) intermittent occupation. We analyse fifteen different potential heterotopic pocket spaces from a threefold perspective composed by the (1) morphological qualities of pocket spaces, (2) the socio-spatio-temporal relationships of Foucault's heterotopia and (3) the social use based on the capacity of the space to accommodate different uses and practices.

We argue that, due to its complexity and ability to embrace contradictions and conflicts, heterotopic pocket spaces can be used as a valuable concept for describing, analysing, and creating speculative designs for a more democratic city, embracing and re-signifying possible estrangement of the public space in the contemporary, everchanging context.

Keywords: *heterotopia, urban pocket spaces, intermittent occupancy, public space*

Heterotopic Pocket Spaces

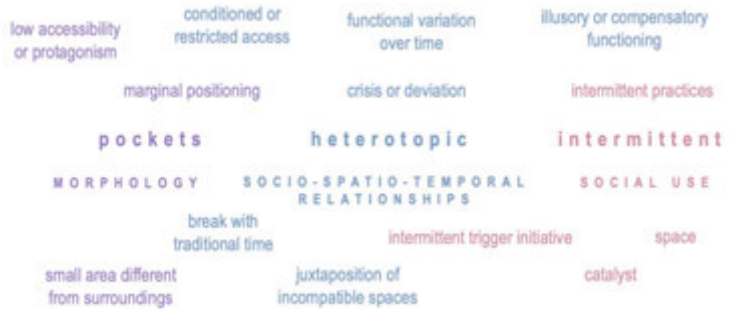
Complexity of contemporary public space is challenging to describe, and it cannot be approached from a one-dimensional only point of view, formal, social, or relational - it requires a comprehensive reading strategy.
While urban morphology can quite clearly describe qualities of the formal dimension of traditional public spaces, the permanently evolving social dimension is more challenging to address. Questions such as of touristification, immigration and social discrepancies are being exposed and becoming evident in the nowadays occupation of public spaces. Negotiation of spatial occupation occurs on various levels and is commonly visible in traditionally recognised and mapped public places. These encounters, as a representation of permanent spatial negotiations between different actors, are bringing certain theatrical qualities to the use of the city as we observe each other from a distance. One finds oneself exposed.

Differently, less known out-of-touristic-map and untraditionally generated public spatial pockets, are emerging in different, less described, and unexpected locations hosting spontaneous community-orientated uses. These emerging spaces are relevant for social cohesion and well-functioning society in terms of interpersonal dynamics and/or collective efforts (Qi, Mazumdar and Vasconcelos, 2024). These spaces can function as "third places" of "great good places" between home and work, the core of a

community's social vitality as designated by (Oldenburg, 1999). Moreover they can work as “fourth place” as defined by (Simões Aelbrecht, 2016), lively and inclusive public spaces, characterised by its social openness beyond social comfort and their capacity to bring strangers together.

Taking into consideration the need for a comprehensive spatial reading and based on empirical observation of 15 public spaces in Lisbon, we propose a descriptive matrix for the description of emerging public spaces. We address these out-of-touristic-map pockets, as heterotopic pocket spaces and define them from a threefold perspective:

1. morphology (based on the definition of pocket spaces)
2. socio-spatio-temporal relationships (based on Foucault’s heterotopic principles)
3. social use (based on their capacity to accommodate intermittent practices)



Definition of Pocket Spaces

“Pocket is a kind of small bag which forms part of a piece of clothing, and which is used for carrying small things such as money or a handkerchief.”; however, the definition goes on, and includes an idea of “a pocket of something” and as “a small area where something is happening, or a small area which has a particular quality, and which is different from the other areas around it.”. [1]

In literature, science fiction and fantasy, the pocket spaces can mean small, hidden, or magical dimensions or realms. These are often used in stories to represent secret or additional storage areas, hidden worlds, or alternate realities that exist alongside the main world. One of the most illustrative examples of pocket space as realm of infinite possibilities is Borges’ Aleph: “the only place on earth where all places are […] all lamps, all sources of light are in it.” (Borges, 1971) In his “The Poetics of Space", Gaston Bachelard delves into the intimate spaces of our lives such as those: “…of a hut, of a nest, or of nooks and corners in which he would like to hide away, like an animal in its hole…” (Bachelard, 1994), which metaphorically can be extended to the idea of pockets considering it as a small, personal world carrying our private thoughts and treasures. Junichiro Tanizaki’s "In Praise of Shadows" (Tanizaki, 1977) apart from primarily dealing with Japanese aesthetics and the beauty of shadows, implicitly discusses the significance of small, contained spaces and how they contribute to our experience of the world. This can be interpreted to include the idea of a pocket as a miniature, intimate space of its own.

[1] Examples given by Collins English Dictionary: “He survived the earthquake after spending 3 days in an air pocket.” And “The army controls the city apart from a few pockets of resistance.” https://www.collinsdictionary.com/dictionary/english/pocket consulted on 11th of May 2024

Regarding the application of pocket spaces in urban design practice, Kimmel describes them as social thresholds and negotiation space. She gives an example of small wire-separated areas of Refugee Cricket Project (East Croydon, London) designed by Muf architecture+art, a London-based practice[2]. These small areas primarily intended for young refugees allowed anyone from the neighbourhood to come, watch the cricket game and engage with the teams. It was unpolished, low cost and temporary, public space that was a threshold between communities. Another quality of pocket spaces is that they are negotiation spaces, where different actors negotiate presence and movement. The author recognizes these negotiation spaces in skating areas of parks where small size skating platforms are pocket spaces and surrounding area are thresholds between semi-private skating area and public space. (Kimmel, 2021 pp.119-120).

Thus, pocket spaces refer to different concepts depending on the context they are applied at. In urban planning and architecture, pocket spaces refer to small areas within a city or urban environment, like pocket parks or public squares. They provide green space, relaxation areas, or pedestrian-friendly environments within a dense urban setting. In the "Architecture of threshold spaces: a critique of the ideologies of hyperconnectivity and segregation in the socio-political context" (Kimmel, 2021) describes pocket spaces "as an architecturally defined place of social interactions in public space, such as an 'open urban room' where people linger[3]" (2021, p.116, par.1) and they are commonly localized at the margins of main paths in less accessible areas[4].

Foucault's Heterotopia and Socio-spatio-temporal Relationships

The understanding of heterotopia necessarily implies the understanding of utopia. The prefix "hetero" designates "different", while the prefix "u", from the Greek "ou" means "not", or, also from the Greek "eu", which means "good"; in other words: utopias are unreal places (good, as opposed to dystopias), heterotopias are "other", different places (*Des Espaces Autres*). The word "utopia" is used for the first time in 1516, as the title of the influential book by Sir Thomas Moore, which describes a perfect society, in opposition to the English court of the time. The word "heterotopia" is first used by Michel Foucault four hundred and fifty-one years later. In fact, before naming heterotopias as such, Foucault presented the concept under the name of "localized utopias"[5] which, despite being a contradiction, is very suggestive: "real places situated outside all other spaces destined to efface, to neutralize, to compensate or purify the spaces they oppose."[6]. The concept of heterotopia, was introduced by Foucault on a lecture in 1966 and, having gained significant protagonism, published in several versions and various translations[7].

The notion of Heterotopia has inspired diverse interpretations of complex and conflicting contemporary public spaces. In her chapter "The many mirrors of Foucault and their architectural reflections" Boyer (2008) criticizes architects for, given the fascination with the concept developed by Foucault, reducing heterotopic space to "any autonomous fragment set in opposition to the compositional totalization of the city" (p. 64, par.4). There are several works that overpass this reductionism by introducing the intrinsic quality of 'otherness' in understanding public space. In their analysis of urban margins Wallace and

[2] "Muf base their project designs on concepts around the resolution of social conflicts. They primarily work for people in social minorities so that they can be present in, and use public space, interacting with other communities."

[3] Laurence Kimmel uses the example of Yokohama Ferry Terminal

[4] Public space of the Oslo Opera House

[5] "The many mirrors of Foucault and their architectural reflections" Boyer, 2016; from Heterotopia and the City, Public Space in post-civil society" first published in 2008 by Routledge

[6] Ibidem

[7] Here we use the translation of Lieven De Cauter and Michiel Dehaene, from "Heterotopia and the City, Public Space in a post-civil society" by the same authors, first published in 2008 by Routledge

Stalcup, (2022) use heterotopy to grasp the visibility of adjacent spaces and how individuals perform when they are visible, revealing how they comprehend themselves in relation to others. Soja, (1996) employs the heterotopy in his definition of "Thirdspace" and deconstructing traditional spatial dialectic between real and imagined space. Based on the reading of Foucault's heterotopia, Tekinalp and Şentürer, (2024) created seven-step view lens for analysis of public space regarding presence of different identities that coexist with others.

Instead of reducing heterotopic spaces to fragments, in this work, we propose to start precisely from the opposite, that is, from the idea of "compositional totality of the city". We evoke heterotopia as quality that instead of discretising space into parts, puts into a relationship diversities and oppositions of the city as a whole. Starting from compositional totality of a city we define heterotopic pocket spaces by looking not only at the pocket itself but the socio-spatio-temporal fabric in which the pocket is tailored.

In his text, Foucault introduces six principles:

1st Principle of Crisis or Deviation

Heterotopias often house individuals experiencing crises or those considered deviant. In earlier societies, these spaces might be reserved for rites of passage, such as puberty, marriage, or pregnancy. In contemporary times, they tend to house those who deviate from the established (societal) norms, like prisons or psychiatric hospitals. Nowadays, there is a cultural obligatoriness for inclusion that almost cancels any possibility for deviation, as deviation ought to be accepted. In urban-architectural practices the principle of so-called crisis or deviation are nowadays evident in the contexts of queer spaces (Doan, 2007) or those of people that are houseless and occupy public spaces by temporarily shelters. In the case of Lisbon, in the garden António Feijó, next to the Church of Nossa Senhora dos Anjos, houseless people are not necessarily unemployed but have chosen provisional shelters as answers to high cost of living space rents.

Fig. 1. Jardim António Feijó
https://poligrafo.sapo.pt/fact-check/imagem-de-tendas-que-servem-de-abrigo-a-dezenas-de-pessoas-junto-a-igreja-em-lisboa-e-real/

Fig. 2. Marvila 8
https://www.8marvila.com/gallery

2nd Principle of Functional Variation Over Time

The function of heterotopias can evolve with time and cultural shifts. For instance, cemeteries were historically central to communities, and thus placed at city centres, but later moved to city outskirts due to changing conception of health and death. This principle indicates that the meaning and role of heterotopias is deeply rooted on their context. In the contemporary urban-architectural practice this principle is being widely explored. Such an example is Marvila 8 project, situated in Lisbon, which is an on-going ephemeral initiative that transformed 22.000 m2 of the old Abel Pereira da Fonseca wine warehouses, a city landmark, retaining their original space delineations created by the wine cellars. The "8" symbolizes the space's reuse, as Marvila 8 has refurbished the distinctive façade and embraced a reuse philosophy, repurposing over half of the rubble, wood, iron, and sheet metal, including the warehouse counters.

3rd Principle of Juxtaposition of Incompatible Spaces

Heterotopias can contain or juxtapose various spaces that wouldn't normally coexist. A theatre stage can depict multiple locations within a single play, while a garden can symbolize a microcosm of the world and represent an ideal of Eden. This principle reveals how heterotopias can bring together contrasting spaces within one setting. This juxtaposition nowadays seems less invasive as limits between categories such as for example those between sacred and profane blur (see an example of Kruisherenhotel Maastricht in Netherlands).

Fig. 3. Kroon Gallery & Kruisheren Hotel Maastricht
https://maastrichtgalleryweekend.nl/author/johan/

4th Principle of Heterochronism (Link to Time)

Some heterotopias are linked to different concepts of time. Cemeteries represent a kind of timelessness, whereas museums and libraries are heterotopias where time accumulates through historical artifacts and records. This principle highlights how these spaces can create a very singular relationship with time, either as static or constantly evolving. As an outcome, heterotopic spaces also culminate in a rupture with current or traditional time.

5th Principle of Conditioned or Restricted Access (Opening and Closing)

Heterotopias often have specific systems for access and control. They can be restricted with barriers or require rituals and permissions for entry, like prisons or religious sites. This principle acknowledges that access to heterotopias is often regulated, creating a sense of separation from everyday spaces.
https://maastrichtgalleryweekend.nl/author/johan/

6th Principle of Function as Illusion or Compensation

Heterotopias can serve to create a space of illusion or compensation. As illusions, they can reflect the illusory nature of societal norms (like brothels, which offer an alternative to mainstream society). As spaces of compensation, they can offer a more ordered or idealized environment compared to the real world (like utopian colonies or carefully planned gardens, such as Persian). This principle suggests that heterotopias function as a critique or provide an alternative to conventional societal structures.

Intermittent Practices as Heterotopic Pocket Uses

Apart from the ideas of pocket spaces and heterotopias we introduce the notion of intermittent practices which are the validation of existence of heterotopic pocket spaces. We observed the use of these public spaces through the lens of "**Intermittent Practices**"[8], as defined by Allegri and Ochoa (2021) that refer to temporary and flexible activities or uses of urban spaces that deviate from traditional, permanent arrangements. These practices are characterised by their adaptability and responsiveness to changing urban needs and conditions and emphasise values of temporariness and sharing, reflecting broader socio-economic, political, and technological shifts. These new and unconventional dynamics are emerging in various forms: housing models (co-living, co-housing, temporary accommodation); work arrangements (co-working, remote work); shared mobility (bike-sharing, car-sharing); shared goods and services (creative commerce, Netflix, Spotify); spontaneous cultural events; and innovative uses of spaces (parties in abandoned buildings, urban agriculture in vacant lots) (ibid.).

In Search for Heterotopic Pocket Spaces

Taking into consideration the morphological characteristics of pocket spaces and relational aspects of heterotopic spaces proposed by Foucault we examined fifteen different spaces of the Metropolitan area

[8] https://intermittentcity.fa.ulisboa.pt consulted on May 17, 2024

of Lisbon. We considered the properties descriptive of pocket spaces such as: marginal positioning, low accessibility, and small area in comparison to surrounding urban tissue and the 6 principles of Foucault's heterotopias. In these fifteen different spaces, we further analysed the existence or absence of intermittent practices and the triggers that initiated them.

In the table we observe a set of diverse open public spaces that are recognized and mapped by Ochoa and Allegri as places for intermittent practices. These places host different functions (social, economic, cultural, etc.) that occur in different intervals (yearly, weekly, daily, irregularly) and are initiated by different actors (municipality, small entrepreneurs, community groups, squatters citizens, etc.).

Fig. 4. collection of examples for analysis; 1st two rows from https://intermittentcity.fa.ulisboa.pt; 3rd row, 1st and 2nd author's photographs and google maps.

	1 praia do Torel [010]	2 feira dos alfarrabistas [028]	3 superblock, jardim da parada [039]	4 largo residências [003]	5 cozinha popular da mouraria [006]	6 jardim das plantas doodas [007]	7 brincar de rua [008]	8 ateliers da penha [011]	9 fcultesta [019]	10 fazer do bairro a nossa casa [043]	11 igreja da Trindade	12 largo são José	13 largo Dr. Passos Vella	14 largo Monterroio de Mascarenhas	15 traseiras Avenida Costa Pinto
marginal positioning	yes*	yes*	no	no	yes*	yes*	yes*	yes	yes	yes*	yes*	yes*	yes*	yes	yes
low accessibility or protagonism	yes*	yes*	no	no	yes	yes*	yes*	yes	yes	yes*	yes*	yes	yes	yes	yes
small area, different from surroundings	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes
crisis or deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
functional variation over time	yes*	yes*	yes*	yes*	yes*	yes*	yes	yes*	yes*	yes	no	no	no	no	no
juxtaposition of incompatible spaces	yes	yes	yes	yes	yes	yes*	yes	yes*	yes	yes	no	no	no	no	no
break with traditional time	yes	yes	yes	yes*	no	yes	yes	yes	yes	yes*	yes	yes	yes*	yes*	yes*
conditioned or restricted access	yes	no	yes	yes	yes	no	no	yes	no	no	yes*	no	yes*	yes*	yes*
illusory or compensatory functioning	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	no	no
intermittent trigger initiative	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	no	no
intermittent practices	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	yes	yes
when	yearly (aug.)	weekly (sat.)	irregular	irregular	weekly	daily	weekly	daily	weekly (sat.)	irregular	-	-	-	-	-
where	leisure	cultural, art	mobility	service, cultural	working, leisure, service	activ. com. use	cultural leisure, service	working , leisure	activ. com. use	activ. com. use	-	-	-	-	-
who uses	society realm	society realm	society realm	society realm	society realm	society realm	society realm	soc. realm	society realm	soc. realm	-	-	-	-	-
who does	municipality	small entrepreneurs	municipality	community group	commun. group	squatters citizen	community group	small entrepreneurs	citizens activism	community group	-	-	-	-	-
why	social	economical	cultural, social	cultural, social	cult., soc.,econ	eco., cultural	social, cultural	economical	eco., cultural	social, cultural	-	-	-	-	-
how	subversion	appropriation	appropriation	subversion	appropriation	appropriation	appropriation	coex., netw.	appropriation	propelling	-	-	-	-	-
catalyst	water	old books	traffic stop	cultural activits.	food	plants	play	craft design	trees	exchange	-	-	-	-	-
space	public park	public street	public square	priv. building	priv. build.	public street	pub. park	private building	public space	pub. space	pub. sq.	pub. sq.	pub. square	pub. square	pub. sq.

1 intermittent city's* heterotopic pocket spaces

11 potential heterotopic pocket spaces

pocket spaces

heterotopia

intermittent city*

Heterotopic Pocket Space + Intermittent Practices

In the first example, the beach in jardim do Torel, Lisbon, the use or intermittent practice takes place one month per year, namely in August, and occurs in this public garden and viewpoint. Since 2014, a part of the garden is transformed into a beac sand and sun umbrellas brought in, and the 18th cer tank is filled with water enjoyed by the public.

Fig. 5. from https://intermittentcity.fa.ulisboa.pt/praia-do-torel/

This heterotopic pocket space is situated in the centre of Lisbon, yet it is of low accessibility and has controlled opening and closing times. To access this beach in the garden one must go through different spatial transitions, such as sinuous streets, or an overwhelming staircase that goes through a yard of a primary school. Apart that, this garden is 'different', or 'other' as explained by Foucault[9]; since, like all gardens, the meaning of their existence and creation comes from a need for the representing the paradise on earth, of nature in the city (natural environment vs. built environment). The principles of juxtaposition of incompatible spaces and illusory or compensatory functioning are especially interesting here. On the first one, the desire of having a beach in the middle of the city, literally (since the viewpoint-garden of Torel allows for a panoramic view of the city), is in itself quite incompatible with the garden's situation in the city, usually, (in the case of Lisbon, Barcelona, etc.) when there are beaches near the city, they are located at its borders, never, geometrically or geographically in the middle, as is the case in this occupation.

This garden is already both a pocket space and a heterotopy, however, what enhances these characteristics, and truly turns it into a heterotopic pocket space is its intermittent occupancy, the desire of intermittently turning it into a beach.

Heterotopic Pocket Space - Intermittent Practices

Heterotopic pocket spaces where intermittent practices don't occur, are only *potential* heterotopic pocket spaces, left-over, marginal space. Like heterotopic pocket spaces, their morphology is linked to the fact that these spaces are rather small spaces, and different from their surroundings: this relates to their shape, scale, and dimensions. This aspect is linked with Foucault's principle of restricted or conditioned access since the access of these heterotopic pocket spaces is what segregates (restricts and conditions) them from their surroundings – not exactly in Foucault's visualization of restriction, the one that demands a permission (ritualistic, religious, legal) – rather in urban-architectural terms, in the way our bodies are influenced

Fig. 4. author's photograph

[9] *Des Espaces Autres* (Foucault, 1984)

by built space, the morphology of the access of these spaces is what restricts and conditions them (Hillier *et al.*, 1984, p. ix)[10].

The morphology of potential pocket spaces also contemplates the morphology of their access, as we understand this as being a crucial part of them: namely, because, by differing in scale, dimension and sometimes in shape, they evoke the principle of restricted or conditioned access, the perception of being in some *other* space. Thus, their morphology is indissociable from the built space that contains them: they do not have a specific shape (they rather vary in shape) and do not correspond to any typology.

Use, or rather, lack of use, is the major characteristic of *potential* heterotopic pocket spaces, and is what ultimately differentiates them from heterotopic pocket spaces. Unlike the latter, characterised, as seen previously, by an occupation, these are rests[11], remaining, located in the back façades of buildings, commonly occupied by parked cars and garbage cans[12], this is, they haven't yet been occupied by people, they are exempt of activity.

Final Considerations

The search for an explanation regarding these by us called heterotopic pocket spaces, originally came from an empirical observation of neglected, marginal spaces. A link with Foucault's heterotopia was very helpful, since it exemplified how space can function as a tool for embracing contradictions and conflicts rising from the contemporary crisis of public space (neglected space vs. over-exposed and 'touristified' space). However, heterotopic pocket spaces are not merely conditioned by morphology (pocket spaces' qualities) nor socio-spatio-temporal relations (heterotopia's qualities), they need a social use, without which they cannot be considered as such. The social use (occupation: appropriation, subversion) is ultimately the clue for differentiation between heterotopic pocket spaces and *potential* heterotopic pocket spaces. The study carried by Intermittent City is very relevant, since it shows how people perceive and therefore project themselves in the space (often, but not always pocket spaces) they inhabit, giving a hint of what they think is missing in their city (Foucault's principles). This analysis clarifies how use (occupancy, appropriation, subversion) is crucial for understanding the concept of [intermittently occupied] heterotopic pocket spaces, since without it, this activation of neglected and marginal spaces, doesn't occur.

Finally, we argue that this result (combining these three different frameworks: morphological, socio-spatio-temporal, and social use) provides a comprehensive tool for operating in towns and cities suffering from excessive tourism, fast gentrification, and loss of character – such as in the Metropolitan area of Lisbon, Portugal.

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[10] "By giving shape and form to our material world, architecture structures the system of space in which we live and move. In that it does so, it has a direct relation — rather than a merely symbolic one — to social life, since it provides the material preconditions for the patterns of movement, encounter and avoidance which are the material realization — as well as sometimes the generator — of social relations." (Hillier, *et al.,*1984, p. ix).

[11] "The space of rest is always also the space for the rest, for what has to remain hidden" (Dehaene *et al.,* 2016., p.94)

[12] "I want to suggest a different logic of the ruin, which is not romantic, not baroque, not melancholic, but a form of toleration of disharmony – a toleration of plural 'modernities' with which we live." (Boym, 2014, in Pailos-Otero *et al*., 2016, p.77)

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Designing the 'Right to Mobility': a Holistic Analysis to Rethink the Public City and Fighting Heat Waves in Urban Areas

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Abstract
This study examines the relationship between urban design, walkability, and climate change, with a particular focus on the necessity for public spaces that can accommodate rising temperatures and heat waves. Using Bergamo, Italy, as a case study, the research combines GIS-based spatial analysis with stakeholder interviews to assess the impact of urban heat islands on pedestrian mobility. The findings indicate that effective urban design must balance the practical needs of mobility with the social benefits of public spaces. The paper advocates for the implementation of adaptive design strategies that enhance walkability, promote social interaction, and mitigate heat-related barriers. These strategies are expected to support the health and well-being of urban residents, particularly those who are most vulnerable.

Introduction
The future of urban areas appears to be contingent upon the implementation of sustainable and active transportation strategies. However, the effects of climate change are intensifying, particularly in relation to rising temperatures and heat waves (IPCC, 2023). Consequently, novel approaches are required to promote a soft mobility paradigm that considers the implications of climate change, while designing 'spaces for mobility'. Cities and their vitality are pivotal to societal well-being. Nevertheless, it is essential to ascertain whether these urban areas are accessible and available to all members of society. There are major differences in the mobility requirements and various degrees of social relationship needs of different street users, and public space planning must necessarily take these into account.
Henri Lefebvre identified the practice of the use of the city, describing pairs of opposing and complementary needs. These included security and openness, certainty and adventure, work organisation and fun, predictability and the unexpected, unity and difference, isolation and encounter, and independence and communication. He posited that humans need to see, hear, touch, taste, and fuse all these perceptions into a World (Lefevbre, 2013). For 75% of the European citizens (Eurostat, 2022) the concept of the World encompasses a specific urban form – cities, towns, suburbs. These needs are distributed in different ways among people and evolve over time, both in the short term (from morning to night) and in the long term (across different age groups). The importance of public space, and particularly of the sidewalk, has been widely documented in the literature. In her 1961 work, The Dead and Life of Great American Cities, Jane Jacobs identified three primary functions for this section of the street. Firstly, it serves as a form of self-surveillance, protecting residents and non-residents alike. Secondly, it provides a space dedicated to the formation of networks based on trust. Thirdly, it facilitates the assimilation of younger individuals into the urban social context (Jacobs, 1992). It is important to note that the three roles are not contingent upon mobility, even though the sidewalk was

originally designed for that purpose. The three roles that Jacobs describes are primarily social in nature, with the public walkability space serving as a conduit for interaction. It is important to recognise that urban life is not solely about the movement between spaces; it is also about the act of staying in spaces. As Cerdà observed, urban life is constituted by two fundamental elements that include all of the functions and activities that comprise human life. The human being rests and the human being moves (Cerdà, 1867).

The term 'walkability' is open to interpretation. To identify a clear definition, Ann Forsyth (2015) conducted a literature review. The outcomes can be condensed into three categories:

- Walkability is defined as a condition that favours or enables walking. This definition emphasises elements such as movement, the compactness of the urban fabric, safety, security, and the attractiveness of the pedestrian route. It is the simplest definition of walkability.
- Walkability is defined as the perceived outcome of walking. It encompasses a number of factors, including livability, sociability, sustainability, and physical exercise. It places emphasis on the secondary outcomes that pedestrians obtain in addition to the main objective of moving from one point to another.
- Walkability is defined as a proxy for the evaluation of urban environments. The conversion of pedestrian mobility into numerical values provides a means of comparing different environments or, in the case of the same environment, highlighting the results of a design intervention. In essence, it is the measurement of pedestrian mobility.

The absence of a unified accepted definition can potentially make the phenomenon challenging to comprehend and, subsequently, slow its advancement. Nevertheless, there are some similarities between the three categories. Firstly, the environment that a pedestrian must traverse and secondly, the distance to the destination. The configuration of the city, and in particular the area allocated to pedestrians, is of paramount importance. Whether it is the absence of obstacles that impede walking, the provision of adequate lighting to enhance perceived security, or even the simplicity of creating spaces conducive to social interaction, the manner in which the pedestrian aspect of the city is conceived and designed aligns with numerous of these definitions. The second factor to be considered is the distance. It is evident that pedestrians are unable to traverse distances that can be covered by other forms of transportation at fixed times. In such instances, the use of motorised or public transport is unavoidable. Nevertheless, urban compactness can positively influence the security and sociability of places. A denser city tends to offer a greater number of accessible locations and services that can be reached on foot. Consequently, an increase in the number of pedestrians will result in more opportunities for social interaction and a perception of enhanced security.

The concept of pedestrian public space can then be seen from two distinct perspectives. Firstly, it is the pathway that allows pedestrians to traverse between two points, thereby ensuring the walkability of the space. Secondly, it is a social space where public life takes shape and 'things happen' (Gehl, 2010). Mobility space, therefore, is also a part of the public city system and should fulfil both the roles of becoming a quality space and facilitating the movement of people.

Once the space of walkability has been defined, it is necessary to frame the people who move in this space. The World Health Organization (WHO) define the pedestrian as '*any person who is travelling by walking for at least part of his or her journey. In addition to the ordinary form of walking, a pedestrian may be using various modifications and aids to walking such as wheelchairs, motorized scooters, walkers, canes, skateboards, and roller blades. The person may carry items of varying quantities, held in hands, strapped on the back, placed on the head, balanced on shoulders, or pushed/pulled along. A person is also considered a pedestrian when running, jogging, hiking, or when sitting or lying down in the roadway.*' (WHO, 2013, p. 3). While this definition is comprehensive, the difficulty in identifying the characteristics of

pedestrians is considerable. The utilisation of public space is contingent upon the characteristics of the pedestrian in question. Individuals with temporary or permanent mobility impairments, the elderly, parents with children, pregnant women, and so forth, may necessitate different requirements than those that the city can provide.
The mobility behaviour of a pedestrian is influenced by internal or external factors. Internal factors include the state of health (e.g. temporary injuries), the time and objective of the journey, whether they are alone or in company, the possibility that the individual is carrying material burdens (e.g. a package) or immaterial burdens (e.g. sadness or depression), the age, etc. The external factors include physical elements – such as pavement and street width, number of people, climate, etc. – and subjective qualities of the walking environment: imageability, enclosure, human scale, complexity, etc. (Singh, 2016). The walking speed of moving pedestrians varies considerably, with a range of between 1 km/h and 5 km/h (GDCI, 2016). This fact alone should highlight the extreme differences within the usually generalized category of pedestrians.

The objective of this contribution is to propose a rethinking of the design process and organisation of public mobility space, with a particular focus on those aspects related to walkability. This is achieved by emphasising the role and impact of heat waves, a highly topical subject given climate change, in shaping the design principles of public space, which is defined here as an open and accessible space for city users. This is done trying to promote walkability, in particular for the more vulnerable people. To do so, it is necessary to apply methodologies based on complex and diverse analyses to investigate and define the main spatial critical points. These must be the basis for the definition of subsequent mitigating actions aimed at removing urban barriers to walkability, in particular the effects of heat waves and the urban heat island, so as to intercept different aspects including the personal perception of the inhabitants.
The next paragraph introduces the topic of heat waves and the urban heat island, emphasising their barrier effect on walkability in urban public space. The case study is then presented, namely the Redona district of Bergamo, a medium-sized city in northern Italy. The methodologies and materials used are then illustrated, dividing them into quantitative and qualitative. The same division is applicable to the data analysis and comments section, where both positive and negative findings regarding the effect of heat on walkability are highlighted.

Heat, public spaces and walkability
The walking practice can be reduced or limited by the design of the streets and by various public spaces' barriers, which are connected both to the space-time context and to the characteristics of the people walking. The environmental conditions can act as a limiting factor to walkability, as the utilisation of public space varies throughout the day and across different seasons. This is due to the influence of varying temperatures on human behaviour. Among the various effects that climate change is causing on human beings' daily lives, the rise in temperatures is of particular concern, with the greatest impact being felt in urban areas. Heat can be then conceptualised as a form of hidden barrier. In Italy, the average global temperature in 2020 was 1.44 °C higher than in the 1961-1990 reference period. Furthermore, the ten hottest years recorded are all positioned after 2005 (ISPRA, 2021). The projections indicate a rise in average temperatures between 1.6 °C in the case of drastic reductions in emissions and 5.1 °C in a scenario of constant emissions, over a reference period between 1990 and 2100. Additionally, the number of heat waves days is projected to increase from 10 in 1990 to a range between 75 and 250, respectively, in a scenario of strong emission reductions or constant emissions (UNFCCC, 2018). From 1960 to 2020, temperatures in urban areas increased by approximately 3 °C, with cities such as Milan, Turin, Bologna, Florence and Genoa experiencing the greatest rises (IIPH, 2022). The effects of heat waves are worsening when it

is combined with the urban heat island (UHI) effect. This is the phenomenon whereby temperatures in urban areas are higher than in rural areas (Oke, 1982). The UHI phenomenon is the result of the accumulation of heat during the initial hours of the day, followed by its subsequent release, which leads to a sharp increase in urban temperatures. This situation is potentially dangerous for people, especially those in vulnerable categories. It is not possible to generalise the impact of the UHI and heat waves on human beings. The personal thermal comfort varies based on environmental factors such as temperatures, humidity, wind, atmospheric pressure, and direct sun exposure (Yang et al., 2015). However, there are general studies about heat effects. The results of the EuroHEAT project showed that people living in areas with moderate climates are more susceptible to heat waves. Italy was identified as one of the European countries with the highest rates of morbidity and mortality associated with high temperatures, with an increase of 20.3% in mortality observed on days with average temperatures approximately 3 °C higher than the historical seasonal distribution (CCM, 2019). For example, in the city of Bologna, a 1 °C increase in temperature above 24 °C is associated with a 2% increase in mortality (IIPH, 2022). It is well documented that several physical diseases are closely linked to heat. One of the immediate effects of heat stress is dehydration, which is caused by sweating and a failure to replenish fluids (CCM, 2019). This phenomenon is particularly detrimental to individuals with a diminished capacity to perceive dehydration, such as children and the elderly. The latter are particularly susceptible to the phenomenon due to causes such as reduced perception of thirst, impaired kidney function or cognitive impairment (ASUGI, 2020). Heat-related lipothymia is a transient alteration in blood pressure balance that can manifest in a variety of ways, ranging from mild dizziness to complete loss of consciousness. (CCM, 2019). Finally, heatstroke represents one of the most serious consequences of heat exposure and, if not treated promptly, can result in death. The condition is caused by an impairment of the body's ability to thermoregulate due to a temperature that is too high. Once more, it is important to note that there are several symptoms associated with heatstroke, which can manifest in a number of ways. These include, but are not limited to, weakness, nausea, pulmonary oedema and shock. The potential for confusion regarding symptoms is a further complicating factor. For instance, the elderly may experience temporary temperature rises due to medication (CCM, 2019). In urban areas, where green spaces are scarce, the risk of mortality from elevated temperatures is elevated by 5% (UNEP, 2021). In addition to the direct effects on the human body, high temperatures are also linked to mental and psychological health problems. These include increases in suicide, anxiety, and stress, as well as decreases in personal happiness and well-being (IIPH, 2022).

Case study

To identify relationships between temperature and walkability, this paper uses as a case study a district in the city of Bergamo, a medium-sized city in northern Italy, located 50 km from Milan at the confluence of the Brembana and Seriana valleys. Over the past decade, the population of Bergamo has grown from 115.000 in 2011 to 120.000 in 2022. As is the case with the rest of Italy, Bergamo is also characterised by a progressive ageing of its residents. In 2022, the over-65s constituted 25% of the total population (ISTAT, 2024). The city was founded by the Romans and is situated on a hill. From this centre, fortified during the sixteenth century by the Venetian Republic – the walls of which are today UNESCO heritage – roads were developed, and boroughs grew up around them. Therefore, the ancient Bergamo is characterised by a hand form. At the beginning of the 20th century, the area between the boroughs was developed, resulting in an increase in population density within the city (Pagani, 2000). Following the Second World War, as was the case in many Italian cities, the urban form underwent a significant expansion, resulting in the creation of entirely new neighbourhoods or the expansion of the periphery with the establishment of small settlements, known as 'Corpi

Santi'. This rapid expansion from one side enabled the city to meet housing demands, yet on the other side resulted in a detachment from historical and cultural values, as well as from forms of mobility other than the car.

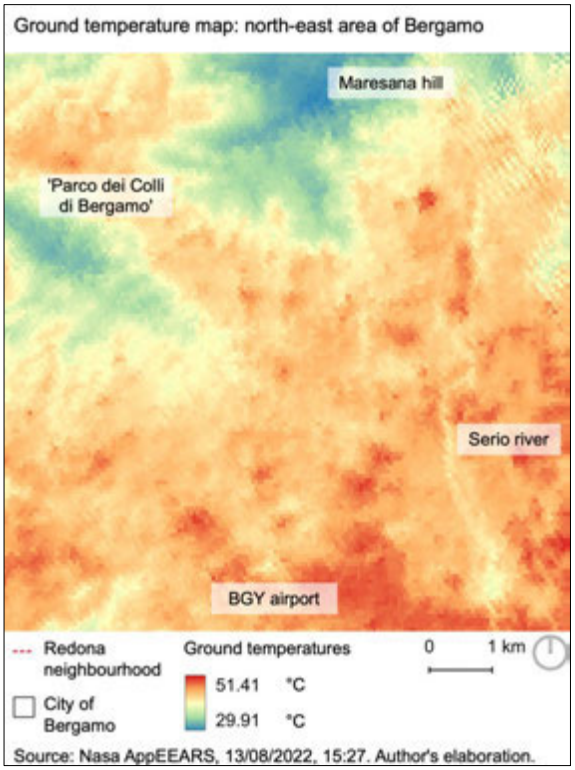
The Redona neighbourhood, which serves as a case study for this examination, was established as a 'Corpo Santo' on a road that connects Bergamo to the Seriana Valley. The district's population has increased since 1995, reaching a total of 7.041 in 2021. The proportion of the population aged 65 and above is approximately 25%, which is comparable to the citywide figure (retidiquartiere.it, 2024). During the period of urban densification, the district underwent a profound transformation, with the construction of both residential buildings and factories (which are now largely unused). The Redona neighbourhood was selected as a case study due to three key characteristics: i) it is a highly dynamic area in terms of past, ongoing, and planned urban regeneration processes. ii) It encompasses a diverse range of building types (tower blocks, single-family houses, commercial complexes, brownfields, etc.) and green features (parks, agricultural areas, nature reserves, etc.). iii) It serves as an infrastructural node for rail and road transport, both on a local and provincial scale.

Methodology ad materials

The methodology adopted for the analysis of spatial aspects is based on a combination of quantitative and qualitative approaches. The quantitative analysis is comprised of a series of investigations into the spatial aspects of the problem, primarily conducted through the use of geographic information systems (GIS). In contrast, the qualitative analysis is based on a series of semi-structured interviews with local stakeholders, which aim to gain an understanding of the perception and awareness levels regarding the problem.

The data used in the quantitative analysis was gathered from three main sources: the Regional Topographic Database (DBT) of the Lombardy Region, which was updated to January 2022. The DBT is an official geographical database of digital spatial information representing and describing the topographical objects of the territory and is the basic cartography. The data set contains information on a range of geographical features, including roads, railways, buildings, natural and artificial watercourses, altimetry, quarries and landfills, vegetation cover, and so forth. However, some geometries about recent interventions were absent. Consequently, data from Open Street Maps (OSM) were employed. The dataset was obtained from Geofabrik and updated to September 2022. To validate the data and collect new data not available from the first two sources, multiple surveys were conducted on the field in the second half of 2022. The data not officially available include the width of pavements, the type and colour of surface materials, the facilities of public transport stops and pedestrian crossings, and permanent and temporary point obstacles. The data was used to conduct four sets of analyses. The preliminary analysis included green spaces, mobility and the built environment, shop windows and abandoned businesses, neighbourhood-scale demographics, the dynamics of motorised traffic, and building heights. The pedestrian accessibility analysis considered pavement width, punctual obstacles (permanent or temporary), surface materials, facilities at pedestrian crossings and public transport stops. The pedestrian mobility analysis included walkable catchment areas from public transport stops and theoretical pedestrian flows. The UHI analysis employs data from the preceding three groups, namely building heights, public surface materials, and the location of green areas, trees, and bodies of water. These elements are among the factors that influence the urban heat island effect (Map B). Furthermore, a city-scale heat analysis was conducted utilising data from NASA-AppEars, which enables the clear delineation of urban areas (BGY airport) and rural/natural areas (natural park 'Parco dei Colli

di Bergamo', Maresana hill, Serio river) based on the temperature differences illustrated by the map (Map A).
The surface materials have particular importance when analysing the UHI because of the Albedo index. This index has a range from 0, representing a perfectly black surface that absorbs all solar radiation, to 1, representing a completely white surface that reflects all solar radiation (Moretti et al., 2021). The properties of the material itself and the colour influence the Albedo index. A low index indicates a high capacity to absorb solar radiation, which has a negative impact on the urban heat island, as is the case with asphalt (Albedo 0.10). The calculation of the Albedo index is complex and varies based on the methodology and instruments used during the survey. However, for comparative purposes, other materials with different albedo indices include marble (0.80), limestone (0.70), concrete and granite (0.50), and basalt (0.40) (Moretti et al., 2021).



Map A: ground temperatures using Nasa AppEEARS data and G.I.S. elaboration.

Qualitative analysis was conducted through four semi-structured interviews between December 2022 and January 2023. Nine people were interviewed, both as individual stakeholders and as representatives of the respective association. The objective of the dialogue

with local stakeholders was to confirm and integrate the information gathered during the initial phase of the analysis. All interviews were conducted in person, with an average duration of one hour. The associations interviewed were selected with the objective of achieving the greatest possible representation of citizens and thus of different users of public space. The first group, *Associazione Genitori Costruire Integrazione ONLUS*, is a non-profit organisation of social utility that was established in 2006 by a group of parents with children with impairments. Its objective is to create projects that will enable young people with disabilities to participate in a community and enjoy quality leisure time. The *Comitato per Redona* was established in 2001 by a group of citizens who were opposed to the municipality of Bergamo's proposal to construct a new sports hall within a local park. Their efforts were successful in preventing the implementation of this project. The *Gruppo Aquiloni* is an organisation that provides disabled young people with the opportunity to engage in leisure activities in the form of excursions, theatre, painting workshops, and so forth. The *Banca del Tempo Scambiotemporedona* is an association for social promotion founded in 2010. Its objective is to offer the residents of the area a form of service exchange that does not involve the use of money, using time as the unit of measurement. The interviews were structured by introducing the research themes (walkability, urban barriers, UHI, etc.) and leaving the interviewees free to highlight the specificities of the neighbourhood in relation to these themes. For some interviews, additional tools were used, such as paper maps – on which it was possible to write and draw – or digital maps.

Data analysis and comments

The combination of the three elements selected for analysis of the UHI effect – surface materials, building height, and green elements – has identified certain heat-susceptible areas.

The majority of the car parking areas in the neighborhood (1 on map B) are covered by asphalt, with the southern side lacking protection from the buildings' shade and generally devoid of trees. Parking areas are among the most straightforward areas to intervene in order to mitigate the heat absorption capacity. This can be achieved by improving the shade effect and changing the pavements, thereby increasing the albedo index. The main local road, via Corridoni, presents two different conditions. The northern side (2.1 on map B) is characterised by a greater presence of tall buildings and trees, which, despite the use of asphalt as a main surface material, can offer mitigating effects. In contrast, the southern side (2.2 on map B) presents an opposite situation, with a general lack of shade due to the absence of tall buildings and trees, and an abundance of asphalt. The Plorzano highway and adjacent roads can also be divided into two sections. In the southern part (3.1 on map B), pedestrian transit is rare and in certain portions forbidden. In the northern sector (3.2 on map B), this road system serves as a connection route between districts. The former Reggiani factory provides shade in a portion of the pedestrian path, but the total absence of trees and green areas, the presence of a large car park, and the use of asphalt as the sole pavement material make the stretch highly susceptible to the effects of the UHI.

However, an overall assessment of the neighbourhood indicates that the UHI effect is adequately counteracted in almost all areas. Despite the neighbourhood being strongly composed of asphalt elements (more than 87%), the large amount of greenery, whether in the form of trees or public parks within the urban area or agricultural areas surrounding the neighbourhood, offers the possibility of cooling. Furthermore, the new urban interventions are based on materials with a high Albedo index.

The results of the interviews can be classified according to the following categories: urban barriers, car traffic, and heat effects. The first category is not pertinent to the scope of this contribution. The second category, similar to the first, generates problems that are not directly related to the subject matter of this work. Nevertheless, the interviews yielded some insights

that could inform strategies to address the issue of heat. In particular, rush hours are identified as the most challenging for walkability, due to the difficulty in breathing and the accumulation of heat on asphalt and the emission of heat from car engines. The final category, heat effects, reveals that the most significant challenge in discussing heat is the bench situation in Redona. The area in question is deficient in seating facilities, which are both a source of respite and a venue for social interaction. While there are benches situated around the district, these are often combined with bus shelters. Furthermore, there are few seating areas within parks, with the notable exception of Turani Park. The park benches have recently been replaced with new ones, and their position has also been changed. Consequently, a series of problems directly related to heat have emerged. The benches were previously constructed from wood but have since been replaced with iron ones. The combination of the new position and the lack of shade results in the benches becoming uncomfortably warm, rendering them unusable for several hours, particularly during the summer months. Additionally, the benches were placed at a considerable distance from one another, which has the effect of reducing the spontaneity and complexity of social interaction. It is not uncommon for elderly individuals to visit the park with a folding chair or stool from their own homes.

Map B: triggering and mitigating elements of the UHI in Redona Neighborhood.

A discontinuity in the quality of pedestrian public space can be identified when the results of quantitative and qualitative analysis are considered. Such deficiencies can often be rectified through the implementation of relatively minor alterations. The creation of continuous and protected walkability spaces within street areas is possible through the implementation of NBSs, depaving interventions, street space redesign, green areas, and pedestrian resting points. However, there is a need to integrate mobility road design and road functions within planning tools. This can be achieved by linking mobility management and planning management, which

are often administered by different offices within the Italian context. This would facilitate the enhancement of not only the mobility role that roads fulfil but also the social function of public space that the footpath has lost.

Conclusions

To comprehend the impediments to walkability resulting from urban barriers, particularly the effects of the UHI, it is essential to adopt an analytical approach that integrates the spatial configuration of cities, the citizens' perception of streets, and the impact of heat waves in an urban context. The reduction of walkability represents a barrier to the opportunity to utilise public spaces, particularly for the most vulnerable population groups. An integrated project offers the potential to establish minimum conditions that would ensure the widest possible use of the road and pavement. This would facilitate the right to the city and the ability to walk to the widest possible number of citizens, while also enabling public space to fulfil its social function.

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In the name of Peace, Sanitise!

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Sanitised space is a concept that is quickly gaining momentum in the disciplines of urban planning and architecture. It refers to the process in which urban space is 'cleansed' from all things that make it dirty, undesirable, and differentiated. The process can be achieved through the use of soft power or it can also be achieved through hard power. Through the use of semi-structured interviews with municipal officials, this paper seeks to showcase the various efforts by the capital city of Tshwane, South Africa to sanitise space in the name of peace. With the use of examples from public parks, the paper argues that although the sanitisation of space is done in the name of public interest, peace, it often conflicts with the public experience.

Key words

Sanitisation, Public Space, Safety and security, Peace, Symbolic violence

Introduction

Public spaces are regarded as quintessential for any settlement; they provide opportunities for interaction, recreation, leisure, public expression and greening, amongst other benefits. They are also spaces in which historic events have occurred, in different eras and contexts. For instance, The George Floyd protests demonstrations against police brutality and riots in the United States in 2020, The Soweto Student Uprising in South Africa in 1976 to change the medium of instruction from Afrikaans to English, The Arab Spring in Tunisia in 2010, The annual Rio Carnivals in Brazil and the Holi in India, amongst many others. As such, public spaces are spaces in which communities come together to demonstrate solidarity, to celebrate and to rebel against matters of public interest. Public spaces thus play an important role in transforming society and contributing to civic culture, values and peace. However, what happens when public spaces are not of good quality? threatened by crime, are a breeding ground for social ills, housing undesirable members of society and are underutilised? How does urban planning and urban management institution respond or ought to respond, in the name of peace?

This paper focuses on public spaces in the Capital City of Tshwane, South Africa. It investigates different public open spaces and the way in which peace in public space ideas, perceptions, and management practices are conceptualised in the City of Tshwane from those in decision-making positions. It also explores these conceptions in relation to the inter-conflicts between society and the municipality in the production of peaceful public spaces. Moreover, it also interrogates the intra-conflicts between municipal officials themselves. This is done in an attempt to uncover the various processes of sanitising public spaces in the city and contestations embedded in the realisation of peaceful public spaces. The paper employs the concept of conceived space by Lefebvre's (1991). It will draw links between the said concept and the concept of sanitisation, so as to make a contribution to the current literature on the topic. This paper offers new insights to the ongoing conversation of sanitising space through soft and hard power by municipalities.

The Historical Overview of Urban Public Spaces in South Africa: A History of Sanitisation

Many South African cities have a shortage of quality public space, and much of our public space is considered unsafe, due to perceived and real crime, under management and under resourced spaces (Landman,2017). According to the South African Urban Reference Safety Group (2020), this is due to the historic spatial injustices of colonialism and apartheid, which left a legacy of inadequate public space in disadvantaged areas like townships and informal settlements (Makakavhule, 2022). Venter (2020) , also argue that the legacies of Apartheid and how it distributed resources and infrastructure such as public spaces continues to shape the levels of access and perceptions of public spaces to date.

This section focuses on the overview of urban public spaces in South Africa during the apartheid era. It seeks to demonstrate how urban public space were perceived and conceived, and attempts to lay a foundation for understanding public spaces today. The Reservation of Separate Amenities Act of 1953 is crucial to mention in this section. The Act was put in place to regulate public spaces and spaces meant to cultivate civic culture. It was used to expand existing segregation practices that came before it, for example, the Urban Areas Act of 1923, which sought to segregate and restrict the presence of blacks in urban areas. However, the Reservation of Separate Amenities Act later extended to include restrictions and the segregation of particular races in public and private premises, such as public parks, restaurant, squares, public transport, hotels and cafes (Donaldson; 1996; Sidogi, 2020; Swilling et al. 1991). Therefore, the Act allowed the provincial and municipal authorities to regulate public access and use. The Act also regulated private spaces by preventing “indecent acts” as defined under the Immorality Act of 1927. In 1960, the Act was amended to include beaches, in the quest to control all spaces of potential multiracial contact (Goitom, 2015). According to Lemon (1991: 51), the Act was deployed to “minimise racial contact and thereby, it was argued to minimise friction.” The Reservation of Separate Amenities Act had to be paired with other pieces of legislation that would support it so as to contribute to the realisation of the Apartheid dream. For example, it was paired with the Prohibition of Mixed Marriages Act of 1949 to engrave a sense of “otherness” which could discourage interaction amongst different racial groups.

Upon reflection, such controls represented stiff forms of sanitisation whereby groups in society were regulated to portray a certain image as conceived by those in power and decision-making positions. Urban public spaces were discursively represented using rhetorical strategies, which imagined urban space through the eyes of the beholders, whether that beholder was the cartographer, the planner, the politician or the municipal official. In other words, black people were not to be visible in public spaces because they did not represent the urban image that the apartheid government sought to establish and maintain. As such, public spaces were reserved for interactions between white people, representing apartheid beliefs. Therefore, the uses and users of urban public spaces physically represented and communicated apartheid ideology.

The local authorities in white neighbourhoods would also control society and enforce legislation through signage that served to remind both blacks and whites of the rules and regulations of public and private spaces. Therefore, town planners, architects, and designers would work to design, provide and regulate public spaces as instructed by the state. Accordingly, they would communicate apartheid rationale and ideology through policies and by-laws. Evidently, harsh punishment was inflicted on those who broke the law either by making use of spaces that they were not supposed to, or through their associations with other racial groups. People would face brutal police violence or even prosecution for such violations.

The Reservation of Separate Amenities Act was fortunately repealed in the year 1991. Thereafter, all citizens of the country could use the same public spaces and meet and integrate as they so wished. However, even with this development, urban public space planning in South Africa continues to represent efforts by the state to sanitise space and dominate it for ideological reasons. This experience of space throughout history has had implications on how public space is perceived, and how urban managers, in the name of creating and maintaining peace, plan and govern these spaces.

Conceived Space and Sanitised Space In Post-Apartheid South Africa

Lefebvre's framework – which is also the most popular - is his unitary theory or 'spatial triad' (Ghulyan, 2019; Nkooe, 2015). Lefebvre's triad introduced the concepts of perceived (spatial practices), conceived (representations of space), and lived space (representational space) which he regards as the premise for the production of space (Lefebvre, 1991: 33, 38-39). These spaces can be thought of as (1) the routine and spatial activities that can be perceived in the world (perceived space); (2) the conceptions of space which order our notion of what is possible (conceived space); and (3) the spaces that are produced by the body in everyday practice (lived space).

A discussion of the conceived space is discussed as the crucial element central to the conceptual thinking of this paper. Conceived space refers to the mental and conceptual space encompassing normative standards and ideologies (Lefebvre, 1991). It is identified as a set of representations of space that are rendered and produced by technical planners, designers, architects, technocratic, sub-dividers, and bureaucrats that have legitimised power to (re) produce space (Ng, Tang, Lee and Leung, 2010). Conceived space produces the images, sketches, and visions of the urban space. These are influenced by state institutions and are devised in plans, maps, and schemes to order society. Everyday human spatial practices and processes in this space are either legitimised or contested against a set of ideologies. This done through the use of surveillance, plans, policy, zoning laws, and by-laws which are often conceptualised in an effort to uphold normative ideas (Lefebvre, 1991; Zhang, 2006).

The state is then able to control planners, architects, and geographers and instruct them on how to represent certain locations and order their social and spatial practices according to its own socio-cultural or economic posture. This is important to note because of the role that the apartheid state played in the conceived space of South Africa. As such, Eden (2004), Lefebvre (1991), Mwathunga (2014) and Nkooe (2015) argue that conceived space is not neutral or passive, but rather, it is instrumental in seeking order and control, sometimes through extreme measures of violence.

Reflecting on the nature of perceived space as discussed earlier, one can argue that it is the manifestation or embodiment of conceived space. This is because what is conceived is physically produced and therefore, perceived. This close association of the concepts can make the triad somewhat confusing. Therefore, an example is used to clarify. In the context of urban public space, perceived space is the physical composition of a space. This includes the benches, pavement, lighting, fences and gates, and all other objects which can facilitate or hinder certain activities within that space. The by-laws and rules and regulations of the space form part of the conceived space. These can also facilitate or hinder certain activities within that space. In this context, what these two spaces have in common is the fact that they offer an objective view of how public spaces should work for all, through their attempts at creating a homogenised social life. Adversely, this often results in unintended consequences where, instead of homogenisation, resistance manifests in the name of informality and disorder. Thus, conceived

space is seen to undermine the realities of everyday citizens, their conditions, and circumstances through how it imposes its ideologies and normative ideals.

Sanitisation of space on the other hand seeks to create spatial relations that encourage behaviours that are repeatable, predictable and compatible with the dominant social roles and rules of engagement (Stavrides, 2015). More recently, we have witnessed these efforts of normalisation through the use of surveillance cameras, biometrics, and other forms of technology that shape human behaviour and sanitise public space in the name of peace and security.

Drawing the link between sanitised space, and conceived allows for a focused interrogation on urban planning actions in urban spaces. For example, Dorman's (2016) article on the regulation and control of urban life in Zimbabwe highlights how processes of urban control and sanitisation are represented by policies that seek to dictate the behaviour of urban people. These policies lie in the hands of planners and politicians alike, whom according to Healey (1997) and Harvey (2006), are engulfed with scientific and technical knowledge which often overrides their human convictions. In this regard, urban planners and architects exist as decision-makers who disregard their emotions in the work that they do. Healey (1997) echoes are verified in the Zimbabwean case of Operation 'Murambatsvina' (translated as one who rejects filth). This was a programme used to enforce by-laws and eradicate informality and illegal activities in the city of Harare and surrounding urban areas. This operation was legitimised in the name of 'planning' and seen as an effort to rebrand the image of Harare and spruce up its reputation as a world class city by ensuring that it is 'clean, well laid out and comparing favourably with cities anywhere in the world' (City of Harare 2005 as referenced in Dorman, 2016). The case of Zimbabwe is one, amongst many other cases, that describes how space can be sanitised in the name of the planning, order, and organisation that exists in the conceived space.

The city of New Delhi is also a good example of how cities sanitise their urban spaces in order to appear more modernised, beautiful, and appealing to tourism and business investments. New Dehli's hosting of the commonwealth games in 2010 is a direct example of this. The city had a campaign to remove beggars, vendors, and the homeless off the streets whilst also deploying police men and women to roam the streets so as to discourage the troubling population from being visible in the public spaces (Cook and Whowell, 2011). The city argued that it was creating a safe, peaceful and conducive environment for tourisms to enjoy and experience New Delhi. However, it was taking away the character of the city and disseminating the injustices suffered by those of lower classes who were regarded as 'undesired'.

In Italy, decades after the Second World War, the processes of urban expansion represented the clean-up of Italian city centres. The process was undertaken by removing the poor from the urban centres after which they were moved to mono-functional high density neighbourhoods on the periphery of the historical city centres. These areas were homogenous, segregated and far from all city amenities (Chiodelli, 2013). To date, the city centres in Italy are inhabited by the upper class who are afforded access to entertainment, other conveniences, and an active social life. On the other hand, the peripheries are still inhabited by the poor who are hidden away and excluded from city life.

The deployment of the concept of sanitised space alongside the concepts of space provided by Lefebvre provide an opportunity to zoom in and out of the complexities, continuities, and discontinuities of the urban public space controls and orderings in The City of Tshwane. In addition, it can also reveal the contradictions and paradoxes that exist between the societal and municipal perceptions and meanings of peace in urban public spaces.

Methodology

The paper draws its findings from multiple case studies on different types of public spaces, in different parts of the city of Tshwane. The data was collected over the period of 2016-2021 as part of a larger project on understanding the nature of public spaces in the Capital city. The paper will draw examples from different public spaces which are part of the larger project. The paper is specifically concerned with the municipal official's perceptions of peace in public spaces, how they create, restore and maintain peace, as such, the paper will refer to the qualitative face to face interviews and focus group data that was collected in this regard. As expected, professionals working in public spaces come from different disciplines. Therefore, town planners, landscape architects, environmentalists and horticulturalists were interviewed and given pseudonyms to protect their identity. The paper will also refer to some of the official municipal documents that give information about how the city conceptualises its public spaces, its vision and mechanisms of management and governance. The rationale behind the selection of these specific documents was their accessibility not only to professionals, but also the general public. The officials interviewed and the documents reviewed are summarised in Tables 1 and 2 respectively.

The data for this paper was analysed thematically. Municipal responses and information contained in municipal documents were analysed to draw emerging themes and sub-themes as it pertains to the topic. This was also triangulated with observations conducted at the different sites, where pictures were taken and activities were documented.

Table 1: Summary of Interviewed Municipal Officials

Departmental Division	Number of Officials
Environmental Management	9
Parks and Horticulture (Regional Office)	9
Urban Forestry, Nursery and Training	5
Integrated Development Planning (Office of the Executive Mayor)	1
Total 24	

Source: Author

Table 2: Summary of Official Documents Reviewed

Official Documents	
The City of Tshwane Vision 2055 Strategy	Town-Planning Scheme
The Public Open Space Framework (Volume 1: Status Quo Report)	Public Amenities By-law

The Public Open Space Framework (Volume 2: Open Space Vision, Policy, current Metropolitan and Regional Open Space Plans, and Local Open Space Plans in future)	Street trading by-law
The Public Open Space Framework (Volume 3: Implementation Strategies)	City of Tshwane Resident's manual on by-laws and legislation

Source: Author

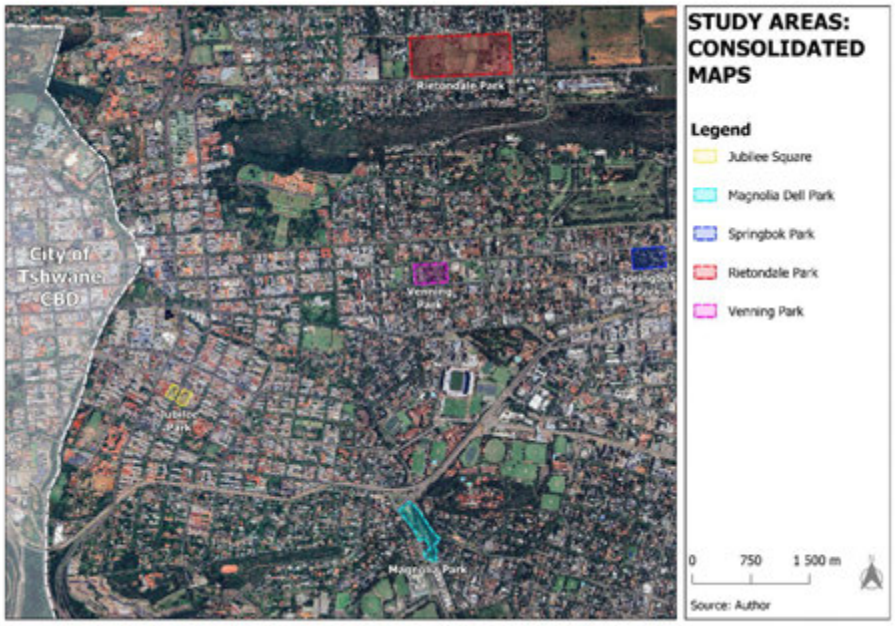

Figure 1: Maps of All public spaces under study

Findings:

Global Competition and Its Influence on Sanitising Public Space

Municipal officials seem to be facing structural pressures to produce peaceful and safe public spaces in the midst of existing and ever increasing global and capitalist pressures. According to Castells (1996), there are tensions that exist between globalisation, global competition, and local identity which affect planners and designers in their everyday quest to produce meaningful spaces. Mamdeli (2019) also argues that city officials are increasingly emphasising new versions of public spaces to generate and globally disseminate the promotional images that make their cities competitive. This is done in the name of attracting investment either through the tourism industry or private business and property investments. However, scholars

such as Allmendinger (2001) and Qian (2017) carry the assumption that these efforts of global competition are rationalised sanitisation, at the expenses of existing socio-cultural ideas and needs in public space.

In line with the above, interviewed officials indicate that they face pressure within their everyday working environment because of the need to provide locally contextualised public spaces whilst also chasing global titles in the name of performing according to global and capitalist standards. According to Lefebvre (1991), the conceived space maintains the hegemony of the ruling class by prioritising exchange value over use value, thereby producing abstract space. Unfortunately, the results of such prioritisation can easily lead to measures of sanitisation and over regulation. Furthermore, these global and capitalist aspirations shared by municipal officials have implications on what is produced in the material space, and how the material space is perceived and therefore managed as demonstrated by the responses below:

> In my experience, all those informal things taking place now in Jubilee Square, like the soccer and informal trading repeal the investors and kill the beauty of the environment as well. It does not look good for us, like we are not doing our job. We need to remove all those things if we want to attract investors there.
>
> (Jim: Parks and Horticulture, 2019)
>
> When you see other cities like Paris and Buenos Aires, they have nice looking public spaces … we went to Argentina for a tour as the division, and we want to bring back the things we saw there.
>
> (Mike: Parks and Horticulture, 2019)

The rationale shared by the officials above perpetuates the marginalisation of those who are already marginalised, for example, the homeless community, street vendors, and the poor. The ever growing anxiety over homelessness, trading and other "informalities" in the public parks of the City of Tshwane, is, therefore, related to the rationalities of beauty, investment, and competition as discussed by the officials. Moreover, it presents dilemmas in cities filled with a rich diversity of inhabitants with different spatial needs, wants, and desires, and which may conflict with the desires of the elitist few. According to Marais and Nel (2019), planners and designers find themselves in a space where rules, plans, and frameworks regarding urban space need to be drafted amidst such relativity.

With this in mind, it is apparent that processes of sanitising space in post-apartheid South Africa and, particularly, in the City of Tshwane should be analysed beyond the questions of inclusion or exclusion, black or white, the haves and the have nots, and move towards more empirical examinations of the powers, interests, institutions and ideas which govern and ultimately influence decisions of sanitisation. With such interrogation, the understanding of the drivers of privatisation, regulation, and sanitisation of space become more meaningful. This interrogation may also be useful in understanding certain imposed public space identities and their implications on broader global city pursuits. It is within this dichotomy between the city's aspirations and meeting the needs of the public that professionals need to navigate. However, as a result of this, we continue to witness an increase sanitising processes under the legitimised pursuit of global competitive public spaces and cities.

Polarised State Responses: Planning Contradictions and Forms of Domination

Neighbourhood socio-economic statuses have influenced the ways in which municipal officials respond to, and act on, certain matters. This is also seen in how law enforcement agencies handle informality. There are certain unspoken assumptions about certain neighbourhoods that

lead to officials treating communities differently. In the context of this paper, the planning contradictions in sanitisation processes are seen in the different treatment of the same activities in public spaces. For example, Jubilee Square's, located in a diverse predominantly black neighbourhood, showed an obvious presence of unanticipated trading, whilst Magnolia Dell, located in a predominantly wealthy white neighbourhood has the same. However, the views and acceptability of the two activities differ. In Jubilee Square, trading activities were frowned upon by the officials whilst the same activity was approached with empathy in Magnolia Dell Park. According to Ghertner (2011), the state responds differently to the rich and the poor. In rich areas, informal activities are dealt with in terms of legalisation, whereas in poor areas their response is violence. Such contradictions allude to the fact that municipalities respond to poverty and not necessarily informality. In light of this, the City of Tshwane officials lamented over the 'invasion' of street traders in Jubilee Square, and how they are destroying the image of the city and emphasising the need for their removal:

> On the streets and in parks of Sunnyside, they should be removed because we haven't allowed it, we haven't designed for it and even our policies don't allow it.
>
> (Rendi: Environmental Management, 2018)
>
> I would say remove them, simply because their presence there also influences littering and influences all sorts of other trading that you don't want to subject your kids or people who use the parks to. People are kind of naïve about what's going on around the park, and trading can conceal a lot of things. It's just better to remove them.
>
> (Leslie: Environmental Management, 2018)

The officials in this regard hold the power of producing a space according to their image. Ultimately, they pave the way for law enforcement to handle the issue on the ground and in many instances, through violence and public disgrace (Pezzano, 2016). The urban poor who attempt to salvage a living in the city outside the 'formal' market find themselves having to contend with hostile officials who are bent on sanitising the city (Bayat, 2004; Graham and Healey, 2007; Lindell, 2010; Steck et al., 2013).

Interestingly, although informal traders are also present in Magnolia Dell Park, officials did not indicate their disapproval of them there. Surprisingly, they communicated with empathy regarding the trading in the area. Jubilee Square traders predominantly serve the Sunnyside community with their goods and services. However, Magnolia Dell Park traders serve the tourists who visit the park. One can argue that the market being served has implications on the official's perception of the activity. This substantiates Campbell and Marshall's (2002) ideas which suggest that there is no single public and therefore, no unified public peace. Although trading was unwanted and clearly stipulated on the rules and regulations board when entering Magnolia Dell Park, the officials had different sentiments regarding the practice, as one official noted:

> So... the trading in Magnolia Dell Park is something we need to take into consideration...because they are trying to make a living and it probably activates that space a little more. The tourists can also see something different.
>
> (Longtom, Environmental Management, 2019)

It is comforting to hear a humanistic sentiment from the official regarding this particular activity. However, it was saddening that this sentiment was only directed to this specific space. Planning contradictions can be detrimental when officials refuse to acknowledge practices in a

just manner. However, in light of this, one may argue that such a response also indicates that there is a paradigm shift towards consideration of unanticipated activities in urban areas.

The unanticipated trading activity that occurs in public parks seems to be increasing in the City of Tshwane despite all the attempts to combat it. According to officials, they have been dealing with this phenomenon for quite some time. They discussed the different ways in which they have attempted to get rid of the traders in public parks or at least find a way to regulate them, even in different political administrations as is evident by the respondent below:

> What happened is that, with the previous administration, they realized that they needed to formalise the informal traders in order to regulate them. So, they built an area, a place here in the city. It is municipal structures and then we just rent [the structures] out to the public.
>
> (Motho: Environmental Management, 2018)

The statement above alludes to a particular method that the city has used in effort to clean up and sanitise public spaces. Moreover, it indicates that such a planning rationale exists alongside the political rationale because planning and politics are working together in the city to ensure the realisation of a globally competitive city that has been envisioned. Moreover, one cannot simply ignore the environmental degradation and health hazards prominent in the informal sector, as discussed by the respondents below:

> To me, the trading in Jubilee square is kind of unhygienic. They cook the food in the trailer or the tent, then they throw out the used oil just next to the trailer. Health inspectors must come and see what they are doing and even where they get their water from. I don't think the trading would pass the health test.
>
> (Leslie: Environmental Management, 2018)
>
> Some of these kiosks are on a trailer there at Jubilee, and they need to pull it on a bakkie or a car to move it, so now they move into the parks and they damage our irrigation and sprinklers.
>
> (Colt: Parks and Horticulture, 2019)

As noted from the quotes above, there are valid concerns pertaining to the use of public parks for unanticipated trading and these concerns are justified. Accordingly, the officials' responses towards this phenomenon can be regarded as well-meaning. However, the approaches that are suggested perpetuate the sanitizing tendencies. The notion of creating safe and clean spaces in urban planning should be sensitive to function and quality of life, not merely aesthetic, and image. Mandeli (2019) argues that public spaces should progress beyond ruthless functionalism and aesthetic concerns in the global south. In moving forward, there is a need for planners to be well aware of how people on the ground survive, how livelihoods are stitched together in public spaces and in what ways planning can positively reinforce the positives of these phenomena. It is imperative to study the practice from those practicing it and to refrain from seeing the task of sanitising informality as an elite project that is reserved for technical experts.

In Space but Out of Place: Homelessness as a Complex Sanitisation Motivation

Homelessness remains a persistent social issue throughout the world. This is also the case in the City of Tshwane (Brand, De Beer, De Villiers and Van Marle, 2013; Kriel, Tembe, and Mashava, 2017.) The officials in the city of Tshwane were very eager to discuss the homeless community, how they make use of public space, and their general sentiments towards the rising phenomenon. It was clear that all officials were aware of the significant presence of homeless

people in parks in the city. The general consensus was that homeless people should not be there and that they were out of place as echoed by the officials below:

> These vagrants have such a big impact on our parks, we are on the break of doing a redesign of Springbok Park which is a monument. Because people won't use it anymore. They don't feel safe in the park because of these vagrants, we don't want Jubilee Square and Magnolia to also end up like that.
>
> (Colt: Parks and Horticulture, 2019)
>
> When people visit the park, we don't want them to think "someone will break into my car whilst I am here". Vagrants are just a threat
>
> (Mike: Parks and Horticulture, 2019)

Contrary to the above quotes, scholars such as Baron (2015) argue that this threat in South Africa is merely a perception constructed by the dominant groups and cultures in society and that it does not mimic reality. Furthermore, it is used as justification for the privatisation of space of bourgeois cleanliness. However, in a country like South Africa, one may argue strongly against such a proposition. Crime rates in South Africa have continued to rise steadily since 1994. In 2020, South Africa was rated as the third highest in terms of the crime rate in the world (Crime Index, 2020) following Venezuela and Papua New Guinea. Moreover, scholars in the domain of public spaces and sustainable neighbourhoods in South Africa have also written extensively on the impact that crime has on the use of public spaces (Breetzke, 2010; Kruger et al, 2017; Landman, 2017, 2019; Mavuso, 2016).

Accordingly, it was not surprising that the officials would view the homeless community as predominantly made up of criminals and, therefore, consider them not welcome to share spaces with mainstream society. Their views on homelessness and its prevalence in public spaces was not only shaped by their professional ideas of aesthetics and order, but also because of the overall perception of the homeless community as shared by society. According to Kriel et al (2017), most people who are homeless are treated with suspicion, alarm, annoyance, and fear in the public spaces that they occupy. This is rooted in the stigmatisation of poverty. The urban poor who have homes to live in, are "out of sight" and, therefore, "out of mind". However, the homeless are unfortunately often in plain view and therefore, subjected to this harsh stigmatisation justifying sanitisation processes.

During focus group discussions, officials often referred to themselves as civil servants who work to please their customers. Moreover, they discussed how they need to ensure the safety and peace for the communities they serve. An official in particular mentioned that they received pressure from various communities regarding the removal of homeless people in parks, and as a way to maintain the peace, they need to respond:

> Communities come to our office, requesting that we take care of the vagrant problem in their parks. That puts us in a very difficult position because we get complaints from the public all the time. For example, Rietondale community has approached us. Look at the state of the park, how can you allow the vagrants, it's not safe for them to stay there, it is not hygienic for them to stay there, how can you allow it. It is not a question that we are allowing it, we can do nothing about it because we don't have shelters for these people.
>
> (Shane: Parks and Horticulture, 2019)

As alluded to in the quote above, communities have certain expectations of their public spaces, and officials are seen as the people who should deliver on these expectations. Officials lament on how communities expect them to regulate the homeless community's presence in public spaces. However, according to them, this is the task of the Metropolitan Police Office. Officials argue that it is their duty to draft by-laws and institutionalise them. However, it is the task of the metro police to enforce those by-laws. This lamentation is not surprising because scholars such as du Toit (2010) have argued that local governments tend to see homelessness as an issue outside their jurisdiction because it can be ascribed to individuals' lack of affordable housing or their individual moral failure and, therefore, should be the responsibility of law enforcement:

> Come on, we do not have the power to arrest these people or even give them fines to get them out of the parks. That is what the metro police are supposed to do. I will see them in the park, like all the time in Jubilee, but I will just pass like any other person.
>
> (Longtom: Environmental Management, 2019)

According to the City of Tshwane Metropolitan Municipality By-Laws Pertaining to Public Amenities (under the section of loitering and prohibited action), "it is illegal for anybody to be homeless and perform actions like begging or being on the streets without a home to return to" (Environment and Recreation Management, 2014 as quoted in Kriel et al, 2017: 433.) The by-law statement above can be regarded as problematic because of how it explicitly discriminates against the homeless.

The criminalisation of homelessness, informal trading, loitering, and unauthorised gathering (Landman, 2019; Middelmann, 2020; Nkooe, 2015) depict the attempts that were made to cleanse the public spaces from disorder, to create and maintain peace. For instance, the regulations on loitering, as per the City of Tshwane Metropolitan Municipality By-Laws related to public amenities (City of Tshwane Metropolitan Municipality, 2010) state that no loitering or lingering by the general public is permitted in public spaces. In this regard, loitering becomes an activity that infringes on the desired public space order as conceived of by local authorities.

With the above in mind, the control of public spaces in the city, as represented by the by-laws, prove to be a violation of the homeless community's democratic right to enjoy state provided public spaces (Lefebvre,1991). Moreover, it can be regarded as an attempt to sanitise space and display an image of "public space neatness" whilst institutionally hiding the brutality of rigid urban space controls. However, one can also argue that the concerns regarding the presence of homeless people in public spaces and their use of the spaces are not completely unwarranted. Unfortunately, the homeless community is not made up of a homogenous group of people with the same socialisation, aspirations, and view of life. Thus, they cannot be discussed as such (De Beer, 2013). The officials are aware of this, and also indicate that this makes their task to design, develop, maintain and regulate peace in public spaces that much more difficult. For example, the officials argue that they need to navigate between protecting the rights of all urban citizens whilst also maintaining safe public space, to attract and maintain investments and to decrease the deterioration and vandalism of public infrastructure as echoed by the following respondents:

> Yes, they have the right to use those spaces, it would be nice if they could use it like all other people. But they don't only use it exercising the democratic right, some of them actually have got this urge to break something. You can use it; we can't complain if you use it. We complain if you break it.
>
> (Jammy: Parks and Horticulture, 2019)

> In Jubilee we've got the outdoor gym and the homeless people come and steal everything that they can take for scrap metal so we can't keep advocating for them when they are destroying everything.
>
> (Jim: Parks and Horticulture, 2019).

From the quotes above, it is clear that the officials are not against the use of space by the homeless, therefore, not maliciously advocating for their exclusion. They are merely against the vandalism that they have witnessed. Bergamaschi et al (2014), mentions that once a person has lived on the streets their former identity disappears and they form a new identity based on their situation and as such, many act and engage in activities that they normally would not, for example, the unwarranted vandalism as explained by the officials above. From the focus group discussions, it was made clear that the harsh by-laws pertaining to the homelessness phenomenon in public spaces came into being as a result of such activities. The officials were also adamant that the locking up of public abolition facilities in parks in the city was a decision taken because of the criminal activities that would take place, as well as the homeless people who would sleep in them as one official noted:

> I don't know how to handle the question on access to toilets, it is very difficult. You find that parks that have toilets end up being a very scary park. Because homeless people will hide in the toilets, you go there and they ambush you because you don't know what happens in the toilet. So we are trying to manage, that but unfortunately it is creating problems but we still don't know how to handle it.
>
> (Rendi; Environmental Management, 2018)

The decision made by officials to lock up toilets in the public parks deals with the issue of crime, safety and illegal occupancy which are highly prioritised matters. Unfortunately, the trade-off is that society's experience of public life and comfort becomes constrained. Officials also indicate that the other alternatives could be the introduction of a payment system where individuals could pay a certain amount to use the facilities. However, the question that kept recurring was "what about those who cannot afford?" One participant mentioned that:

> Public toilets are a problem in the city, not only in the public spaces you are researching. The city is now stinking because of this. So every night we have people that go around all corners spraying chemicals. It's costing the city a lot of money. We are saying build more toilets and have a lady at the entrance charging R1.00. But then again, how can you charge a homeless person R1.00 to use a toilet when he has nothing.
>
> (Oupa: Integrated Development Planning, 2019).

The concern raised above by the official is a valid one. Moreover, the introduction of payment fees to enter and use the toilet has direct exclusion implications for the less privileged. However, it is clear that the first priority in public spaces is safety and restrictions which function to protect society. In light of this, officials recognise that there is more that still needs to be done to ensure safe public spaces for both the homeless and other members of society. Their approach leans towards soft governance measures that can be interpreted as over-regulation of the public space. According to Carmona (2010), public space can be placed into two broad classifications in contemporary society, either being over-managed or under-managed. In this situation, the officials either under-manage by insisting that there is nothing that they can do in a situation and, therefore, the spaces are left neglected and invaded. On the other hand, they over-manage by proposing measures that result in exclusion, access control, and sanitisation. The homeless community in the City of Tshwane continue to be at the mercy

of the officials, their urban policies, by-laws and law enforcement agencies. Whether it is in the name of preserving the image of the city, sanitising space, protecting civil society or attracting businesses, the homeless communities' right to the city and their place in the production of democratic public space remains contested amongst an array of competing interests.

Conclusion:

This paper explored the ways in which public space ideas, perceptions, and desires are conceptualised in the City of Tshwane from the perspectives of technical practitioners and those in decision making positions. It explored the thinking and rationale behind the plans and policies that we see in the pursuit of peace in public space and the contestations thereof.

Using the concepts of sanitisation and conceived space, the paper revealed that the officials involved in public spaces in the City of Tshwane do not work in isolation, nor are they immune to the social, political, economic and global factors, which inevitably influence their decisions. Officials find themselves having to constantly construct and deconstruct their identity as 'technical professional' and 'civil servant' in rationalising what is order, peace and safety in public spaces. The paper locates the conflicts and contestations between global competition, planning contradictions, forms of domination and fixation on universal standards as phenomenon's perpetuating the continuity of sanitised spaces in the city. Lastly, the paper discussed the complex problem of handling homelessness in public spaces and how sanitisation practices are seen as legitimate, in processes of maintain peace in communities. The justifications of such rationalities lie in the conceived space which is supported by the measurable variables of health, public safety, security, sanitation, and environmental protection as emphasised in the physical design and legal controls of public spaces. However, the unintended consequences of such practices result in the control and suppression of minorities, the creation of societal divisions, and the perpetuation of classism. The concept of peace and how it is pursued by municipal officials in public space presents conflicts when interrogated in terms of whose peace and with what sacrifices.

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Analytical study of hospitality culture and urban identity and its impact on the future of marine tourism in Red Sea coastal port cities: case study of Jeddah Saudi Arabia.

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Abstract:

This paper discusses the oldest and most important port city in the Kingdom of Saudi Arabia focusing on the impact of modernity on development that occurred in the architectural and urban spaces in contemporary passenger ports in the city and their historical comparators. Contemporary passenger ports in the city are supposed to reflect the identity and spatial, cultural, and social heritage of the port cities in the Kingdom. The passengers' experience and view of the culture and identity of these port cities is discussed within the context of the non-place theory (Auge, 2010). This paper will present a comparative study method based on literature review and personal interviews of cruise visitors' experiences, evidenced and measured through different taxonomies (envelops). The study particularly focuses on the forms of architectural building space and the users understanding and interpretation of these spaces created during the arrival, visiting and departure process, resulting in a critique and dialogue between past rituals, culture, and future aspirations.

Key words:

Port cities - Culture – Hospitality spaces – Passenger experience - Maritime architecture- Jeddah.

1. Introduction

This paper focuses on contemporary passenger ports in Jeddah, Saudi Arabia and their handling mass tourists and pilgrims and reveals and considers the types of practices taking place in architectural spaces in contemporary passenger ports in the city. The paper compares these with the past to propose what ports could look like in future within the context of the 2030 Vision of the Kingdom. The paper explores the influence of modernity in the development and evolution of architectural space and contemporary passenger ports in the historical port city of Jeddah, looking at these architectural spaces thorough the theoretical lenses of place and non-place to understand the effect on the passengers' experiences.

Through study of the concept of "non-place" and how modernity affected forming bonds of familiarity between the traveller and place in contemporary ports, the paper raises questions of how to create an identity for each user who can then develop an intention to return, based on their experience. This paper presents findings based on the concept of 'then' versus 'now', incorporating a comparative study between an historical literature review and personal contemporary interviews that charts the evolution and development of hospitality in Jeddah. This is designed to identify developments and changes to spaces of hospitality over time with a particular focus on the forms of building and architectural building space, unpacking the users understanding and interpretation of these spaces.

Non-place theory provides a theoretical framework for understanding why we perceive places as we do, proposing that anthropologically formed spaces began to recede after the rise of modernity and supermodernity, which led to the loss of identity, history, and social relations and the emergence of the banal non-places, often associated with spaces of transit and movement. (Auge, 2010) argued that non-placeness boils down to self-similar, unremarkable places where some sort of process based, spatial patterning process occurs. The non-place is designed for a specific purpose, such as an airport, train, or bus station. In addition, the familiarity with the typology of experience between the user and the place, regardless of where the users are going, it's important to recognise and understand the various specific criteria shaping experience in these spaces. Sequencing and ritual filter the users through processes, places, and systems that are not of their choice. The user is an integral part of the rituals of arrival, transit and departure that nowhere involves a personal relationship with its users. There are several reasons why theories of place and non-place are essential to this study. Contemporary passenger ports are both a characterization and visualisation of non-place, creating a kind of architectural spatial identity in port cites. Understanding and taking a theory and applying or testing it in place and space creates a connection between the theoretical approach to enable development of design frameworks; finding the boundaries of possibilities of the future ports that makes the conditions of place and non-place connect better through design.

1.1 Background

The Red Sea ports form a link between East and West trade, the oldest and most important of which is the Islamic Port of Jeddah in the city of Jeddah. Historically Jeddah port was famous for its hospitality and reception for pilgrims, Umrah pilgrims and visitors (Mawani, 2021). It was a major centre for the Hejaz trade and a safety crossing for travellers since ancient times, and it played a major role in reflecting the spatial, cultural and social identity of the city of Jeddah as well as being known as the Gate of Mecca and the Gate of Holy Mosques.

Jeddah was included in this study as a case study for several reasons. Jeddah city is the oldest and the largest port city in the kingdom, the poet Taher Zamakhshari, called Jeddah 'Bride of the Red Sea' (Zamakshari, 1987) and it was later known by this name and also locally called Al Balad. The unique and strong architectural identity of the historic city supported a strong hospitality culture. In 2014, the Historical Jeddah in Jeddah city was classified and included in the UNESCO List of World Heritage Sites, confirming its cultural heritage and global significance (UNESCO, 2014).

Vision 2030 stated that the Kingdom of Saudi Arabia is committed to strengthening its distinctive heritage and historical identity in all spheres, particularly in tourism, and it desires to encapsulate this identity in all areas of development through vision's projects and programmes (2030, 2017).

Tourism in the Kingdom has improved significantly since the launch of Vision 2030. According to the Ministry of Tourism statement, the total number of tourists for all purposes only in the first half of the year 2023 reached 53.6 million, including 14.6 million international tourists and 39 million local tourists in the Kingdom. The Kingdom ranked first in the G20 for the growth of international tourists. KSA Vision 2030, focusing on strategic goals and programs through approved implementation plans guided by pre-defined goals and key performance indicators(arabiya, 2023, Tourism, 2024).

Among the most important of these programs, which represent a direct relationship within the current study, is the Public Investment Fund and Quality-of-Life Program to develop the tourism sector in the Kingdom and to contribute to strengthening the Kingdom's position as a global tourist destination. Infrastructure and real estate development, development of significant projects and formation of international strategic partnerships have resulted accordingly (Vision, 2017a, Vision, 2017b, 2030, 2017).

The Public Investment Fund was launched as one of the programs to achieve Vision 2030, which works to achieve the goals of the vision by working on a targeted mechanism that contributes to the launch of new sectors and companies. The Fund launched the Saudi Cruise Company in line with the Fund's 2021-2025 strategy, which focuses on unleashing the capabilities of promising non-oil sectors, enhancing the Kingdom's efforts to become a tourist destination on the map of international tourist cruises, and developing the tourism sector in line with the Kingdom's (2030, 2017).

On the 29th July, 2021 Saudi Cruise Company established with the launch of the Kingdom's Vision 2030, and it is responsible for the development of this sector. Saudi Ports Authority (Mawani) and the Saudi Cruise Company inaugurated the first terminal for cruise ships at Jeddah Islamic Port (Mawani.gov.sa., 2021, Mawani, 2021). The size of the cruises arriving into the port has been increasing since then, targeted to reach one million tourists by the end of 2025. Through this collaboration between government and industry to develop the area, the tourism and cruise sectors have seen significant growth recently.

Contemporary Jeddah Port is going through significant development to accommodate cruise liners and their passengers as an outcome of this. During the year 2023, Cruise Saudi received more than 170.5 thousand cruise tourists representing 120 different nationalities on 65 trips aboard 16 ships belonging to 11 international cruise companies (CruiseSaudi, 2024, newspaper, 2024)

2. Methodology:

This study uses a mixed qualitative methods approach which began with a literature review, focusing on historical Jeddah as a port and the visitors' experiences of Jeddah city. Additionally, reviewing appropriate literature sources allowed conceptualisation of the spatiality of the port such. This included *Non-place*, (Auge, 2010), *The image of the city* (Lynch, 1977) and *Space and Place theory* (Tuan, 1979). Subsequently a series of semi structured interviews were undertaken with stakeholders and users of the port, which generated a series of outcomes including interview transcripts and the drawing of mind maps. This material was then developed into word clouds to identify focus key themes (Figure 1).

The literature review and the semi-structured interviews that chart the evolution and development of hospitality experience in port city in Jeddah, identify developments and changes to spaces of hospitality with a particular focus on the forms of building and urban space that have been created over time.

Qualitative data was considered one of the best methodological approaches in this study, which is used to identify multiple ways for analysing a group of people's behaviour and ethics. Furthermore, it facilitates the necessity for a detailed understanding of people, their behaviours, and their perspectives. Linda Groat had argued that providing qualitative research into user needs, cultural context, spatial experiences, and socio-environmental dynamics can contribute to the enhancement of design processes (Groat, 2013).

The research is designed to focuses on a deeper understanding, interpretation, and contextualization of data, so that researchers can identify nuances, patterns, and relationships that may not be easily quantifiable. Based on Creswell and Poth, (Creswell and Poth, 2016) this can only be accomplished by participating in their lives and visiting their homes, workplaces, and excursions. Moreover, to be able to evaluate how people interact with each other and their stories in society, which can sometimes be challenging to comprehend due to its complexity, it conveys the information in a flexible literary style that can provide insight into the contexts and settings in the study of a particular problem or issue; also, emphasis is on developing theories that have not been adequately narrated.

Figure 1 : An extract of words from the transcriptions of the interviews was used to generate a word cloud the by the Author.

3. Discussion of 'envelopes'

This paper develops and frames conceptual the idea of 'envelopes' of historical, contemporary (and future) hospitality. These envelopes divided into multiple themes, each focused on a particular area of research. In the beginning, the history and legacy review addressed a series of three different envelopes that observed spatial, cultural, and visual aspects during that period of time, then compared them with current experiences through narrative stories in the interviews. Aids in unpacking each theme of envelopes were based on a number of taxonomies; rituals, hospitality and customs within the cultural envelope, landmarks, architectural façade and ornamentation within the visual envelope, and proximity (or distance) of inhabitation and relationship to climate within the spatial envelope (Figure2).

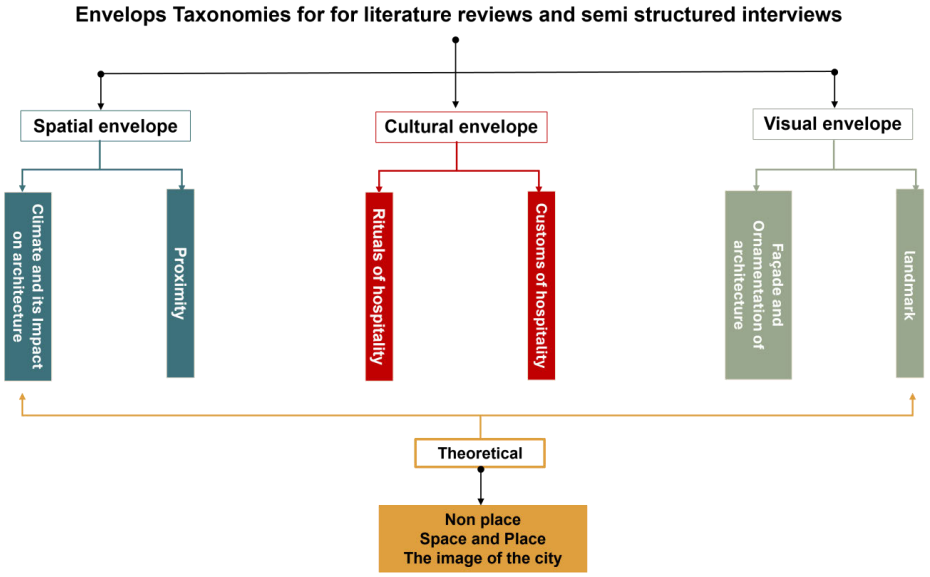

Figure 2 : General methodology diagram by the Author.

3.1 Spatial envelope:

3.1.1 Climate and its Impact on architecture:

The location of the city of Jeddah in the middle of the Red Sea has played an important part in its prosperity and expansion in urbanisation, as it was considered the connecting point between production centres and international and local consumption areas until it became one of the most important ports in Hejaz. Moreover, the architectural and cultural character of Jeddah is primarily influenced by its geographical location. This region is affected by high levels of humidity most days of the year and this usually rises at the end of summer (late August to early October), when the sea temperature is at its highest (Najib, 1987). Summer is generally characterized by higher humidity levels than winter (Division, 2005).

According to (Al Jaziri, 1962) the city of Jeddah witnesses' changes in the winds during the day, referred to as sea breezes. The north-westerly and western winds are the ideal winds due to the cooling effect they have during the summer (Al-Lyaly, 1990). All of these factors significantly affected the urban planning of Jeddah and the architectural design of exterior and interior of buildings' spaces to achieve the greatest benefit from good ventilation and coolness during the summer period, considering it to be the longest season during the year by 50% (Figures 3-5).

Figure 3, :Layout of Old Jeddah map (Abu-Ghazzeh, 1994).

Figure 4: Old Jeddah showing the wall, and the Sea edges. (Abu-Ghazzeh, 1994)

Figure 5 : The contemporary city of Jeddah made of gridiron patterns with the Old City at the centre. by (Mahbub

Historic iterations of urban space in old Jeddah worked with environmental forces in a more direct way, where the sea breezes had value in regard to the city design and the architecture. The city was designed and built in such a way that, with respect to the waterfront, sea breezes were captured to maximised their cooling climatic benefit. Thus, Jeddah in the past served as a port city, where the sea meets human settlements, directly connecting nature with culture via its urban plan and architecture. Although the city of Jeddah is situated in a semi-desert coastal area, which directly influences its atmosphere, its residents were more aware of their surrounding environment. Their structural system for the city was designed to attract cold north and northwest winds during the summer months.

This climatic relationship has significantly changed. Contemorary iterations of urban space and architecture in Jeddah relies on air conditioning and climatic control systems, which separate the inhabitants and tourists from engaging with the true nature of the area. This shapes the tourist's experience. Interview responses indicate that the process of passengers arriving in the city via Jeddah Islamic Port goes through several stages, all of which depend on temperature controlled environments all the time, starting from disembarking from the air-conditioned ship, all the way to their destination. Essentially, it means that the value of these temporal climatic effects of the coastline are now about their removal, rather than their celebration.

3.2 Spatial envelope:

Proximity:

History of Shuaiba Port and the Origin of Jeddah Port: Until 646 AD, Al-Shuaiba, nicknamed the Port of the Ship Cemetery, was the port of Makkah until people complained about the damage to ships from this port due to the large number of coral reefs located near Cape Black, located about 50 km south of Jeddah, near the confluence of Wadi Fatima in the sea. From this point on, Jeddah was adopted as a port city and outpost for Mecca in 646 AD, where it began to grow because it was taken as the main entrance to the city of Mecca during the Hajj and Umrah seasons, supplemented by trade movement (Shuaib, 2020).

In the tenth century AD 901, the city of Jeddah became a prosperous port and was described as the treasury of Mecca, Yemen and Egypt due to the abundance trade movement. The port of Jeddah continued to grow as it received ships loaded from Aden. These ships unloaded their cargo and then transported goods by private ships in the Red Sea to other ports such as the port of Al-Tur and Eila, due to the significant number of coral reefs north of the Red Sea, which large ships could not cross due to their large size. In the fifteenth century, it became one of the most important ports in the Red Sea due to the arrival of Indo-Sino ships. As a result, Jeddah became a prosperous international port. In 1514 Hussain Al-Kurdi built the port of Jeddah, including several residences and two large yards for storing goods coming by sea from ships.

In 1805, the explorer, Viscount Valentia, visited the port of Jeddah to discover whether European ships could dispense with the Red Sea. He described the port of Jeddah as having many coral reefs that extend nearly four miles from the shore and reach the deepest of which is 22 meters, valid for entering large ships, and ships can only enter with the guidance of sailors. The traveller Tamisier described the port berths during his visit to Jeddah in 1834 as several longitudinal beams completely covered by wooden panels made of teak. During a visit by Russian officer Dolchin in 1898, the port was so strong and robust that it was even suitable for warships. The port of Jeddah has been distinguished since ancient times by its natural immunity represented by the coral reefs, which made it difficult for ships to enter the port, and it was impossible to enter the port after the afternoon without a guide. Therefore, ships do not enter or exit it except during the day (Al-Amayreh, 2007, Al-Ghamdi, 2021).

The port had several facilities, such as customs and commercial stores. Over time, it went through several stages of restoration and rebuilding due to climatic conditions and events including water torrents that flowed into the Red Sea and the high humidity due to its proximity to the sea. Port facilities were the focus of the rulers' attention during the Ottoman era because of the high economic income they generated. He renovated warehouses due to damage to commercial funds in 1872 to build new stores. In 1883, the General Secretariat of Customs submitted a request to build dilapidated warehouses within the customs administration in Jeddah.

By the mid-1950s, Jeddah had become an established international port (Figures 6-9). Punt was considered the first port for pilgrims, and visitors to enter the city of Jeddah until it was built in 1867. It consists of three vital facilities, which are "Al-Iskala", "Al-Karantina" and "Al-Hajjaj Customs". The Karantina section was the medical examination for pilgrims and visitors to ensure they were free of contagious diseases. This building stopped working in the mid-fifties to transport all facilities to the Jeddah Islamic Port (Al-Thaqafi, 2015).

Figure 6 :Old Jeddah port (Al-Bunt)1950-1955. (Traboulsi, 2008)

Figure 7 :Old Jeddah port (Al-Bunt) Port Terminal(Al-Iskala)1950 (Traboulsi, 2008)

Figure 8 :Old Jeddah port (Al-Bunt) First pier1950.d. (Traboulsi, 2008)

Figure 9 :Old Jeddah port (Al-Karantina, and PilgrimsCustoms1950. (Traboulsi, 2008)

Figure 10: Old Jeddah port map (Al-Bunt) that illustrate the tow points of proximity between the port and the City. (Al-Thaqafi, 2015) edited by the author.

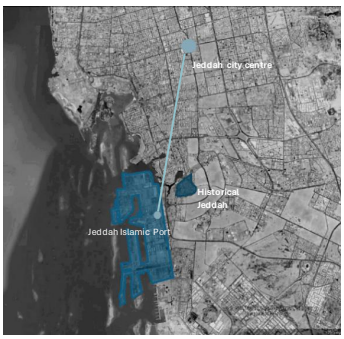

Figure 11: Current map of Jeddah that illustrate the tow points of proximity between the port and the central Jeddah. Google Map edited by the author.

Historically the proximity and location of the port connected it to the city's heart, according to many travellers' narratives and pictures. Thus created a kind of connection between the city's edges and the city itself, including its landmark, its identity, its streets, its paths, and its districts. As a result of the proximity in space and the move from the edge to the heart of the city, it achieved one of the most important elements of the Sense of Place theory by Yi-Fu Tuan (Tuan, 1979). Emphasising creating an impact on the place on human interaction and attachment, creating memories of this experience that lead to connection to the place.

This historical reading and experience of arrival in Jeddah significantly differs from contemporary readings of transit spaces captured by Auge's concept of non-places. The factors shaping diametrically different character of contemporary spaces of arrival underpin this research. Why are contemporary spaces of arrival now non-places that do not motivate their users to build social interactions? These non-places are characterized by forcing users to move within specific parameters to experience in these spaces, which leads to feeling of anonymity and separation from his surroundings and other individuals (Auge, 2010).

A factor raised by interviewees mentioned the time and distance it takes to get from the ship to the station and then to the destination itself, which goes through several stages using modern transportation methods. This can cause a delay in the customer's immersion in the experience of the port city and can occasionally lead to disorientation. Historically, there was a similar time taken in transportation phases between sea and land, but the differences were in the speed of immersion in the experience and the distance between the port station and the city centre. Auge's (Auge, 2010) described this as evidence of modernity's influence on spaces and the reason for the loss of identities of users and spaces as well. Even though some of these specific parameters were present at that time, the surrounding environment and proximity to the heart of the city mitigated the feeling of them. We conclude from the above that there are similarities and differences regarding proximity. The contrast is that things used to be compact, and now they're extensive. While the similarity included in rituals of moving through the experience, regardless of the difference in the visitor's immersion in the experience (Figures 10-11).

3.2 Cultural envelope History

Rituals, and customs of hospitality:

Local residents have long used the port as a major source of income and trade from the Red Sea in the form of ships coming from the Mediterranean Sea carrying ivory, feathers and sandalwood and serving pilgrims (Figure 8). Consequently, residents of Jeddah speak different languages due to their close contact with non-Arab merchants, visitors, and pilgrims. As a custom Jeddah was converted into a 'factory' of hospitality where all its residents worked in serving the pilgrims in order to provide the service, and to make a living from their service, as houses turned into caravanserais. Jeddah's historic homes are designed to be accommodate pilgrims until they leave the Holy Land and after they return to continue the sea journey that returns them to their homelands.

Historically the Arabs custom of hospitality is three days of hospitality of course. It is possible for the guest to stay for a longer period of time than this, but the guest has the right to full hospitality during this period.. Hospitality is known as Hafawa, which is the highest form of generosity, welcome, and attention to the guest in the Arabic language, evident in their daily practices, their poems, and stories told. As the first commercial gate and been the main sea crossing serving the holy sites of the Kingdom of Saudi Arabia, Jeddah city has served as an applied example of Hafawa.

Those passing through Jeddah had several options and rituals of hospitality if they wished to stay. They could stay in Khan or Ahwash, which hosted visitors, or they could stay in residents' homes called Almabet, a ritual familiar to Jeddah residents. Almabet consists of a room located on the upper floors of the houses to provide privacy for the visitor and the people of the house, as was narrated by the traveller Tamizier 1834, where he said (we were accommodated in a beautiful house with a location overlooking all the roofs of the houses adjacent to it). Walls are usually built of wood to allow the maximum amount of air to pass through, as is the house of Noor Wali, in which the dorm rooms are located on the third floor Figure 13.

Where the first area is located in the northwest corner of the floor, its area is 7.55 square meters by 3.74 square metres. This room is divided into two parts by an ornate wooden partition consisting of three bent wooden columns linked to each other at the end by three arrayed arches. The architect constructed the north and west walls of the room out of wood rather than excavated stone to allow an air current to arrive and relieve the loads on the foundations. The room in the northeast corner has a large facade and measures five meters in width of Roushan Figure 12,13.

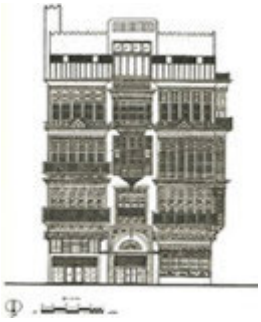

Figure 12: Elevation of Noor Wali home one pf the hospitality home_in Jeddah. Architecture in the Ottoman era. prepared by Nibur Architecture in the city of Jeddah in the Ottoman era, by Dr. Abdullah Al-Thaqafi

Figure 13: Plan of Almabeet in third floor at Noor Wali home one of the hospitality home_in Jeddah . Architecture in the Ottoman era. prepared by Nibur Architecture in the city of Jeddah in the Ottoman era, by Dr. Abdullah Al-Thaqafi

As narrated by the traveller Tamizier in 1834, when he said: “We were accommodated in a beautiful house with a location overlooking all the rooftops of the houses adjacent to it’’ (Al-Thaqafi, 2015). As well as Philby describes his journey and hospitality in the city of Jeddah In his book, The Heart of the Arabian Peninsula. Philby entered the door of that big house that welcomed them from its balcony and went up two floors to welcome and meet them on the stairs of a person whose rank is no less than the ruler of the city, who is Sharif Mohsen. Sharif Mohsen grabbed Philby's hand and then led him into his private reception room, in which he sat next to him on the porch furnished with pillows next to the window, and he gestured with his hand to my companions to sit in the corners of the room and then asked us for coffee (Philby, 1922-2009).

From the above, we can observe the strength of social construction, which is reflected in the rituals, customs, traditions, and societal norms of Jeddah. The culture of Jeddah city as a port city has a distinctive heritage and identity, which is unique among port cities along the Red Sea. The city of Jeddah is known by many names, including the port of Mecca, since it is its sea gate. Residents have a reputation for their custom of receiving pilgrims and visitors from the port as soon as the ship docks there. Hospitality persists through rituals that provide for the guest, including food and drink, and a place to stay in their homes until they leave. Consequently, these values, rituals, and customs contribute to a visitor's sense of identity and belonging to a particular place. Thence, promoting emotional connections between visitors and destination establish meaningful social interactions spaces. Performing these rituals and customs created a sense of familiarity and physical experience for the visitor, which was chronicled and recorded by foreign travellers in their writings.

At the present time, it is clear that the Kingdom is keen to emphasize the rituals and customs of hospitality in the tourism sector as a mechanism that contributes to attracting tourists. Several interviewees indicate that Historic Jeddah is a top-selling tourist destination because of its historical and cultural significance. Many of them agreed that capturing the cultural and heritage identity of the city of Jeddah, plays a vital role in tourism experience. According to some of them, tourists expressed a desire to return to Jeddah for a longer period of time, as well as to visit the historic city again.

3.3 Visual envelope History

Facade and landmark of architecture form impact on the visitor experience:

The taxonomy of facades of architectural forms and landmark is presented in this envelope. It frames the concept of "imageability" in the city of Jeddah as well as the importance of the architectural characteristics of the city in influencing the tourist's experience. This highlights the most significant architectural visual elements, including facades and ornamentation that created visual interest and variety in the built environment, and which were praised by foreign tourists.

Historical Jeddah has a distinctive architectural character and facades that includes iconic elements of the city's most important fortification system, the wall that is visible from the city's entrance as a first-land mark. Built in 1509 AD, the wall features five sides and three main gates serving as entrances and exits to the city: Bab al-Madina in the north, Bab Mecca in the east, and Bab al-Bahr, also known as Bab al-Bunt, in the west, facing the sea(Ismail, 1997).

Jeddah's architects had consistently focused on building facades and ornamentation incorporated and illustrated into the Rawashin and Mashrabiyas as geometric and plants motifs. Architects design the building facades and add the ornamented Rawashin in order to provide beauty to the rest of the parts of the city, reflect its identity, and give a cohesive sense of the city Figures 14,15. Rawashin and Mashrabiyas are the most important architectural statements that distinguished the facades of the city of Jeddah.

Figure 14: The façade of Rawashin in old Jeddah residential houses.(AL-LYALY, 1990)

Figure 15: The façade of Rawashin in old Jeddah residential houses at present time.(2022)

These architectural huge windows serve not only aesthetics but also satisfy the public's taste and provide privacy for the users. Jeddah had numerous visits by foreign travellers and Arab historians because of its status, geographical location, and openness to the whole world, who in turn provided a description of their visual experience of the city of Jeddah and what its buildings looked like and the places of hospitality in which they were hosted. As the first traveller to visit Jeddah at the beginning of 1806, he described the houses as beautiful, gigantic, beautifully decorated, and with large and numerous windows (Roshawn) overlooking the north and south.

Based on writings by the traveller Burkhardt, he described the buildings of Jeddah as well-built, built of square-shaped stones, most of which come from the Red Sea coast (Mangabi, Coral stone), and each house has two floors. Most have windows with wooden covers, and some have arched doors.

Tamisier observed that Jeddah's houses were constructed from rock blocks with a characteristic white colour, which were transported from the sea specifically for this purpose, and their windows were decorated with wooden panels. These houses were well ventilated, spacious, and clean. According to French traveller Charles Didier, the houses of Jeddah and their architectural style are very beautiful, and he described them as a rare style in the countries of the Islamic world. In addition, he mentioned that their architectural design depends on the continuity of the inside with the outside while preserving the privacy of those inside the building due to the design of the windows, which are covered by finely crafted wooden brocades (Ismail, 1997) (Figures 16,17).

Figure 16: On one of the facades of the northern wall of Jeddah, one can see the houses of the city of Jeddah, including the home of Sharif Muhanna(Bakr, 2014).

Figure 17: The waterfront of Jeddah's old port, Al-Bunt, one of Jeddah's landmarks.(Bakr, 2015)

In light of the above, many travellers agreed during their visits to Jeddah, at different times, on the extent of the cohesion and sequence of the visual experience of the image of the city of Jeddah. Jeddah's architectural language, which extends from it's the port as a major landmark to its building facades and landmark, significantly influences visitors' experiences in the city. This demonstrates the strength of the city's architectural and spatial character, as evidenced by the facades and landmark of its architectural forms. Through its architectural facades and ornamentation, the city not only reflects the identity of its residents, but it also fosters a sense of belonging among visitors. This visual communication significantly enhances the imageability and memorability of the visitor experience. Additionally, visitors used it as a landmark to signify their arrival at their destination.

Landmarks are the brand of the city, while architectural facades are a language of cultural exchange that reflects the identity of the coastal city. Although they are two symbiotic factors that contribute mainly to attracting tourists, they differ in the way they are read and received visually by the visitor and tourist (Lynch, 1977). This attributed to the difference in scale between each of them, where landmarks are often looked at from a distance and seen as a whole or as a shape, while the facade is viewed as the building envelope within urban space.

At present, industrial interfaces for logistics services in ports have become part of the features and landmarks of the modern port city, while passenger ports function as transit points in most parts of the world. Several interviews indicated that port stations must be smoothly and quickly operated to achieve the principle of comfort for the traveller and to save time. This idea of efficiency and smoothness, demonstrates the quality of performance and operation of these spaces, which is the prevailing principle around the world that determines the quality of these spaces. According to some, that the purpose of this place is purely operational, allowing passages through to reach their destinations without remembering the experience through these spaces.

Consequently, the way passenger ports are understood today reflects the experience of non-place, where among its characteristics is the emphasis on speed of movement and passage through environments (Auge, 2010). The current understanding of the role and function of passenger ports is as frictionless landmark. Facades (in the port) act as dislocated symbols that reflect the city port City identity and culture in the passenger experience. This is differs from historic understanding of the port where it was considered to be one of the distinctive landmarks of its residents and played a significant role in leaving a stamp on the tourist's first visual impression, its buildings also representing and embodying the language of cultural exchange for its visitors.

4. Conclusion:

In conclusion, this study discusses passenger ports, including the ways that they are viewed, received, and understood by the user. This is not only from a historical and contemporary perspective, but also from a social perspective, an environmental perspective, a cultural perspective, and a visual perspective. The development of the research methodology is designed to help understand and communicate the vision of the port as a place of diverse opportunities in many ways, beyond those perspectives defined by a framework of operational efficiency or a gateway to transit. The study examines the impact of non-place, sense of place, and imageability on users' perceptions of port spaces. As a method is intended to promote a more complete understanding of passenger port spaces by reintroducing ideas that can eliminate placelessness in public spaces in the future and stimulate the evocation of history in a meaningful manner. This work examines and discusses potential trajectories for designing and realising passenger port spaces, aiming to frame, speculate and unpack possible rather than the probable futures for those spaces.

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Track 09: Inclusion

INCLUSION - Planning for Fair, Plural, and Welcoming Cities

Chairs:

- Stefano Cozzolino, ILS Dortmund
- Christine Lélevrier, Université Paris Est Créteil
- Dalila Sicomo, Università degli Studi di Palermo

Keywords: *Diversity, Equity, Cultural Integration, Coexistence, multiculturalism, Community Engagement, Minority Groups, Welcoming and Accessible Cities, reception systems, Open Space, Social and Economic Inclusion*

There is a growing awareness of the significance of diversity and the tensions it may generate in societies, with major cities leading the way in facing this challenge. Inclusivity is now a fundamental principle in urban planning theories and practices, marked by a renewed commitment to advocating for cities that are fair, multicultural, welcoming, and open to all. Among other topics, issues such as migration, multiculturalism, minority groups, gender, religion, identities, accessibility, and the quality of essential services and spaces, as well as urban inequalities, urban poverty, and the emergence of diverse lifestyles (or the possibility of embracing new ones), are all central to the contemporary discourse. How can planners deal with these challenges? What kind of planning frameworks and approaches can better support inclusivity?

This track aims to thoroughly explore the multifaceted concept of inclusion in urban planning, with a particular focus on the idea of the open city—a city capable of embracing diversity, multiculturalism, experimentation, and fairness while acknowledging the diverse challenges planners must address in upholding these values. It is designed to encompass a wide range of contributions, including theoretical reflections, ethical perspectives, urban policies, urban design strategies, discussions on regulation and the law, interesting case studies, analyses from the field, best practices, and other pertinent urban planning viewpoints that can enhance the contemporary discourse. Therefore, the track welcomes diverse contributions, encompassing the formulation of policies and planning interventions, examinations of current socio-spatial dynamics, and broader reflections on the issue at hand.

The track aims to facilitate a dynamic exchange of ideas and experiences and welcomes abstracts addressing, but not limited to, the following themes:

- Diversity and Equity: How can urban planning promote equity and accommodate the diverse needs of urban populations?
- Cultural Integration and Coexistence: What strategies can cities employ to foster cultural integration and multiculturalism?
- Community Engagement and Minority Groups: How can planners ensure that residents can be heard and included in relevant decision-making processes?

- Welcoming and Accessible Cities: What initiatives can cities, along with other public and private actors, implement to create welcoming environments for newcomers, individuals with disabilities, etc.?
- Open Space and Social Interaction: How can open spaces and the built environment be designed to promote interaction and exchange among diverse people?
- Social and Economic Inclusion: What policies and practices can bridge the gap in access to resources, education, employment opportunities, and (small) entrepreneurship?

Research on the Psychological Health Impacts for Children in Urban Built Environments

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Abstract:

In recent years, the incidence of psychological and behavioral problems in children has increased, making it a critical intervention target within the framework of the Healthy China Action. The development of children's psychological health is influenced by a myriad of factors, with psychological biases potentially accumulating over time and evolving into psychological health issues such as depression and autism. Various disciplinary fields address the development of children's psychological health through genetic factors, family dynamics, social surroundings, and material space. Among these, urban and rural planning disciplines optimize the material spatial environment through planning design and indicator regulation, mitigating or reducing biases in children's psychological development and thus preventing or ameliorating the psychological health risks they face. Existing studies indicate a substantial correlation between factors of the urban built environment and residents' psychological health, exerting long-term, sustained, widespread, and subtle effects on psychological well-being with the potential for optimization and improvement. Moreover, owing to their social vulnerability, health susceptibility, and highly malleable biological characteristics, children's psychological health is particularly susceptible to the influence of urban built environments. The developmental trajectory of children's psychological health possesses unique characteristics, and their utilization and experience of urban space differ from that of adults. Some studies have noted that certain material spatial elements relevant to adult psychological health may not hold the same significance among children and adolescents. Therefore, in urban planning research addressing the psychological health needs of children, the following questions merit further elucidation: (1) What constitutes the specific connotation of children's psychological health, and what comprises psychological health at different age stages? (2) What are the characteristics of the effects of urban built environments on children's psychological health? (3) What potential impact pathways exist during this process? This article aims to explore the impact of the urban built environment on children's psychological health across these three dimensions. Comprehensive interdisciplinary research seeks to clarify the concepts, processes, and compositions of children's psychological health, along with the psychological health characteristics of children across all age groups; extract and identify elements and characteristic indicators of the urban built environment, analyzing their impact pathways from various perspectives on the psychological health benefits for children.
Keywords: Children's Psychological Health; Urban Built Environment; Interdisciplinary Research

1. Introduction

The healthy development of children is crucial for determining a nation's future potential. With the advancement of modernization, improvements in living environments, and enhancements in medical care, there has been a significant improvement in children's health levels. However, simultaneously, there has been a rising occurrence of and public concern about psychological health issues in children.

Existing research suggests a significant correlation between urban built environment elements and residents' psychological health. These influences are long-term, continuous, extensive, and subtle, with the potential for optimization and improvement. Additionally, due to their social vulnerability, susceptibility to health risks, and highly malleable biological characteristics, children are particularly susceptible to the influences of urban built

environments (Evans, W, G. and Ferguson, T, K., 2011). The developmental process of children's psychological health is unique, as children utilize and experience urban spaces differently from adults. Some studies have also found that certain material spatial elements relevant to adult psychological health are not significant among children and adolescents (Foster, S. et al., 2015). Interventions in children's psychological health development across various disciplinary fields, including genetic factors, family atmosphere, social environment, and material space, are crucial (Culbertson, L, J., Newman, E, J. and Willis, J, D., 2003). Urban and rural planning disciplines aim to alleviate or reduce biases in children's psychological development through planning design and indicator regulation to optimize material spatial environments. Consequently, this helps prevent or ameliorate the psychological health risks faced by children.

Therefore, in the context of urban planning research focusing on children's psychological health, further clarification is required on the following issues: (1) What are the specific connotations of children's psychological health and the psychological health characteristics at different age stages? (2) What is the relationship between urban built environments and children's psychological health? (3) What are the pathways through which urban built environments affect children's psychological health? These will provide insights for the construction of child-friendly cities.

2. The composition and age characteristics of children's psychological health

The meaning of psychological health has become increasingly enriched with the development of medical, psychological, and social psychological service systems, extending gradually from individual mental aspects to various facets including cognition, language, emotion, and social adaptation (Bhugra, D., Till, A. and Sartorius, N., 2013). Research on children's psychological health focuses on the developmental processes of psychological behavior based on brain development and the associated issues arising from biases (Shvaleva, M, N. et al., 2018). Children's psychological health emphasizes the changing processes of psychological and behavioral development, exhibiting stage-specific characteristics at different age stages while demonstrating a continuity of mutual influence and connection throughout the overall developmental process. The age range of children can be divided into four stages: infancy, preschool, school-age, and adolescence (Clay, T. and Fox, G., 2008).

(1) Cognitive Ability

Cognition generally refers to the process of knowing or cognitive activities, which is a higher psychological activity that reflects the characteristics, states, and interrelations of objective things in the brain, and reveals the significance and effects of things on individuals (Chernikova, V, I., 2014). Cognitive development is closely related to changes in brain morphology and the development of brain function. Cognitive abilities mainly include aspects such as perception, memory, attention, and thinking (Flavell, H, J., 1992).

(2) Emotions and Feelings

Emotion is the attitude experience generated by whether objective things meet human needs, reflecting the relationship between objective things and human needs (Rodríguez, L., Ramos, F. and Wang, Y., 2012). Feelings are attitude experiences related to whether advanced social needs are satisfied, gradually formed in the practice of social interaction, such as feelings of friendship, morality, beauty, and rationality (Keung, H., 2013). This is a unique emotional state of human beings. Emotions and feelings play an important role in the lives and overall psychological development of children and adolescents, influencing their cognition, behavior, social relationships, and personality formation and development (Suveg, C., Southam-Gerow, A, M. and Goodman, L, K., 2007).

(3) Personality and Socialization

In the process of growth and development, influenced by various factors, each individual gradually forms a unique personality. At the same time, as social beings, humans inevitably form various relationships with others and gradually develop sociality. The development of sociality is crucial for children, as well as for groups and society (Mukhina, V., 1982).

2.2 Age Characteristics of Children's Psychological Health

(1) Infancy (0-3 years old)

During infancy, children's brains develop rapidly, marking a key period of cognitive, motor, and language development, as well as the initial stage of personality formation (Bornstein, H, M. and Shriver, K, E., 2015). Scholars widely agree that psychological development during infancy is the result of interactions between individuals and their environment (Sale, A., Berardi, N. and Maffei, L., 2014).

(2) Preschool Period (3-6 years old)

As children acquire language skills, they begin to engage in representational thinking. However, thinking at this stage tends to be rigid and irreversible (Ulu, E. and Kiraz, A., 2014). Children's emotional experiences become quite rich during this period, gradually developing higher-level emotions such as trust, sympathy, aesthetic sense, and morality. Moreover, they begin to develop self-awareness and can begin to regulate their activities and behaviors (Brown, T. and Jernigan, L, T., 2012).

(3) School Age (6-12 years old)

Psychological development in school-age children, including attention, thinking, and emotions, is more stable compared to preschoolers and adolescents (Collins, A, W., 2001). Their memory and imagination abilities undergo significant development, and they exhibit various forms of human emotions. The stability and regulation ability of their emotions gradually strengthen (Ferdinand, K, N. et al., 2018).

(4) Adolescence (12-18 years old)

During adolescence, thinking becomes more comprehensive and profound. Adolescents exhibit psychological characteristics that retain traces of childhood while also showing the emergence of various adult behaviors (Brizio, A. et al., 2015). Their sense of morality, rationality, and aesthetics undergo significant development. Their interpersonal relationships become more complex, and they engage in meaningful social activities (McLaughlin, A, K., Garrad, C, M. and Somerville, H, L., 2015).

In summary, infancy is a critical period for psychological development, with infants exhibiting significant plasticity. The preschool period prepares children for school before formal education begins. School age represents a significant transition period in psychological development. Adolescents' psychological characteristics become richer and more stable.

3. Factors influencing children's psychological health

Psychological health refers to a state of complete psychological well-being, encompassing both positive and negative aspects (Bhugra, D., Till, A. and Sartorius, N., 2013). Research on psychological health has been conducted across various disciplines, including psychology, medicine, sports science, education, sociology, geography, and urban planning (Fusar-Poli, P. et al., 2020). Numerous studies have shown that psychological health is influenced by a diverse array of factors, which can be classified medically into biological factors and

psychosocial factors (Singh-Manoux, A., Macleod, J. and Davey, S., 2003).

Children's psychological health emphasizes the changing processes of psychological and behavioral development, exhibiting stage-specific characteristics at different age stages while demonstrating a continuity of mutual influence and connection throughout the overall developmental process. Similarly, the influencing factors follow medical classifications and can focus on intrinsic genetic and individual factors as well as external environmental factors. External environmental factors can be further categorized into social determinants, family environment factors, and material environment factors. The pathways of influence can be direct or indirect through behavioral means.

3.1 Endogenous influences

Genetic and individual factors are endogenous influences on children's psychological health, determining the potential for children's psychological health development. At the same time, the development and changes of these potentials are also subject to various external environmental constraints and interventions. The prenatal cortisol levels and telomere lengths of parents with adverse childhood experiences can affect their offspring through genetic or environmental pathways, thereby increasing the risk of psychological problems in children such as negative emotions, depressive symptoms, and defiant behaviors. However, the impact of genetic factors during childhood is much lower than that of external environmental factors (Gene–environment interactions in psychopathology throughout early childhood: a systematic review, 2015)(Vendlinski, K, M. et al., 2014), and the degree of influence diminishes with age(Franić, S. et al., 2010). In terms of individual factors, temperament traits, personality characteristics, cognitive abilities, self-awareness, and other aspects all influence children's psychological health. The family environment is an important external environmental factor that contributes to children's psychological health (Aronen, T, E., 1991)(Ferguson, T, K. et al., 2012)(Hank, K. and Steinbach, A., 2018).

3.2 Exogenous influences

With the rapid development of society, external environmental factors have gradually increased their impact on children's psychological health, making family environment, social environment, and material environment hot topics in this field. The influence of family environment on children's psychological health is profound. Factors such as family economic status, family atmosphere, family structure, parenting styles, and parental education level all have varying degrees of influence on children's psychological health (Bornstein, H, M., 2013)(Veronese, G. et al., 2014)(Manor-Binyamini, I. and Naamneh, G., 2019). In terms of social influences, socioeconomic background, cultural differences, medical services, personal social interactions, neighborhood cohesion, and school life all impact children's psychological health (Perna, L. et al., 2010)(Immelt, S., 2006)(Ferguson, T, K. et al., 2013). Social psychological stress exposure is one of the most significant factors affecting adolescent depression (Twenge, M, J., 2020).

Material environment has a significant impact on children's psychological health (Jevtić, M. and Bouland, C., 2019). The impact of climate change on children's psychological health includes direct effects on emotions, stress, and happiness, as well as indirect effects such as trauma, post-traumatic stress disorder, depression, and cognitive development disorders resulting from secondary disasters (Karaliūnienė, R. et al., 2022)(Cianconi, P., Betrò, S. and Janiri, L., 2020)(Xu, Z. et al., 2012). Studies in regions such as Northern Europe and North America have found seasonal variations in the incidence of psychological health problems in children, such as anxiety disorders, obsessive-compulsive disorders, attention deficit hyperactivity disorder, and severe depression (Nillni, I, Y. et al., 2009)(Kovalenko, P. et al.,

2000)(Copeland, N, J. et al., 2022). Children are particularly susceptible, and exposure to environmental factors such as air pollution, noise, electromagnetic radiation, and radiation can disrupt the normal development of children's psychological behavior. Due to children's faster respiratory rates and lower activity spaces, various air pollutants such as vehicle exhaust, cooking fumes, and odors from garbage are more likely to trigger emotional responses in children, and even cause respiratory system damage, leading to lung inflammation and poisoning (Song, J. et al., 2018). Different types of noise pollution from traffic, construction, and neighborhoods can affect the activity and function of children's nervous systems, leading to psychological health risks such as depression and anxiety (Schubert, M. et al., 2019). Children have larger pupils than adults, and facilities such as nighttime lighting or overly bright signs and illuminated buildings with high contrasts in environmental light are more likely to inhibit children's melatonin secretion, affecting their circadian rhythm regulation (Navara, J, K. and Nelson, J, R., 2007). Exhaust deposition and meltwater containing de-icing agents can cause heavy metal or chloride pollution in soil and surface water, affecting children's intellectual and immune function development (Brockmeyer, S. and D'Angiulli, A., 2016).

3.3 The influence of children's behavior on psychological health

Children's behavior is the outward expression of their lifestyle and habits, serving as an intermediary factor for various psychological influences. Children's activity behavior includes physical activity, sedentary behavior, and sleep (Karwowska-Struczyk, M., 1998).

Physical activity refers to any activity that involves energy expenditure through skeletal muscle contraction, including exercise training, daily chores, commuting, and other leisure activities, which may occur in urban outdoor environments. The social-ecological model suggests that the main influencing factors of children's physical activity behavior include: a. Individual factors such as motivation, skills, attitudes, knowledge, and perception; b. Interpersonal relationship factors such as family, peers, teachers, and social support; c. Institutional or organizational factors such as school regulations, attention from relevant departments, and health services; d. Community factors such as public green spaces, recreational facilities, and road traffic, as well as neighborhood effects; e. Public policy factors such as laws and regulations, education policies, financial support, and public health strategies (Gao, W. et al., 2022).

Outdoor physical activity is closely related to children's psychological health and promotes the cultivation of willpower, cognitive abilities, optimistic emotions, and good interpersonal relationships. Physical activity affects children's psychological health through three pathways: biological factors, individual psychological factors, and social psychological factors (Biddle, H, J, S. et al., 2019). Biologically, physical activity can improve sleep and alleviate childhood depression by increasing hippocampal volume (Vancampfort, D. et al., 2018). Psychologically, physical activity can improve self-esteem and self-efficacy mechanisms to alleviate childhood depressive symptoms (Ahn, S. and Fedewa, L, A., 2011). Socially, physical activity enhances children's social connections, increases social support, and reduces anxiety (Gorham, S, L. et al., 2019).

4. The factors and pathways of urban built environment impact on children's psychological health

In the process of urban planning, the elements of urban built environment intertwine with the factors affecting residents' psychological health, mutually influencing each other. Numerous studies have confirmed that the urban built environment has long-term, sustained, extensive, and subtle effects on residents' psychological health, with the possibility of optimization and

improvement (Núñez-González, S. et al., 2020)(Gascón, M. et al., 2015)(Gong, Y. et al., 2016)(Clark, C. et al., 2007). Building on this foundation, scholars have further focused on the child population, conducting research on the impact of community built environment, external building environment, urban green-blue spaces, and equity of facilities on children's psychological health (Villanueva, K. et al., 2016)(The influence of the neighborhood physical environment on early child health and development: A review and call for research., 2015)(Alderton, A. et al., 2019)(Hitch, L. et al., 2023). Buttazzoni constructed a research framework for urban planning and children's psychological health from the perspective of neuro-urbanism (Buttazzoni, A., Doherty, S. and Minaker, L., 2021), which has significant reference value.

4.1 Influencing factors

Research on urban planning for children's psychological health is closely related to the concept of child-friendly cities, which align with the 12 characteristics outlined by the United Nations Children's Fund (UNICEF) (Vliet, v, W. and Karsten, L., 2015). The urban planning elements influencing children's psychological health are highly similar to the healthy environment and services that children should enjoy, including green-blue spaces, land use, road layout, space site, and service facilities.

(1) Green-blue spaces

Green spaces such as water bodies, parks, and walking trails have various beneficial effects on improving children's physical and mental health and rarely induce negative behaviors. The proportion of green spaces and their accessibility determine children's opportunities to interact with nature. Insufficient green space indicators reduce children's contact with nature, diminish their environmental perception and activity levels, leading to phenomena such as nature deficit and psychological and behavioral problems (Vanaken, G. and Danckaerts, M., 2018). Microscopic spatial visual indicators such as green view ratio, color richness index, sky openness index, and transparency affect children's sense of security, comfort, and pleasure (Dadvand, P. et al., 2014). Excessively monotonous and desolate green spaces are detrimental to the formation of children's attention and imagination and may even lead to emotional depression and disorders (Engemann, K. et al., 2019).

(2) Land use

Land use indirectly affects children's psychological health by influencing their physical activity. Moderate physical activity helps alleviate children's emotional problems and promote cognitive development. The intensity of community land development affects children's physical activity levels. Building height is positively correlated with children's physical activity levels (Li, L. and Hin, ., 2009). Overall building density is negatively correlated with children's physical activity (Durand, P, C. et al., 2011). Mixed land-use environments in communities promote children's physical activity (Masoumi, E, H., 2017). Additionally, the building layout and spatial form of high-rise communities alter the microclimate environment, affecting children's immune, nervous, and skin systems to varying degrees (Vanos, K, J., 2015).

(3) Traffic layout

The richness of social activities and interfaces, population density, and pedestrian accessibility on streets affect children's activity preferences (Villanueva, K. et al., (no date)). The safety of intersections, parking forms, and pedestrian facilities influence parental supervision and significantly determine children's physical activity decisions (Carver, A., Timperio, A. and Crawford, D., 2008). Behavioral activities are crucial intermediary factors

in streets' impact on children's psychological health and affect children's perception and nervous system development (Tappe, A, K. et al., 2013).

(4) Space site

In recreational spaces within urban public areas, factors such as zoning functional complexity, composition of gaming elements, and size of connection areas influence children's choices of social behaviors (Dong, N., Chen, J. and Zhang, S., 2017). The accessibility of sports facilities and the cleanliness and attractiveness of activity environments affect children's physical activity, thereby influencing their psychological health development (Xiao, Z. and Li, H., 2012).

(5) Service facilities

Service facilities are closely related to children's health risks. The service scope and accessibility of medical facilities affect the emergency response time for children's accidents and the availability of medication for children in need of psychological healing (Savagea, R., Helfer, B. and Lash, M., 1997). The types and accessibility of retail and food facilities affect the variety of food children can access and the balance of nutritional intake. Low-income communities are more prone to "food deserts," increasing health risks such as childhood overweight and obesity (Ploeg, V, M., 2010), affecting children's personality and social development. The accessibility and visibility of tobacco and alcohol retail facilities affect children's exposure probability and increase tobacco smoke exposure, affecting children's neurological and respiratory health (Marsh, L. et al., 2021), thus influencing the formation and development of perception.

4.2 Influencing pathways

Urban built environments primarily affect children's psychological health through two pathways: direct effects on senses and indirect effects through spatial or service changes. The former directly impacts children's psychological health under environmental stressors (such as environmental colors, housing congestion, neighborhood safety, etc.). The latter involves changes in social interactions, physical activity, and environmental perception resulting in psychological behavioral changes such as a sense of belonging, security, or discomfort (Franklin, M. et al., 2020). Additionally, indirect impact mechanisms are not limited to the above processes and can produce multiple or multidirectional potential influences, such as physiological health mapping and coexistence of promotion and inhibition. For example, research has found that when children are in environments with low street connectivity or school accessibility, they tend to choose active commuting modes such as walking or cycling (Pabayo, R. and Gauvin, L., 2007). Such commuting modes can increase their psychological well-being and reduce psychological stress. From the perspectives of neurobiology, social psychology, and behavioral science, green spaces have been found to improve children's psychological health levels by reducing exposure to harmful factors, enhancing recovery capabilities, and strengthening self-capabilities (Vanaken, G. and Danckaerts, M., 2018). However, the specific results are influenced by children's socioeconomic backgrounds.

5. Research Prospects

In the fields of medicine, psychology, education, sociology, architecture, landscape architecture, and urban planning, both domestically and internationally, research has been conducted on the factors influencing children's mental health, including genetic and individual factors, family factors, social environment, and physical environment. This research has accumulated certain methodologies and findings, highlighting the specificity of children's mental health development. It's recognized that children's use and experience of urban spaces

differ from those of adults. Additionally, some studies have found that certain physical spatial elements related to adult mental health are not significant among children and adolescents. Therefore, it's necessary to conduct research on the impact of built environments on mental health specifically targeting children, this unique population.

The practice and research of building child-friendly cities mainly propose planning and design methods from the perspective of urban public spaces, residential areas, and streets, with a greater focus on children's physiological and behavioral needs and safety risks. Although some scholars have conducted research on children's psychological development, much of it focuses on special groups of children and specific mental health issues. Moreover, the translation and application of relevant research results into planning intervention paths in the practice of building child-friendly cities still require further exploration. Therefore, it's particularly important to conduct research on the mechanisms and planning intervention paths of the impact of built environments on mental health at the scale of school districts, which is most relevant to the daily lives of school-age children.

In the field of urban planning, many studies are limited to cross-sectional data due to data constraints, although the medical field often uses correlation analysis methods based on cross-sectional and panel data in research on factors affecting mental health. The mechanisms through which built environment elements in urban school districts affect children's mental health are complex. Cross-sectional data-based correlation studies cannot control for potential variables, thus reducing the accuracy of mechanism analysis and making it difficult to determine causality. Therefore, integrating longitudinal tracking experiments and analysis methods from other disciplines such as medicine and psychology and incorporating a time dimension through the comprehensive use of panel data to quantitatively explore the relationship between urban school district built environments and children's mental health holds significant scientific value.

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Study on the Comparison of Development Efficiency between Inner and Outer Urban Circles and the Balanced Development Strategy of Marginal Areas : Analysis based on the county scale of Chongqing

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Abstract. The article takes 38 counties in Chongqing as the research object, conducts social and economic development data statistics and spatial analysis, and divides them into the core, inner circle and outer circle counties based on the theory of 'core-periphery' and the circle structure characteristics of municipal areas. The data envelopment analysis (DEA), exploratory spatial data analysis (ESDA) and geographically weighted regression (GWR) models are introduced to conduct a comparative analysis of the characteristics of the spatial patterns and factors affecting the development efficiency of the inner and outer circle counties in the municipal area, and to explore the differences in the development of the inner and outer circle counties, as well as the main development problems and strategies.

Keywords: urban circles; development disparities; peripheral areas; balanced development; ESDA

1. Introduction

The interaction between regional development differences at the geographic spatial level and unbalanced regional development policies has accelerated the emergence of the 'core-periphery' structure in regional space (Yang *et al*., 2023). In this regard, many scholars use qualitative, quantitative and other methods to carry out the regional unbalanced development research to demonstrate. Some studies have found that the 'core-periphery' feature is not only reflected in the regional economic differences but also manifested in the social elements such as the cultural divide (Savini *et al*., 2016). When identifying the core or peripheral areas of the region, the regional economic, demographic, political and knowledge levels should be considered and reflected in regional policymaking (Eder, 2019). Meanwhile, the spatial variation trend and distribution characteristics of socio-economic development inequality have also been increasingly concerned (Wei, 2015). Some studies have used the Theil Index (Wei *et al*., 2020), Reilly's Law of Retail Gravitation model (Rana, Routray and Younas, 2020) and Cluster Analysis (Shi, 2023) to reveal the internal development differences of the region and their dynamic evolutionary processes and spatial pattern. Research based on the Multi-dimensional Equality Development Index (MEDI), including economic vitality, innovation capacity, social convenience and inclusiveness, found that the

pattern of spatial inequality in China has shifted from 'coastal-inland inequality' to 'core-periphery inequality' (Yang *et al*., 2023). There is a prevalence of 'core-periphery' spatial development structure in provinces and large cities in China, the phenomenon is mainly produced by the combined effect of natural geographical spatial differentiation, socio-economic spatial organisation and regional spatial connection (Wang and Fan, 2019), and the significant 'core-periphery' structure can exacerbate provincial spatial polarisation and reduce local mobility (Wei *et al*., 2020). Multi-dimensional and multi-scale studies have been carried out on the 'core-periphery' structure within the region. Some scholars have focused on the temporal and spatial variation characteristics of the 'core-periphery' structure in the economic development process of counties within the Yellow River Basin, and used regression models to explore the driving mechanism of the evolution of the 'core-periphery' structure of counties on provincial boundary (Zhang *et al*.,2023). On the inter-provincial scale, the spatio-temporal pattern and formation mechanism of regional economic differences in the inter-provincial fringe areas were discussed (Xia *et al*., 2014; Yu *et al*., 2012). At the provincial and city scales, research often focuses on a typical provincial or municipal unit, specifically analysing the process of change, stage characteristics and internal mechanisms of districts from core to fringe (Yang *et al*., 2023), as well as analysing the spatial pattern of inequality in the provincial area through Spatial auto-correlation Models (Wei and Ye, 2009; Wei *et al*., 2020; Li, Ding and Liu, 2012), and applying multi-level regression model to explore the influencing factors for the formation of the provincial 'core-periphery' structure (Li, Miao and Ye, 2016), and using Geographically Weighted Regression (GWR) to explore the spatial heterogeneity of the factors affecting inequality in the provinces (Wei and Ye, 2009; Cao and Xu, 2018).

Research on the 'core-periphery' structure within regions has been ongoing and has produced rich results, but most of the existing studies have focused on inequality within developed regions in eastern China (Wei and Ye, 2004, 2009; Wei *et al*., 2020; Liao and Wei, 2012, 2015; Zhang, Tong and Liang, 2018), and there are less analyses of county economic differences in less developed western provinces (Zhou and Li, 2021). Therefore, a multidimensional division of analysing the development differences in typical western regions, tailoring regional development strategies according to the degree of marginalisation of the region, and helping marginalised regions to break through geographical constraints to form agglomeration advantages, which have strategic value for accurately improving the level of regional coordinated development (Eder, 2019). Chongqing is a typical city with a 'core-periphery' structure (Wang and Fan, 2019), although counties have made remarkable achievements in economic and social development in recent years, the development level of counties in the non-central urban area is lagging behind, and not only is there a clear gap with the top one hundred counties in the country, but also has no competitive advantage in the ranking of the top one hundred counties in the west. There is significant spatial dependence in the economic and social development of counties in the long term, that is, the economic growth of a district is significantly positively affected by the economic growth of

neighbouring counties. For Chongqing, this trend is even more pronounced, with significant positive spatial correlation in the economic growth of counties, significantly forming a high economic growth agglomeration area mainly consisting of the nine districts in Chongqing's central urban area, as well as a low economic growth agglomeration area mainly located in southeastern Chongqing and northeastern Chongqing. According to 'the Outline of the Fourteenth Five Year Plan and Vision for the 2035 Plan for the National Economic and Social Development of Chongqing Municipality', the ratio of per capita GDP between the 'one region' and the 'two clusters'[1] was 1.84:1 by 2020. Chongqing has markedly regional uneven development characteristics, forming an economic spatial pattern with the 'one region' as the core and the 'two clusters' as the periphery.

Given this, this paper selects Chongqing as the research area, takes counties as the research unit, and divides them into three levels: core, inner circle and outer circle. Analyse the development efficiency of counties in Chongqing, as well as their spatial distribution characteristics and agglomeration patterns. Furthermore, it uses stepwise linear regression and geographically weighted regression models to quantitatively analyse the factors influencing the development efficiency of the counties and explores the spatial heterogeneity of their influencing effects. On this basis, a balanced development strategy for marginal counties is proposed, to provide a theoretical basis for the coordinated development among various circles in the city, and to enhance the overall inclusiveness of the city.

2. Overview of the Study Area, Data and Methods

2.1 Overview of the Study Area

Located in southwestern China, Chongqing is an important growth pole in the western region of China. It covers an area of 82,400 square kilometres and currently has 38 districts and counties under its jurisdiction, including 26 municipal districts, 8 counties and 4 autonomous counties. According to the Fourteenth Five-Year Development Programme of Chongqing, the economic spatial layout of Chongqing has a significant development pattern of circle structure. At the municipal scale, promoting the

[1] 'One Region' and 'Two Clusters': 'One Region' refers to the main urban metropolitan area of Chongqing, which includes nine counties in the central urban area and other twelve counties. Nine central urban counties including Yuzhong, Dadukou, Jiangbei, Shapingba, Jiulongpo, Nanan, Beibei, Yubei, and Banan. Other twelve counties including Fuling, Changshou, Jiangjin, Hechuan, Yongchuan, Nanchuan, Qijiang, Dazu, Bishan, Tongliang, Tongnan and Rongchang, with a permanent population of over 21.22 million in 2022. 'Two Clusters' refers to the town cluster of Three Gorges Reservoir Area in northeast Chongqing and the town cluster of Wuling Mountain Area in southeast Chongqing. The town cluster of Three Gorges Reservoir Area in northeastern Chongqing includes eleven counties, including Wanzhou, Liangping, Kaizhou, Chengkou, Fengdu, Dianjiang, Zhongxian, Yunyang, Fengjie, Wushan and Wuxi, with a permanent population of over 8.04 million in 2022. The town cluster of Wuling Mountain Area in southeast Chongqing includes six counties (autonomous counties), including Qianjiang, Wulong, Shizhu, Xiushan, Youyang, and Pengshui, with a permanent population of over 2.86 million in 2022.

coordinated development of 'one region' and 'two clusters', forming two basic circles, including the main urban metropolitan area and the peripheral counties. At the scale of the main urban metropolitan area, a pattern of gradual development is formed with the 9 central urban districts as the core to drive the tiered development of the new districts of the main urban area.

According to Friedmann's 'core-periphery' theory (Friedmann, 1966), there is a dominant 'core' in the regional development process, where production factors such as capital, technology, labour and production activities are concentrated. From the current development situation of Chongqing, the central urban area composed of nine districts constitutes the core circle. The various elements of the surrounding counties continue to flow out under the siphoning effect of the central urban area, which is gradually being at an unfavourable position in the process of economic development, forming the 'periphery'. According to the Fourteenth Five-Year Development Plan of Chongqing, the counties in the main urban new area are in the main circle of influence of the central urban area, and most of them border directly with one or more administrative districts in the central urban area, and are directly driven by the central urban area, and undertake the spillover of the functions and the industry of the central urban area. With the characteristics of 'the periphery near the core', they are divided into inner-circle counties. The town clusters in the Three Gorges Reservoir Area in the northeast of Chongqing and the Wuling Mountain Area in the southeast of Chongqing, which are developed relatively independently of the central urban area, have a certain spatial distance from the central urban area, do not border one or more administrative districts in the central urban area, and are subject to the limited radiation by the central urban area, and are gradually marginalised in the process of development to form a group of their own. The counties and districts contained in the 'two clusters' are classified as outer-circle counties.

Fig.1. Spatial distribution map of core, inner circle, and outer circle counties in Chongqing

2.2 Data

There is a substantial interactive correlation between the level of regional basic public services and the quality of economic and social development (Fang, 2012; Rana, Bhatti and e Saqib, 2017). Basic public service is one of the core factors directly or indirectly determining the state of economic and social development of a region (Holtz-Eakin and Schwartz, 1995), which plays an important role in promoting economic growth and significantly improving the social equity level (Liu, 2012). At the same time, the level of regional economic development also significantly affects the development of basic public services (Wang *et al*., 2023). Therefore, based on the empirical analysis of the interaction between basic public services and county economic development in Chongqing (Xiong, Yu and Wang, 2019), it is feasible and effective to use the financial expenditure and allocation efficiency of basic public service facilities as an indicator to measure the level of regional development in this paper.

This paper takes 38 districts and counties in Chongqing as the research object. The basic data of all the indexes come from the 2019-2023 Chongqing Municipal Statistical Yearbook, China County Statistical Yearbook (County and Municipal Volume), and 2022 Statistical Bulletin of the districts.

In terms of the selection of indicators for calculating efficiency, based on comparability and accessibility, this paper mainly selects three per capita indicators as input variables, including education expenditure, health expenditure, and social security and employment expenditure. In setting the output variables, the effectiveness of education, health care and social welfare services are taken into account. Adopting a series of representative indicators, including the ratio of students per full-time teacher in general secondary schools, and the ratio of students per full-time teacher in primary schools, which are used to assess the efficiency of the allocation of education resources. Four indicators have also been introduced, including the number of beds in medical and health care institutions per thousand people, the number of medical and health technicians per thousand people, the number of beds in adoptive social service institutions per thousand people and the number of industrial activity units per thousand people, to comprehensively reflect the coverage and effectiveness of public health services and welfare services. Together, these output indicators build a three-dimensional, multifaceted evaluation system to accurately measure the efficiency of financial expenditure and allocation of basic public services.

Table 1
Input and Output Variables for the financial expenditure and allocation of Basic Public Services

Input Variables	Output Variables
Education Expenditure	Number of full-time teachers in general secondary

	schools / Number of students in general secondary schools
	Number of full-time teachers in primary schools / Number of pupils in primary schools
Health Expenditure	Number of beds in medical and health care institutions per thousand people
	Number of medical and health technicians per thousand people
Social Security and Employment Expenditures	Number of beds in adoptive social services institutions per thousand people
	Number of industrial activity units per thousand people

2.3 Methodology

2.3.1 Data Envelopment Analysis (DEA)

DEA is a non-parametric method for efficiency evaluation that can be applied to Decision-Making Units (DMU) with multiple inputs and multiple outputs. This paper adopted the DEA-BCC model in STATA software to measure the efficiency of financial expenditure and allocation of basic public services in each district and county of Chongqing, and used it as a quantitative value to measure the level of regional economic and social development. The model formula is as follows (Charnes, Cooper, and Rhodes, 1978; Liu *et al*., 2020):

$$(BC^2)\begin{cases} \min \theta \\ s.t.\sum_{j=1}^{n}\lambda_j x_{jm} + s_i^- = \theta x_0, i = 1,2,...,m \\ \sum_{j=1}^{n}\lambda_j y_{js} - s_r^+ = y_0, r = 1,2,...,s \\ \sum_{j=1}^{n}\lambda_j = 1, \lambda_j \geq 0 \\ s_i^- \geq 0 \\ s_r^+ \geq 0 \end{cases}$$

Where: $\theta(0<\theta\leq 1)$ is the combined efficiency of decision-making units; n is the number of decision-making units; λ_j is the weighting variable; x_{jm} represents the inputs of the m^{th} indicator of the j^{th} unit, and y_{js} represents the outputs of the s^{th} indicator of the j^{th} unit. s_i^- and s_r^+ are slack variables for the m input variables and s output variables, respectively.

2.3.2 Stepwise Regression Model

Stepwise regression equations were created using the Statistical Package for the Social Sciences (SPSS) to extractive analyse the key factors in the independent variables. Using the optimal model R^2 to explain the coefficients of the model, which represents the overall significance. The standardised coefficients explain the positive and negative correlation with efficiency. Using the sig. to explain the significance of the independent variable on efficiency. The factors that are the main drivers of district and county development efficiency were analysed in this paper, where the various development indicators were the independent variables and the efficiency values were the dependent variables. The model formula is as follows (Paudel and Thapa, 2004):

$$\gamma = b_0 + b_1 x_1 + b_2 x_2 + ... + b_n x_n$$

Where： y is the efficiency value of the dependent variable, b_0 is the intercept, b_1， b_2,..., b_n are the coefficients of the explanatory variables x_1, x_2,...,x_n respectively.

2.3.3 Exploratory Spatial Data Analysis (ESDA)

This paper applied ESDA to measure the spatial correlation of counties in Chongqing. Used the description and visualisation of district and county distribution patterns to detect spatial clustering and spatial anomalies. Took Global Moran's *I* index to analyse the global spatial auto-correlation characteristics of the distribution of counties, and clarified the spatial clustering relationships of the analysed units, that is, high-high clustering, low-low clustering, low-high outliers, high-low outliers or insignificant features. Used hotspot analysis tools to analyse local areas where spatial （1） ıg of high or low development efficiency units were clustered in space. The m nula is as follows (Liu, Hu and Li, 2014):

$$I_i = \frac{n}{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}\left(x_i - \bar{x}\right)}{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}} \qquad (2)$$

$$Z(I_i) = \frac{I_i - E(I_i)}{\sqrt{VAR(I_i)}}$$

Where: I_i represents the overall trend in spatial correlation across the study area; x_i represents the development efficiency at location *i*. W_{ij} is the spatial weight value between elements *i* and *j*, and the neighbourhood matrix is used here. The neighbourhood matrix defines a binary symmetric spatial weight matrix W_{ij} to express the spatial neighbourhood of *n* positions, when *i* and *j* are neighbouring, the element of spatial weight matrix W_{ij}=1, otherwise W_{ij}=0. The value of Moran's *I* is generally in the range of [-1,1], I>0 indicates a positive correlation, and the closer the value tends to be to 1, which indicates that the spatial agglomeration of the research units with the same level of economic development is more significant; I<0 indicates a negative correlation, and the closer the value is to -1, which indicates that the spatial agglomeration of the research units with the different level of economic development is more significant. I=0

means that the regional units are independent of each other, spatially uncorrelated, and randomly distributed.

2.3.4 Geographically Weighted Regression (GWR)

GWR is a spatial regression model based on the idea of local smoothness. Embedding the geographic location of the data in the regression equation can effectively estimate the data with spatial auto-correlation as well as reflect the spatial non-stationarity of the parameters in different regions, which makes the spatial location of the different parameters change, and the results are more in line with reality. This paper used it to study the spatial heterogeneity of the factors affecting the development efficiency of counties in Chongqing. The model formula is as follows (Wei and Ye, 2009):

$$y_i = \beta_0(u_i, v_i) + \sum_{k=1}^{p} \beta_k(u_i, v_i) x_{ik} + \varepsilon_i$$

Where: y_i is the value of the dependent variable of sampling point i; β_0 is the intercept, (u_i, v_i) is the coordinate of sampling point i, β_0 (u_i, v_i) is the constant term of sampling point i; β_k (u_i, v_i) is the coefficient of the k^{th} independent variable of sampling point i; x_{ik} is the k^{th} independent variable of sampling point i; ε_i is the random error term.

3. Result

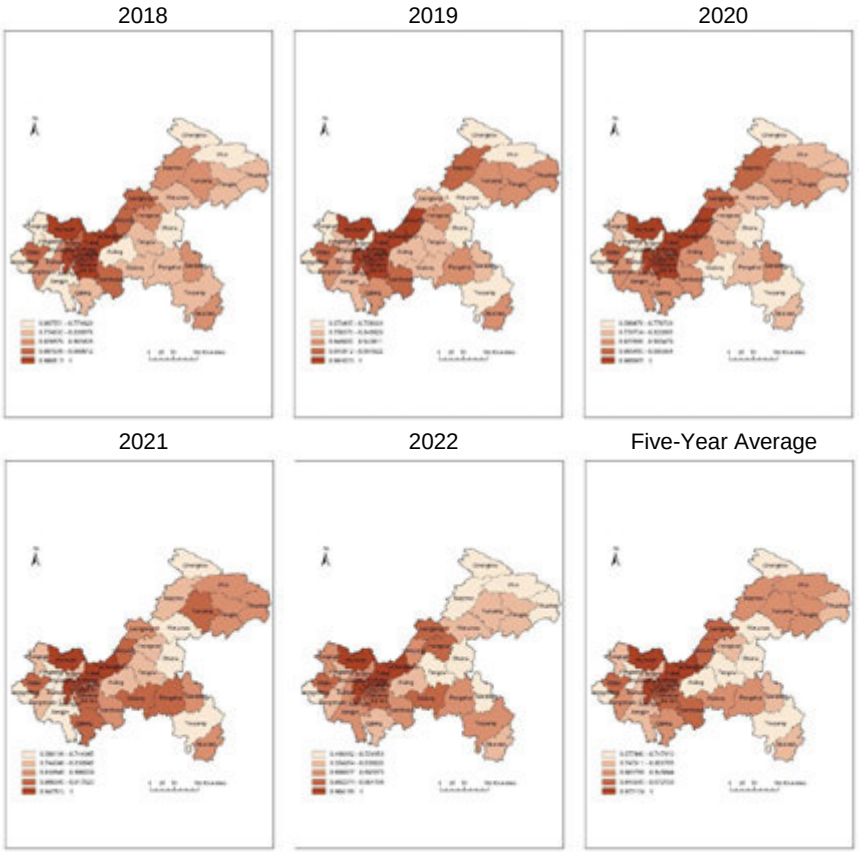
3.1 Spatial Patterns of Development Efficiency

3.1.1 Spatial Distribution Patterns

The spatial distribution of development efficiency in Chongqing's districts and counties were markedly geographically differentiated. The overall development efficiency in the western, northeastern, and southeastern of Chongqing was low. During the study period, areas with less development efficiency had shifted, with the least efficient zones formed in 2018 in western Chongqing, consisting of Tongnan, Tongliang, Rongchang, and Jiangjin districts, which gradually shifted to the least efficient zones in northeastern Chongqing, consisting of Chengkou, Wuxi, Wushan, and Kaizhou counties, and the lowest in southeastern Chongqing, consisting of Shizhu, Fengdu, and Qianjiang counties. From the perspective of circle division, the low-value areas of development efficiency were shifted from the inner circle to the outer circle, and in 2022, there were as many as seven low-value areas of development efficiency in the outer circle of Chongqing, accounting for more than 40 percent of the total.

An analysis of the average development efficiency of the districts and counties in Chongqing found that Yubei, Yuzhong, Shapingba, Nanan and Jiulongpo districts in the central urban area, as well as Hechuan and Changshou districts, which are directly neighbouring the central urban area, had better development efficiency. While Fengdu,

Chengkou and Wanzhou districts in the northeastern part of Chongqing, Shizhu and Youyang counties in the southeastern part of Chongqing, Rongchang and Tongliang



districts in the western part of Chongqing and Fuling districts in the central part of Chongqing had poorer development efficiency, of which Chengkou, Wanzhou, Shizhu, Youyang, and Rongchang district are all located in the municipal boundary area. From the point of view of circle division, the development efficiency of the core circle of Chongqing had been higher, with a stronger radiating and driving role. The number of counties with low development efficiency in the outer circle was significantly higher than that in the inner circle. This showed that the inner circle of counties are being radiated and driven by the central urban area, and the overall level of economic and social development presented a good trend, while the outer circle counties are relatively disadvantaged in terms of spatial distance, subject to the location of the marginalisation of the city, the urbanisation process and the construction of basic public facilities had lagged behind for a long time, the level of economic and social development was relatively low, in the process of economic development, they were in a crisis of being continuous marginalised.

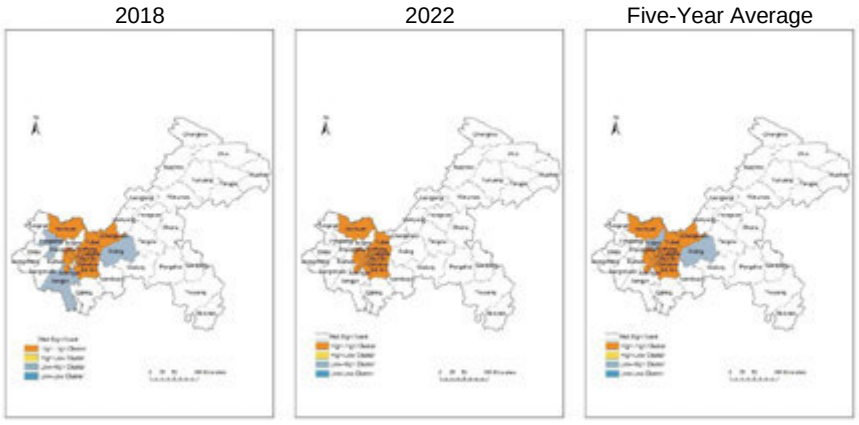
Fig.2. Spatial distribution characteristics of development efficiency of counties in Chongqing during the period 2018-2023.

Further using the global spatial auto-correlation tool（Global Moran's *I*）in ArcGIS *10.2* to analyse the spatial pattern of the development efficiency of Chongqing counties. The Global Moran's *I* index of the development efficiency of counties in Chongqing in each year of the study period was *0.3340*, *0.1528*, *0.2813*, *0.1086*, *0.4577*, and the *Z*-value of the normal statistic was *5.29*, *2.65*, *4.55*, *1.99*, *7.08*, respectively. The Global Moran's *I* index of the spatial distribution of the average development efficiency of Chongqing counties during the study period was *0.3265*, and the *Z*-value of the normal statistic was *5.19*. The index values were all positive and passed the test of significance at the level of *0.05*, indicating that the distribution of development efficiency of Chongqing counties had always had obvious global spatial auto-correlation characteristics. Despite fluctuations, counties with comparable development efficiency had always been highly agglomerated in space, and reached the highest value in 2022. At the same time, there had always been a significant difference in development efficiency between inner-circle counties and core-circle counties, but the gap was gradually decreasing.

Comparison of the results of the spatial clustering and outlier at the beginning and end of the study period showed that， in 2018, the central urban area (except Beibei district), Changshou district, and Hechuan district were high-high clusters, while Tongliang district, Jiangjin district, and Fuling district were low-high anomalies. In 2022, the central urban area (except Beibei district) and Hechuan district were high-high clusters, and the other areas were not significant. This indicated that: 1) counties exhibiting high-high clustering of development efficiency were always concentrated and contiguous, but the scale was shrinking. 2) Tongliang, Jiangjin and Fuling districts had gradually reached almost the same level of development efficiency as their neighbouring counties at the end of the study period.

From the analysis of the average development efficiency of the counties in Chongqing, the central urban area (except Beibei district), Changshou and Hechuan district were high-high clusters, and had formed a trend of taking the central urban area as the core to drive the continuous development of surrounding counties in the north. Beibei and Fuling district were low-high anomalies, forming two major 'depressions' around the central urban area, and facing the risk of marginalisation around the core circle.

Fig.3. Spatial clustering and outliers of development efficiency of counties in Chongqing at the beginning and end of the study period.

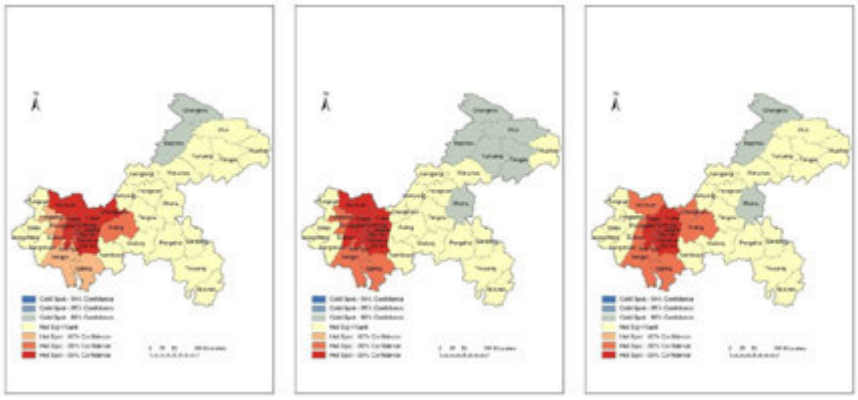


3.1.2 Spatial Agglomeration Patterns

Using the hotspot analysis tool to carry out local spatial auto-correlation analysis, the results showed that in 2018, the high value of the development efficiency of the counties in Chongqing was mainly concentrated in the hot spot area composed of the central urban area, Hechuan and Changshou district, and the Tongliang, Bishan, Jiangjin, Qijiang as well as Fuling district immediately adjacent to the central urban area had become secondary hot spots. The low value of the development efficiency was mainly concentrated in the cold spot area composed of the Chengkou and Kaizhou districts. By 2022, the high value of development efficiency of counties in Chongqing was mainly concentrated in the hotspot area composed of the central urban area, Hechuan, and Bishan districts. The hotspot area was basically unchanged, and was still centred on the nine districts of the central urban area, and its surrounding counties, Chanshou district, had insufficient development efficiency, and became non-significant, while Bishan district, with significant improvement in its development efficiency, integrated into the hotspot area, and Tongliang, Jiangjin, and Qijiang district, which were adjacent to the central urban area, form a sub-hotspot area. The Fuling district was non-significant. The scope of the low value of development efficiency of counties in Chongqing further expanded, adding Wuxi, Yunyang, Fengjie and Shizhu county based on Chengkou and Kaizhou district, forming a large-scale cold spot area in the northeast of Chongqing. In terms of circle division, the development efficiency of the core circle had always been

at the high values, the secondary hotspot area composed of counties and districts in the inner circle had shrunk. The cold spot area composed of some counties and districts in the outer circle had significantly expanded, and the number of counties with low values of development efficiency had increased significantly. This indicates the emergence of a 'periphery of the core' character of the inner circle districts, and the marginalization of counties and districts in the outer circle was becoming increasingly serious.

Analysing the spatial clustering characteristics of the average development efficiency of each district and county in Chongqing during the study period, it was found that the hotspot areas were mainly the nine districts in the central urban area and their direct neighbouring counties, of which only Nanchuan district was insignificant. Chengkou and Kaizhou district in northeastern Chongqing, and Shizhu county in southeastern Chongqing constituted the cold spot areas. The distribution pattern of circles was



significant, with the nine districts in the central urban area as the core circle with high development efficiency, the inner circle counties directly neighbouring the nine districts in the central urban area with high development efficiency, while other outer circle counties had low development efficiency.

2018 2022 Five-Year Average

Fig.4. Spatial agglomeration characteristics of development efficiency of counties in Chongqing at the beginning and end of the study period.

By calculating the average development efficiency of the core circle, inner circle and outer circle counties each year, it was found that the core circle had always maintained a significantly high level of development efficiency, and the fluctuations of the development efficiency had tended to be stable. The overall development efficiency of the inner circle and outer circle was generally on a downward trend, and the development efficiency of the inner circle is always higher than that of the outer circle. In 2022, the development efficiency of both the inner and outer circles decreased

considerably, with the outer circle experiencing a significantly larger decrease than the inner circle, while the core circle showed a slight increase. This suggested that the vulnerability of the peripheral counties was higher when dealing with major risk challenges, with the inner counties being more resilient to risk than the outer counties.

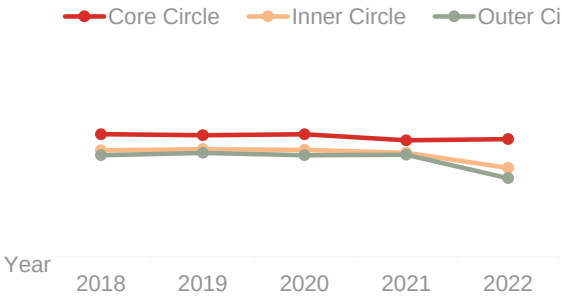


Fig.5. Changes in the overall development efficiency of counties in the core circle, inner circle, and outer circle of Chongqing during the period 2018-2023.

3.2 Analysis of Influencing Factors

3.2.1 Independent Variable Selection

Existing studies have shown that the development efficiency of cities and towns in China is affected by various factors, including economy, population, land, industry, and income (Sun Wang and Sun, 2013; Li *et al*., 2019; Yin, Wang and Duan, 2021; You, Jiang and Li, 2022; Luo, Cai and Wen, 2022). Therefore, this paper selects 20 indicators as independent variables from five dimensions: economic development level, population agglomeration capacity, built-up area development conditions, industry agglomeration capacity and residents' income level. Taking the efficiency value of financial expenditure and allocation of basic public services as the dependent variable to explore the factors affecting the differences in the development efficiency of counties.

Table 2
Development indicators and variables classification of counties in Chongqing

Development Indicators	Variables Classification
Level of Economic Development	• Gross regional product (10,000 yuan). • Gross regional product per capita (yuan). • Average land output value (10,000 yuan/square kilometer). • Per capita tax revenue (10,000 yuan). • General public budget revenue at district and county level (yuan).
Population Agglomeration	• Permanent population (10,000 people). • Population density (person/hectare).

Capacity	• Share of county population in total city population (%).
Development Conditions of Built-Up Areas	• Built-up area (square kilometers). • Built-up population density (10,000 people/square kilometer). • Land urbanisation rate (%). • Population urbanisation rate (%).
Industrial Aggregation Capacity	• Total industrial output value (100 million yuan). • Number of industrial enterprises above designated size. • Share of industrial output value in the city's secondary industry output value(%).
Level of Residents' Income	• Per capita investment in social fixed assets (yuan). • Per capita disposable income of rural permanent residents (yuan). • Per capita disposable income of urban permanent residents (yuan). • Per capita savings deposit balance of residents (yuan).

3.2.2 Stepwise Regression Analysis of Influencing Factors

The variables were processed in SPSS *20.0* using the stepwise regression model. The calculation results showed that three explanatory variables passed the significance test and covariance diagnosis, that is, the influencing factors of the development efficiency of counties in Chongqing were mainly related to the per capita tax revenue, the urbanisation rate of the population and the per capita balance of residents' savings deposits, which were respectively related to economic development level, development conditions of built-up areas and residents' income levels. All three indicators had a positive impact on the development efficiency of counties. In terms of the intensity of the effect, the balance of per capita residents' savings deposits > per capita tax revenue > population urbanisation rate, indicated that the level of residents' income had the strongest impact on the development efficiency of counties.

Table 3
Stepwise regression modelling results

Variable	Standard Coefficient	Sig.
Population Urbanisation Rate	0.486	0.027
Per Capita Tax Revenue	0.571	0.006
Per Capita Residential Savings Balance	0.509	0.027
R^2	0.363	

3.2.3 Analysis of Spatial Heterogeneity of Influencing Factors

To explore the spatial differences in the effects of the above three significant influencing factors, the GWR model was used to further analyse the spatial heterogeneity in the intensity of the effects of the influences. The results of the GWR model showed that:

(1) Tax revenue per capita.

The per capita tax revenue was positively correlated with the development efficiency of counties, that is, the higher the per capita tax revenue, the higher the development efficiency of the counties. The regression coefficient of per capita tax revenue showed the distribution characteristic of gradually increasing from west to east, and the regression coefficient fluctuated a lot, which indicated that its influence effect on the development efficiency of counties in Chongqing had strong spatial heterogeneity. In terms of inner and outer circles, the regression coefficients of the factors in the outer circle of the eastern area were larger, that is, the per capita tax factor had a more significant impact on the development efficiency of the counties located in the periphery. The per capita tax reflected the industrial tax contribution capacity and economic development level of counties, the higher the per capita tax, the stronger the industrial development, the stronger the tax contribution capacity and the relatively higher the development efficiency of counties. In the long-term development of outer-circle counties, they had been constrained by the unbalanced development strategy at the policy level. At the same time, their development emerged with a lot of problems, including weak industrial foundations, unclear advantageous industries, imperfect industrial systems, as well as limited location conditions, insufficient construction of production factors, slow improvement of the investment environment and so on. The cumulative cycle of all kinds of problems, emerged from the lack of development impetus, which had influenced the improvement of the economic development level of the outer-circle counties.

(2) Population urbanisation rate

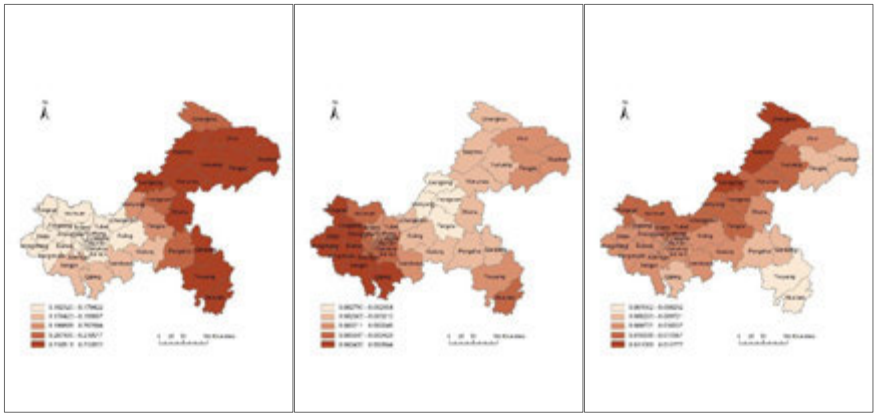
The population urbanisation rate had a positive impact on the development efficiency of counties. The regression coefficient of the population urbanisation rate showed a spatial distribution characteristic of gradually decreasing and then gradually increasing from west to east, and the spatial heterogeneity was relatively obvious. From the perspective of inner and outer circle division, the regression coefficients of inner circle counties in the west were larger, that is, the population urbanisation rate had a greater impact on the development efficiency of counties located on the edge of the core in the west. The population urbanisation rate reflected the changes in the urban and rural population structure and the development level of built-up areas in the counties. Counties located at the edge of the core were subject to the obvious siphoning effect of the core circle counties, and the phenomenon of the population moving to the central urban area in pursuit of higher levels of public services and higher quality employment opportunities was obvious, while the level of their urban construction was insufficient, making it difficult to attract the transfer of surplus rural labour to the cities, and the

development elements were insufficiently concentrated, resulting in the overall development efficiency of the counties being relatively low.

(3) Per capita residential savings deposit balance

There is a positive correlation between per capita savings deposit balance and development efficiency of district and county. The regression coefficients of per capita savings deposit balance showed a spatial distribution characteristic of decreasing from north to south. In terms of inner and outer circles, the regression coefficients of the factor were larger in the outer circle counties in the northeast area that were located in municipal border areas, which meant that the development efficiency of these counties was closely related to the per capita savings deposits balance. The per capita savings deposits balance reflected the level of residents' income. Chengkou, Kaizhou, and Liangping districts had poor local production conditions, and limited sources of income for residents, mainly relying on agricultural production and migrant work, the income level was low, making the overall development efficiency of the counties relatively low.

Fig.6. Spatial heterogeneity of influencing factors of tax revenue per capita, population urbanisation rate, per capita residential savings deposit balance.



4. Strategy

The classical theory of urban geography holds that the core and the periphery are interdependent, jointly constructing a complete spatial system, the development process of which has evolved from unrelated, isolated development to unbalanced development, and from unbalanced to interrelated balanced development (Lu *et al.*,2016). Based on the efficiency differences between the inner circle counties and outer circle counties in Chongqing, the city is in the stage of unbalanced development. To optimise the

economic spatial pattern of Chongqing, and to promote the formation of an interlinked balanced development pattern in counties of each circle, combined with the differences in the influencing factors of the development efficiency of each district and county, the following suggestions are put forward for the development of the inner circle counties and the outer circle counties, respectively.

4.1 Inner-Circle Counties

The factors affecting the development efficiency of inner circle counties are mainly the population urbanisation rate in the indicators of built-up area development condition. As a result, raising the urbanisation level of built-up areas, enhancing the attractiveness of counties, and promoting population concentration and development are the keys to raising the development efficiency of inner-circle counties.

On the one hand, inner circle counties need to comprehensively improve their soft and hard capabilities based on the diverse needs of various types of populations. At the hardware level, through the phased promotion of urban construction and renewal, the quality of the spatial environment in built-up areas should be optimised, and good housing, transport and other living conditions should be provided; and the efficiency, quality and satisfaction of public services should be upgraded in key areas, such as education, medical care and housing, so as to create conditions to attract the outgoing population back to the county. Second, reforms and innovations in the population system, community governance, and employment policies at the software level should be implemented to jointly promote the citizenship of the agricultural transfer population and the inward migrant population. By deepening the reform of the household registration system and relaxing the restrictions on urban settlement, it will guide the rural population and the migrant population from outside to gather in counties in an orderly manner. At the same time, to enhance community governance capacity, improve the quality of residents through organising community education, cultural and sports activities, and so on., and promote greater interaction among residents, to foster social integration among different groups of citizens. As well as implementing a proactive employment policy, optimising the environment for innovation and entrepreneurship, creating more high-quality jobs within counties, supporting the expansion of employment, and promoting high-quality development of the population.

On the other hand, take the initiative to collaborate with the integration of the Chongqing metropolitan area and strengthen the joint development with the core circle, thus effectively curbing the continuous loss of population in inner circle counties. Narrow the gap with the central urban area by upgrading public services and establishing a mechanism for the common construction and sharing of public service facilities, to achieve the sharing and accessibility of public resources. Strengthening transport and information links with the central urban area, so that residents of the counties can more conveniently enjoy high-quality resources as well as employment opportunities in the central urban area, and attracting the population of the central urban

area with the unique ecological and cultural resources of the counties, and promoting the reverse flow of population. Enhance industrial collaboration between inner-circle districts and the central urban area, forming industrial linkage effects, create more local employment opportunities, reduce the out-migration of residents due to employment, and at the same time, attract industrial spillover and talent overflow from the central urban area, to jointly improve the development efficiency of inner-circle counties.

4.2 Outer-Circle Counties

The development efficiency of outer-circle counties is mainly affected by the per capita tax revenue in the indicator of the level of economic development, while some outer-circle counties are also affected by the per capita residents' savings balance in the indicator of the level of residents' income. It can be found that promoting economic growth and increasing residents' income is the core driving force to enhance the development efficiency of Chongqing outer-circle counties.

On the one hand, the outer circle counties should focus on optimising their development environment and gathering internal forces for development. Firstly, according to the comparative advantages of their resources, they should guide the transformation and upgrading of traditional industries and cultivate competitive leading industries. At the same time, increases financial expenditure on innovation, stimulates the vitality of scientific and technological innovation, actively cultivates emerging industries, forms a diversified, high-value-added industrial system, improves product value-added and labour productivity, and drives tax growth. Secondly, optimize the allocation of public services and infrastructure, improve the investment and living environment, attract talent, technology and capital pouring in, and in the spatial planning of each level, strengthen the layout of the outer circle counties of transportation, information and other infrastructure, promote the interconnection of counties of each circle, shorten the spatial and temporal distance between the outer circle and the core circle, and improve the flow efficiency of resources between counties to support the Economic growth.

On the other hand, make full use of the positive edge effect of interaction and borrow development momentum. Firstly, based on regional synergy policy, using the radiation-driven role of the core circle and the inner circle to undertake the transfer of industries and technological overflow, and take the initiative to buttress its advantageous industries, develop supporting industries, and form an upstream and downstream linkage, division and collaboration of the industrial system. Secondly, given the weak economic foundation of the outer circle counties, which are at a disadvantage in regional competition, it is possible to establish a cooperation mechanism, build a group development mode, focus on cultivating group-level growth poles, and promote in-depth cooperation between counties in the form of co-built industrial parks, tourism zones, and logistic hubs, to form a secondary interrelated development mode in the outer circled districts and enhance the overall competitiveness.

5. Conclusion

Under the guidance of the 'core-periphery' theory, interpret policy documents and identify the uneven development of counties at the level of the regional development strategy of Chongqing, and divide them into three circles, including the core, the periphery of the core, and the periphery. Using the DEA model to measure the development efficiency of counties, and analyze the spatial distribution characteristics of the development efficiency of counties in Chongqing through the spatial auto-correlation method, identify the hot spots, cold spots and outliers of the development efficiency at the end of the study period, and analyze the spatial variations of the development efficiency of counties in different circles. A total of 20 variables in 5 dimensions, including economic development level, population agglomeration capacity, built-up area development conditions, industrial agglomeration capacity and living standard of residents, are selected to study the spatial heterogeneity of factors affecting the development efficiency of the counties of Chongqing and the effect level of the factors by applying the stepwise regression model and the GWR model, and to discuss the development strategies of the counties in different circles of Chongqing. The main findings are as follows:

（1）During the study period, the development efficiency of counties in the core circle of Chongqing has remained consistently high value, and the development efficiency of counties in the inner circle as a whole has continued to be higher than that of counties in the outer circle. Some inner-circle counties
have large differences in development efficiency with core-circle districts and counties in the process of development, and face the risk of marginalisation around the core circle. The area of low development efficiency in outer-circle counties is expanding significantly, and the characteristics of marginalisation are increasing.

（2）Tax per capita, population urbanisation rate and per capita savings deposit balance are the main factors influencing the development efficiency of counties in Chongqing, and their effects are spatially heterogeneous and positively correlated with the development efficiency. The development efficiency of counties in the inner circle is mainly affected by the population urbanisation rate, especially in Tongnan, Tongliang, Dazu, Bishan, Rongchang, Yongchuan, Jiangjin and Qijiang. The development efficiency of outer circle counties is mainly affected by per capita tax revenue, with the outer circle counties represented by Liangping, Kaizhou and Chengkou simultaneously significantly affected by per capita residential savings balances.

（3）Inner-circle counties need to optimise urban space and public services to retain population, and realise population agglomeration through population management, community governance and employment policy innovation. Also, strengthen collaboration with the core circle, share resources, smooth traffic and information, and cooperate with industrial development to mitigate the impact of siphoning and curb the outflow of population, as well as to stimulate economic vitality and efficiency through

the convergence of human capital. The outer circle should focus on building a competitive industrial system to accelerate economic growth, improve infrastructure, optimise the investment environment, participate in the division of labour under the framework of regional coordination, undertake industrial transfers, and develop complementary industries; deepen cooperation between counties to form a development model of clusters, cultivate growth poles, and drive economic growth in the region.

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Maintain Temporal Dynamics

What temporal characteristic needs to be preserved within the historic marketplaces of Palermo to encourage sustained interactions?

Abstract:
Immigration to Europe significantly increased in the 21st century, which challenges the integration of these immigrants. Palermo, is a significant destination for immigrants where tensions unfold between immigrants and locals. Many newcomers are economic immigrants seeking informal opportunities to secure their income in historical marketplaces where dynamic characteristics unfold. The aim is to identify the temporal characteristics that shall be retained within the historic marketplaces of Palermo, which encourage sustained interactions. The study uses Doreen Massey's theoretical framework on temporalities (2005) and Gehl's methods through an observational study (2013) in Ballaró and Vucciria markets. The results of the analysis demonstrate two market space typologies which encourage sustained interactions. Furthermore, five key spatial and social factors are defined as necessary to retain within historic marketplaces.

Keywords: immigration, sustained interaction, immigrant-local coexistence, marketplaces, temporality, social and economic inclusion

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1. Introduction

Over the past decade, immigration to Europe increased by 18% between 2020 and 2021 (Eurostat, 2023). This surge in the population is due to localised wars and considerable loss of habitats (Sassen, 2016; Montgomery, 2016). Italy is a significant destination for immigrants from Northern Africa, East Asia, and Europe (Comune di Palermo, 2021). However, the rise in illegal smuggling networks into Italy is host to many human rights issues. On the one hand, numbers rose due to criminal actions and environmental catastrophes in Northern Africa (Carney, 2021). On the other hand, the increasing number of people being trafficked to Lampedusa and Sicily is uncertain and dangerous (De Bruycker, 2013). The concern amongst many researchers is neutral on those committing to the journey as minimal resources are shared between them.

Across many Southern Italian cities, the distribution of immigrants is a concern as newcomers are undemocratically assigned a much greater percentage of residences compared to Northern Italy. Even if there are economic benefits for cities to accept immigrants, as they take on low-paying work that locals reject (Cole and Booth, 2007), their social integration is problematic. In Sicilian cities, the concern is the tensions between immigrants and locals that unfold due to cultural differences (Gutekunst et al., 2016). Palermo is a critical mediator between Lampedusa and Northern Italy. Over the 19th and 20th centuries, the middle and upper classes moved to the outskirts. Meanwhile, criminal forces surged in the historic centre (Schneider and Schneider, 2003), resulting in its physical degradation (Lo Piccolo, 1996). Consequently, the centre became a major attraction for immigrants to settle and form informal economic networks.

Liveability, access to employment, and socio-economic mobility are all human rights that economic immigrants seeking financial prosperity deserve. In informal economies, the illegalities and tensions between them and locals are unfolding due to the unresolved socioeconomic inequalities that immigrants face. The informal economies within the historic centre are crucial survival opportunities for immigrants, illustrating the significance of its study (Akiyode, 2017). Many economic immigrants trial informal vending on unauthorised lands such as residential and servicing streets (Lo Piccolo and Leone, 2018) and historic marketplaces on secondary commercial streets. Secondary streets are significant when discussing the tension between residents and immigrants as they are well-connected

to primary streets. Furthermore, these streets provide higher commercial prospects, which attract residents.

Previous research highlighted the urgency for revitalising the historic centre due to its physical degradation. These strategies outlined the historic marketplaces as a primary area to take action on (Wulff, 2020). Relevance to this focus includes the increasing number of low-income immigrants reliant on informal vending and the marketplaces' historical significance within the city. Therefore, the strategies infer the need to study the characteristics of historical marketplaces to suggest how to approach their continually dilapidating civic and built infrastructure.

The increasing number of immigrants and their informal practices present challenges in revitalising the city centre. Their socioeconomic characteristics can be defined by their propensity to change spatially, revealing the social characteristics of their practices (Kamalipour and Dovey, 2020). Therefore, the research focuses on studying the dynamism of historic marketplaces that demonstrate opportunities to ease tensions between immigrants and locals. As a theoretical framework, temporality is applicable and is defined through the incomplete nature of space (Massey, 2005). Temporality can be seen as both spatial and social processes. The former is viewed as the spatial morphology of space, and the latter is observed through encounters. Therefore, the research aims to define the temporal characteristics of historic marketplaces that shall be retained within historic marketplaces due to their physical degradation.

The research hypothesises that identifying temporal characteristics that shall be retained within the historic marketplaces of Palermo can gain benefits to the vibrancy and dynamism of the city.

The study's objective is to show which temporal characteristics can aid policymakers in developing alternative proposals for the revitalisation of the historic centre. Furthermore, the research provides a chance for a socio-spatial perspective which can support arguments on retaining the marketplaces' multicultural assets (Cole and Booth, 2016; Napoli and Bonafede, 2021) – such as the benefit to both immigrant and local citizens whose tension unfolds within them. Finally, this study is relevant to other Sicilian and Southern Italian streets of cities where informal vending activities are dominant. This can shed light on cities' informal, self-initiated employment structures that shall not and cannot be erased (Lefebvre, 1996).

An empirical visual assessment study is applied to study the temporal characteristics of marketplaces in Ballaró and Vucciria markets. Culturally diverse groups are investigated due to the difficulty in differentiating between the number of immigrants and residents (without implying bias). The theoretical framework investigates temporality through Massey's definition (2005). Three key concepts of her work can be applied in the historic marketplaces of Palermo to answer the following three research questions:

1. To what extent are the spatial characteristics of historic marketplaces temporal, measuring their spatial characteristics (through the theory of space as a process, constantly under construction)?

2. What spatial characteristics of marketplaces can be defined as everyday, and what can be seen as sustained by observing social actors (through the theory of space as a multiplicity of coexistence)?

3. What social characteristics of marketplaces are everyday and sustained measuring social interactions (through the theory of space as a product of interrelations)?

To answer the research questions, Section 2 introduces temporality as a theoretical framework by first discussing Doreen Massey's (2005) and Henri Lefebvre's (1996) definitions. Section 2 introduces the relevance of this research's empirical, observational methodology - using Doren Massey's theoretical framework (2005). Gehl's and Sverre's research methods (2013). Section 4 research question by

research question presents the observational study's findings, and Section 5 discusses and concludes the relevant temporal characteristics of historic marketplaces that shall be retained.

2. Theoretical Background: Temporality's role in historic marketplaces

The temporal was introduced through the philosophical conceptualisation of sharing spaces (Foucault, 1980, p.70). As societies develop over time, new occupations and, in turn, spatial pluralities are formed. The historical understanding of space understood the temporal as the layering of urban forms. However, spatial pluralism opened diverse discussions on the temporal by analysing time and breaking it down into smaller intervals (Bergson, 1911, p.131; Deleuze, 1980). Here, Deleuze's conception of continuous multiplicity is implemented, where the small intervals are seen as infinite and indivisible. Based on this definition, temporality can be examined through the morphological changes within the city. Two theorists' works are relevant in the context of historic marketplaces' multiculturalism, describing temporalities through simultaneity: Henri Lefebvre and Doreen Massey (1996, p.19; 2005, p.48).

Lefebvre's *right to the city* captures the incompleteness and ever-changing nature of the city (1986). He states that citizens shall practice this over spatial use. He sees temporality as an openness that shall be allowed and located among the homogeneous forms that connect the spatial and the social (1996, pp.105-106). According to his views, the marketplace is a mediation (1996, p.107) since it is neither a fragment nor a homogeneous part of the city. When marketplaces are closed, they become spatially fragmented (divided into unused spatial segments) and homogeneous (for instance, used for residents to retreat for the night). Therefore, the temporal can be seen as a mediation that serves everyday life. Lefebvre believed such mediation between the two is not accidental but the condition of the urban form.

In comparison, Massey's understanding of spatial justice considered the differences between spatial occupations that require negotiation and constraints. Her emphasis highlights the proximity of social actors occupying spaces (2005, p.93) which derive from Giddens's understanding of exclusion based on distances (1984, p.192). This results in space's dynamic and plural characteristics. She described the *simultaneous* characteristic of space as a critical principle that is constantly present in temporal sequences (2005, p.23). Instead of seeing as fragmented elements, she considers space as always incomplete, which becomes temporal through social relations. These relations unfold negotiations across its spatial occupation to acknowledge its plurality (Massey, 2005, pp.9-13). Plurality illustrates that space constantly changes as social processes inform spatial alterations, which then alter social relations. (Massey, 2005, p.71). Based on Massey's understanding, temporalities are located where social relations occur.

Applying this concept to marketplaces suggests that Massey's concept is relevant. Marketplaces are understood as the collection of individual market spaces, open for alteration through the spatial occupation of merchants and visitors. These two groups enact new social relations through interactions. A temporality is created when a new spatial use occurs that makes a market space open for change (for instance, expanding a vending area). Based on Massey's theoretical understanding, temporality can be defined according to three conditions of space: process, constantly under construction, multiplicity of coexistence, and product of interrelations. These concepts need to be studied to reveal the marketplaces' temporal characteristics.

Firstly, by seeing space as a process, constantly under construction, allows marketplaces to be perceived as open-ended (Massey, 2005, p.107), which defines them as both spatially and socially temporal. Consequently, the characteristics of marketplaces can be divided into a continuous and indefinite number of events (Massey, 2005, p.23). These events are a sequence of spatial changes, and, as such, the market spaces' dislocation (removal and displacement of spatial characteristics) can be understood as a process that defines them within an open system (Bergson et al., 1911, p.43). For instance, a user might infer spatial change that impacts another spatial condition and; therefore, impose alterations elsewhere. This understanding shows that marketplaces and their market spaces can be observed through their spatial changes, locating their frequency and occurrences.

Secondly, investigating space as a multiplicity of coexistence acknowledges its simultaneity and spatial plurality (Massey, 2005, p.9). The social processes that change them can be seen as minor co-constitutions that are temporal in character (Massey, 2005). Once a social relation (interaction) ends, the spatial differs from the temporal. This concept demonstrates that the temporal influences the spatial; therefore, the spatial constantly changes (Massey, 2005.p.18). While the temporal can be reduced to an event, the spatial cannot. For instance, a vendor might change the market space that a pedestrian uses for commuting. This example presents that a singular event (a vendor altering its market space) can be described as temporal. At the same time, the marketplace (seen as the spatial) has plurality, which is defined by social actors. This concept suggests the significance of studying market spaces according to the location of social actors (users).

Thirdly, space as a product of interrelations can be viewed as a negotiation that informs temporal changes (Massey, 2005, p.9). These social alterations occur at the edges of market spaces' different spatial elements and can be described as social relations. These social relations (interactions) are negotiations that require a mutual opening of borders spatially and socially (Massey, pp.56-66). This understanding implies that an encounter requires two participants to acknowledge each other's presence and form a relationship temporally. This social condition is significant because, if mutual recognition is not provided (for instance, one social actor observes another social actor), there is no encounter and; therefore, no spatial change. Alternatively, the spatial change can cause tensions between social actors. This concept highlights the need to study social relations in marketplaces, revealing spatial changes.

2.2. Interactions as Social Temporalities: differentiating everyday and sustained encounters

The concept of social relations as drivers of spatial changes derives from public life studies (Jacobs, 1961; Gehl, 2010) to ensure the vibrancy of the street. These studies demonstrate the significance of examining spatial conditions that influence the number of social actors and interactions between them. Encounters can be defined as everyday or sustained, depending on their nature (Jacobs, 1961; Mayblin et al., 2016, p.213).

In some cases, everyday interactions can be seen as a pleasant exchange (for instance, asking a stranger for directions). However, these encounters can also be considered inconvenient or cause discomfort (for example, bumping into someone on the street). These are often established within unfamiliar contexts (Loukaitou-Sideris and Ehrenfeucht, 2009) and seen as the initial contact. Consequently, these encounters are not timebound, and; thus, they can be defined as temporal interactions (Maybin et al., 2016; Massey, 2005). In contrast, sustained interactions are decided by individuals before the encounter. These can be considered sustained upon contacting them for the second time, which can occur in a familiar context.

Therefore, the difference between the encounters infers that there is significance in observing the spatial characteristics that promote sustained interactions. As everyday interactions occur more frequently, these affect the spatial alterations within marketplaces. Consequently, accidental interactions, and the context in which they occur, must be observed to study sustained encounters. Furthermore, their situational characteristics present the need to uncover what spatial characteristics contribute to both everyday and sustained interactions within the historic marketplaces of Palermo.

3. Methodology

The historical marketplaces must be observed to present the temporal characteristics that shall be preserved in Palermo. An empirical study visually and qualitatively assesses the historic marketplaces (Ewing and Clemente, 2013). Although other marketplaces were considered, Vucciria and Ballaró markets are studied as these have a high ratio of informal vending and are well-connected to formalised high streets that attract many residents.

The historic centre is divided into four quarters by Via Roma and Via Vittoria Emanuale. Ballaró market sits in Palazzo Reale, between two major pedestrian routes (Via Vittorio Emanuele and Via Maqueda) and is located near other tourist attractions (Palermo Cathedral and Norman Palace). However, the networks towards those areas are in poor condition and; consequently, the marketplace is mainly accessed from Via Maqueda. In comparison, Vucciria market is in Castellamare, which is close to the city port, a major pedestrian route called Via Vittorio Emanuele, and a significant vehicle road (Via Roma). This indicates that Ballaró and Vucciria are comparably accessible with slightly greater attraction towards Ballaró market (see Figure 1).

Figure 1. Ballaró and Vucciria markets presenting similar connectivity to primary street networks and touristic attractions.

A centrally located 50-metre stretch of the main street of both marketplaces is observed, providing the basis for the comparison (Via Ballaró and Via Maccherronai, respectively). This central location enables the assessment of similar flows and interactions between the two marketplaces. Massey's theoretical framework on temporality (as presented in section 2.1) (2005) is applied to understand the marketplaces' temporalities through both their spatial and social temporalities. The framework is divided into a three-stage analysis of spatial temporalities (spatial changes), social actors (users), and social relations (encounters). Using Gehl and Svarre's visual assessment methodological framework (2013), data is collected and analysed qualitatively to define the spatial and social factors that contribute to sustained interactions. All data is collated under similar conditions and during the end of tourist seasons. Consequently, it could be anticipated that the number of observations tallied would likely drop during other seasons over the course of the year.

The spatial alterations are observed in historic marketplaces by applying the concept of *space as a process, constantly under construction*. Both Vucciria and Ballaró marketplaces have a continuous row of market spaces. Their common spatial characteristics include: a storage unit or shop within the built fabric (serving space) and a unit where the products are sold (exchange space). The space between exchange spaces can be defined as the transition space where the commute occurs. Each market space has an associated transition space based on the centre of the street.

Massey interprets the temporal as being open-ended. Based on this understanding, the edges between serving, exchange, and transition spaces can be seen as the drivers of spatial alteration. Social processes

generate these by adding, removing, or dislocating their elements. The aim is to define where the highest alteration occurs and which spatial characteristic drives spatial changes (Lynn, 2004, p.44). For instance, it can be observed that the edges between transition and exchange spaces are constantly changing if many people and interactions are occurring within them. Therefore, these must be mapped according to the location of these changes (Gehl, 2010). Based on this, seven different spatial temporalities can be defined within the historic marketplaces in Palermo (see Figure 2):

1. Serving space
2. The edge between serving and transition spaces
3. The edge between serving and exchange spaces
4. Exchange space
5. The edge between exchange spaces
6. The edge between exchange and transition spaces
7. Transition space

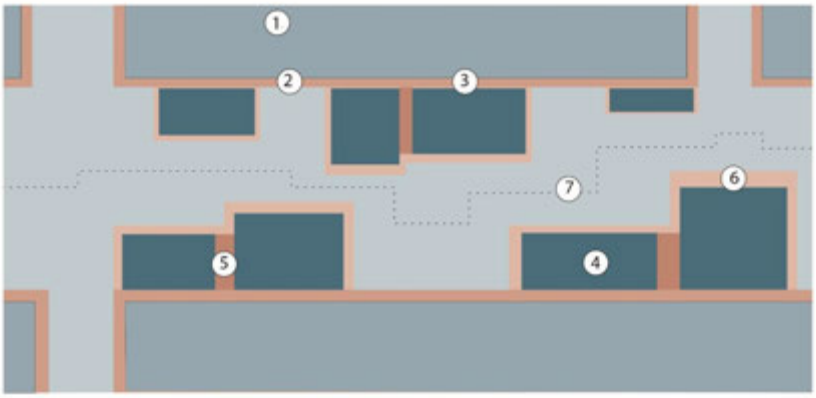

Figure 2: The Spatial Temporalities within historic marketplaces of Palermo

The study conducts a morphological mapping exercise using Gehl's soft and active edge methods. These methods can help quantify the spatial temporalities of Palermo's historic marketplaces. Firstly, soft edges are defined based on the transition between built fabric and public space. In this context, all spatial characteristics can be seen as soft edges as they constantly change. This concept can be applied to this research by examining the market space's size and frontage length. Secondly, active edges are defined based on the frontages' activity related to when a market space is open or closed. This approach can be applied to market spaces by examining opening days and hours. Therefore, spatial changes are mapped according to social actors' location.

Both marketplaces are observed at incremental intervals (hourly, daily and weekly) to establish the time in which spatial changes occur. The aim is to establish the time within which spatial temporalities are not changing and, therefore, are static (Tang and Long, 2019). This approach can be used to justify marketplaces' open-ended nature and define spatial factors that alter within them.

Applying the concept of *space as a multiplicity of co-existence*, spatial plurality can be observed in transition, exchange, and serving spaces (where people are present). For instance, a pedestrian might commute to the same area within the transition space where a market vendor wants to extend their exchange space. This demonstrates both users' need to negotiate over space, forming a temporality within which spatial alterations occur. Consequently, the users that inform these spatial changes must be identified according to their location and length of spatial occupation, using the spatial factors defined in section 3.1.1 (Pratt, 1992).

Social actors' location and length of spatial occupation can be mapped using Gehl's behavioural method. This approach can be applied to this study (Gehl and Svarre, 2013, pp.84-85) by observing pedestrian and stationary activities. Pedestrian transitions are movements between different spatial characteristics. In contrast, stationary activities are static, where users remain within spatial characteristics. Users' location is measured twice at three different times of the day (9 a.m., 12 p.m. and 3 p.m.) The aim is to define the number of people, differentiating market vendors, visitors, pedestrians, and stationary users. This will aid in differentiating everyday and sustained spatial characteristics of the marketplaces. Furthermore, it can help to define social actors within marketplaces which inform spatial changes, using the spatial factors established in section 3.1.

Using the concept of *space as a product of interrelations*, social relations can be seen through interactions based on the location of social actors. As the focus is on examining encounters between spatially different conditions, these are only observed based on the edges between transition, exchange, and serving spaces. Everyday and sustained interactions are differentiated between these edges to determine how these affect the spatial and social alterations (as presented in sections 3.1.1. and 3.1.2). For instance, market vendors often develop encounters with visitors at their counter space, where successful commerce can reinforce the exchange space's expansion. However, an encounter between two users of the transition space does not form spatial alterations in the marketplaces (as they do not withhold agency over trading spaces). Based on this, the study examines four edges where everyday and sustained interactions occur (see Figure 2).

Using Gehl's and Svarre's behavioural mapping method (2013, pp.84-85), encounters are observed based on the users' location in serving, exchange and transition spaces. Using this, the frequency and duration of encounters can be measured to distinguish between sustained and everyday encounters. An interaction lasting longer than five minutes is considered a sustained encounter. The study aims to define spatial and social characteristics (as presented in sections 3.1.1 and 3.1.2) that contribute to sustained encounters.

4. Results: Market space typologies that encourage sustained interactions

4.1.Space as a 'process, constantly under construction'

The study aims to define the extent to which the marketplaces are temporal. Firstly, the analysis presents differences between marketplaces using the seven identified spatial characteristics (serving, exchange, transition spaces and the edges between them). This can aid in defining the alteration rate within market space elements. Secondly, these observations are reasoned by highlighting the differences between market spaces. This analysis enables the identification of dependencies between the observed parameters (opening hours, opening days, frontage length, and area) that aid in defining spatial factors that alter the spatial characteristics of marketplaces.

Firstly, comparing Ballaró and Vucciria markets, the transition space demonstrated a highest alteration rate (minute-based changes), and exchange and serving spaces exhibited hourly and daily changes, respectively. The defined edges illustrate characteristics similar to how the transition, exchange, and serving spaces alter. For instance, the edge between the transition and serving space would present spatial change on a minute basis that matches the transition space. The minute-based alteration rates indicate that the changes in the transition space and associated edges result from direct social relations (interactions). In contrast, the daily and hourly changes of other spatial characteristics result from indirect social relations. These indirect encounters can be interpreted as deriving from more complex social relations between social actors based on market vendors' socio-economic position. For instance, one would enter the market space's serving space following a sustained encounter with the vendor. However, it is assumed that once market vendors become friendly with each other, and have performed multiple previous sustained encounters, they would be willing to allow each other to occupy the area of their exchange space when required. Therefore, minute-based changes need to be recorded through observation of the social actors and direct social relations (interactions). However, the hourly and daily

changes can be observed through the indirect social relations manifested in other market spaces' spatial occupations. These can only occur directly with neighbouring market spaces.

Secondly, the spatial factors that impact changes can be identified upon comparing the market spaces to each other. The hourly and daily spatial alterations are displayed through visual diagrams which investigate four spatial factors which were identified in section 3 (opening days and hours, area, and frontage length). The diagrams indicate that the market spaces with shorter opening hours and days are less likely to change (see Figure 2), whereas market spaces with longer frontages are more likely to occupy other spaces. This factor is more relevant in Vucciria market. The area of market spaces did not reveal any relevance to these factors (see Appendix 7.3.1 and 7.4.1).

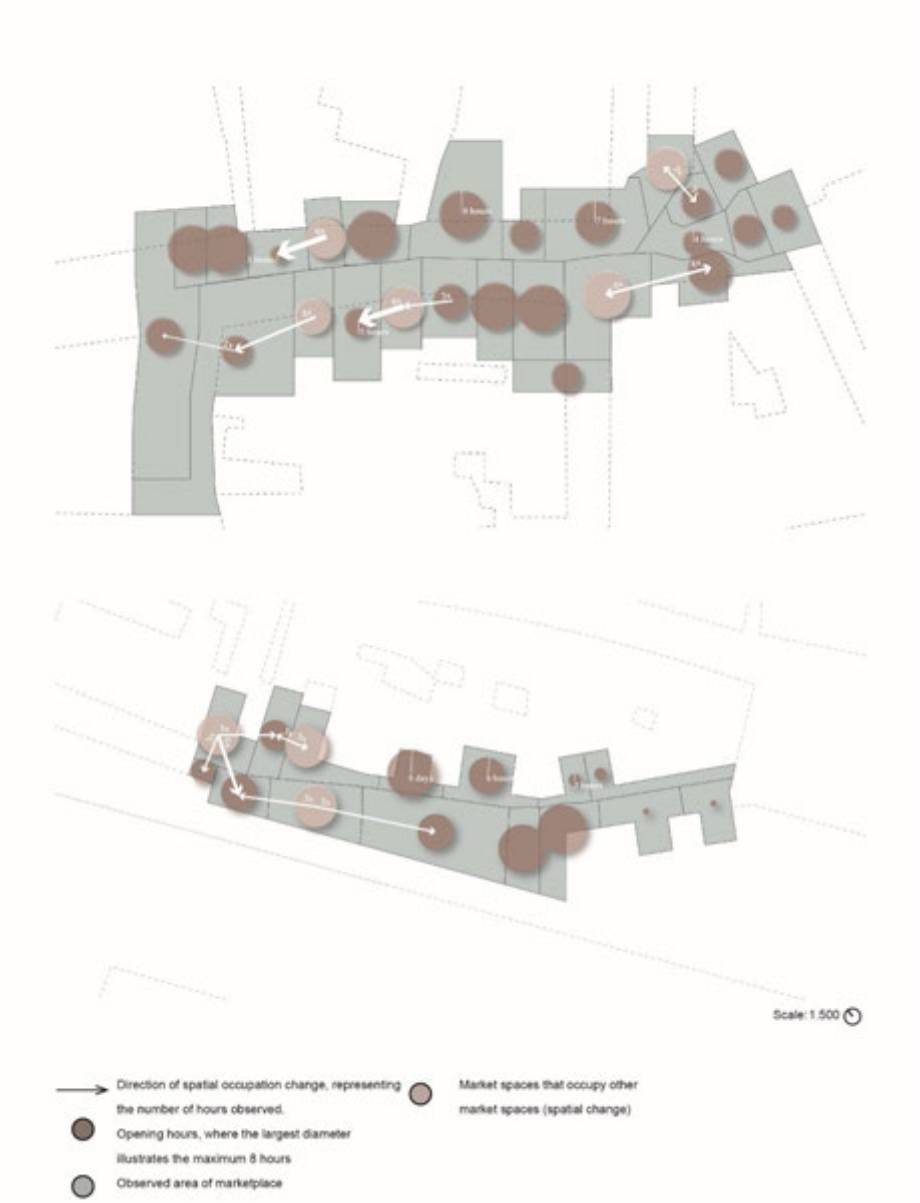

Figure 3: The number of open hours on a day indicated by the diameter size in relation to the direction of spatial occupations of neighbouring market spaces in Ballaró market.

Overall, both indirect and direct social alterations drive the spatial changes in market spaces. Differences were indicated between market spaces that are reflected in the frontage length, opening hours, and opening days. The correlations suggest that the alteration rate can be identified through these spatial factors.

4.2.Space as a ‘multiplicity of coexistence’

The study aims to define if the spatial characteristics of marketplaces can be seen as everyday or sustained. The analysis is based on seeing stationary and pedestrian activities as sustained and everyday spatial characteristics, respectively. Firstly, the number of social actors (pedestrian and stationary) and their roles (as vendors or visitors) are observed between the two marketplaces. Secondly, a comparison is made between the market spaces to understand the relationship between the number and role of social actors. Thirdly, the spatial factors (identified in section 4.1) are observed with regards to social actors to grasp the nature of their relationships qualitatively.

Firstly, comparing Ballaró and Vuccira markets, the analysis shows a similar number of market vendors. Furthermore, similar tendencies can be seen between the two marketplaces when comparing the observation times according to the number of pedestrian and stationary activities. Both Ballaró and Vucciria markets are host to high stationary and pedestrian activities at 12 p.m. However, Ballaró exhibits an average increase of more than 1.5 pedestrian users, with an average of 152 users in comparison to 90 in Vucciria market at 12 p.m. This exhibits a significant difference between the number of visitors between the two marketplaces, showing relevance at all observed times. Similar patterns can be noticed when assessing the spatial distribution of social actors. In the case of stationary users, the difference in distribution is insignificant (see Figure 5). Regarding pedestrian users, both Ballaró and Vucciria markets indicate the highest population of people in the transition spaces (see Figure 4). However, the comparison demonstrates a significant difference in pedestrian users, with an average of 100 users in Ballaró and 51 in Vucciria. Furthermore, serving and exchange spaces exhibit a similar number of everyday and stationary users, similar to the number of stationary users in the transition space for both marketplaces (see Appendix 7.3.2 and 7.4.2). This indicates that transition space generates a significant number of everyday users. However, none of the spatial characteristics can exclusively be defined as everyday. Therefore, the analysis infers that both everyday and sustained conditions are present within all spatial characteristics.

Figure 4: The average distribution of pedestrian users across spatial temporalities in Ballaró and Vucciria markets, showing significance to transition space.

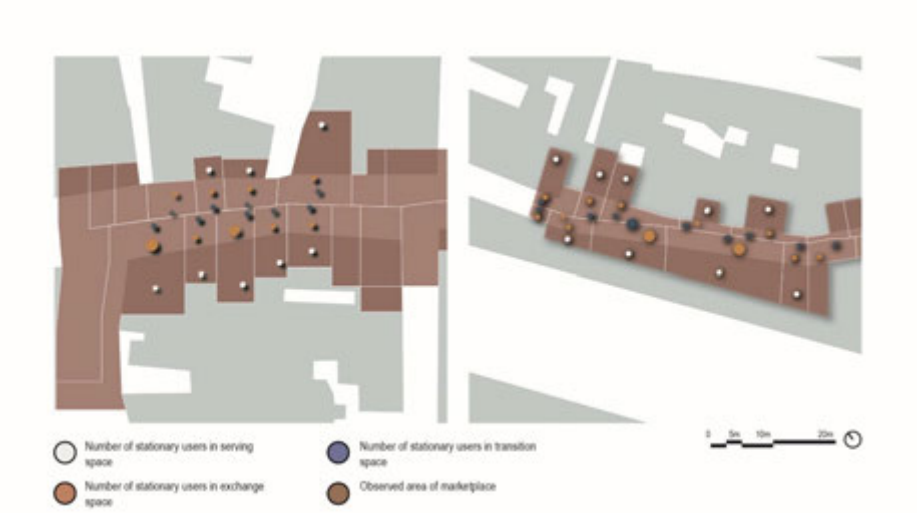

Figure 5: The average distribution of stationary users across spatial temporalities in Ballaró and Vucciria markets, showing significance to transition space.

Secondly, the market spaces are compared to understand the reason all spatial characteristics can be described in everyday and sustained conditions. This study can aid in defining the relationship between pedestrian, stationary, and market vendors. The observed relationship between the number of market vendors and pedestrian activities shows minimal positive correlation (see Figure 35). However, there is a positive connection between the number of people attracted to stationary activities and the number of market vendors. The analysis demonstrates that market vendors play a significant role in generating more sustained encounters. This positive correlation can be interpreted as the market vendors initiating encounters with visitors, encouraging them to become stationary users within market spaces.

When examining the relationship between pedestrian and stationary activities, differences were shown between the two marketplaces and between market spaces according to the measurement time. On the one hand, in Ballaró market, there is a higher density of stationary activities, where pedestrian movement is greater. On the other hand, Vucciria market suggests that the higher number of stationary users is not located in the areas with the highest number of pedestrian users. Both indicate that there is a positive correlation between stationary and pedestrian users. However, the case of Vucciria illustrates that, even if a significant number of pedestrian movement is needed, pedestrian users are widely distributed across all market spaces. This result can be interpreted as Ballaró market driving large pedestrian traffic, certain areas of marketplaces exhibit a high concentration of pedestrian users. Such areas are where a higher number of sustained activities occur in market spaces.

Thirdly, to understand what spatial factors explain the difference between the two types of market spaces, the results of section 4.1 are examined. Based on the comparison, a positive relationship is seen between the opening hours, the area of transition space, the overall market space, and pedestrian movement. The market spaces with shorter opening hours indicate a higher rate of pedestrian activities in both marketplaces. These trends can be interpreted from two differing perspectives: the market spaces might open for shorter periods to generate substantial income more quickly; or market vendors focus more on engaging visitors to make them stop.

However, when looking at the area of transition spaces and overall market spaces, a similar difference can be identified between the two marketplaces, as illustrated previously. In the case of Ballaró market,

the larger market spaces and transition spaces exhibit a larger pedestrian flow. In comparison, in the Vucciria market, those market spaces present the largest pedestrian flow, which indicate an average size. This difference is not apparent when comparing the two marketplaces' spatial factors and stationary activities. Both marketplaces show that stationary activities are indicative of a positive relationship between the area of transition space, the overall area, and the frontage length of market spaces. Consequently, the larger the area and the longer the frontage of the market space, the more stationary users can be accommodated.

Overall, it is possible to see that transition, exchange, and serving spaces all exhibit everyday and sustained spatial characteristics. The positive correlation between stationary and pedestrian activities was examined to understand this condition. This demonstrated how Ballaró and Vucciria market requires a high and average frequency of pedestrian activities, respectively, when the number of stationary activities is high. A similar pattern was indicated when looking at the relationship between the two types of activities and spatial factors. However, the two marketplaces did not differ when examining stationary activities. The results show that the differences are based on pedestrian activities instead of stationary ones. One potential interpretation is that the degradation of the city centre's physical civic infrastructure makes market spaces more accessible to economic immigrants. The dilapidation can be seen as relevant to the ratio of tourists and visitors that should be considered regarding the number and type of users.

Therefore, it can be concluded that seeing marketplaces as a multiplicity of coexistence is relevant to understand their ability to generate everyday and sustained spatial usage. Furthermore, a positive correlation was qualitatively observed between pedestrian and stationary activities. The differences between the two marketplaces suggest the importance of considering the ratio of tourists and visitors relative to the physical degradation of the marketplaces.

4.3.Space as a ‘product of interrelations’

The study aims to define the social factors that are positively related to sustained encounters. Firstly, encounters are examined to compare marketplaces, differentiating their length of time (everyday and sustained). Secondly, market spaces are compared to observe the relationship between the two types of interactions. Thirdly, these differences are observed in relation to the results of sections 4.1 and 4.2.

Firstly, comparing Vucciria and Ballaró markets, the number of sustained and everyday interactions present similar trends according to the time of the day. The largest number of everyday and sustained encounters are exhibited at 12 p.m. This shows similarities to the observations in section 4.2. However, differences are indicated in the overall number of encounters, as Ballaró market hosts twice the number interactions across the day compared to Vucciria market. Similarly, the same patterns can be observed between the two marketplaces in accordance with the location of interactions. In Ballaró market, most encounters happen between exchange and transition spaces (see Figure 6). Furthermore, everyday interactions are observed more frequently in Ballaró market than sustained interactions. In comparison, in Vucciria, interactions are equally distributed (see Figure 7). Moreover, the two types of encounters are equally spread across transition, exchange, and serving spaces in Vucciria.

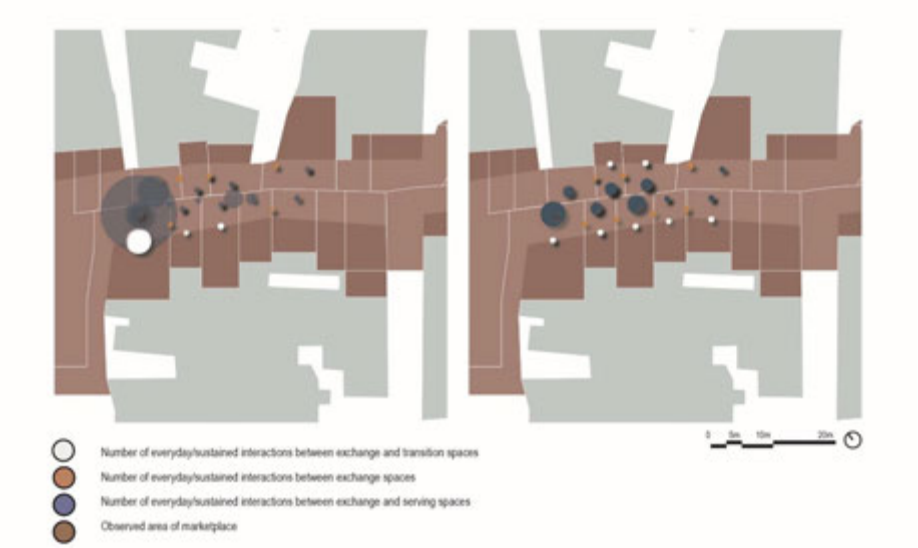

Figure 6. The spatial distribution of everyday (left image) and sustained (right image) interactions in Ballaró market, showing similarities between a higher proportion of encounters between transition and exchange spaces.

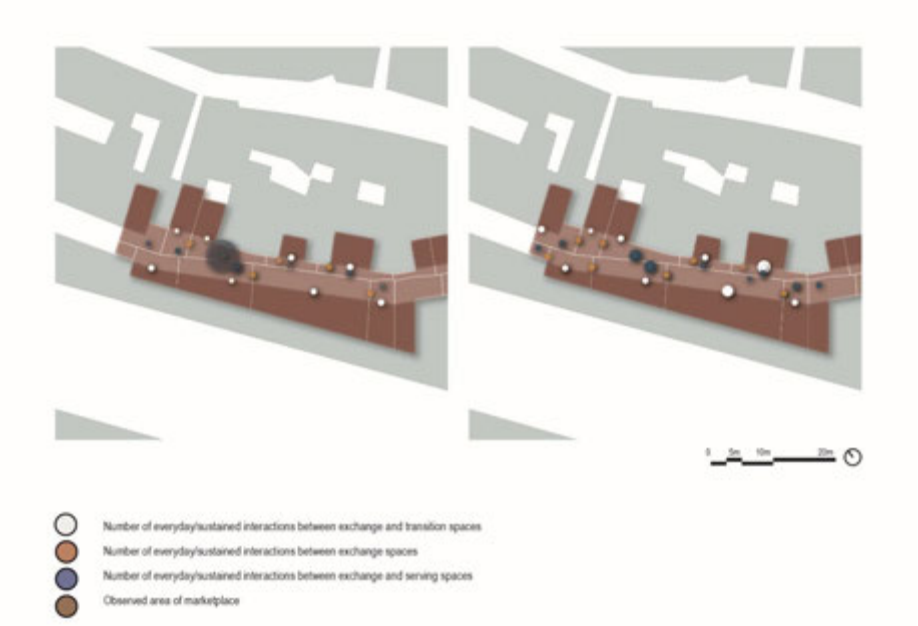

Figure 7. The spatial distribution of everyday and sustained interactions in Vucciria market, showing an equal distribution of interactions across all spatial characteristics.

Secondly, the market spaces are compared to understand the differences in the spatial distribution between the two marketplaces. Looking at the relationship between everyday and sustained interactions, both marketplaces suggest a higher number of sustained interactions in areas with a high number of everyday interactions. However, there are differences in where they occur. In the first case, there are market spaces that are host to the highest ratio of everyday encounters between exchange and transition spaces (as displayed in Figures 6 and 7). When relating these market spaces to sustained interactions, many are held between transition and exchange spaces. However, these market spaces demonstrate a larger proportion of everyday interactions between exchange and serving spaces. In the second case, market spaces show an average number of everyday encounters between exchange and transition spaces. However, these present the highest number of sustained interactions in the same area. Furthermore, these exhibit a higher proportion of sustained encounters between exchange and serving spaces. The analysis indicates that everyday interactions can be a catalyst in forming more everyday encounters within the marketplace. More crucially, there are two different scenarios when a high number of sustained interactions are observed. The spatial factors (illustrated in section 4.1) and social actors (presented in section 4.2) must be examined to understand the reason for these differences.

Thirdly, different positive correlations are presented when comparing spatial and social factors to sustained and everyday interactions. Opening hours, size, and pedestrian users positively connect to everyday encounters. As illustrated in section 4.2, pedestrian activities positively relate to larger opening hours and areas. Looking at the relationship between everyday and pedestrian users, everyday encounters are reproduced if there is a high pedestrian flow. Ballaró market was particularly susceptible to this, being host to the highest number of everyday encounters at these times. When examining sustained interactions, relevance is given to the size, frontage length, and number of stationary activities. As shown in section 4.2, stationary activities positively relate to frontage length and size of market spaces. A positive correlation exists in the relationship between stationary users and sustained interactions. The results show that sustained encounters are spread more widely within the market spaces in both the Vucciria and Ballaró markets. In contrast, everyday interactions are concentrated in certain areas of the marketplace. This pattern indicates that the spatial distribution between the two types of encounters generates two spatially different market spaces where a high number of sustained interactions occur.

In the first scenario, market spaces demonstrate a high number of everyday and an average number of sustained interactions between the transition and exchange space. Furthermore, there is a high number of sustained and everyday encounters between the exchange and serving spaces. As there is a high pedestrian flow, this exhibits shorter opening hours and an average size of market spaces. In this case, everyday interactions generate sustained encounters between the exchange and transition spaces. Furthermore, everyday interactions benefit the generation of sustained ones, mainly between the exchange and serving spaces.

In the second case, market spaces demonstrate an average number of everyday interactions (compared to the first) and a high number of sustained encounters between the transition and exchange spaces. Furthermore, between the exchange and serving spaces, a low number of everyday and an average number of sustained interactions are indicated. In the case that there is an average pedestrian flow, these market spaces are often bigger and can be open slightly longer. In this case, everyday interactions in the transition space generate sustained encounters, mainly between the transition and exchange spaces.

Therefore, the two scenarios infer that the hypothesis must be correct, and there can be beneficial spatial and social constructs where everyday interactions aid in developing sustained ones. It must be understood that Ballaró market is host to more market spaces than Vucciria market. However, Vucciria market holds more examples of the second market space typology. It must be noted that both market space typologies are present in the two marketplaces. The difference is in the user number, and the number of market spaces demonstrated. Consequently, the spread of market spaces needs to be considered regarding the condition and affordability of buildings for immigrants.

5. Discussion and Conclusion: Temporal characteristics that encourage sustained interactions

5.1.Key findings

To study the temporal characteristics which shall be retained within Palermo's historical marketplaces (Ballaró and Vucciria).. Temporalities are studied through Massey's framework (2005) in three analyses, using Gehl and Svarre's empirical and observational methods (2013). Firstly, the extent to which marketplaces are temporal is discussed, identifying spatial factors that alter them. Secondly, marketplaces are studied through social actors that enable distinguishing everyday and sustained spatial characteristics. Finally, everyday and sustained interactions are observed in relation to the identified spatial and social factors.

The research concludes that five key spatial and social characteristics contribute to sustained interactions: the area of market space, the length of frontage, the area of transition space, opening hours, and the number of vendors. These temporal factors manifest in two market space typologies that show beneficial social and spatial constructs where sustained socio-spatial constructs occur. The result infers that marketplaces' spatial and social characteristics should be maintained and encouraged when considering how to regenerate Palermo's historic centre. To accommodate the differences in temporal factors, economic accessibility, physical degradation (civic and built), affordability, tourist appeal, and social integration must be considered. In contrast, the regeneration will not address those socio-economic realities that immigrants inevitably face.

5.2.Contextual factors

Firstly, based on the analysis of spatial factors, the differences between marketplaces showed relevance to land value that influence spatial changes. When comparing the immigration rate and sales value of Palermo's neighbourhoods, both marketplaces are located in the areas with the lowest values (Napoli and Bonafede, 2022, pp.1281-1282). Ballaró market has an immigration rate of 20%, whilst Vucciria market has an immigration rate of 17% (Napoli and Bonafede, 2022, p.1275). Additionally, Ballaró market, on average, has a lower sale value per unit than Vucciria market. These indicators suggest there is a higher association with illegalities and black economies within these areas. The higher immigration and lower sales value in the neighbourhood of Ballaró market suggest that criminal forces have become more prevalent. Therefore, criminal forces can impact immigrants' accessibility to marketplaces, their socioeconomic status and where spatial changes occur.

On the one hand, if forceful incentives continue to be implemented, informal practices would significantly decrease in the historic centre. Such incentives already include the documentation of supply chains, formal registration of business transferral, taxation after commercial activities, and rented property (Comune di Palermo, 1995; ibid, 2021). Consequently, these would continue to reduce the survival activities of immigrant workers. On the other hand, if the dominant actions of criminal forces continue, these will keep altering the temporal practices within the marketplaces. The lack of governance can strengthen black economies, posing challenges to economic growth due to untraceable and untaxable supply chains. Furthermore, these can expose highly unattractive illegalities (such as vandalism and violence) to locals and tourists, reducing marketplaces' attractiveness.
Bottom-up incentives (such as SOS Ballaró and Associazione Mercato Storico di Ballarò) implemented strategies to promote the self-management of marketplaces (Wulff, 2018). These strategies benefited immigrants by indicating the necessity of engaging with local communities and authorities to maintain the spatial dynamism of the marketplace. However, as there is an increasing number of economic migrants and a lack of formal employment, these initiatives need to be considered by local governmental bodies. The self-management of the marketplaces must be encouraged by a regeneration policy involving the participation of locals and market vendors. Furthermore, these need to consider criminal forces that may irresponsibly expand them. Such self-management can be applied by reviewing the existing social infrastructure provision for immigrants (including skill-building and social security).

Secondly, based on the analysis of social actors, there is a difference between Ballaró and Vucciria markets regarding the number of pedestrian users caused by their touristic appeal and physical civic degradation. As presented in Chapter 3, Vucciria is less accessible through pedestrian networks and further away from primary tourist hubs than Ballaró market. These differences can be indicated by comparing these observations to the sales and rental value of high streets (Napoli and Barbaro, 2022, pp.1281-1282). The highest unit sales value can be seen around Vittorio Emanuele and the second section of Maqueda (see Figure 8). These areas are near the key tourist attractions and Politeama, where high-value shops are located. In contrast, the lowest unit values are in the first section of Via Maqueda, which significantly dropped between 2017 and 2020. This decrease in sales value is suggested in both sections of Via Roma, but their unit sales value is closer to the value of Via Maqueda's first section.

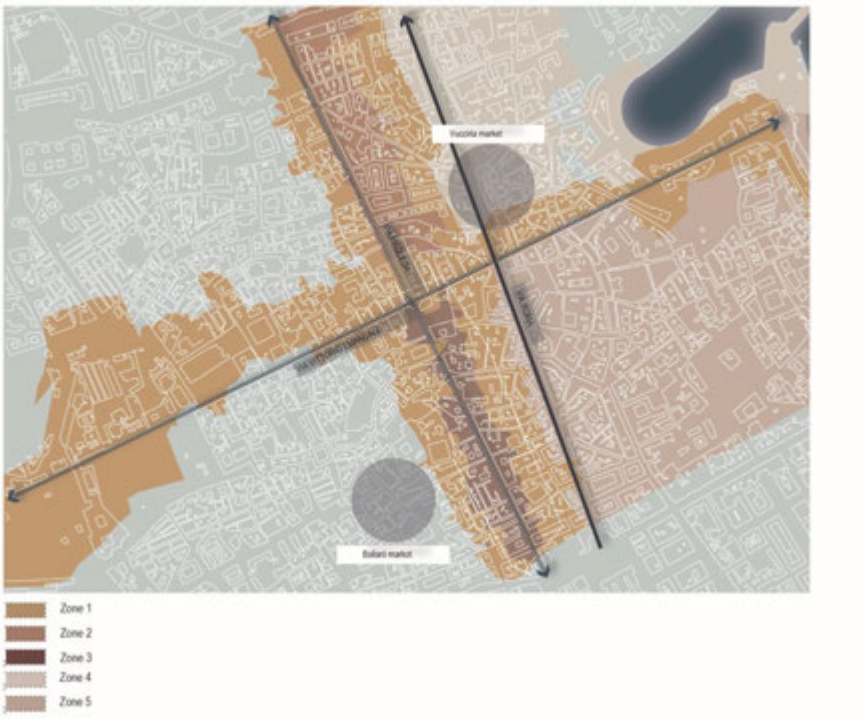

Figure 8. Sales and rental value differences between high streets, figure adapted from Napoli and Barbaro (2022, pp.1281-1282).

A significant difference can be seen between Vittorio Emanuele and the first section of Via Maqueda when looking at the rental value of high street shops. This difference indicates that the marketplaces' location has likely devalued over time, with a more substantial drop in the Ballaró market. The decreasing value can be interpreted as an accessibility issue in Via Vittorio Emanuele, reducing the number of tourists visiting the marketplace. Instead, many users access it from Via Maqueda's first section. Furthermore, the value decrease can also be understood as being due to the higher rate of immigrants within these neighbourhoods (Napoli and Bonafede, 2022, p.1275). However, Ballaró market's proximity to the highest sales value area attracts more tourists than the Vucciria market. Therefore, the analysis shows that regeneration plans must consider the physical civic condition of marketplaces to improve their accessibility and visibility, considering their differences in land value. However, upgrades to physical civic infrastructure must also be proposed with the understanding that

it will raise the property and land values of the areas. Consequently, these market spaces will become less accessible for immigrants to settle and form informal practices.

Finally, the two market typologies derive from the different spatial distributions of everyday and sustained interactions. In Ballaró market, there are more market spaces where a high number of sustained encounters occur in the transition space. In comparison, in Vucciria, these are within the exchange and serving spaces. Therefore, the physical condition (regarding affordability) and social integration (in relation to tourism) need to be considered for future proposed development strategies. On the one hand, in the first scenario, the strengthening of transition spaces can be challenging due to the constrained area between exchange spaces. However, these can be addressed more quickly and allow the continuous running of market spaces. On the other hand, the second scenario, where the exchange and serving spaces require improvements, demonstrates accessibility constraints by large vehicles, restrictions due to the historical setting, and the displacement of market vendors. Furthermore, those market spaces that perform well in generating sustained encounters are dilapidating the most. This negative correlation suggests that accessing these buildings and developing a higher-performing business is only a temporary solution for vendors. This is due to the building's lack of maintenance and the inhabitance of squatters, reducing safety and hygienic conditions.

Therefore, both scenarios indicate that there are difficulties in regenerating marketplaces, and there is a need for affordable incentives for economic immigrants. Contrastingly, the regeneration will result in the dispersal of immigrants into various city segments instead of allowing them to remain within the historic centre. Furthermore, both marketplaces presented a high tourist appeal and opening hours and days that responded to their need. This approach, and the lack of safety around marketplaces, demonstrates why residents avoid entering marketplaces within and beyond tourist periods. Consequently, regeneration strategies must encourage the expansion of the marketplace's opening period to attract more residents and develop better connections between them and immigrants.

5.3.Outlook

The current research findings conclude that the identified temporal characteristics shall be retained within the marketplaces should be considered regarding the broader regeneration of the historic centre. The devaluing of the area attracts many immigrants and causes tensions between them and the residents. Such conditions are influenced by the increasing number of immigrants, the difficulty of their social integration, criminal forces' control over the marketplaces, and the physical degradation of buildings and civic infrastructure. Therefore, to accommodate for sustained encounters within the historical marketplaces, five key requirements must be granted and achieved: social infrastructure provision, self-management of the marketplaces, upgrading physical civic infrastructure to improve the accessibility of marketplaces, affordability of market spaces for market vendors, and extending usage time to attract various social groups.
However, it must be noted that the validity of the results is restrained to the analysed case studies, and the conclusions are essentially qualitative, as the data used to conduct the analysis are not quantitative. The empirical research is, based on observations, beneficial to studying the socio-spatial conditions of these secondary streets where informal economies dominate. Further studies on the historical marketplaces of Palermo and other marketplaces within Sicily and Southern Italy would better this study. Collating additional spatial and social data from wider street networks, using digital scanning methods and observational studies, would be beneficial. Moreover, the study could be expanded to observe different types of streets where informal economies are dominant to give suggestions on how these findings relate to other informal practices.

Similarly to Palermo, many other Sicilian and Southern Italian cities demonstrate similar patterns. To consider the regeneration of decaying historic centres, the study shows that it is crucial to preserve informal economies due to their indispensable ability to ensure marginalised groups' liveability. Therefore, maintaining the temporal characteristics of historic marketplaces plays a significant role in resolving tensions between culturally diverse groups.

6. Data statement

The research has undergone ethical approval, by the Welsh School of Architecture's Research Ethics Committee (SREC reference: 23021).

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Equity in essential services accessibility among the elderly: a comparison of community resilience during and after the COVID-19 pandemic

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Abstract
The COVID-19 has caused heavy damage across the globe. Lockdown measures implemented during the pandemic have affected residents' normal daily lives. During the stay-at-home orders, the elderly faced greater challenges in accessing essential services due to their physical limitations. Reducing inequities in access to essential service facilities is crucial for enhancing community resilience. In this research, three indexes were developed to measure community resilience in accessing essential services. Specifically, we have considered the differences in walking ability between the elderly and healthy adults, as well as the unique needs of the elderly. The Lorenz curve and the Gini coefficient were employed to measure spatial equity. Shanghai was selected as our case study. We utilized datasets from 2020 and 2023 to compare changes in equity during and after the COVID-19 pandemic. The results indicate that the Diversity Index exhibits the highest equity, followed by the Demand Accessibility Index, while the equity of the Per Capita Quantity Index is the lowest. The distribution of essential service facilities post-pandemic is moving in a direction unfavourable to the needs of the elderly. These findings provide valuable scientific insights for policymakers to strengthen community resilience and reduce inequities in essential facility access.

Keywords
equity; the elderly; essential services; accessibility; community resilience

1. Introduction

The COVID-19 has been a serious global pandemic in the past four years, claiming millions of lives and causing significant damage worldwide. During the most severe periods of the pandemic, many countries implemented various restrictions on travel and activities(Abdullah et al., 2020), collectively known as 'lockdowns'. These measures included school closures, remote work, limitations on public gatherings, curfews, the suspension of international flights, and the enforcement of social distancing guidelines, etc.

During the lockdown, only essential services remain open, and residents are permitted to leave their homes only to collect essential items, such as food and medicine.

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Lockdowns are considered the most effective means of controlling the spread of the virus(Kabiraj et al., 2020), but they also inevitably result in the decline of urban functions and disrupt citizens' normal daily lives. Additionally, the lockdowns have exacerbated many inequities, with vulnerable groups facing greater difficulties such as accessing essential services and working from home, etc. Various viruses may continue to emerge in the future, we need to learn from past lockdown periods and focus on reducing the inequities they cause, thereby enhancing community resilience in the face of infectious diseases.

Recent studies have highlighted that the vulnerability of the population and the built environment are two key factors affecting the resilience of communities impacted by COVID-19(Xu et al., 2021). In this paper, our main focus is on the equity of community resilience concerning residents' accessibility to essential service facilities, particularly for senior citizens. We have found that the elderly suffered more unfairness due to the COVID-19. They are at a higher risk of contracting the virus and developing severe symptoms(Sasson, 2021). Due to limitations in physical condition and mobility, they encounter more difficulties in accessing essential services, especially for those who are not living with their children. Moreover, they have unique needs for essential services, such as a higher demand for healthcare resources. Therefore, we aim to explore whether the elderly experience more inequalities in accessing essential service facilities compared to the general population.

Additionally, with the economic downturn post-pandemic, we have observed changes in the distribution of many facilities, including service facilities and shops. Many facilities in urban areas have closed down or relocated to the suburbs. The redistribution of facilities inevitably affects people's access to essential services. Hence, it is also essential to examine whether the equity of essential service facility distribution after the pandemic is improving or deteriorating.

While some previous studies have focused on the accessibility of essential services(Corso et al., 2000, Manning, 2010, Mayer, 1979), most have only considered spatial accessibility in normal daily life. In fact, there are several differences in accessing essential services during the pandemic. Firstly, public transportation may be suspended or routes adjusted, leading most people to rely on walking to access essential services. Secondly, people's needs for facilities differ from usual during the pandemic. Outings are primarily for obtaining essential services to sustain life, such as for groceries and seeking medical care. Additionally, the needs of the elderly for essential services differ from those of the general population. Thirdly, due to social distancing requirements, essential service facilities often have capacity restrictions or require advance appointments during a pandemic. Therefore, the per capita quantity of facilities is also an aspect that needs to be measured.

Based on these considerations, we created three indexes. Using Shanghai as a case, we calculated these three indexes separately for the general population and the elderly.

Subsequently, we utilized Lorenz curves and Gini coefficients to assess the equity performance of these three indexes. Finally, we compared the data from 2020 and 2023 to illustrate how these three indexes changed in terms of equity performance during and after the pandemic.

The significance of this study lies in examining whether elderly individuals faced inequities in accessing essential service facilities. It explores changes in equity during and after the pandemic and provides recommendations to policymakers, thereby contributing to enhancing community resilience and reducing inequities in essential facility access.

This paper is organized into sections. Section 2 reviews relevant work involving community resilience and equity. Section 3 briefly introduces our study area and data. Section 4 describes the methodology. Section 5 presents the results and discussions. Section 6 concludes the main findings and discusses future research.

2. Literature review

2.1 Community resilience

Resilience was initially introduced in ecology by Holling(Holling and S, 1973), which originally meant "a measure of a system's ability to absorb shocks while still maintaining its previous resistance". Since then, the concept of resilience has been gradually applied to various fields including engineering, environmental sciences, business, disaster management, and urban studies(Hollnagel et al., 2006, Manyena, 2006, Masnavi et al., 2019).

Affected by the COVID-19, improving urban resilience and community resilience has received widespread attention(Yip et al., 2021, Fransen et al., 2022, Bento and Couto, 2021). Cities, especially as dense centres of the mobile population, are more prone to pandemics than rural areas. Intercity and intra-city transporting systems and dense transactions pose more threats to urban areas and make them more vulnerable to pandemics (Mollalo et al., 2020).

Many studies conclude that the pandemic has taught policymakers valuable lessons for planning more resilient communities(Elcheroth and Drury, 2020). The mainstream view is that resilience relies on qualities that enable a community to prepare for, respond to, recover from, and improve after hazards(Zautra et al., 2008). Resilient communities can absorb the impacts of the pandemic more effectively and recover rapidly.

According to previous research(Suleimany et al., 2022), community resilience to pandemics includes institutional, social, economic, built environment and infrastructural, and demographic dimensions. Among these dimensions, built environment and infrastructural resilience reflects the physical infrastructural capacity of a city(Keenan, 2020, Programme, 2021), and it is the most relevant dimension for urban planning.

In terms of built environment and infrastructure resilience, previous researchers have mainly focused on critical infrastructure networks, such as electricity, transportation, and communications, with the goal of quickly recovering from disasters, such as earthquakes and floods(Bruneau et al., 2003, Barker et al., 2013). However, community resilience during the pandemic differs from that during disasters. Infrastructure has not been physically damaged during lockdown(Chang et al., 2022); rather, urban functions have weakened due to limited activities. Therefore, the primary criterion of this dimension of community resilience is the availability of services, including various services such as health and hygiene services, retail, and commercial services, etc.

Therefore, we can explore community resilience from another perspective. Firstly, it's important to understand which essential services people need the most during lockdown. Many studies have highlighted the importance of accessibility to services such as education, healthcare, food, and cultural amenities for a community's vitality and cohesion(Contreras et al., 2017, Dempsey et al., 2011, Talen, 2003). Those services are important in normal times, but the situation is different during the pandemic lockdown. In this paper, we focus on the essential services that need to be obtained by reaching a physical facility. The distribution of these essential facilities is a key determinant of community resilience (Valinejad et al., 2022).

In this paper, these essential services are divided into four categories: food and daily necessities services, health care services, express delivery services, and financial services. These categories were selected based on a comprehensive review of existing research(Foli and Ohemeng, 2022, Figliozzi and Unnikrishnan, 2021, Giebel et al., 2022) and consideration of people's basic living needs during lockdown. Food and daily necessities services are crucial for maintaining physical fitness and daily life. Health care services enable people to receive treatment when sick. Express delivery services also play an essential role, especially with the increasing reliance on e-shopping. During lockdown, e-shopping can reduce people's travel and minimize the risk of cross-infection. Therefore, the distribution of delivery terminals is critical to ensure that people can collect their purchased goods even if the number of couriers is reduced during lockdown. Financial services are also essential as obtaining the aforementioned services usually requires payment. However, other needs such as education and recreation were not included in our research as we focused only on basic needs for maintaining life.

Based on the classification of essential service facilities in China and residents' frequency and preferences in accessing these facilities, these four types of essential services are further subdivided into eight facilities. These include four kinds of facilities related to food and daily necessities services: supermarkets, convenience stores, food markets, and greengroceries. Two kinds of facilities related to health care services: hospitals and pharmacies. One facility related to express delivery services: delivery terminals, and one facility related to financial services: bank ATMs.

Many scholars have conducted research on essential services during the pandemic, but their focus varies. For example, some studies have focused on food access, including

food security(Béné et al., 2021, Laborde et al., 2020), food purchase behaviour(Ellison et al., 2021), and food supply chain(Rejeb et al., 2022), while less attention has been given to the spatial distribution and accessibility of food stores. Additionally, although there have been some studies on the accessibility of certain types of services(Logan and Guikema, 2020, Mayaud et al., 2019, Feng et al., 2017), research on equity in these essential service facilities is still insufficient, especially for vulnerable groups such as the elderly. Therefore, this study aims to fill these research gaps.

2.2 Equity

Litman(Litman, 2002) presented two categories of equity: horizontal equity and vertical equity. Horizontal equity concerns the distribution of impacts between individuals and groups considered equal in abilities and needs, whereas vertical equity concerns the distribution of impacts between individuals and groups that differ in abilities and needs.

Undoubtedly, vulnerable groups face more inequity from the impact of the pandemic, as evidenced by the fact that adults over 65 years of age represent 80% of hospitalizations due to the COVID-19 and have a 23-fold greater risk of death than those under 65(Mueller et al., 2020). Therefore, the elderly are more affected by the pandemic(Sam, 2020). Elderly people are typically less inclined to cover long distances on foot(Somenahalli and Shipton, 2013). Therefore, specific considerations to improve services should adopt an equity-focused approach to address the pandemic needs of vulnerable groups (Sam, 2020).

This is why we emphasize vertical equity. Vertical equity means essential services are accessible to populations with the greatest potential need. Vertical equity in the distribution of resources plays a crucial role in coping with pandemics(Suleimany et al., 2022). Under these considerations, it is imperative to investigate whether the elderly have equal access to essential service facilities.

3. Study area and data

3.1 Study Area

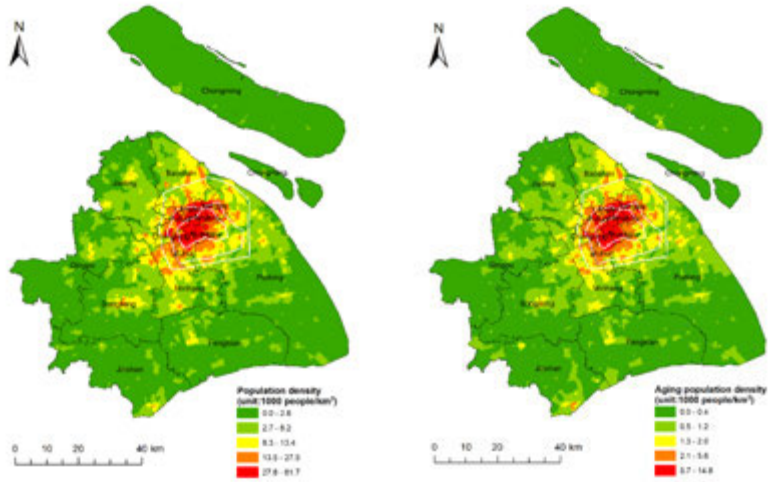
Shanghai, located in the east of China, is the most rapidly urbanizing and developed megacity in the country, encompassing a total area of 6340.5 square kilometres and a population of 24.87 million in 2020(Bureau, 2021). Shanghai is divided into 16 districts (Fig.1). There are three Ring Roads in Shanghai: the Inner Ring Road, the Middle Ring Road and the Outer Ring Road. The area within the Outer Ring Road is defined as the urban area, including the city centre, several sub-centres, and other densely populated areas. Meanwhile, the area outside the Outer Ring Road consists mainly of suburbs, including some new towns and rural areas. Fig.2 shows the distribution of total population density and elderly population (aged 65+) density in Shanghai. It can be observed that the population density is higher in the urban areas and some suburban new towns, while it is lower in other areas.

Fig.1. Study area

Furthermore, Shanghai has entered an aging society. Table 1 shows the total population and aging rate in Shanghai from 2010 to 2022, indicating a continuous deepening of aging in Shanghai. Considering the vast elderly population, Shanghai was chosen as the case city for our research. Investigating the equitable distribution of essential service facilities and offering insights into community resilience within such a megacity holds significant importance.

Table 1 The total population and aging rate in Shanghai from 2010 to 2022

	2010	2020	2021	2022
Total population(million)	23.01	24.87	24.89	24.75
Aging rate (60 years and above) (%)	15.1	23.4	24.0	25.0
Aging rate (65 years and above) (%)	10.1	16.3	17.4	18.7



(a) (b)

Fig.2. (a) Population density distribution in Shanghai, (b) Population density distribution of the elderly over 65 years old in Shanghai (The values are presented as quantile ranges)

3.2 Data

Population data was sourced from the WorldPop-Constrained-individual-countries-2020-UN-adjusted dataset (https://www.worldpop.org/), published in 2020. Moreover, population data for individuals aged 65+ were extracted to represent the elderly population for comparison with the overall population in this study. The selection of the age threshold of 65+ is mainly based on previous research, which suggests that individuals in this age group are more susceptible to health issues(Molarius and Janson, 2002). Additionally, it is a common age threshold in many studies related to aging(Pickering et al., 2001).

The digital geographic data, including eight types of essential service facilities, was obtained from Points of Interest (POI) sourced from Gaode Maps. We acquired Shanghai POI data for 2020 and 2023 to compare facility distribution during and after the pandemic. This data has been converted into WGS1984 coordinates for consistency and compatibility in our analysis.

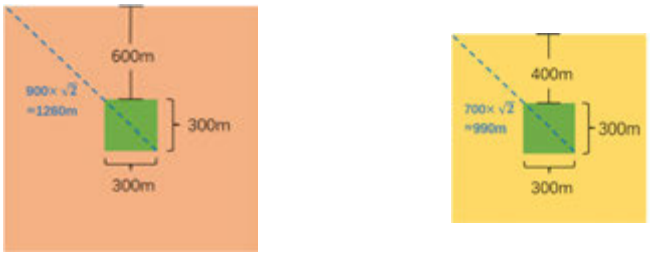
4. Methodology

We divided the entire study area into 300m × 300m grids, which served as our basic research units. We set two types of buffer zones for the grids: one for the general population and another for the elderly. Considering the weaker walking ability of the elderly, the buffer zone for them is smaller than that for the general population. We developed three indicators, calculated separately for different buffer zone sizes to compare the results for the elderly and the general population. Since each grid produces calculation results, we visualize these results on the map. Finally, we use the Gini

coefficient and Lorenz curves to reveal the equity of these three indicators. The following will introduce the specific methods and details of each step.

4.1 The walking buffer area for the elderly and the general population

Due to reduced physical strength in the elderly, their acceptable walking range is smaller than that of the general population. We assume that the maximum acceptable walking time is 15 minutes (Guzman et al., 2021). Given a walking speed of 1.4 m/s for the general population (Bohannon, 1997) and 1.1 m/s for the elderly(Duim et al., 2017), the corresponding walking distances for 15 minutes are 1260 meters and 990 meters, respectively. To establish buffer zones, we determine the maximum walking distance of vertices at the edge of each grid (Fig.3). For the general population, the buffer zone distance is set at 600 meters (Fig.3(a)), while for the elderly, it is 400 meters (Fig.3(b)). Within these buffer ranges, we assume that all essential service facilities are reachable. The following three indexes for measuring the ability to access essential service facilities are calculated within these two buffer ranges, respectively.



(a) (b)

Fig.3. Buffer area for each grid: (a) for general population, (b)for the elderly.

4.2 Demand Accessibility Index

The first index is the Demand Accessibility Index(DAI). It's important to consider that people have different needs and preferences for service facilities. To capture these differences, we conducted an online questionnaire survey in March 2020 to characterize the travel demands and frequencies of different groups in Shanghai during the lockdown. The survey included 1540 respondents, of which 9.4% were over 65 years old. Respondents were asked about the purposes of essential travel, their purchasing preferences for food and daily necessities (shopping at physical stores or online), their preferred shopping locations (supermarkets, convenience stores, wet markets, greengroceries), as well as the frequency of their outings per week.

Based on our previous survey findings, significant differences exist in the demands and preferences between the elderly and the general population. When it comes to purchasing food, senior citizens tend to favour affordable and fresh options, leading them to prefer wet markets over supermarkets and convenience stores. Additionally, due to a higher likelihood of experiencing health issues, the elderly have a greater demand for access to hospitals and pharmacies.

Moreover, with the rapid development of express delivery and smartphone payment services in China, young people show a preference for online shopping and cashless transactions. In contrast, elderly individuals often stick to traditional shopping methods in physical stores and prefer cash payments due to their limited proficiency with internet usage and smartphones. Consequently, senior citizens exhibit lower demand for express delivery services and a higher demand for bank ATMs.

In this study, we utilized weighted values to compute the DAI (see Table 2). The assignment of these weights, totalling 1, draws from our survey data and is supplemented by insights obtained from existing literature(Weng et al., 2019, Lian and Yen, 2014). The computation process for the DAI of a grid involves multiplying the count of each essential service facility within the buffer zone of each grid by its corresponding weight and subsequently aggregating these values.

Table 2 Weights in the calculation of DAI

		Weight (for general population)	Weight (for the elderly)
Food and daily necessities services	Supermarket	0.15	0.08
	Convenience store	0.13	0.04
	Wet market	0.1	0.18
	Greengrocery	0.12	0.12
Health care services	Hospital	0.1	0.2
	Pharmacy	0.1	0.2
Express delivery services	Delivery terminal	0.25	0.06
Financial services	ATM	0.05	0.12

4.3 Diversity Index

As Jacobs(Jacobs, 2016) commented, a fine-grained mixing of diverse uses creates vibrant and successful neighbourhoods. Shannon information entropy is the most widely used tool for quantifying diversity in land use distribution (Christian et al., 2011). In this study, Shannon entropy is applied to measure the Diversity Index(DI) of essential service facilities within each buffer zone, calculated using the following formula:

$$H(X) = -\sum_{x \in X} p(x) lnp(x) \quad (1)$$

where $H(X)$ represents the diversity of essential service facilities within the buffer zone of each grid. X denotes the number of essential service facility types. This study mainly includes eight facility types: supermarkets, convenience stores, food markets, greengroceries, hospitals, pharmacies, delivery terminals, and ATMs. $p(x)$ denotes the proportion of the xth type of facility in each buffer zone.

4.4 Per Capita Quantity Index

The two aforementioned indexes do not involve population quantity, whereas the Per Capita Quantity Index(PCQI) correlates with population size. As previously mentioned, given the constraints on social distancing during the lockdown, the capacity of each service facility is also limited, thus necessitating the measurement of the number of facilities per capita.

The calculation method for this index involves dividing the number of essential service facilities in the buffer zone of each grid by the grid population. Naturally, this calculation is also performed separately for all residents and the elderly population.

4.5 Min-Max Normalization of the data

As each index is measured in a different unit, we adopt a minimum-maximum normalization approach to convert the data into dimensionless values ranging between 0 and 1. Given that higher index values indicate greater community resilience, we perform minimum-maximum normalization using the following equations:

$$z' = \frac{x - x_{min}}{x_{max} - x_{min}} \quad (2)$$

where z' represents the normalized value between 0 and 1, x is the original value, x_{max} is the maximum for a specific index, and x_{min} is the minimum value for a specific index.

4.6 Equity assessment

To assess equity, we employ Lorenz curves, which enable us to visualize and quantify the fairness of the three indexes across residents in various grids. Originally used in economics to depict income or wealth inequality, the Lorenz curve illustrates the relationship between population (%) and wealth (%) (Lorenz, 1905). Now it has been applied to various fields to demonstrate the equity of resources among population(Delbosc and Currie, 2011, Rezaei and Nouri, 2015, Melkamu and Bannor, 2015).

In our study, the Lorenz curve was utilized to illustrate the relationship between the indexes and the population. Subsequently, the Gini coefficient will be computed to quantify spatial equity. The Gini coefficient is calculated using the following formula(Delbosc and Currie, 2011):

$$G = 1 - \sum_{k=1}^{n} (P_k - P_{k-1})(R_k + R_{k-1}) \quad (3)$$

where P_k is the cumulative percentage of grid population, and $R_k$is the cumulative percentage of the index. The Gini coefficient ranges from 0 to 1, where 0 means complete equity and 1 denotes complete inequity. A lower Gini coefficient indicates a more equal distribution of that index. A study suggested that a Gini value under 0.2 denotes satisfactory equity, whereas a value between 0.2 and 0.5 indicates medium inequity and a value above 0.5 is considered high inequity(Delbosc and Currie, 2011). In some studies, 0.4 is considered as a warning threshold of inequity(Wen et al., 2016).

5. Results and discussions

5.1 Community resilience in accessing essential service facilities

5.1.1 The results of DAI

Fig.4 shows the DAI value for all residents and the elderly. Overall, only the regions within the Inner Ring Road have a higher DAI. In the urban area, the Demand Accessibility Index for all residents is usually higher than that for the elderly. In 2020, high values of DAI were primarily concentrated in the core areas of the city, while in 2023, the distribution of high values within the urban area exhibited a trend of dispersion, with some sub-centres of the city also showing high DAI values. Additionally, in some suburban new towns, the DAI values in 2023 were higher than those in 2020. These findings indicate a trend of decentralization and dispersion in the distribution of POIs after the pandemic.

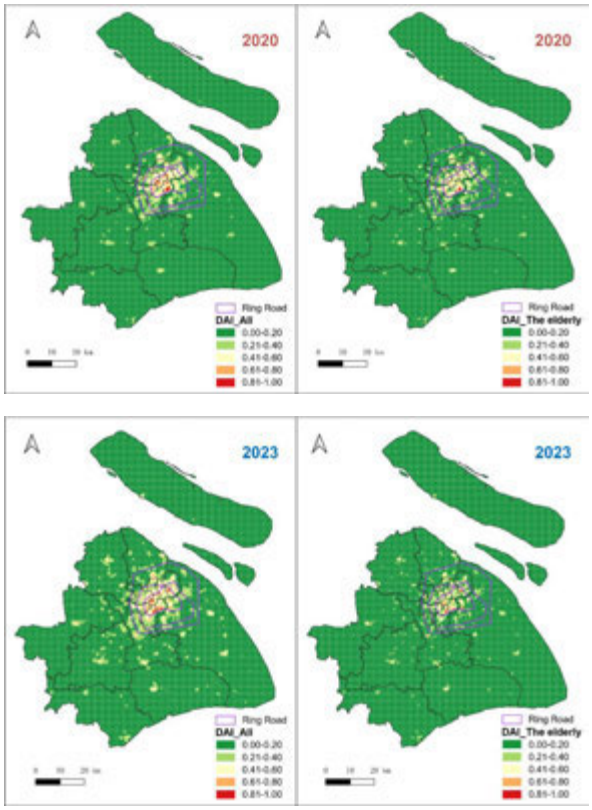


Fig.4. Demand Accessibility Index distribution.

5.1.2 The results of DI

The DI depicts the variety of essential service facility types within the buffer zone of each grid. A higher DI indicates a greater diversity of facilities. As shown in Fig.5, the

distribution of DI appears relatively balanced. Apart from the high values observed in urban areas, many suburban regions also exhibit high DIs, sometimes even comparable to those in the city centre. In comparing all residents with the elderly, the DI for all residents tends to be higher, suggesting that larger buffer areas also mean a richer variety of essential service facilities.

Fig.5. Diversity Index distribution.

5.1.3 The results of PCQI

PCQI is calculated by dividing the number of facilities in each buffer by the population of the grid. Therefore, although the number of POIs in the urban area is large, considering the large population, we can find that the PCQI value in the urban area is not high(Fig.6). Conversely, in many suburban areas, this value is relatively high. Moreover, the PCQI value for the elderly is higher than that for all residents.

Due to the reduction of many POIs in the urban area and the increasing trend of POIs in the suburbs after the pandemic, the PCQI value in some suburban areas in 2023 have

increased compared to 2020, while the PCQI value in some urban areas have decreased compared to 2020.

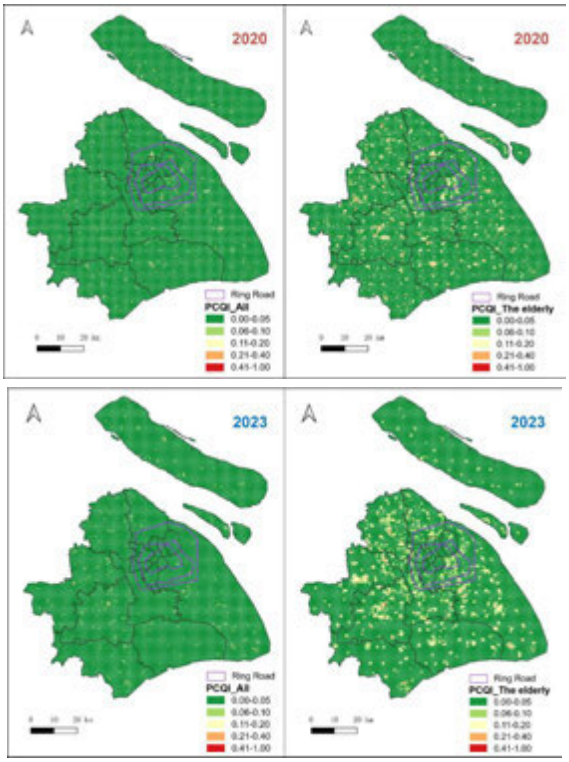
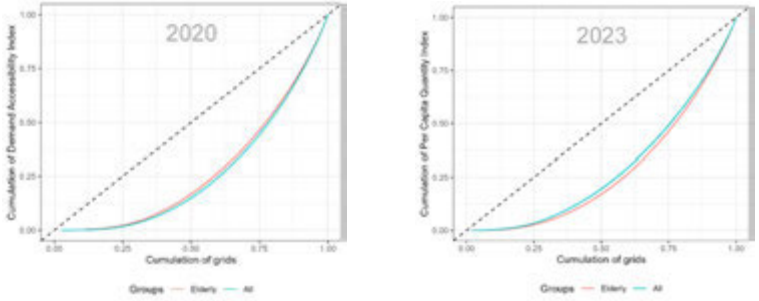


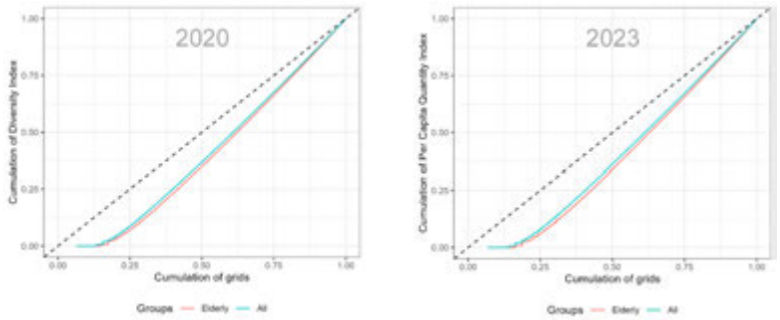
Fig.6. Per Capita Quantity Index distribution.

5.2 Spatial equity of essential service facilities' distribution

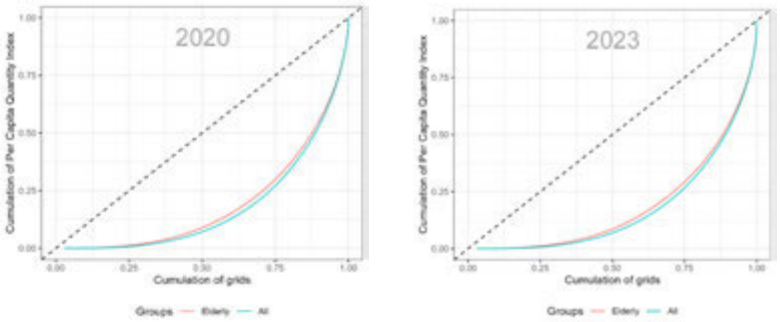
The Lorenz curves for the three indexes were drawn to show the equity of essential service facilities' distribution, and is divided into for all residents and for the elderly (Fig.7). The dash line represents perfect equity. If the curve is closer to this dash line, it means better equity. The Gini coefficients are shown in Table 3.



(a)



(b)



(c)

Fig.7. The Lorenz curves for the three indexes: (a) for DAI, (b) for DI, (c) for PCQI

The results are summarized as follows:

Firstly, The Gini coefficients of PCQI is often the largest of the three indexes, reflecting the most pronounced inequity exhibited by that index. The Gini coefficients of DI is often the smallest among the three indexes, reflecting a relatively balanced distribution of these facilities in terms of diversity. We can see that the Gini coefficients of DAI and PCQI all exceeded 0.4, which is the warning line of inequity.

Table 3 Gini coefficients

	Gini coefficients -DAI		Gini coefficients -DI		Gini coefficients -PCQI	
	All	The elderly	All	The elderly	All	The elderly
2020	0.478	0.456	0.200	0.224	0.649	0.622
2023	0.419	0.451	0.209	0.236	0.657	0.632

Then, let's focus on the differences between all individuals and the elderly in these three indexes. The Gini coefficients of DAI values in 2023 are smaller than those in 2020, respectively. This indicates an improvement in equity in DAI after the pandemic. This phenomenon is mainly attributed to the decentralization of POIs, with many

suburban areas having a richer array of POIs than before the pandemic. However, in 2020, the equity performance of DAI for the elderly was better than that for the general population, while in 2023, the situation reversed, implying a weakening of facility distribution catering to the needs of the elderly after the pandemic.

As for DI, the Gini coefficients in 2023 are a little bit larger than those in 2020, indicating a slight decrease in the equity of facility diversity after the pandemic. Whether during or after the pandemic, this index reflects better equity for the general population compared to the elderly.

For the PCQI, the Gini coefficients in 2023 are also larger than those in 2020, indicating a decrease in the equity of per capita facility quantity after the pandemic. However, when considering the comparison between the elderly and the general population, the equity is better for the elderly.

This outcome indicates a fundamental difference between the three indexes: Shanghai is a diverse and highly commercialized city, so the types of essential service facilities are relatively balanced. However, due to the different population densities between the urban and suburbs, there is a great inequity in terms of per capita quantity of essential service facilities. Among the three indexes, particular attention needs to be paid to the DAI. During the pandemic, the equity of DAI for the elderly was better than for the general population, while the opposite is true after the pandemic. This suggests that the distribution of essential service facilities post-pandemic is moving in a direction unfavourable to the needs of the elderly. This is something that the government should pay attention to, especially in areas with high elderly population density, ensuring that essential service facility distribution meets the needs of the elderly.

6. Conclusions

Strengthening community resilience in cities is urgently needed in this post-COVID era. Reducing the inequity in access to essential service facilities is considered an effective way to improve community resilience dealing with pandemics and to improve the livelihoods of all populations.

In this research, we created three indexes to measure community resilience in accessing essential services. We classified the essential services and their corresponding facilities, taking into account the varying walking capacity and needs of the elderly when measuring accessibility. The Lorenz curve and the Gini coefficient were used to assess the spatial equity of the three indexes, which represents an innovative application of interdisciplinary methods.

The results of our study suggest that the equity level is different among the three indexes. The Diversity Index exhibits the highest equity, followed by the Demand Accessibility Index, while the equity of the Per Capita Quantity Index is the lowest. These findings

underscore the importance of prioritizing fairness in terms of per capita facilities and addressing the diverse demands of different groups.

Several issues need to be addressed in future studies. Firstly, in terms of equity, this paper only considers the elderly as a vulnerable group. However, there are many other vulnerable groups, such as low-income individuals, people with chronic illnesses, and homeless individuals. Future research should also consider these groups to provide a more comprehensive understanding of equity in access to essential services. Secondly, capacity restrictions in public places during the lockdown were not fully addressed in this paper. While the per capita quantity of essential service facilities was considered, the paper did not further limit the number of people allowed to enter these facilities. In the future, this approach can be combined with epidemiological research to conduct accessibility studies based on the maximum number of people allowed to enter each type of essential service facility, which could provide valuable insights for controlling the spread of the pandemic and assisting policymakers in resource allocation decisions.

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Conflicts of Interest
The authors declare no conflict of interest.

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TRACK 09: Planning for Fair, Plural, and Welcoming Cities

Study on Youth Friendly Urban Renewal Strategies from an Inclusive Perspective

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Abstract: With the acceleration of global urbanisation, urban renewal has gradually received attention as a key means to improve urban quality of life and optimise spatial resource allocation. However, the traditional urban renewal model focuses more on land use, construction land development intensity, and other aspects, ignoring the needs of different groups of people. According to data released by the National Bureau of Statistics in 2021, the domestic youth population in China is about 448 million, accounting for about one-third of the total population. This group is an important component of cities and a key part of the city's future development. Currently, youth in urban life face problems such as the lack of urban identity, undersupply of services, and poor quality of living space. Therefore, this study takes an inclusive perspective as the entry point, taking Expo A area of Pudong New Area in Shanghai, China, as an example. Firstly, a literature review, questionnaire survey, and other methods were used to investigate the full needs of young people for public spaces. The research results found that the needs of young people for urban public spaces are mainly reflected in diversity, comfort, and publicness, which mainly reflect their needs for cultural, fitness, social and other public spaces. Afterwards, targeted and actionable youth-friendly city renewal strategies are proposed in terms of spatial optimisation, facility configuration, and business upgrading in order to enhance the sense of security, belonging, and experience of young people. It is not only beneficial for solving various challenges faced by youth in urban renewal, but it also provides feasible solutions for the sustainable development of cities and provides new ideas and methods for future urban planning and urban renewal.

Keywords: Urban Renewal; Youth; Inclusive; Public Space

1. Introduction

In contemporary society, urban renewal has become a key issue in the global urbanisation process. With the rapid changes in economy, society, and technology, urban environments need to constantly adapt to new challenges and demands. Especially for young people, they play an increasingly important role in the cultural, economic, and social activities of cities. However, the traditional urban renewal model focuses more on land use, construction land development intensity, and other aspects, ignoring the needs of different groups of people. According to data released by the National Bureau of Statistics in 2021, the domestic youth population in China is about 448 million, accounting for about one-third of the total population. This group is not only an important component of cities but also a key force for their future development. The proportion of young people in cities, their vitality, innovation ability, and other aspects provide strong support for the sustainable development of cities.

According to the definition of the United Nations Human Settlements Programme, youth-friendly cities refer to cities that carefully consider the needs and rights of young people in policy formulation, planning, and service provision and support their comprehensive development. These types of cities typically have the following characteristics: providing affordable housing, abundant education and employment opportunities, broad social and cultural participation channels, and a safe and healthy living environment. Youth-friendly cities also emphasise the participation of young people in urban decision-making processes, ensuring that their voices are heard in urban development. However, young people often face various challenges in enjoying urban life, such as a low sense of urban identity, insufficient service supply, and poor quality of living space. These issues prompt us to examine urban renewal strategies from a more inclusive perspective, provide a better environment for young people, and ensure that their needs and rights are fully considered.

This study focuses on the exploration of youth-friendly city renewal strategies from an inclusive perspective. Specifically, the study will analyse how existing urban renewal strategies affect young people and explore how innovation in policies and practices can promote the comprehensive friendliness of urban environments and the comprehensive development of youth. This includes evaluating the effectiveness of existing policies, identifying existing issues, and proposing improvement strategies. Through this approach, research not only hopes to provide practical suggestions for urban planners and policymakers but also contributes new perspectives and knowledge to theoretical research. In summary, the purpose of this study is to enhance the construction of youth-friendly cities through urban renewal strategies. This research is not only innovative in theory but also has guiding significance for practice. It is expected to contribute to promoting the sustainable development of global cities.

2. Research on Youth Friendly Cities

The youth-friendly city value the special needs and potential of young people and promote their comprehensive development through a series of methods. In the context of rapid globalisation and urbanization, understanding and implementing strategies for youth-friendly cities has become an important issue in urban planning and policymaking and is conducive to enhancing

the vitality of cities (Della Spina, L., 2019). This article provides an overview of the progress, international cases, and future research directions related to youth-friendly cities.

2.1 Research Progress

Regional competitiveness has become a key factor in achieving sustainable development goals in various research contexts (Cogswell, C., 2018). Sustainable competitiveness is described as determining the productivity level of a region, and young people are the key group to enhance regional core competitiveness. From the practice of urban areas in Europe and America, it can be seen that in the process of forming youth-friendly cities, local governments pay more attention to the needs of young people (Hailu Demeke, Y., 2022), provide diverse ways of participation for young people (Rojas, 2022), accommodate youth culture and activity venues that are conducive to enhancing youth value (Carmona, 2019), provide comfortable transportation environments, and provide facilities preferred by young people (Rigolon, 2018). At the same time, some scholars believe that due to the different geographical locations and economic and cultural characteristics of different regions, the number of people attracted varies, leading to different demands and causing differences in spatial supply, transportation organization, and public facility supply in urban areas (Latham, A, 2019). Understanding the perspectives of different groups of people and finding ways to involve them in urban development is an important process of urban renewal (Konsti Laakso, 2018). Through inclusive urban renewal methods, meet the needs of young people and increase the fair utilisation of urban space (Cole, 2017).

2.2 International Cases

Different countries and cities have demonstrated diverse practices in implementing youth-friendly strategies. For example, D-Street Lawn is a temporary preparation project for the massive expansion of the Boston Convention and Exhibition Center (BCEC) by the Massachusetts Convention Center Authority (MCCA). Before the renovation, D Street was a desolate and underutilised space composed of vacant land, ageing industrial buildings, and parking lots. The Sasaki design team and representatives from the surrounding community and MCCA conceived and constructed a flexible and vibrant temporary urban space - the D Street Lawn as the leading public space for D Street. The ultimate goal of D Street Lawn is to create a vibrant and innovative urban area to support the future expansion of BCEC and the vitality of surrounding communities.

Different countries and cities have demonstrated diverse practices in implementing youth-friendly strategies. For example, D-Street Lawn is a temporary preparation project for the massive expansion of the Boston Convention and Exhibition Center (BCEC) by the Massachusetts Convention Center Authority (MCCA). Before the renovation, D Street was a desolate and underutilised space composed of vacant land, ageing industrial buildings, and parking lots. The Sasaki design team and representatives from the surrounding community and MCCA conceived and constructed a flexible and vibrant temporary urban space - the D Street Lawn as the leading public space for D Street. The ultimate goal of D Street Lawn is to create

a vibrant and innovative urban area to support the future expansion of BCEC and the vitality of surrounding communities(Figure 1).

Figure 1. Young people engage in activities during the day (life) and at night (right) on the D Street（Source:https://www.douban.com/note/700740078/?_i=5934836XNBK1vY）

Nagoya Juya Datong Park takes outdoor sports loved by young people as the starting point, upgrades the park into an urban outdoor centre, and creates a commercial complex that integrates outdoor camping, dining, indoor camping, and product exhibition and sales functions. Young people can see the application scenarios of products displayed here and experience various themed activities in the venue, including outdoor sports, picnics, camping, reading, rest, and other activities that embrace green nature. These cases provide practical experience in successfully implementing youth-friendly city renewal plans.

3. Youth-friendly Urban Renewal Strategy

3.1 Research Area

The research base is located in the northern part of Zhoujiadu Street in Pudong New Area, between the two core areas of Huangpu Riverside: the Bund Lujiazui North Bund core area and Expo Qiantan Xuhui Riverside. Formerly the A-zone of the 2010 Shanghai World Expo Park. The research base starts from the Huangpu River in the north, extends to Xueye Road in the south, faces Shangnan Road in the west, and ends at Bailianjing in the east, covering an area of 85.54 hectares. The base has high-quality riverside resources, high-level cultural facilities, high-density corporate headquarters, and a high-level youth group.

3.2 Demand for Young and Middle-Aged People in The Area

Taking Expo Area A in Pudong New Area, Shanghai, China, as an example, literature review and questionnaire surveys were first used to fully investigate the needs of young people for urban public spaces. During our on-site investigation, we found that the needs of young people for urban public spaces are mainly reflected in diversity, comfort, and publicness, which mainly reflect their needs for cultural, fitness, and social spaces(Figure 2).

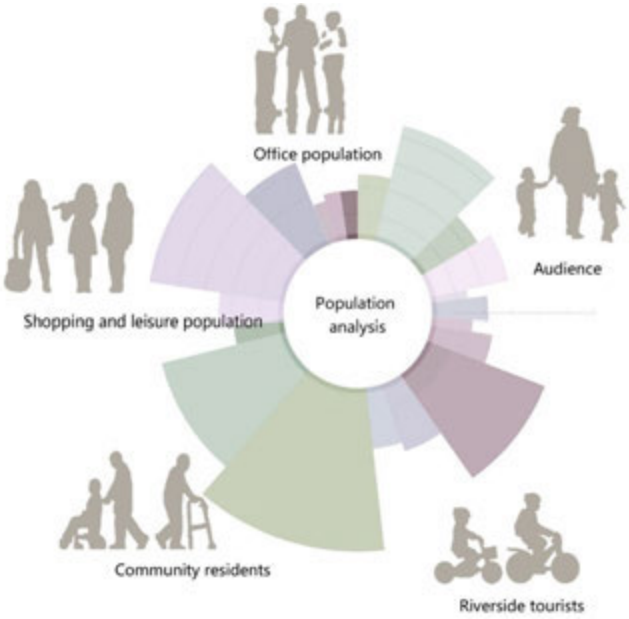

Figure 2. Analysis of the proportion of youth activity groups (Source: author's elaboration)

3.3 Current Problems

Based on current research findings, most of the public core spaces within the base have problems with closed interfaces, low quality, and lack of design. The youth group stays in the public spaces for a relatively short period of time, mostly through pedestrian flow. At the same time, we have found that the space and functions of the business functional areas lack urbanity, and are not attractive to diverse pedestrian flows and activities(Figure 3).

Figure 3. Existing problems in the current situation of the base (Source: author's elaboration)

3.4 Planning Concept

3.4.1 For Public Buildings

Urban-level public facilities, World Expo cultural landmark buildings, with high venue awareness. Local external services are at the bottom level but lack display and scale effects. The main building and celebration square has a huge volume, easily creating a sense of emptiness. The comfort and environmental quality of the surrounding areas of the building need to be improved. It has the potential to initiate cultural activities continuously, and the nearly 10000 spectators attracted by large-scale events have brought evacuation "pressure" but have not played a "resource" role. Expand the influence of landmark buildings, tap into the spillover effects of localised functions, drive surrounding cultural and entertainment, youth gatherings, and catering consumption, and provide diversity in travel and stay. Optimise environmental quality, fully use the venue, and provide tourists and residents with a rich and comfortable venue experience.

Urban-level public facilities, World Expo cultural landmark buildings with a huge scale, unique design, and eye-catching colours. The service functions and spatial interfaces are closed, and there is a lack of dialogue with the surrounding urban spaces. Fully utilise the influence of landmark buildings to strengthen the World Expo's cultural characteristics and visual guidance functions. Collaborate with Meiben Center, Expo Source, and Green Valley to drive vitality in the surrounding space. Enhance the public nature of the street interface by opening up rooftop gardens and entrance squares. Expand the localisation influence of World Expo culture, extract cultural symbols, and create a cultural atmosphere for the surrounding World Expo.

The office building embodies the design concept of "small neighbourhoods and dense road networks". The environmental atmosphere is serious and dull, with homogeneous groups having a single mode of travel and activity. According to the regulations, the bottom layer is open, introducing cultural, leisure, sports, and catering functions to soften the urban interface. Enhance the fun and comfort of outdoor environments, embed unique street furniture and facilities, create relaxed and fun social and sports spaces, and attract young people.

3.4.2 For Open Spaces

A continuous negative interface has formed along Expo Avenue, lacking open space and access channels. The high-quality cycling road along the waterfront cuts through the air, lacking theme venues and necessary leisure service facilities for staying. Transform the "end space" into a "destination", open the southern interface of the riverside green space, increase the places and channels for entering the waterfront shoreline, and promote the integration of waterfront space into daily life in the urban hinterland. Utilise cultural and ecological functional nodes (Meiben Center + Wharf + Bailianjing) to create a POI with distinct functionality and theme, as well as enhance venue awareness and activity attractiveness.

Create daily leisure spaces for office workers and surrounding community residents in Area A.

Connect the development of Snow Wilderness Road Reserve with distinctive functions and environmental quality and build a belt space between Area A and Zhoujiadu Community.

Various ecological green spaces and street squares have abundant spatial resources. Based on system sorting and functional linkage, we have the conditions to shape a high-quality urban environment. Integrate open spaces at all levels and types to inject activity content and build a series of activity venues. Focus on creating the theme of "youth" and the characteristics of "sports". Collaborate with Meiben Center, Zhonghua Art Palace, Green Valley, and other social organisations to plan a series of themed activities to enhance social attention and local attractiveness. Combining the pedestrian space system to build a comfortable and diverse age-friendly open space network, providing local residents with leisure and fitness resources, and supporting the vitality of Area A with daily life activities.

3.4.3 Targeting the Travel Environment

Two high-grade urban transportation arteries have a certain barrier effect on the internal connections of the base but also provide broad pedestrian space. There is a dense flow of people and vehicles on Shangnan Road. On one side of Area A, there is a lack of vibrant places and urban interfaces. Expo Avenue has a wide view and a closed interface, but its riverside advantages have not been fully reflected. The vegetation on the street is beautiful, but the service functions along the street are insufficient.

Guozhan Road runs through Area A, with wide red lines and good greenery. The spatial scale and directional sense of the section near Expo Avenue are out of balance. There is no urban interface on the north side of Xueye Road, and the residential area on the south side is closed, resulting in a poor slow driving experience and a lack of sense of place. The belt area is a key space for two-way functional connection and vitality infiltration, and enhancing interface vitality is crucial.

The subway line along the base has a sufficient flow of office workers during peak hours in the morning and evening, as well as weekend leisure passengers. During large-scale events at Meiben Center, there is a phenomenon of crowds and queuing after the event. The bus stops within the base are mainly distributed on Shangnan Road and Expo Avenue, and there is a pendulum tidal flow of people during morning and evening peak hours. Pay attention to the passenger flow structure and activity characteristics of Meiben Center and World Expo Source, connect the open space of Meiben Center - China Art Palace, and explore opportunities for surrounding services and cultural entertainment spaces for performing arts activities. Improve the quality of public transportation surrounding the environment and the guidance system and strengthen the cultural characteristics of the World Expo. Introduce pedestrian flow and vitality to the east through themes and venues.

The Meiben Center and the Chinese Art Museum lack social parking spaces. The enterprise office building is divided into underground parking lots. Some branches park motor vehicles along the road. The possibility of opening social parking spaces in office buildings. Key

services will be provided for large-scale cultural activities at the Meiben Center, with the establishment of an intelligent indicator system that dynamically guides the flow of vehicles and people during performances.

There are non-motorized vehicle parking areas on Shangnan Road and Gaoke West Road, with no markings on other roads. The current situation is that shared bicycles and non-motorized vehicles are frequently used during peak commuting hours, and the parking methods, locations, and scale need to be organised. Considering the relationship between non-motorized vehicle parking, road walkability, and street interface openness, designate parking areas based on the entrance and exit of the building's underground garage. Strengthen patrols, standardise parking, and control the quantity.

Overall, walking accessibility is good, but comfort and quality need to be improved. The public and continuity of the road interface are insufficient and lacking attractiveness. Sidewalk materials and road facilities' quality need to be improved. The system aims to enhance the public and service-oriented nature of the Road, with a focus on supplementing youth-friendly facilities along Yuntai Road and Gaoke West Road. Focus on building trendy culture and leisure sports characteristics along the horizontal road. Improve the continuity and openness of street interfaces.

3.5 Planning and Design

The planning and design intention is to inject momentum into development, lock in potential human flow, mobilise resource endowment and flow economy, and create a youth development demonstration block. Explore the potential of open spaces and urban interfaces at all levels and types and create sports-themed and vibrant neighbourhoods that meet the needs of young people. Strengthen the World Expo's cultural memory and urban intention and create a district with distinctive World Expo cultural characteristics. By optimising the layout of building clusters, organising slow traffic systems, and opening spaces, we aim to promote the development of youth-friendly urban renewal(Figure 4).

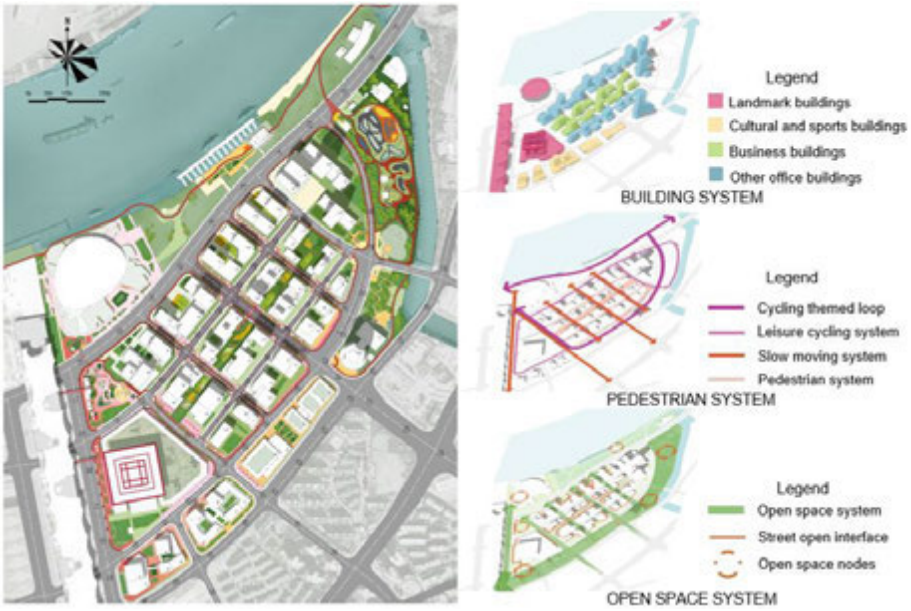

Figure 4. Space system structure (Source: author's elaboration)

In the specific planning and design, method of integrating real-life scenarios, the entrance square of the Meiben Center public building will be moderately opened, with one street square and crossing facilities set up. The celebration square will be equipped with interesting and movable facilities to improve the sense of scale and comfort(Figure 5).

Figure 5. Current situation of Meiben Center (left) and integration of real-life scenes (right) (Source: author's elaboration)

Improve the details of outdoor space and optimize the quality and fun of the neighbourhood environment. The central axis green space is equipped with rich communication and leisure facilities to promote communication and interaction among diverse groups of people. Embed outdoor art exhibitions and smart interactive installations to continue the cultural heritage of the World Expo. Utilise sound, light, electricity, and intelligent means to increase the richness

and fun of street activities, promote full-service functions, and maintain the sustained vitality of the venue. Green valley office area will add youth interactive devices and provide venues for youth activities (Figure 6).

Figure 6. Green valley current situation (left) and realistic integration (right)
(Source: author's elaboration)

4 . Discussion

The study of youth-friendly cities provides effective strategies for urban planners to support youth development, helping to build a more inclusive and dynamic urban environment. This study focuses on exploring the renewal strategy of youth-friendly cities from an inclusive perspective and takes the Expo A area of Shanghai, China, as an example to plan and design, exploring the role of innovative planning schemes in the construction of youth-friendly cities. In addition to the construction of public spaces, transportation environment, and facility supply mentioned in this article, government departments around the world have also generally paid attention to the construction of youth-friendly cities in recent years and have begun to promote policies and practices for urban development. Through continuous practical innovation and improvement, the needs of young people can be better met, and their positive role in urban society can be promoted.

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Dispersed Urban Spatial Structure and Increased Urban Greenness Could Reduce Intra-City Health inequalities in England

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Abstract
The persistence of socioeconomic health inequalities has garnered substantial attention, and a few researchers have explored the impact of neighborhood greenness on mitigating it. However, it remains unclear whether comprehensive planning can address this issue. In this study, we evaluated intra-city health inequality in 105 cities in England and examined the impact of urban spatial structure (measured by dispersion) on it, with adjustment for city size, population density, urban greenness, development level, income gap, and aging. Results revealed that the dispersion of urban population (β=-0.179, p=0.043) and urban greenness (β=-0.147, p=0.087) exhibited significant negative relationships with intra-city health inequalities, while the income gap showed a significantly positive relationship (β =0.5002, p<0.001). These findings underscore the critical role of city comprehensive planning in mitigating health inequalities.

Keywords: urban inequality, city comprehensive planning, urban spatial structure, health and well-being

Introduction

Health inequalities across socioeconomic groups has been increasingly acknowledged in the past decades (Kakwani, Wagstaff and van Doorslaer, 1997; Kawachi, 2002; Kröger, Pakpahan and Hoffmann, 2015). Researchers and politicians have focused on decomposing the drivers of health inequalities and identifying strategies to reduce this inequality (Erreygers and Kessels, 2013; Tan, Wang and Cheng, 2016). Apart from the individual level socioeconomic status such as income, education and employment, researchers have gradually discovered a new perspective in reducing health inequalities at the population level: urban built environment. Starting from the noteworthy Lancet article published in 2008 (Mitchell and Popham, 2008), the effect of greenness in lowering the health gap between the more well-off and less well-off groups of people has come into the view of public health researchers. Subsequent studies further investigated the effect of other neighborhood-level built environment indicators. For example, Mitchell *et al.* (2015) found that the recreational areas are also vital for delimiting the inequality in mental well-being. However, none of the existing studies have revealed the effect of the city level comprehensive planning on health inequalities.

The potential environmental and health effect of urban spatial structure – an important system in comprehensive planning –has received great attention in recent years. Urban spatial structure is defined as the spatial distribution of urban population or economic activities. Following Anas, Arnott and Small (1998), it includes two dimensions: centralisation – dispersion (whether and to what extent population and economic activities are clustered in urban centres), and monocentricity – polycentricity (whether and to what extent an urban system is organised

around a single urban core or a number of proximate and functionally integrated subcentres). Several studies have shown that a more dispersed urban development might exaggerate health risks by elevating the air pollution concentration (McCarty and Kaza, 2015; Cárdenas Rodríguez, Dupont-Courtade and Oueslati, 2016; Fan *et al.*, 2018; Liu *et al.*, 2018; Gao, Yang and Liang, 2020) and greenhouse gas emission (Muñiz and Sánchez, 2018; Hong, Hui and Lin, 2022). The size and accessibility of health resources, such as green space (Han *et al.*, 2023) and urban amenities (Wang, 2021), are also shown to be influenced by urban spatial structures. Additionally, polycentricity might shorten commute distance (Hu, Sun and Wang, 2018), and has an impact on daily activity (Horton and Reynolds, 1971), thus has the potential to influence physical activity.

Although studies have shown that urban spatial structure might influence health, and compared the different urban spatial structure across different cities (Schneider and Woodcock, 2008; Liu and Wang, 2016; Li and Liu, 2018) or along a time span (Garcia-López, 2012; Y. Li, 2020), the potential of urban spatial structure to affect socioeconomic inequality in health within cities has, as far as we aware, received no attention.

In this study, we aim to explore the effect of urban spatial structure on the intra-city health inequalities across areas with varying socioeconomic statuses, so as to inform urban planning strategies and facilitate the eradication of inequality. We postulated that socioeconomic inequalities in health will be less pronounced in cities with a more dispersed and polycentric urban spatial structure. This hypothesis is based on the notion that the relationship between socioeconomic disparities and health inequalities is potentially influenced by urban spatial structure. We know that one crucial pathway of health inequalities is the limited accessibility of health-related material conditions (such as health amenities, shelters and other health resources) for individuals with low socioeconomic status. Consequently, a higher level of intra-city health inequalities indicates a greater disparity in accessing these material conditions among areas with diverse socioeconomic backgrounds. By influencing the distribution of these conditions, urban spatial structure may play a significant role in contributing to the observed inequality. For instance, a centralised city is likely to exhibit larger inequality, as the highly-centralised centre may be equipped with a wide range of high-level amenities, while the sparsely populated outliers may lack sufficient resources and a conducive walking environment. Conversely, a dispersed urban spatial structure is more likely to provide public amenities that are easily accessible. Polycentricity is expected to reduce inequality for the same reasons.

These ideas prompted us to investigate the effect of urban spatial structure on intra-city health inequalities. Here, by utilizing local-scale health and socioeconomic data, we examined this issue within the context of England. The results of this study have significant implications for health-focused urban planning and associated policies, contributing to the advancement of SDG3 (good health and well-being) and SDG10 (reduced inequalities).

Data and Methods

Study design

We compared the income-related health inequalities at the intra-city level, and investigated the effect of urban spatial structure on it, with adjustment for city size, population density, urban greenness, development level, income gap and aging.

Data and variables

We obtained the all-ages standardised mortality ratio (SMR) for deaths from all circulatory diseases from the Office for Health Improvement and Disparities (OHID) by the Office for National Statistics (ONS), which were deaths registered in the calendar years 2016 to 2020 from circulatory disease – classified by underlying cause of death recorded as ICD codes I00 to I99 – for persons of all ages. We selected this indicator because circulatory disease is a leading cause of death, while mortality is a direct measure of health care need, indicating the overall circulatory disease burden on the population and reflecting both the incidence of disease and the ability to treat it.

Data for population income was obtained from the Office for National Statistics (ONS). The total annual household income – the sum of the gross income of every member of the household plus any income from benefits such as the Working Families Tax Credit – was selected as the indicator. This indicator was produced for the financial year ending 2018.

These two indicators were captured at the Middle Layer Super Output Area (MSOA) scale and used to assess health inequalities. Middle Layer Super Output Areas (MSOAs) are a geographic unit designed to improve the reporting of small area statistics in England and Wales. They are built from groups of Lower Layer Super Output Areas, typically 4 to 6, and designed to have a population of between 5,000 and 15,000. There are 6,791 MSOAs in England.

The intra-city health inequalities in our study was calculated as the disparity in standardised mortality ratio across different income levels, with MSOA as the basic geographical unit. To derive it, we first defined the area of the city. Following *Rural and Urban Statistics in England: Guidance Notes*, settlements with populations of over 10,000 are urban. Therefore, leveraging the global urban boundaries (GUB) (Li *et al.*, 2020) and Landscan population dataset, we derived the cities to further calculate intra-city health inequalities. Moreover, to avoid any bias caused by small sample size in calculating the gradient across MSOAs within a city, we only included cities that overlapped with 10 or more MSOAs. 106 cities were identified as a result. Then, we manually excluded the Great London due to its significant disparity from other English cities, leaving 105 geographical units in our further analysis. We adopted the concentration index, which is frequently used in quantifying the health inequalities across socioeconomic gradients, to derive the intra-city income-related health inequalities. The formula is listed below.

$$\mathrm{C} = \frac{2}{\mu} cov(h_i, R_i) = \frac{1}{n} \sum_{1}^{n} \frac{h_i}{\bar{h}} (2R_i - 1) \quad (1)$$

where h_i is the health outcome of MSOA i, while R_i is the rank of income of MSOA i. $\bar{h}$ is the average health status of this city, and n is the number of MSOA included in this city. After being balanced using the average health status and number of MSOA, this indicator is comparable across different cities. Moreover, since the health outcome in our study is mortality, which is negative, we use the absolute value of the concentration index to reflect health inequalities for further analyses. The value is limited to the interval [−1, +1], with −1 indicating an extreme pro-poor distribution of health and +1 an extreme pro-rich distribution of health.

In terms of the independent variables, we involved city size, population density, urban spatial

structure, urban greenness, development level, income gap and aging in consideration. City size was proxied by urban land and urban population. Urban land area was directly derived from the global urban boundaries (GUB) dataset. Urban population is the total population located on the urban land, derived from the LandScan population dataset. Population density was calculated as the division of the former two indicators.

Dispersion was selected as the indicator of urban spatial structure following previous studies. Following the approach of (Lee and Gordon, 2007), we define the degree of dispersion as the share of the population in a city's non-centre areas ($POP_{total} - POP_{cnter}$) to its total population (POP_{total}).

$$DISP = \frac{POP_{total} - POP_{cnter}}{POP_{total}} \quad (2)$$

By definition, the value of DISP ranges from 0 to 1. A higher value of DISP indicates that a city's population distribution is more dispersed.

Our measurement of dispersion draws upon the identification of centres. Following Lee (2007) and X. Liu and Wang (2016), we adopt a relative minimum cut-off approach. By setting a minimum density cut-off at the level of its 95-percentile population density with LandScan grids, we identified the top 5% most densely populated areas for each city. With equation (2), we calculated the percentage of inhabitants that reside outside of the densest urban areas.

Since most of the English cities (90 out of 105) are small cities with inhabitants less than 300,000, it is by large not necessary to involve multiple centres within a city. Therefore, we didn't calculate the indicator polycentricity and only used dispersion as the proxy of urban spatial structure.

Furthermore, by combining the Moderate Resolution Imaging Spectroradiometer (MODIS) data product, we derived the average NDVI of each city as a proxy for greenness. Following previous studies (Kummu, Taka and Guillaume, 2018), we got the gridded GDP per capita and calculated its mean value at the city scale to represent the development level. We obtained the rate of aging over 60 years old using additional datasets from the Office for National Statistics. In addition, we involved the Gini index to measure the degree of inequality of income, with a higher value indicates more inequality. The data source is summarised in Table 1. The descriptive statistics of variables are presented in Table 2.

Table.1 Details of the original data

	Spatial resolution	Time	Source
Urban area	vector	2018	Li *et al.* (2020)
Income	MSOA	2018	The Office for National Statistics (ONS)
standardised mortality ratio for deaths from circulatory diseases	MSOA	2016-2020	the Office for Health Improvement and Disparities (OHID) by the Office for National Statistics (ONS)
Population density	~1km	2017	LandScan population dataset
NDVI	250m	2016	the Moderate Resolution Imaging Spectroradiometer (MODIS)
GDP per capita	~10km	2015	Kummu, Taka and Guillaume (2018)

the rate of aging over 60 years old	MSOA	2018	the Office for National Statistics

Table.2 Descriptive analysis of variables

	mean	sd	min	max
Absolute value of concentration index	0.09	0.03	0.02	0.14
Urban land area (km2)	65.66	111.80	8.68	639.05
Urban population (×e5)	1.95	3.45	0.13	21.95
Population density (×e3/km2)	3.40	0.63	1.90	5.36
Dispersion (%)	90.60	4.88	79.92	100
NDVI (×e-3)	0.51	0.06	0.29	0.68
GDP per capita (×e4)	2.90	0.30	2.36	3.41
Gini index of income	0.09	0.02	0.05	0.14
Proportion of aging above 60 years (%)	24.69	3.53	18.70	37.09

Methods

We pre-examined the association between urban spatial structure and other environmental variables with the intra-city health inequalities using Pearson correlation analysis. Then, we adopted a multivariable regression model to reveal their effects with socioeconomic and demographic variables under control. Urban land area was excluded from the regression due to multicollinearity.

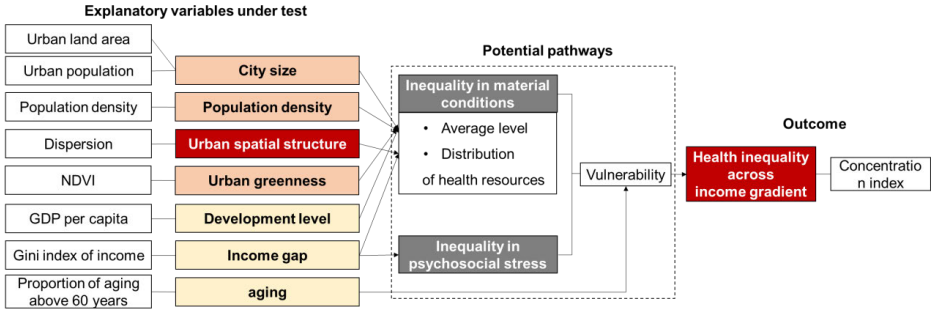

Fig.1 Analytical framework of this study

Results

Income-related health inequalities widely exists across England. We found that geographical areas with higher income presented lower mortality ratio (β=-0.621, $p<0.001$). Intra-city health inequalities range from 0.02 in Cannock to 0.14 in Blackburn (Fig.2), with an average value of 0.09. No significant variance was found between cities of different hierarchies (p-value = 0.388, Fig.3).

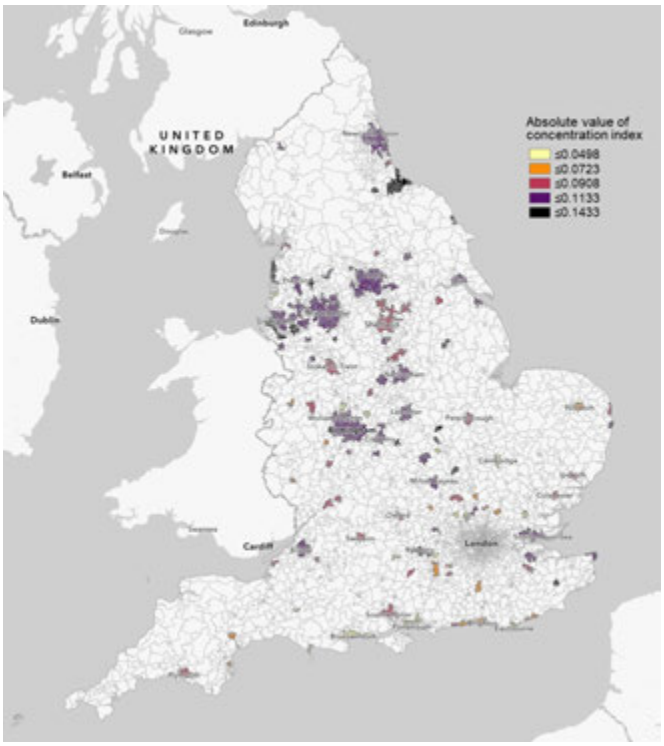

Fig.2 Distribution of intra-city health inequalities in England

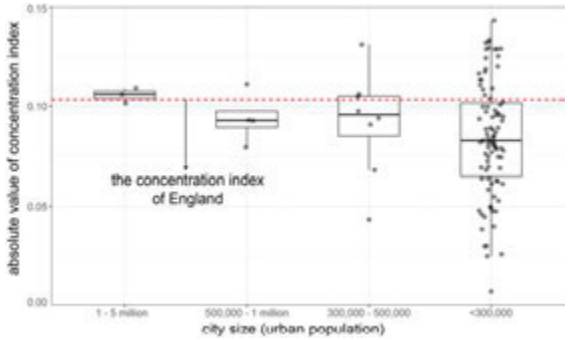

Fig.3 Distribution of intra-city health inequalities across city hierarchies
Note: The division of city size follows World Urbanization Prospects (2018)

In the binary correlation analysis, we found that cities with a more dispersed urban population (β=-0.2507, p=0.010) and a higher NDVI value (β=-0.1663, p=0.090) present lower intra-city health inequality, while cities with more inhabitants present higher levels (β=0.1842, p=0.060). This suggests that the disparity in health outcomes across areas of different socioeconomic statuses might be reduced if a city is greener and less concentrated, while it might be exaggerated when a city is larger.

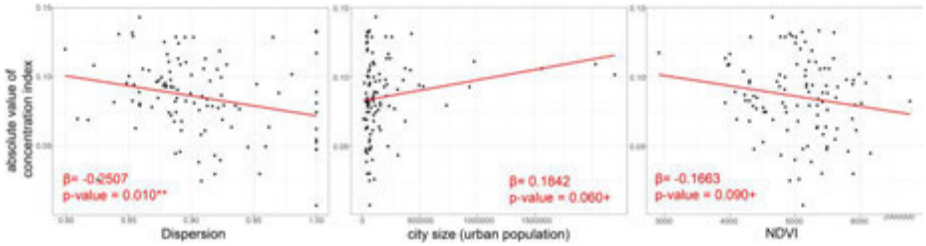

Fig.4 Relationship between environmental factors and intra-city health inequalities

Regression results revealed that the intra-city health inequalities could be explained by urban environment features (F-statistic=7.307, p<0.0001). We identified that the dispersion of urban population (β=-0.179, p=0.043) and greenness (β=-0.147, p=0.087) were in significant negative relationships with intra-city health inequalities. It indicates that cities with more dispersed population distribution and more green areas would exhibit lower levels of intra-city health inequality. Moreover, the disparity in income was also in a super significant positive relationship with income-related health inequalities (β=0.5002, p<0.001), which means that the larger the income gap, the larger the health gap.

Table. 3 Result of the multivariable regression

	Standardised coefficient	Std. Error	t value	Pr (>|t|)
intercept	-3.134e-16	0.08177	0.00	1.0000
Total urban population	0.0080	0.09044	0.088	0.9298
Population density	-0.0207	0.09023	-0.229	0.8193
Dispersion	**-0.1789**	**0.08729**	**-2.049**	**0.0431***
GDP per capita	-0.0450	0.09481	-0.475	0.6362
NDVI	**-0.1465**	**0.08462**	**-1.732**	**0.0865+**
Gini index of income	**0.5002**	**0.09394**	**5.325**	**<0.0001*****
Proportion of aging	0.1141	0.09046	1.262	0.2101
Adjusted R-squared		0.298		
F-statistic		7.307 (p-value<0.0001***)		

Discussion

Our study has demonstrated that, consistent with our hypothesis, intra-city health inequality is lower in cities with a more dispersed urban spatial structure and a greener urban environment. To our knowledge, this is the first study to identify city-scale urban planning factors that contribute to the reduction of intra-city health inequalities.

Our most significant finding is the elucidation of the impact of the urban spatial structure on reducing intra-city health inequalities. This may be attributed to the arrangement of physical conditions (urban amenities) at the city level. From an economic perspective, urban amenities are typically located in densely populated areas due to cost-effectiveness, while sparsely populated areas would have lower accessibility. Therefore, a dispersed urban spatial structure may prevent the concentration of urban amenities in densely populated urban centres, thereby reducing discrepancies in walkability – predicted based on the surrounding urban amenities

(Jones *et al.*, 2021) and significantly influences cardiovascular disease (Zhang *et al.*, 2023) – across different urban areas, leading to lower health inequality. Moreover, the more accessible healthcare resources in a dispersed city is conductive to lowering the inequality in the ability to treat cardiovascular disease. These possible mechanisms, from both the incidence and treatment perspectives, might explain the reduced health inequalities between rich and poor urban areas in dispersed cities.

It is important to note that the analysis regarding the distribution of urban amenities above is based on an assumption that the ability to pay is equally distributed spatially. However, in reality, amenities, especially those with commercial attributes, tend to cater to the rich. This means that even if a poor neighborhood is highly densified, amenities such as healthcare may not be accessible in this area. Conversely, a sparsely populated wealthy neighborhood may have access to highly qualified serves. In the context of England, we observed that the densely populated areas are mainly areas of income deprivation, especially in the Northern part of England. This implies that poor and densely populated neighborhoods might not have the advantage of amenities and may also suffer from overcrowding and poor living conditions. This possibly even exaggerates the health inequalities between rich and poor areas.

Our result also revealed that the average greenness in a city could reduce the intra-city health inequalities. It is not surprising as previous study has demonstrated its effect in mitigating health inequalities at the neighborhood level (Mitchell and Popham, 2008; Mitchell *et al.*, 2015). Here, we extend this finding to the city level, with similar mechanisms including promoting physical activity and alleviating stress (Mitchell & Popham, 2008), both of which are key risk factors for cardiovascular diseases.

Limitations of this study should also be acknowledged. First, the measurement of urban spatial structure is restricted. The population-based method used in our study is a straightforward way to derive morphological urban spatial structure, and is suitable for large scale research without efficient local data. However, during data processing, we found that although this method works well for Chinese cities and US metropolitans (Arribas-Bel and Sanz-Gracia, 2014; Liu and Wang, 2016; Li and Liu, 2018, 2018), its performance in England is not ideal. Due to the relatively small size for most England cities, we can hardly set a minimum threshold for selecting urban centres. For example, previous studies used 3 km^2 as a minimum size for urban centres. When we apply this criterion to England, most of the cities do not have a centre at all. Therefore, we simply used 1 km^2 (a grid in Landscan data) for the inclusion of city centre. But we can hardly tell whether the selected densely populated urban areas are true "centres". Further research is needed to apply other methods to re-test the effect of urban spatial structure.

Second, our data were cross-sectional. We had no means of knowing the migration of urban residents throughout their lives. Therefore, we could not know their living environment and their access to urban amenities and greenness in their earlier life, which also have profound effect on the mortality from cardiovascular diseases (Zhang *et al.*, 2023).

Third, the geographical unit used to measure the inequality in health may also influence the results due to modifiable areal unit problem (MAUP). Therefore, the robustness of our results needs further testing by utilizing available data from other geographic units to calculate health inequalities within cities.

In conclusion, the evidence suggests that built environment interventions at the city level –

which operate upstream and are easily reversible – could be effective in reducing health inequalities across areas with different socioeconomic statuses within cities. Such levels of health inequality are lower in cities with a more decentralised urban spatial structure and higher levels of greening. The implications are clear: while the promotion of compact cities has been prevalent, our findings do not support further over-concentration of the population in existing urban centres, especially when these dense urban centres exacerbate health disparities between the poorest and least poor by worsening the living conditions of poorer urban residents. Additionally, increasing greenness is emphasised as a spatial intervention strategy to effectively mitigate health inequalities. Together, these findings highlight the role of city comprehensive planning in the fight to reduce health inequalities.

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Exploring colour planning strategies for children's outdoor playgrounds in communities: An analysis of children's diverse preferences in Shanghai, China

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Abstract
Children's understanding of the world is largely shaped by their visual perception of their surroundings, with colour playing an integral role. Colour not only creates a visual impact but also has a profound influence on children's emotions, cognition, and behavior. This study explored colour planning strategies for children's outdoor playgrounds in communities, specifically focusing on children's colour preferences. We collected data through a questionnaire survey conducted in Shanghai, China, and employed the chi-square test and single-factor logistic regression to analyze the correlations between colour preferences and individual attributes of children, including gender, age, and community type, which we hypothesized could influence the diversity of children's color preferences. It is found that there exist significant differences in children's colour preferences across various ages and community types. Based on the children's colour preferences and preferences differences, we proposed several strategies for colour planning of children's outdoor playgrounds in the communities. Through these strategies, it aims to enhance the scientificity and universality of colour planning. Overall, this research contributes to the field by providing evidence-based recommendations for colour planning in children's outdoor playgrounds, ultimately contributing to the creation of more inclusive and vibrant child-friendly communities.

Keywords: colour planning, colour preference, children's playground, child-friendly community

1. Introduction

In the process of children's understanding of the world, the primary and most crucial aspect is their perception of the surrounding environment through vision (Proverbio et al., 2004). Within this developmental process, the significance of colour cannot be understated. It possesses the capacity not only to elicit visual impact but also to influence children's emotions, cognition, and behaviour (Jiang et al., 2020). Consequently, reasonable colour planning within the built environment, holds the potential to cultivate a more harmonious, healthful, and conducive environment for children's growth. Conversely, an unsuitable colour environment may inadvertently induce stress and impede the healthy development of children. The community, as the fundamental unit of city, serves not only as the immediate locus of children's daily activities but also constitutes a pivotal point for the realisation of a child-friendly urban environment. In recent years, prompted by the Child-friendly City Initiative (CFCI), there has been a noticeable surge in attention towards the design of children's outdoor playgrounds. Nevertheless, research on colour within the framework of constructing child-friendly communities remains comparatively underdeveloped, marked by a deficiency in quantitative evidence-based studies and systematic planning methodologies. Traditional approaches to colour planning and design predominantly rely on colour coordination skills and planner experience, often neglecting children's colour preferences and the underlying principles. By accumulating and analysing factual evidence, that is, children's colour preferences and laws of

preferences, evidence-based research that replaces empirical means with scientific means can provide an important supplement to planning and design. Consequently, this article takes Shanghai as an example and proposes colour planning and design strategies for children's outdoor playgrounds in communities based on the investigation of children's colour preferences and rules of preferences.

2. Literature Review of Children's colour Preference

In the realm of colour psychology, colour preference, a predilection of an individual or group towards specific hues over others, stands as a pivotal aspect within the broader domain of colour research. This aspect has perennially captivated the scholarly pursuits of various disciplines, including psychologists, urban planners, and artists. Studying colour preferences provides us with a way to understand how perceptual experiences map to cognitive and affective judgements (Ou et al., 2004).

Research on children's colour preferences encompasses three primary dimensions. Firstly, investigations of children's abstract colour preferences. For instance, as early as 1924, Garth (1924) explored the colour preferences of 1,000 white children, revealing an inclination towards blue that heightened with educational attainment, whereas with a decreasing preference for red. Similarly, Xu, Xu, and Guo (2022) corroborated that children aged 3-6 exhibit a predilection for colours with higher brightness, such as red, blue, and yellow. Moreover, as children get older, discernible gender differences emerge, with boys gravitating towards blue and girls towards pink, while red maintains favourability across genders. The second dimension pertains to the investigation of colour preference and perception concerning various objects, including food colour (Walsh et al., 1990), furniture colour (Jiang et al., 2020), and indoor colour (Ghayouri and Ayat, 2020), among others. The third dimension involves examining group disparities in colour preference, with a particular focus on gender and age differences. Sex-based distinctions in children's colour preferences have historically engendered debate. Some studies have identified notable disparities in colour preferences between boys and girls. For instance, Mohebbi (2014) surveyed children aged 7-9 in Islamic countries, revealing significant differences between genders in preferences for blue, green, pink, and black. Conversely, certain studies have indicated the absence of significant gender-based differences in preschool-aged children's colour preferences (Mousavi Samimi and Sadraei Tabatabaei, 2022). Nonetheless, on the whole, a preponderance of research supports the existence of gender differences in children's colour preferences (Child, Hansen and Hornbeck, 1968; Khaki and Mahdavi, 2021). In contrast to the contentious discourse surrounding gender differences, there is a consensus regarding the age differences in children's colour preferences. For example, Baniani (2022) observed marked differences in colour preferences among Japanese primary and middle school students, with primary school students exhibiting a preference for gold. Additionally, there exists a body of research exploring cultural disparities in children's colour preferences.

To sum up, in order to explore evidence-based colour planning for child-friendly community environments based on children's colour preferences, this study intends to address the following two research questions:

(1)What are children's colour preferences for children's outdoor playgrounds in communities?

(2)Are there differences in children's colour preferences for outdoor playgrounds in communities?

Drawing upon existing literature, this study formulates research hypotheses to address the second research question, focusing on gender and age disparities in colour preferences. Moreover, extant studies have evidenced significant variations in city colour preferences among residents inhabiting different housing types (Wen, Himeno and Chung, 2023), with Shanghai exhibiting several distinctive housing typologies. Hence, this investigation posits the following three research hypotheses:

(1) There exist significant differences in children's colour preferences for outdoor playgrounds across genders;

(2) There exist significant differences in children's colour preferences for outdoor playgrounds across ages;

(3) There exist significant differences in children's colour preferences for outdoor playgrounds across various community types.

3. Survey of Children's Colour Preferences

The content of the survey

Colour is the perceptual interpretation of light wavelengths through the visual apparatus of the eyes, processed by the brain, and influenced by life experiences. The diverse colours can broadly be categorised into two groups: achromatic and chromatic. Achromatic colours, characterised by a saturation level of 0, include typical black, white, and grey. In the common perception of the Chinese people, the colour spectrum is traditionally delineated into red, orange, yellow, green, cyan, blue, and purple—commonly referred to as the rainbow colours. Among these, red, yellow, and orange are considered warm hues, while blue, green, and purple are classified as cool hues.

Therefore, the questionnaire item concerning colour preference for outdoor playgrounds within communities is formulated as follows: "What colour do you most would like for the outdoor playgrounds in your community?" Respondents are provided with a single-choice selection from the following options: A. Warm colour, B. Cool colour, C. Black, white, and grey, D. Multicoloured (a mix of warm and cool tones), E. Other. Additionally, demographic details such as gender, age, and housing type of the participants were captured in the questionnaire.

3.1 Selection of survey area and analysis

Housing type is one of the variables of this study, so the area shown in Figure 1 was carefully selected as the investigation area. This area is located in the south-central part of Hongkou District, Shanghai, covering an area of about 1.5 square kilometres and is a 15-minute living circle. Encompassing three prevalent housing typologies emblematic of Shanghai, namely traditional lane blocks predating 1949, post-1949 public housing, and commercial and affordable housing constructed since the 1990s [33], this locale offers a diverse representation of urban residential architecture. Among them, traditional lane housings generally occupy a small area, exhibiting high building density, and dense road networks; public housing residences exhibit obvious grading characteristics, with large land use, low building density and low road network; The newer commercial and affordable housing developments encompass a range of sizes, with high-rise structures characterised by lower density, ample green spaces, and open areas.

There are abundant children's education facilities in the survey area, including one nursery, four kindergartens, four primary schools and three middle schools. Notably, Primary School No. 1

and Kindergarten No. 3 are predominantly surrounded by traditional lane housing, while Primary School No. 2 and Kindergarten No. 4 are situated in high-rise commercial housing. Conversely, Primary School No. 3 and Kindergarten Nos. 1 and 2 are primarily surrounded by multi-storey public housings.

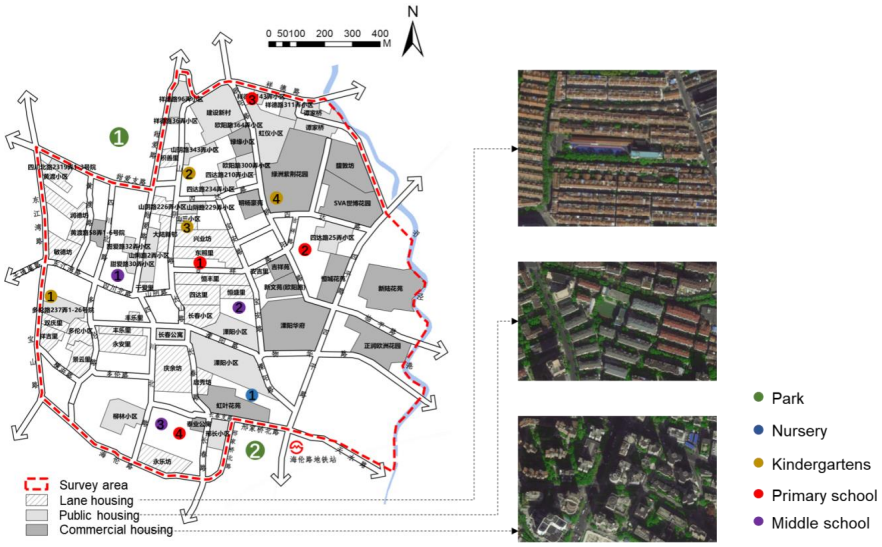


Figure 1. Survey area

3.2 Survey procedures and participants

In October 2023, a questionnaire survey was conducted within the designated area. Employing an offline random sampling approach, the survey targeted children aged below 18 years. Over one month, a total of 210 questionnaires were gathered, out of which 204 were deemed valid, yielding an effective rate of 97.1%. The demographic composition of the participants is illustrated in Figure 2. Specifically, the participants comprised 107 male children (52.45%) and 97 female children (47.55%). The age range spanned from 1 to 17 years, with an average age of 10 years. As per the United Nations Convention on the Rights of the Child, individuals under 18 years are classified as children. In line with the eight-stage theory of personality development proposed by psychologist E.H. Erikson, and the insights from famous Chinese psychologist Zhixian Zhu, the ages of the surveyed children were categorised into four groups: 0-3 years old (1.47%), 4-6 years old (10.78%), 7-12 years old (63.73%), and 13-17 years old (24.02%). Additionally, the distribution of housing types among the 204 participants was relatively even, with 64 children residing in lane housing, and 70 children each inhabiting public housing and commercial housing, respectively.

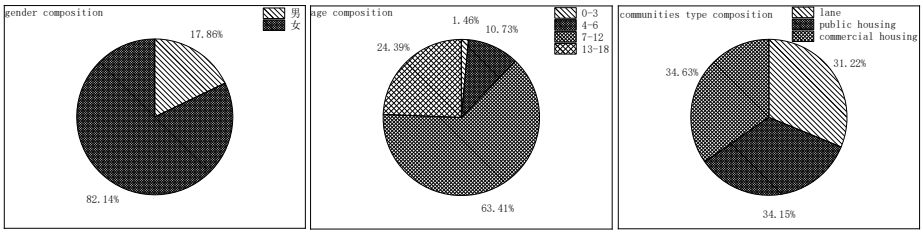


Figure 2. The composition of participants

3.3 Results

Figure 3 depicts the descriptive statistical outcomes of children's colour preferences for outdoor playgrounds in communities, presented as frequencies. Broadly, warm colours emerge as the most favoured choice among children, constituting 40.6% of responses, closely followed by a blend of cold and warm hues, representing 39.2% of preferences. Conversely, the least selected outdoor colour schemes are achromatic options, that are black, white, and grey.

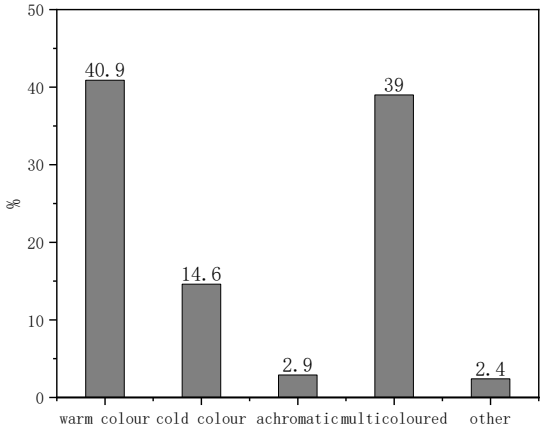
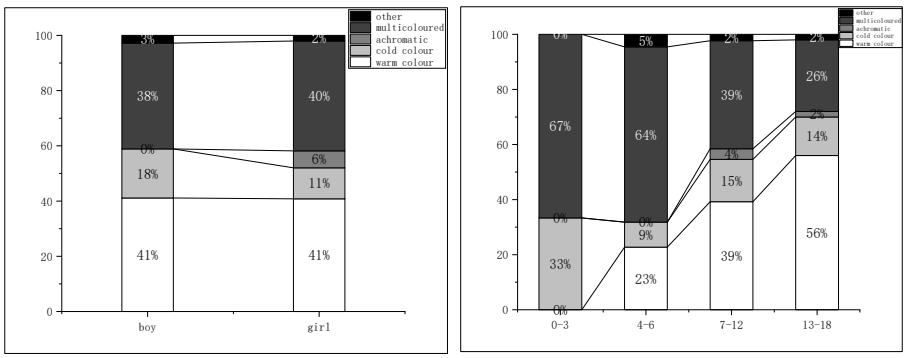


Figure 3. Preferred colour of children

Figures 4 illustrates the colour preferences of children across various genders, age groups, and housing types. Analysis reveals discernible patterns: boys exhibit a greater inclination towards cool colours compared to girls, while girls manifest a heightened preference for achromatic hues in contrast to boys. Regarding colour preferences among children residing in diverse community types, those inhabiting lane communities demonstrate a penchant for vibrant, multicoloured schemes, whereas children in public housing communities preferred warm colour palettes for outdoor playgrounds. Conversely, children in commercial housing communities were more likely to choose cool colours relative to other housing types.



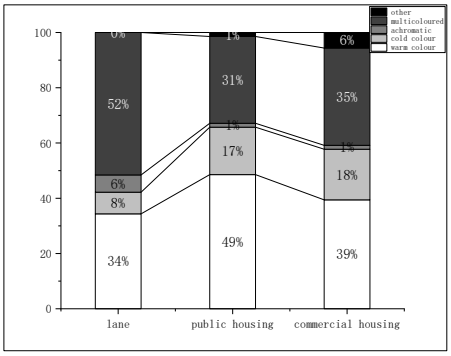


Figure 4. Colour preferences of children across various genders, ages, and housing types

In order to evaluate the statistical significance of gender and housing type differences in children's colour preferences for outdoor playgrounds, this study employed the chi-square test, a widely utilised hypothesis testing method. The chi-square test assesses the extent of deviation between observed and expected values in a statistical sample. The magnitude of this deviation determines the chi-square value, with larger values indicating greater discrepancies and smaller values indicating lesser discrepancies (Wen, Himeno and Chung, 2023). Furthermore, since age is a numerical variable while colour preference is categorical, the chi-square test is suitable for analysing variables when both are categorical. Therefore, to examine the relationship between age and colour preference, this study utilised a single-factor regression model.

The above tests were all performed through IBM SPSS 26. The test results are summarised in Table 1. According to Table 1, the p-value for age (0.043) and housing type (0.043) are both below the significance threshold of 0.05, indicating that the age difference and housing type differences in children's colour preference are significant at the 95% confidence level. That is, children's age and housing type are significantly related to children's colour preference for outdoor playgrounds in communities. Conversely, the p-value associated with gender (0.084) exceeds the 0.05 threshold. Thus, the analysis suggests that gender differences in children's colour preferences for outdoor playgrounds within communities are not statistically significant at the 95% confidence level.

Table 1. Results of significance test

	Value	df	Asymptotic significance	Exact significance
Gender	8.214	4	0.084	0.072
Age	22.346	4	0.000 (significance)	-
Housing type	16.256	8	0.039	0.043

In summary, the findings of this study support the establishment of research hypotheses 1 and 3. Specifically, the results indicate significant age and community-type differences in children's colour preferences for outdoor playgrounds within communities. Conversely, hypothesis 2 is not supported, as there are no statistically significant differences observed in children's colour preferences for outdoor playgrounds across genders.

4. Colour Planning Strategies for Children's Outdoor Playgrounds

Children often exhibit a strong inclination to congregate with peers of the same age group, each age group possessing distinct physiological, psychological, and behavioural needs.

Consequently, many outdoor playgrounds now incorporate activity zones tailored to accommodate children of varying age ranges. However, it is observed that the colour series employed across these activity areas often remain uniform, failing to account for the diverse colour preferences observed among children of different ages. Based on the research findings presented in this article, which underscore significant age-related disparities in children's colour preferences, it is imperative to reconsider the colour schemes utilised in community children's activity venues. Specifically, colour delineations should be integrated alongside age and activity type categorisations. For instance, vibrant and diverse colour palettes are recommended for play areas catering to younger children, whereas a more restrained colour palette may be suitable for play areas targeting older children. By aligning colour choices with the preferences of each age group, community activity venues can better cater to the diverse needs and preferences of children across various developmental stages.

Moreover, given the significant disparities in children's colour preferences for outdoor playgrounds across different community types, this study advocates for tailored colour design strategies for each community archetype. Specifically, lane and public housing communities represent the predominant housing typologies in Shanghai, characterised by high building density and limited space availability. In such high-density urban settings, the scarcity of land resources poses challenges for the incorporation of children's playgrounds. Thus, the study proposes the utilisation of existing spaces, such as idle areas or underutilised spaces within the lane and public housing communities, to augment open space provisions for children. Furthermore, fragmented spaces like stairwells can be repurposed to enhance the availability of recreational areas. Notably, colour can serve as an effective tool for delineating boundaries within these communities. Lane communities are encouraged to employ vibrant and diverse colour combinations, while public housing communities should predominantly utilise warm hues to foster a child-friendly community ambiance. Conversely, commercial housing communities typically offer ample green spaces and open areas, albeit with a more introverted spatial layout. Building upon this foundation, these communities should strive to provide a higher quality colour environment conducive to children's well-being. For instance, outdoor playground floors can be painted according to children's colour preferences, while activity facilities should be adorned with colours tailored to the cognitive and preference profiles of children within the corresponding age groups. By aligning colour design with the unique characteristics and needs of each community type, a more enriching and child-friendly environment can be cultivated within urban neighbourhoods.

5. Conclusion

Children grow up in the urban environment, and the urban environment, especially the community environment, plays a decisive role in their growth. If the community environment is planned in a way that meets the needs of children, such a community environment will not only help children grow up but will also become a beautiful home for future generations. From the perspective of children, this study investigated children's colour preferences for outdoor playgrounds in communities and found the following results: (1) For the colours of outdoor playgrounds in communities, children least like achromatic colours, that is, black, white and grey (2) Children's colour preferences exhibit significant age differences. Specifically, as children's age increases, their preference for warm colours also increases, while their preference for colourful colours decreases; (3) Residential type is related to children's colour preference for the outdoor playgrounds in the community. Children living in lane communities preferred colourful colours than children in other community types, and are less willing to choose cool colours. Children in public housing communities are more willing to choose warm colours for outdoor playgrounds in the communities.

In light of these findings, this article proposes colour planning strategies informed by children's colour preferences and preference trends. By integrating these insights into community renewal initiatives, urban planners and designers can craft children's outdoor playgrounds that are visually captivating, culturally resonant, and emotionally enriching. By prioritising children's colour preferences, community activity spaces can be transformed into vibrant and welcoming settings that enhance the overall experience and well-being of children within the community.

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Enhancing Social Interaction in Urban Spaces: The Role of Vertical Greening Systems in High-Density Areas

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Abstract: The critical role of nature exposure in fostering prosocial behaviour and social connectedness is well-established in existing research, while intensifying urbanization presents growing challenges to the development of the nature in urban areas. The Vertical Greening System (VGS), an innovative approach that conserves land, emerges as a creative solution. However, its potential in enhancing social interactions remains under-explored. To bridge this gap, experiments were conducted to assess the impact of VGS on improving spatial quality, enhancing space attractiveness, and increasing pedestrians' willingness to walk, stay, and engage in social interactions. Results indicate that VGS serve as important visual attractors ang significantly enhances the visual attractiveness of urban spaces, leading to improved perceptions of environmental quality. This enhancement positively affects the affective experience of pedestrians, creating a more inviting atmosphere conducive to walk, stay, and socialize. Eye-tracking data shows that green elements serve as important visual attractors, suggesting that their strategic placement in urban design is critical to promoting social interaction.

Keywords: Vertical greening system, Environmental perception, Affective experiences, Social interaction.

1 Introduction

Continues urbanization has shaped oppressive streetscapes, leading to increased urban population and pressures of city life. The perceived overcrowding and increasing exposure to environmental stressors can significantly diminish individuals' evaluations of the built environment and their willingness to engage in outdoor activities. This, in turn, adversely affects both physical and mental health and reduces opportunities for social interaction, which are crucial for societal health(Zijlema et al., 2024, Luo and Jiang, 2022, Eizenberg and Jabareen, 2017).

The critical role of nature exposure in fostering prosocial behaviour and social connectedness is well-established in existing research. Nature environments not only provide necessary relief from urban stress but also serve as catalysts for social interaction by offering welcoming and livelihood communal spaces for gatherings and recreational activities(Hartig et al., 2014, Kaźmierczak, 2013).

However, intensifying urbanization presents significant challenges to the development and maintenance of natural environments within urban areas, leading to their decline and uneven distribution across cityscapes. Additionally, changes in lifestyle and the accelerated pace of modern life increasingly restrict the time people spend in nature. As Fuller and Gaston (2009) noted, interactions between urban residents and nature are increasingly mediated by informal green spaces, such as streetscape greening and pocket gardens, rather than traditional, large green networks.

In this context, the Vertical Greening System (VGS) emerges as an innovative solution that conservatively uses land while integrating accessible green infrastructure within high-density areas. Several empirical and experimental studies have highlighted the psychophysiological benefits of VGS in urban settings(Chan et al., 2021, Elsadek et al., 2019). Also, the potential of VGS to enhance the attractiveness of urban spaces, increase footfall, and promote social

interactions has garnered increasing attention(Goel et al., 2022), while it remains under-researched and requires further scientific validation.

To address the existing knowledge gap, this study utilized a virtual reality (VR) experiment to evaluate the effects of various streetscape scenes, featuring different coverages of VGS, on individuals' environmental perception, affective experiences, and behaviours. The primary research questions explored were: 1) How does VGS in high-density open spaces affect perceived environmental quality and visual attraction? 2) How does VGS influences pedestrians' affective experiences in urban settings? 3) Does vertical greening enhance pedestrians' willingness to walk, stay, and participate in social activities within these environments?

2 Methods

2.1 Experiment design

A total of 5 streetscape VR scenes were created, each featuring the same building form but varying coverages of VGS, as detailed in Table 1. Each scene comprised 6 panoramic photographs rendered from different positions along the street model to comprehensively depict the street's characteristics. Each photograph was displayed for one minute and shown twice in VR experiment, as shown in Fig.1. Finally, rendered sequence frame images were used to create five 40-second streetscape video segments for post-experiment surveys.

Table 1. Characteristics of streetscape scenes in the 5 experimental groups(G) and 5 videos(V).

Experiment groups	G1/V1	G2/V2	G3/V3	G4/V4	G5/V5
Coverages of VGS in VR scenes (%)[1]	0	8	16	32	48

[1] The coverage of VG in streetscape scenes was quantified by calculating the percentage of the façade covered by VGS relative to the total façade area of the street block.

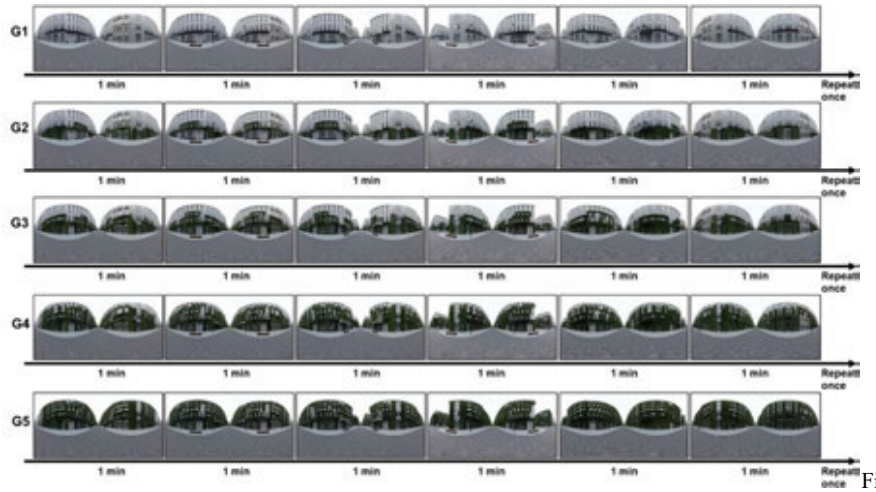

Fig.1. VR experimental stimulation design.

2.2 Participants

We recruited 30 healthy adults from Tongji University to participate in the study. Eligibility criteria required participants to be aged between 18 and 35. Individuals who had consumed tobacco, alcohol, drugs, or caffeinated beverages within 24 hours prior to the experiment, or who had engaged in intensive exercise within 6 hours of the experiment, were excluded. The study received approval from the Science and Ethics Committee of Tongji University, and all participants provided written informed consent before participating.

Prior to the experiment, we collected data on participants' socio-demographic background, chronic mental stress levels, nature connectedness, noise sensitivity, and other relevant covariates through a questionnaire. Participants were then approximately assigned to one of five experimental groups based on their survey responses, allowing for a rough control of these covariates across the groups. The descriptive statistics of their background information are presented in Table 2, and there were no statistically significant differences between 5 VR experiment groups.

Table 2. Descriptive statistics of the participants' background information.

Measures		**Participants Mean (± SD) or Number (percent, %)**					
		G1	**G2**	**G3**	**G4**	**G5**	**V1 to V5**
Gender	Male	4	3	3	3	3	16
	Female	2	3	3	2	3	14
Education	Bachelor	3	2	4	3	4	16
	Master	1	3	2	2	2	11
	Doctorate	2	1	0	0	0	3
Place of upbringing	Central urban district	4	3	2	3	2	15
	Suburbs or townships	2	2	4	2	4	14
	Rural area	0	1	0	0	0	1
Nature connectedness[1]		4.9 (±0.8)	5 (±1.31)	5.3 (±0.84)	5.4 (±0.67)	5.5 (±0.54)	5.27 (±0.85)
Noise sensitivity[2]		92.5 (±6.8)	88.5 (±18)	91.5 (±11)	78.6 (±12.8)	99.3 (±14)	91 (±14)
Chronic mental stress levels[3]		17.5 (±5)	14.2 (±6)	13.7 (±4.8)	12.2 (±7.7)	15.0 (±8.4)	15 (±6)

[1] **Nature connectedness**, describes a psychological state where individuals deeply care for and feel connected to nature, reflecting their innate biophilic tendencies(Capaldi et al., 2014). It serves as an indicator of the extent to which these tendencies are fostered or suppressed(Nisbet and Zelenski, 2013). Research shows that nature connectedness affects, moderates, and mediates the impact of nature exposure on mental health(Liu et al., 2022). In this study, we used 6-iterm and 7-point Nature-Relatedness Scale to measure an individuals' nature connectedness(Gong et al., 2024).

[2] **Noise sensitivity**, which refers to an individual's susceptibility and degree of reaction to everyday noises, was evaluated using the Weinstein Noise Sensitivity Scale (WNSS) in this study(Weinstein, 1978).

[3] **Chronic mental stress levels**, which have been shown to influence the mental effects of nature exposure on individuals(Shanahan et al., 2015), were assessed using the Perceived Stress Scale (PSS-10) in this study(Cohen et al., 1983).

2.3 Procedure

As illustrated in Figure 2, the experiment comprises three phases: preparation, testing, and post-testing.

In the preparation period, participants signed written informed consent and were equipped with the VR devices and biomonitoring sensors. Participants were then asked to close eyes and rest for 3 minutes while electro-dermal activity (EDA) data recording commenced. Subsequently, participants completed a self-reported scale to establish psychological baselines.

During the testing period, participants were divided into five groups and randomly assigned to one of five VR scenes. Initially, they were exposed to traffic noise for 5 minutes and completed a self-reported scale. This was followed by a 12-minute viewing of a VR scene along with the collection of eye-tracking data, after which they filled out the same self-reported scale again. Upon completion, all devices were deactivated and removed, and participants rated their level of discomfort during the VR test using a 5-point Likert scale (1 = very slightly or not at all, 5 = extremely).

After VR testing, participants were required to complete post-test surveys. They viewed five videos through an online link and immediately assessed perceived oppressiveness, environmental quality, visual preference, affective experience, and their willingness to engage in various outdoor activities in such environment. The videos were presented in a random order to prevent any sequence effects.

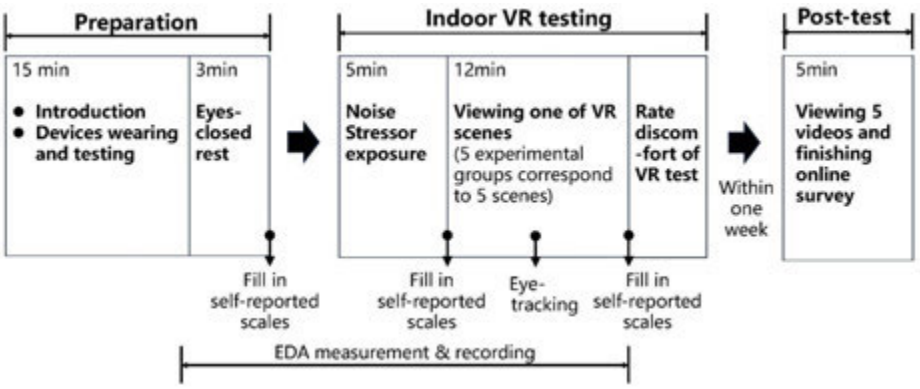

Fig.2. Experimental procedure.

2.4 Measures

2.3.1 Perceived oppressiveness and perceived environmental quality

Perceived oppressiveness (PO) is the subjective experience of feeling overwhelmed or dominated by a physical environment, negatively related to urban environmental quality(Asgarzadeh et al., 2012). Perceived environmental quality (PEQ) involves the subjective evaluation of a physical environment, encompassing an individual's multisensory perception of various environmental attributes. Both PO and PEQ have been identified as mediators in the relationship between an individual's environmental exposure and their psychophysiological responses and behaviours (Luo and Jiang, 2022).

We assessed participants' PO and PEQ in response to online videos by asking, "Do you feel oppressiveness?" and "How would you rate the visual quality/ safety level/ economic level of the street environment depicted in the video?", respectively. An 11-point VAS, ranging from 0 (very low) to 10 (very high), was utilized for these evaluations.

2.3.1 Visual attractiveness

Self-reported visual preferences for online streetscape videos and eye-tracking data collected during VR testing were used to assess the visual attractiveness of the scenes. After viewing the five streetscape videos, participants were asked to rank the videos on a 5-point scale from 1 to 5, where 1 indicates the least liked and 5 indicates the most liked, with scores increasing progressively based on preference. Additionally, eye-tracking data was utilized to analyse visual attention and identify hotspots within the visual stimuli.

2.3.3 Affective experience: psychological and physiological

As detailed in Table 3, the Self-Assessment Manikin (SAM) was employed to assess individuals' affective states through 9-point valence (from 1-unpleasant to 9-pleasant). In addition, individuals' physiological responses were measured using Skin Conductance Level (SCL), which represents individuals' arousal and stress level.

Table 3. Psychological and physiological measures.

Psychological and physiological measures		Description	Relationship with the stress level
SAM	Valence	Affective states	-
EDA	SCL (μS)	Arousal and stress level	Positive

2.3.4 Measures of outdoor behaviours

To measure individuals' outdoor behavioural intent, we asked participants, "How willing are you to visit, walk, stay, or engage in social activities in the street depicted in the online video?" We utilized an 11-point Visual Analog Scale (VAS) for responses, ranging from 0 (not at all willing) to 10 (very willing).

2.5 Statistical analysis

Environmental perception data, including self-reported Perceived Oppressiveness (PO), Perceived Environmental Quality (PEQ), visual preference, and behavioural intent, were collected via a within-subject online survey. Differences in environmental perception and intent data across the five online videos were compared using one-way repeated measures ANOVA for normally distributed data and the Friedman test for non-normally distributed data.

The affective psychophysiological data collected from a between-subject VR experiment design were analysed using one-way ANOVA for normally distributed data and the Kruskal-Wallis H test for non-normally distributed data to compare differences across five VR groups. Additionally, two-way ANOVA models with post-hoc pairwise comparisons were conducted to examine per-minute Skin Conductance Level (SCL) responses to the five VR scenes.

All data were presented as means, and for all comparisons, a p-value of less than 0.05 was considered statistically significant.

3 Results and discussion

3.1 Perceived oppressiveness (PO) and perceived environmental quality (PEQ)

As shown in Figure 3, the post-hoc tests indicated that the PO of V1, which had no VGS coverage, was significantly higher compared to V2 and V3. Conversely, the Perceived Environmental Quality (PEQ) of V1 was significantly lower than that of V2, V3, V4, and V5. This suggests that VGS can significantly enhance people's perceptions of street quality and reduce the oppressiveness of high-density streetscapes. However, it is important to note that when VGS coverage is excessively high, as in V4 and V5, the beneficial effects of reducing perceived oppressiveness in high-density streetscapes may diminish. As shown in Figure 4, the relationship between VGS coverage and PO is depicted by a U-shaped curve. Conversely, the relationship between VGS coverage and PEQ is represented by an inverted U-shaped curve.

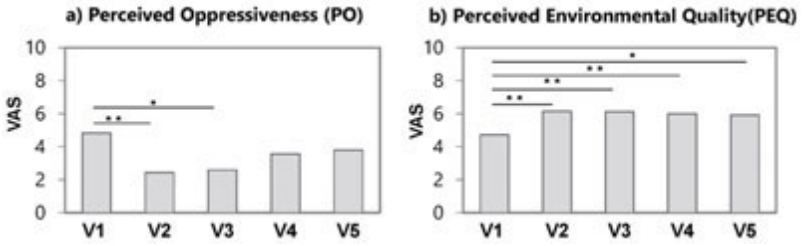

Fig.3. Participants' PO and PEQ across 5 streetscape videos, *p < 0.05, **p < 0.01, ***p < 0.001.

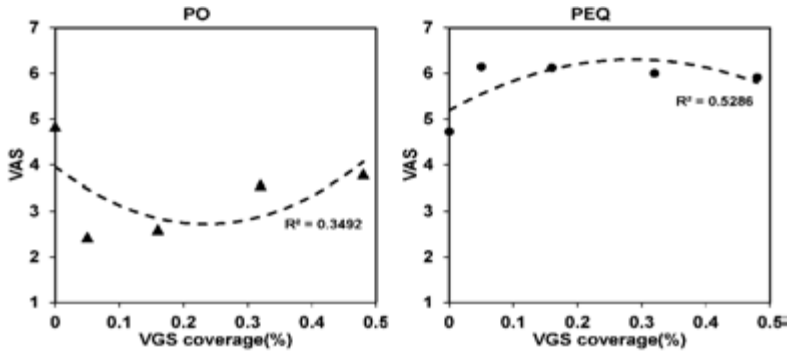

Fig.4. Patterns between VGS coverage and participants' PO & PEQ.

3.2 Visual attractiveness: visual preference and eye-catching factors

As shown in Figure 5, the coverage-response curve between VGS coverage and individuals' visual preference is depicted by an inverted U-shaped curve. Significant differences were observed in participants' visual preferences across five online streetscape videos with varying levels of VGS coverage. Specifically, preferences for V1, which had no VGS coverage, were lower compared to those with VGS coverage in V2, V3, V4, and V5. Statistically significant differences were noted between V1 and V2, V3, and V4. V3, which had the highest visual

preference scores, also showing a statistically significant difference from V5, which had the second-lowest scores.

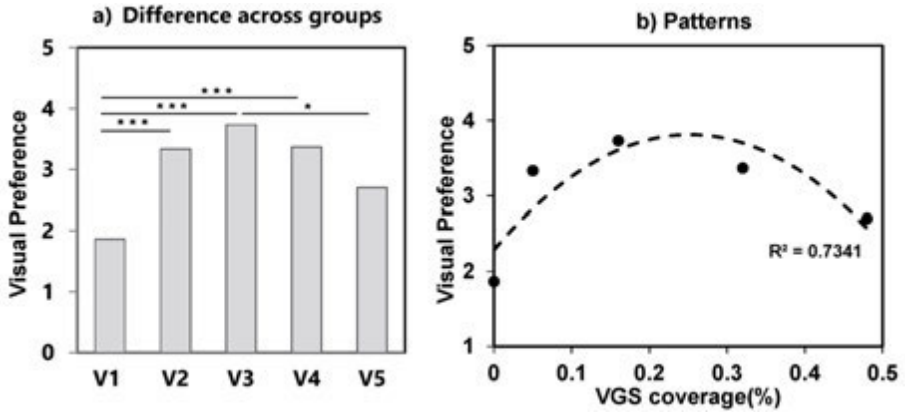

Fig.5. Participants' visual preference across 5 streetscape videos and its relationship with VGS coverage, *p < 0.05, **p < 0.01, ***p < 0.001.

After VR testing, eye-tracking hotspots were generated for five VR scene groups, namely, G1 to G5. As illustrated in Figure 6, participants in groups G1 (with no VGS) and G5 (with very high VGS coverage) tended to look straight ahead. They reported feeling oppressed by facades either devoid of greenery or heavily covered in greenery, mentioning that looking forward allowed them to see more sky. Conversely, in groups G2, G3, and G4—where vertical greening coverage was moderate—participants often turned their heads to appreciate the street facades, especially in G2 and G3, which had higher visual preference scores. This suggests that moderate VGS coverage can significantly enhance the visual appeal and of street facades.

G1 G2 G3 G4 G5

Fig.6. Participants' eye-catching factors across 5 VR scenes.

3.3 Affective experience

In this study, we utilized traffic noise to simulate the mental stress commonly experienced by pedestrians in high-density urban areas, where exposure to environmental stressors like heat and noise is prevalent. We specifically investigated how streetscapes with varying levels of VGS coverage influence the affective experiences of pedestrians after these stressor exposures.

Changes in psychological data (*Δ*Valence) and physiological data (*Δ*SCL) before and after experiencing VR scenes were used to assess the effects of VGS on the affective states of stressed participants. *Δ*valence and *Δ*SCL were calculated using equations (1) and (2) respectively and are summarized in Table 4.

Table 4. Measures of the effects of VGS on participants' affective state

Measures	Calculation

*Δ*Valence	(1) *Δ*Valence = Valence $_{\text{scene experience}}$ - Valence $_{\text{noise experience}}$ "+" represents affective improvement
*Δ*SCL (μS)	(2) *Δ*SCL = SCL $_{\text{scene experience}}$ - SCL $_{\text{noise experience}}$ "+" represents arousal and stress Increasing

3.3.1 Physiological data

Our analyses using paired t-tests and Wilcoxon signed-rank tests indicate a significant increase in participants' physiological stress levels following noise exposure. Additionally, ANOVA results reveal no statistically significant differences in physiological data among the five groups after exposure to the stressor. Participants' mean *Δ*SCL across five groups during are displayed in Figure 7and Figure 8. As Figure 7 indicates, statistically significant differences in ΔSCL across VR scenes begin to manifest after 6 minutes of exposure. Consequently, as illustrated in Figure 8, we compared the average ΔSCL after 6 minutes. The post-hoc tests reveal that the ΔSCL of G1 was significantly higher than those of G2, G3, and G4. The relationship between VGS coverage and ΔSCL is characterized by a U-shaped curve, suggesting that moderate VGS coverage can significantly enhance pedestrians' affective states.

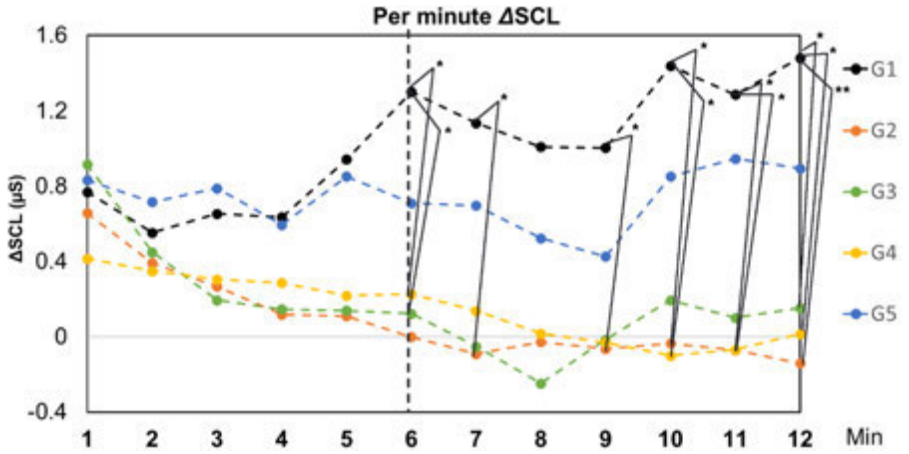

Fig.7. Pairwise comparisons of the estimated marginal means of per minute *Δ*SCL during VR scenes experiencing. *p < 0.05, **p < 0.01, ***p < 0.001.

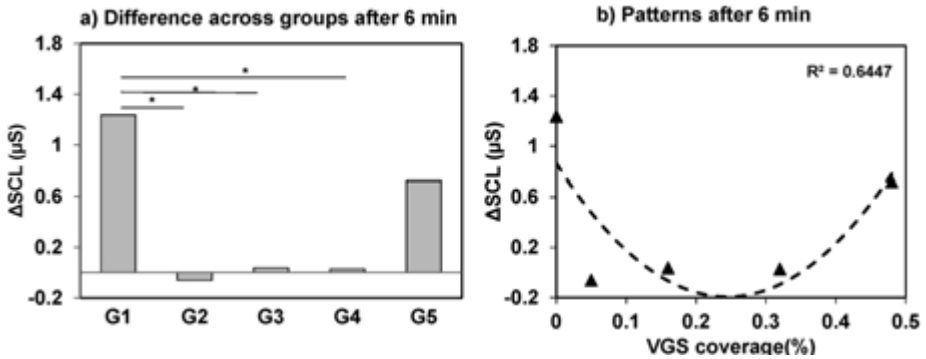

Fig.8. Patterns between the VGS coverage and participants' physiological response, *p < 0.05, **p < 0.01, ***p < 0.001.

3.3.2 Psychological data

As shown in Figure 9, although there were no statistically significant differences of psychological data. comparison between scenes still reflected important trends. The relationship between VGS coverage and Δvalence is characterized by an inverted U-shaped curve.

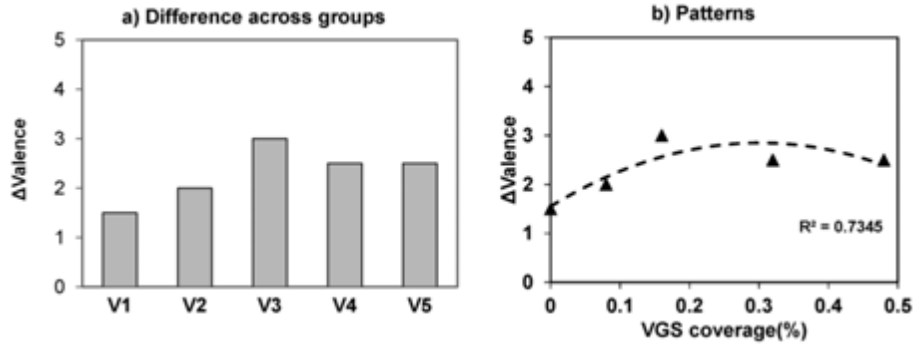

Fig.9. Participants' psychological effect across 5 streetscape videos and its relationship with VGS coverage, *p < 0.05, **p < 0.01, ***p < 0.001.

3.4 Outdoor behavioural intent

As depicted in Figures 10 and 11, individuals' willingness to visit, walk, and stay in V1 was significantly lower compared to V2, V3, and V4. Furthermore, the willingness to socialize in G1 was significantly lower than in V2 and V3. The relationship between VGS coverage and individuals' outdoor behavioural intent is characterized by an inverted U-shaped curve, indicating that both very low and very high levels of VGS coverage may decrease the desire to engage in outdoor activities, with moderate levels proving more conducive to positive behavioural intentions.

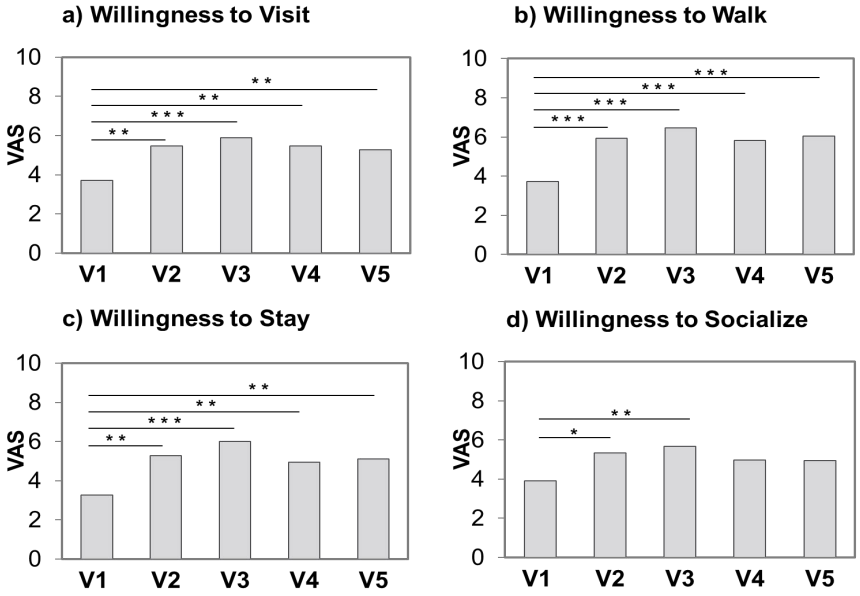

Fig.10. Participants' outdoor behavioural intent across 5 streetscape videos, *p < 0.05, **p < 0.01, ***p < 0.001.

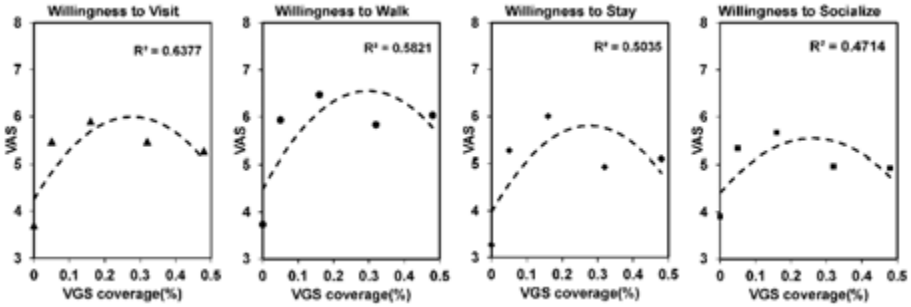

Fig.11. Patterns between the VGS coverage and participants' outdoor behavioural intent.

4. Conclusion

This study investigated the potential of VGS to enhance the attractiveness of urban spaces and promote social interactions. Results indicate that VGS serve as important visual attractors ang significantly enhances the visual attractiveness of high-density urban spaces, leading to improved perceptions of environmental quality. This enhancement positively affects the affective experience of pedestrians, creating a more inviting atmosphere conducive to walk, stay, and socialize. The relationships between VGS coverage and individuals' visual preference, perceived environmental quality and their outdoor behavioural intent are characterized by an inverted U-shaped curve, The relationship between VGS coverage and individuals'; the relationships between VGS coverage and individuals' perceived oppressiveness and stress level ware characterized by an inverted U-shaped curve. Eye-tracking data shows that green elements

serve as important visual attractors, suggesting that their strategic placement in urban design is critical to promoting social interaction.

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Can care help conceptualise place futures? Exploring the potential of care as an analytical framework for understanding place qualities

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Abstract
This paper explores how the concept of care can structure an analytical framework for understanding place qualities. Care is burgeoning as a major concept within the humanities and social sciences. Given its growing application in planning, it is timely to reflect on what the care concept contributes to understanding places and their possible futures. Following a review of the scholarly literature, this paper proposes an analytical framework based around five characteristics of care: (1) objects of care; (2) caring actors; (3) care practices, (4) care motivations; (5) care relations. The final part of the paper reflects on the potential of the care concept for imagining possible place futures.

Keywords
Care; place; futures; analytical framework

Full text

1. Introduction**:**

The future of the places we engage with – whether, to live, work, visit or use more indirectly concerns us on both personal and professional levels. A plethora of challenges: uncertainties brought by changes in climate, economy and social patterns destabilise long term planning goals. At the same time, planning efforts are asked to meet the needs of a diverse range of stakeholders. In this challenging planning climate, there is a clear need to reflect on and discuss how to cultivate place futures. A range of existing scholarship seeks to address this question, proposing an impressive range of methods and approaches to deliver sustainable futures. However, such efforts are plagued by the fact that the goals and underlying assumptions of how to realise place futures are not clear but at times undermine and contradict each other.

In this paper I use the term place futures to describe in a broad way all the things a place may come to be – whether by design or as a gradual unfolding of incremental, everyday practices. It is a deliberate choice in order to remain unaligned with the conceptual baggage carried by more established terms such as local development or place making. In writing about place futures, I recognise that the motivation for taking action in a place is often explicitly connected to realising a particular future. However, I also recognise that futures of places unfold without (or despite) deliberate interventions, motivated rather by a sense of connection to or concern about a place (Healey 2023). Finally, I use the term place futures to shift the focus from a particular end goal to provide space for seeing that sometimes futures aren't about change, but can equally be about maintaining and sustaining. After all, even a state of sustainability needs maintenance (Ringel, 2021).

It is also necessary to elucidate my perspective on what constitutes a place. Although theoretical definitions of place abound, in this paper I borrow the term 'place qualities' from Healey (2018) to refer to the constituent features of places. This is a relational understanding that casts places as 'loosely-structured assemblages of people and other species, material objects and meanings, action arenas, physical forms and flows, possibilities and memories, emotional attachments and moral values, connected to other times and spaces through complex and multiple webs of relations' (Healey, 2018, p. 67). This paper is not about any one specific place, but rather explores how the concept of care can contribute to how we understand places and conceptualise their possible futures.

Before examining what contribution care might make to how we conceptualise place futures, it is first necessary to review current approaches to cultivating place futures in theory and practice. To this end, the first section of this paper reviews some of the major strategies and approaches to delivering sustainable place futures and classifies the major assumptions on which they are founded. Drawing from the need to broaden our gaze and nuance our understanding beyond these assumptions, the second part of the paper reviews care literature to consider the utility of the care concept to planning. Drawing from this literature, I use five characteristics of care to structure an analytical framework for understanding place qualities. The final part of the paper reflects on the potential of the proposed framework and concludes with some broader thoughts about how care can help to conceptualise other possible place futures.

2. Categorising approaches to place futures

There are two core assumptions that underly approaches to place futures in planning theory and in practice. The first is the assumption that specific futures for places can be created or made. These approaches are characterised by goal-directed action, such as the socio-economic regeneration of a place through the construction of a new museum, or an improvement in social cohesion through a city branding initiative. By contrast, the second assumption rejects the notion of achieving predefined goals, arguing instead that places unfold or emerge over time. These two broad areas of literature are explored below.

2.1 Making futures

There is a plethora of terms that are used in the literature to describe approaches based on the idea of making or creating the future. This making perspective is founded on what Dupre (2019, p. 103) calls a 'determined before-after temporality'. That is, action in the place is taken with a predetermined idea of what the future should be after the intervention. This is not surprising, given the long history of planning to realise desired ends through socio-spatial interventions (Allmendinger, 2017).

One common term that describes structured approaches to realising place futures is place-making. Although poorly defined (Dupre, 2019; Courage, 2021a), place-making is generally recognised as an interdisciplinary field that has particular prominence within the fields of spatial and strategic planning and design, often within an urban development context. Examples of the types of activities structured place-making projects employ include the creation of a sense of place or belonging through the development of place images; physical interventions in space;

and creative initiatives (Dupre, 2019; Courage, 2021b). The wide range of activities that fall under place-making in the literature reflects a lack of consensus over what place-making is and may involve (Strydom, Puren and Drewes, 2018). Much of the regeneration literature also falls into this category, with focus ranging from waterfronts (Jones, 2017) to heritage assets (Wincott, Ravenscroft and Gilchrist, 2020).

Another common term is place branding. Likewise poorly defined (Kavaratzis and Ashworth, 2010; Vuignier, 2017), place branding can be broadly understood as an approach to spatial governance (Van Assche, Beunen and Oliveira, 2020). Place branding initatives differ in scope, from projects that emphasise city uniqueness and value using built heritage resources (Guzijan, 2018) to strategies for recovering after natural disaster (Gotham and Irvin, 2018).

Another common approach to achieving predefined place futures is culture-led development. This body of scholarship seeks to use cultural resources to attain various kinds of local development. It ranges for instance from investments in "capital C" cultural institutions such as museums (Heidenreich and Plaza, 2015), efforts to attract the "creative class" (Florida, 2003) and mobilisation of heritage assets for socio-economic development (Della Lucia and Segre, 2017; Kähkönen and Lähdesmaki, 2019).

The structure of these projects, by whichever term, also differ. Some are more formalised, with an emphasis on common processes (Alwaer and Cooper, 2019), whilst others focus on informal initiatives such as DIY urbanism (Krishnamurthy, 2018). Initiatives may be both individual and collective in nature (Dupre, 2019; Mengi, 2020), and are at times understood as a democratic process (Strydom, Puren and Drewes, 2018). In general, place-making initiatives are following a participative trend where inclusion and participation of the local community is important, and much literature is dedicated to community centric, collaborative processes (Strydom, Puren and Drewes, 2018; Mengi, 2020; Courage, 2021a). This at times includes an emhasis on everyday elements of place-making (Dyck, 2005; Platt, 2021; Vitiello and Willcocks, 2021). The same is true in place branding, where scholars see the need for inclusive, bottom-up processes (Colomb and Kalandides, 2010; Insch and Florek, 2010; Trueman *et al.*, 2010; Brown, 2018; Lucarelli, 2018a; Warnaby, Koeck and Medway, 2018). The importance of local participation is likewise recognised in culture-led development (Sacco and Crociata, 2013).

Whilst the pursuit of a desired future state unites the otherwise diverse body of literature above, the actual goals of these approaches differ widely. Goals of place-making include the improvement of public spaces and community life (Krishnamurthy, 2018); social and spatial justice (Borrup, 2021; Courage, 2021a); environmental sustainability (McKeown, 2021); and economic development and growth (Lima and Jones, 2021). Place branding likewise shares a strong goal orientation (Guzijan, 2018) for economic development (Campelo, 2017), spatial development and physical place making (Therkelsen, Halkier and Jensen, 2010; Oliveira, Van Assche and Beunen, 2021). Place branding efforts may also aim at social inclusion (Eisenschitz, 2018) and community cohesion (Stoica *et al.*, 2021).

Although these approaches clearly aim to improve the future of places in social, economic and ecological ways, there have been a number of criticisms levelled at such initiatives. Place branding in particular has been critiqued as contributing to a neo-liberal transformation of society (Friedmann, 2016; Eisenschitz, 2018; Lucarelli, 2018b) that needs to address issues of power and inclusion (Vuignier, 2017; Kavaratzis, Giovanardi and Lichrou, 2018; Medway, Warnaby and Byrom, 2021). The metrics focus of place branding may also lead it to be a reductive process (Medway et al 2021) that leads to a greater homogenisation of places (Lichrou, Kavaratzis and Giovanardi, 2018).

More generally there is critique of the very idea that places can be "made". These critics argue that places are never new constructions, but rather evolutions of what they were before. The next section reviews literature advocating this perspective.

2.2 Emerging futures

Although the majority of literature falls into the category of goal-oriented approaches outlined above, there is a sizable body of literature that advocates for a different approach to place futures. Rather than setting out with any particular future in mind, or a goal to change the place in some measurable way, scholars in this body of literature argue that place futures emerge in an unplanned way.

To understand this perspective it is useful to review Rauws, de Roo and Zhang's (2016) critique of goal-based planning and its underlying conception of reality. They (2016, p. 244) identify two paradigms of planning: a 'command and control' factual reality where 'planners are…viewed as creators of place…based on facts and predictions', and a communicative planning approach where reality is agreed and consenusal. Both paradigms are critiqued for understanding reality as a 'fixed product in time' (Rauws, de Roo and Zhang, 2016, p. 244). In their view, such an understanding limits the capacity of planning to respond to uncertain and complex planning contexts, and remains in opposition to more emergent, adaptive and autonomous behaviours (Rauws, de Roo and Zhang, 2016, p. 244). To move beyond this linear perspective in planning, they propose that planners need to 'explore alternative views on reality and different ways of guiding spatial transformations' which recognise processes of emergence and employ a relational understanding of space and time (Rauws, de Roo and Zhang, 2016, p. 244).

One alternative perspective is a non-linear planning reality in which direct causal relationships between variables of change are lacking, and where change occurs through the interaction of a system and subsystems and their contextual environment (de Roo, 2012, pp. 142; 151). This perspective emphasises the role of time, where, in contrast to the static perspectives underlying goal-oriented planning, present 'a world in flow, full of discontinuous change' (de Roo, 2012, p. 135). This alternative notion of reality underlies post-structuralist planning perspectives that focus on 'processes of becoming'; poststructuralist planners are interested in processes of change rather than predefined end goals (Boonstra and Rauws, 2021, p. 7). Indeed, in what Boelens and de Roo (2016, p. 43) identify as a 'planning of undefined becoming', the ultimate goal is not known beforehand. Rather 'uncertainty prevails', and futures 'co-evolve' through the reciprocal interaction of actors and their surroundings, and is shaped by specific historical-spatial contexts (Boelens and de Roo, 2016, pp. 43; 48). A core feature of this perspective is the view that meaning is multiple and relational – this means that 'even notions of a good, just or sustainable society, are never closed but always open' (Boelens and de Roo, 2016, p. 44).

Such a post-structuralist perspective has been applied in a place-making context by Dovey (2010). Writing against a concept of place as 'static', or subject to deliberate place-making efforts, Dovey (2010, p. 3) argues that places should instead be understood as being in 'states of becoming'. Platt and Medway (2022, p. 105) likewise critique the idea of 'interventionist' place-making, employing a post-structuralist perspective to emphasise the 'ongoing, always emerging, and never finished presence of the urban placemaking'. This illustrates a different underlying assumption about how place futures come to be – they unfold from the 'middle' and are always in process, rather than having clear before and after states driven by predefined goals.

2.3 Differing positions: navigating approaches to place futures

The exploration of literature above shows that there are different assumptions when it comes to understanding how place futures come to be. Whilst they fall into two broad categories (structured and emergent), there is a further complication: the goals and methods of attaining place futures also differ. To further complicate matters, a tendency for disciplinary silos makes full sharing of knowledge difficult. Many scholars point to this problem, arguing that the 'intent and outcomes' of placemaking may be 'wholly different and in opposition' (Courage, 2021b, pp. 4–5). That such differences can undermine the best efforts of practitioners involved in cultivating place futures is clear in the following statement from Legge (2021, p. 391):

> 'I have never met anyone involved in city-making who does not want to make good cities that support happy and healthy citizens. Of course, we all do this through a different lens.The planner focusses on systems of land use and connectivity, the transport engineer believes that making it fast and easy to get around makes a good city; the architect via beautiful buildings, the social planner through equitable access to services and amenity, the landscape architect will use nature as their tool. Our professional expertise is our strength, but it can also be our limitation – if all we have is a hammer, then all we see are nails (Maslow, 1966)...It is often the differences in professional priorities and in the range of scales involved in place planning that create the most significant barriers to successful placemaking.'

In short, there is a lack of agreement about how (and if) particular place futures should be cultivated. To address this challenge, and building on the metaphor in above, I argue that a different pair of glasses is required; a lens that will help us see the qualities of places more holistically. We need different conceptual glasses in order to ask different questions: what matters in places, and to whom? What motivates action in places? How might we arrive at a more nuanced understanding of the relationships between place qualities, and learn to see beyond boundaries and foci conditioned by fields of expertise and norms of practice? The next section of the paper explores the potential of the concept of care to provide such a lens.

3. Possibilities of care

Care is burgeoning as a major concept within the humanities and social sciences. Developed originally from feminist scholarship within traditional care contexts, care is increasingly being mobilised as a concept for thinking and analysing in contexts including science-technology studies (Puig de la Bellacasa, 2017), heritage studies (Veldpaus and Szemző, 2021) and planning (Davoudi, 2023). Within these contexts the uses of care are diverse, ranging from speculative thinking to identifying practices of care. Given its growing application in planning and fields relevant to place futures more broadly, it is timely to reflect on what the care concept contributes to understanding places and their possible futures.

The next section of this paper reviews current understandings of care in the literature. Drawing from this scholarship, I use care to develop an analytical framework for identifying place qualities. This lays the foundation for a reflection on what other parts of the care concept may be helpful in conceptualising possible place futures.

3.1 Current understandings of care

A review of the care literature indicates that it is a rapidly emerging field. Although common agreement about the scope and meaning of the concept is lacking, it is possible to identify three broad themes: care as a conceptual model, care as practice, and care as a way to foreground relationality. These categories are not mutually exclusive, but often intersect.

3.1.1 Care as a conceptual model

One major way the care concept is utilised in the literature is as a conceptual model. Literature using care in this way spans fields as diverse as nursing (Cloyes, 2002) to the green humanities (Bernau, 2023). The review identified three major uses of care as a conceptual model.

3.1.1.1 Care as a model for thought/action

Care here is used to reframe or rethink through already recognised issues and challenges. This includes, for instance, reframing heritage conservation as a practice of care in order to broaden understandings of the outcomes of conservation (Veldpaus and Szemző, 2021), and exploring expressions of care in hedgerows in order to think though landscape maintenance practices in times of ecological crisis (Bernau, 2023).

3.1.1.2 Speculative care

Used speculatively, care provides a way to imagine alternatives to the current status quo. A widely cited perspective is articulated by Puig de la Bellacasa (2017) who uses care speculatively to question how we might live 'as well-as-possible' in more-than-human worlds. Speculative perspectives arise in critique of certain existing conditions, such as Jacobs and Wiens's (2023, p. 12) interest in the possibilities of care for creating possibilities to live 'in refusal of systems that perpetuate social and ecological injustices'.

3.1.1.3 Care as a critical lens

Care is also employed as a critical lens for analysing contemporary problems. Examples include efforts to further understanding of the problems facing urbanisation (Gabauer *et al.*, 2021), for addressing fast paced societal change (Dyck, 2005) or considering the skillsets required for transitioning to low carbon futures (Carr, 2023).

3.1.2 Care as practice

Care is also referred to in the literature as a set of practices. This is often not separate from drawing on a conceptual understanding of care, and in most instances complements it. The types of care practices that are included in the literature differ widely. They include the more traditional domains of care work in health and dependency contexts within domestic and institutional settings (Tronto, 1998; Cloyes, 2002; Dyck, 2005; José, 2016). More recently however care is being taken up to embrace a wider range of acts of taking care – of humans (Dombroski *et al.*, 2023), more-than-humans (van Dooren, 2014; McConnell, 2023) and their wider environments (Till, 2012; Veldpaus and Szemző, 2021; Woodhead, 2023). It is worth noting that these categories of what is looked after are often blurred, and care for one area is often seen as bringing benefits for others (Bartel, Hine and Morgan, 2020).

One area that emerges from the literature is an understanding of maintenance and repair as forms of caring practice. These concepts appear for instance in the widely cited definition of care by Tronto and Fischer as 'a species activity that includes everything that we do to maintain,

continue, and repair our world' (Fischer and Tronto, 1990 in Tronto, 1998, p. 17). Maintenance is a practice of keeping something the way it is – necessary for instance in the context of growing things such as hedges (Bernau, 2023) or to arrest decay, such as in the context of cultural heritage preservation (Veldpaus and Szemző, 2021). Although maintenance is often discussed in the same context as repair, the concepts are ultimately different. Carr (2023) points to the different temporalities of the two practices, seeing maintenance as anticipatory action required to prevent something happening in the future. Repair on the other hand is retrospective, seeking to restore order following breakdown (Carr, 2023, p. 226). It is important to note that decisions about how and what is maintained are informed by underlying values – for instance, "mow and blow" landscape maintenance may value crop yield over socio-ecological relations (Jacobs and Wiens, 2023, p. 9), or prioritising tidy hedgerows through mechanical trimming may harm biodiversity (Bernau, 2023).

3.1.3 Care and relationality

A key feature of the care concept is its focus on relationality. Evident in the care literature is the notion that all care is relational – care is not an action that occurs on its own but rather always in relation to others – care is always interdependent, it is "care-with" (Tronto, 2013). Whilst much of the care scholarship focusing on relationality has drawn attention to more-than-human relationships (Puig de la Bellacasa, 2017; Dombroski *et al.*, 2023; Jacobs and Wiens, 2023; McConnell, 2023), other scholars seek to recenter human intentionality in regards to care (Huijbens, 2023).

3.1.4 Normative and non-normative trends

Care is often employed to make a normative argument. Some of this literature emphasises the politico-ethical obligation to care (van Dooren, 2014; Puig de la Bellacasa, 2017; Jacobs and Wiens, 2023). Others use care to critique neoliberal practices (Gabauer *et al.*, 2021; Kopitz, 2022) drawing particularly from Tronto's (2017) argument for care as an alternative ontology to neoliberalism. Although acknowledging the body of care literature in this vein, this paper does not take such a normative position.

3.1.5 Care in planning

It is clear that care is becoming an important concept in a planning context. Although not explicitly theorised, Healey (2018: 67) uses the care concept to discuss a relational approach to place governance. This understanding lays the foundation for explicating that people care about different qualities of place, necessary for a place-based politics and improved place governance. Healey (2023) further utilises care in her analysis of citizen-led planning initiatives for local development in Wooler, England. Here again, care is not explicitly theorised, but rather functions to illustrate how collective care about place and its current challenges mobilsed action in the form of self-organisation and citizen-led initatives. It becomes clear that care shows where different community actors have a shared interest or concen (they "care about" an issue) and that this becomes mobilsed in action ("care for"). The caring efforts are in some way about shaping the future of the place, aiming at different forms of local development through grassroots activity.

Other uses of care in the planning scholarship emerges out of dissatisfaction with neoliberal planning contexts and desires to imagine different possible futures. Davoudi (2023) introduces care as an ethical, relational and political concept that he uses to discuss a prefigurative planning approach. A critique of the underlying assumptions of the neoliberal system underlies his

argument, seeing prefigurative planning as a way to negate given assumptions and imagine alternatives to the status quo. Although not fully defined, Davoudi points to relations of (un)care as underlying prefigurative planning in everyday spatial practices.

Gabauer et al (2021) also employ the concept of care to examine the production of urban space through (un)caring practices and relationships. In doing so, they position care as practice, relation and ethics. In particular, they point to the need to recognise contexts of uncare produced by the neoliberal paradigm, and argue for the potential of care as an analytical scope for understanding the urbanising world. Like Davoudi (2023) and Healey (2023), they point to the importance of paying attention to everyday urban life. Furthermore, they go beyond care as a frame for analysis but see it as having potential to alter 'social conditions' (Gabauer *et al.*, 2021, p. 7)

I stand alongside these scholars in seeing the potential of care to further our undertanding of places as complex assemblages of everyday life, shaped by the relations between people and their environments. However, unlike Davoudi (2023) and Gabauer et al (2021) I refrain from presenting a critique of current planning contexts. Instead, I stand back in order to provide a broader perspective on the different approaches to cultivating place futures. Furthermore, I draw from major trends in the care literature to propose an analytical framework for understanding place qualities, which has potential to support thinking about possible place futures. The next section of the paper introduces this analytical framework of care, before briefly reflecting on the broader utility of care in thinking through place futures.

4. An analytical framework of care

To explore how planning might benefit from the care concept, the next section of the paper proposes an analytical framework built from five characteristics of care: (1) objects of care; (2) caring actors; (3) care practices, (4) care motivations; and (5) care relations. Taken together, these characteristics have the potential to structure a more holistic understanding of place qualities.

In presenting this framework, I build on the efforts of scholars such as Tronto (2017) to unpack the care concept. Tronto (2017) identifies five phases of care, which explains the shift from caring *about* something (a noticing of needs) to caring *for* something (practices of delivering and receiving care). Tronto's (2017) understanding of care is also caring *with*, in relations with others. The framework articulated below approaches care in a different way. Instead of identifying phases of care, the proposed framework functions as a tool for mapping the qualities of a place, and their interrelationships, in a broad way. Such a holistic understanding is a prerequisite for conceptualising possible place futures, and has potential to extend the lenses through which we currently conceptualise place futures.

It should be noted that this framework is intended to be applied to places in particular. As Tronto (2017, p. 33) notes, care 'is always contextual and, as a result, non-essentialist…focusing on care requires much attention to the precise details of the situation'. Accordingly, this framework has greatest utility when applied to places in specific moments in time and space.

4.1 Care characteristics for analysing place qualities

(1) Objects of care

The first characteristic of care that has utility in structuring analysis of place qualities is the recognition that there are different objects of care. By object of care, I mean that for which care is given. It is evident from the care literature that a wide range of people, non-humans, material objects, and physical environments can be objects of care. Furthermore, the selection of what is worthy of care is underpinned by socio-cultural and professional values (Healey, 2018; Harrison, 2020; Bernau, 2023). Identifying that for which care is given is applied in a heritage studies context by Veldpaus and Szemző (2021) to question which histories, stories and aspects of the historic environment are preserved through the practice of heritage conservation. I propose that such a technique has utility more broadly in identifying the widest possible spectrum of place qualities that receive care, including people, material things, activities, intangible qualities, and the physical environment.

In particular, broadening what we identify as objects of care can provide a way to break out of specific lenses shaped by fields of expertise that condition what is seen as valuable in places and worthy of carrying into the future. Given the implication of values in determining objects of care, such a broadening also widens our understanding of the values at stake in cultivating place futures.

(2) Caring actors

The second characteristic of care useful to this analytical lens is the recognition that the capacity to care about and for qualities of place is not restricted to experts (be they planners, place branders, heritage managers or other professional actors) but rather open to anyone who engages with place, including the full range of civil society. Although most of the time it is actors who are explicitly involved in efforts to realise place futures (for example city planners and self-organised citizen groups) that receive analytical attention, the growing body of evidence for the importance of everyday practices shows that even actors who are not part of deliberate efforts to realise place futures nonetheless play a role in the way place futures unfold (Carr, 2023). Furthermore, a focus on caring actors opens up the possibility to consider the role that more-than-human actors play in unfolding place futures (Puig de la Bellacasa, 2017; Dombroski *et al.*, 2023).

(3) Care practices

It is clear from the literature that there are different ways to care about place futures. Practices of care range widely, from looking after elderly people to trimming hedgerows (Tronto, 1998; Bernau, 2023). It is also evident from the first part of the paper that different fields of expertise endorse different practices for realising place futures. Incorporating an analysis of care practices into the framework provides a way to identify these practices and see where they may be conflictual or complementary. Furthermore, examining care practices shows that care is not universally “good” or “good for all” (Puig de la Bellacasa, 2017), and that care for one thing might be at the expense of another (van Dooren, 2014). Like care objects, care practices are motivated by different values, and through their implementation give rise to different possible futures.

(4) Care motivation

In order to nuance our understanding of place qualities it is necessary to examine the motivations behind why care is given, and ask what end does giving care seek to achieve? Like objects of care, care motivation is related to values. However, where objects of care is mainly care *about* something, care motivation is what shifts it into care *for* by motivating a practice or action of care. Such an interrogation can enrich our understanding of places by allowing us to identify where different actors care for the same object, but for different reasons. As such it has potential in identifying value conflicts in place.

(5) Care relations.

An important contribution that care can bring to understanding place qualities is its focus on relationality. Many scholars point to the fact that there is a interdependence of care not only between human actors, but also the objects they care for (Tronto, 2017; Gabauer *et al.*, 2021; Davoudi, 2023; Jacobs and Wiens, 2023). This is particularly important in nuancing our understanding of the factors that shape the selection of objects of care and how actors work together (or not) to care for them. Furthermore, knowing and thinking are themselves 'inconceivable without a multitude of relations that also make possible the worlds we think with' (Puig de la Bellacasa, 2012, p. 2). Recognising the wider relations – such as norms of professional practice - that condition our approach to place futures can help us to identify and reflect upon the types of place futures that are considered desirable and possible.

5. Discussion: what do we gain when we use care?

The notion of using care to structure analysis is not new. Indeed other scholars also use care to understand the complexities of place (Healey 2023; Gabauer et al 2021). However, the framework proposed above differs in that it provides a structured approach that is explicitly derived from characterisitcs of the care concept present in previous scholarly work. In this way it contributes to development of the care concept in a planning context.

In addition, the proposed framework has potential to address the problem identified in the first part of this paper: that a lack of shared understandings and different goals, assumptions and practices can oppose and undermine efforts to cultivate place futures. In this sense I follow from Dyck (2005, pp. 235–6) in recognising the potential of care in 'chipping away at sub-disciplinary borders' and realising 'analyses that can bring together the economic, political, social and cultural in understanding the rapid changes of contemporary society'. Employing care as set out in the analytical framework above can facilitate a structured and nuanced identification of place qualities and the values and relationships underlying their care. As such care provides the possibility to broaden our understanding of which qualities of place are important in the realisation of place futures beyond approaches conditioned by specific fields of expertise and norms of practice.

In addition to its utility in structuring an understanding of place qualities, the care concept has further potential in conceptualising the kinds of place futures that are possible or permissible. Harrison (2020) recognises that different practices realise specific futures. The first part of the paper identified two broad approaches to cultivating place futures – structured, goal oriented approaches and post-structrualist emergent ones. Care can help us to think through other possibilities. For instance, maintenance is commonly identified as a practice of care (Bernau, 2023; Carr, 2023; Dombroski *et al.*, 2023). Focussing on maintenance can help shift the point of focus in efforts to cultivate place futures. Rather than striving to achieve particular goals, or

manage emerging transitions, care can help us to see where change is less of a driving factor; sometimes what is needed is a maintenance of what already is.

6. Conclusion

This paper has explored the utility of the care concept in a planning context through proposing an analytical framework structured by five characteristics of care. A brief reflection on other qualities the care concept may help us see, such as place futures centered around maintenance rather than change suggests further potential for the development of the concept in a planning context. Further work is required to test the proposed analytical framework and explore further benefits of applying care in conceptualising place futures.

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Enhancing Social Interaction in Urban Spaces: The Role of Vertical Greening Systems in High-Density Areas

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Abstract: The critical role of nature exposure in fostering prosocial behaviour and social connectedness is well-established in existing research, while intensifying urbanization presents growing challenges to the development of the nature in urban areas. The Vertical Greening System (VGS), an innovative approach that conserves land, emerges as a creative solution. However, its potential in enhancing social interactions remains under-explored. To bridge this gap, experiments were conducted to assess the impact of VGS on improving spatial quality, enhancing space attractiveness, and increasing pedestrians' willingness to walk, stay, and engage in social interactions. Results indicate that VGS serve as important visual attractors and significantly enhances the visual attractiveness of urban spaces, leading to improved perceptions of environmental quality. This enhancement positively affects the affective experience of pedestrians, creating a more inviting atmosphere conducive to walk, stay, and socialize. Eye-tracking data shows that green elements serve as important visual attractors, suggesting that their strategic placement in urban design is critical to promoting social interaction.

Keywords: Vertical greening system, Environmental perception, Affective experience, Social interaction.

1 Introduction

Continues urbanization has shaped oppressive streetscapes, leading to increased urban population and pressures of city life. The perceived overcrowding and increasing exposure to environmental stressors can significantly diminish individuals' evaluations of the built environment and their willingness to engage in outdoor activities. This, in turn, adversely affects both physical and mental health and reduces opportunities for social interaction, which are crucial for societal health(Zijlema et al., 2024, Luo and Jiang, 2022, Eizenberg and Jabareen, 2017).

The critical role of nature exposure in fostering prosocial behaviour and social connectedness is well-established in existing research. Nature environments not only provide necessary relief from urban stress but also serve as catalysts for social interaction by offering welcoming and livelihood communal spaces for gatherings and recreational activities(Hartig et al., 2014, Kaźmierczak, 2013).

However, intensifying urbanization presents significant challenges to the development and maintenance of natural environments within urban areas, leading to their decline and uneven distribution across cityscapes. Additionally, changes in lifestyle and the accelerated pace of modern life increasingly restrict the time people spend in nature. As Fuller and Gaston (2009) noted, interactions between urban residents and nature are increasingly mediated by informal green spaces, such as streetscape greening and pocket gardens, rather than traditional, large green networks.

In this context, the Vertical Greening System (VGS) emerges as an innovative solution that conservatively uses land while integrating accessible green infrastructure within high-density areas. Several empirical and experimental studies have highlighted the psychophysiological benefits of VGS in urban settings(Chan et al., 2021, Elsadek et al., 2019). Also, the potential of VGS to enhance the attractiveness of urban spaces, increase footfall, and promote social

interactions has garnered increasing attention(Goel et al., 2022), while it remains under-researched and requires further scientific validation.

To address the existing knowledge gap, this study utilized a virtual reality (VR) experiment to evaluate the effects of various streetscape scenes, featuring different coverages of VGS, on individuals' environmental perception, affective experiences, and behaviours. The primary research questions explored were: 1) How does VGS in high-density open spaces affect perceived environmental quality and visual attraction? 2) How does VGS influences pedestrians' affective experiences in urban settings? 3) Does vertical greening enhance pedestrians' willingness to walk, stay, and participate in social activities within these environments?

2 Methods

2.1 Experiment design

A total of 5 streetscape VR scenes were created, each featuring the same building form but varying coverages of VGS, as detailed in Table 1. Each scene comprised 6 panoramic photographs rendered from different positions along the street model to comprehensively depict the street's characteristics. Each photograph was displayed for one minute and shown twice in VR experiment, as shown in Fig.1. Finally, rendered sequence frame images were used to create five 40-second streetscape video segments for post-experiment surveys.

Table 1. Characteristics of streetscape scenes in the 5 experimental groups(G) and 5 videos(V).

Experiment groups	G1/V1	G2/V2	G3/V3	G4/V4	G5/V5
Coverages of VGS in VR scenes (%)[1]	0	8	16	32	48

[1] The coverage of VG in streetscape scenes was quantified by calculating the percentage of the façade covered by VGS relative to the total façade area of the street block.

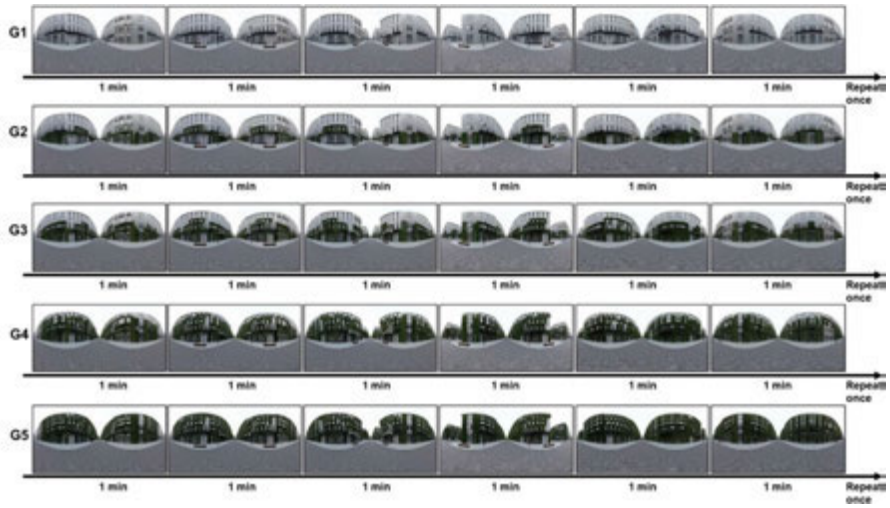

Fig.1. VR experimental stimulation design.

2.2 Participants

We recruited 30 healthy adults from Tongji University to participate in the study. Eligibility criteria required participants to be aged between 18 and 35. Individuals who had consumed tobacco, alcohol, drugs, or caffeinated beverages within 24 hours prior to the experiment, or who had engaged in intensive exercise within 6 hours of the experiment, were excluded. The study received approval from the Science and Ethics Committee of Tongji University, and all participants provided written informed consent before participating.

Prior to the experiment, we collected data on participants' socio-demographic background, chronic mental stress levels, nature connectedness, noise sensitivity, and other relevant covariates through a questionnaire. Participants were then approximately assigned to one of five experimental groups based on their survey responses, allowing for a rough control of these covariates across the groups. The descriptive statistics of their background information are presented in Table 2, and there were no statistically significant differences between 5 VR experiment groups.

Table 2. Descriptive statistics of the participants' background information.

Measures		Participants Mean (± SD) or Number (percent, %)					
		G1	G2	G3	G4	G5	V1 to V5
Gender	Male	4	3	3	3	3	16
	Female	2	3	3	2	3	14
Education	Bachelor	3	2	4	3	4	16
	Master	1	3	2	2	2	11
	Doctorate	2	1	0	0	0	3
Place of upbringing	Central urban district	4	3	2	3	2	15
	Suburbs or townships	2	2	4	2	4	14
	Rural area	0	1	0	0	0	1
Nature connectedness[1]		4.9 (±0.8)	5 (±1.31)	5.3 (±0.84)	5.4 (±0.67)	5.5 (±0.54)	5.27 (±0.85)
Noise sensitivity[2]		92.5 (±6.8)	88.5 (±18)	91.5 (±11)	78.6 (±12.8)	99.3 (±14)	91 (±14)
Chronic mental stress levels[3]		17.5 (±5)	14.2 (±6)	13.7 (±4.8)	12.2 (±7.7)	15.0 (±8.4)	15 (±6)

[1] *Nature connectedness*, describes a psychological state where individuals deeply care for and feel connected to nature, reflecting their innate biophilic tendencies(Capaldi et al., 2014). It serves as an indicator of the extent to which these tendencies are fostered or suppressed(Nisbet and Zelenski, 2013). Research shows that nature connectedness affects, moderates, and mediates the impact of nature exposure on mental health(Liu et al., 2022). In this study, we used 6-iterm and 7-point Nature-Relatedness Scale to measure an individuals' nature connectedness(Gong et al., 2024).

[2] *Noise sensitivity*, which refers to an individual's susceptibility and degree of reaction to everyday noises, was evaluated using the Weinstein Noise Sensitivity Scale (WNSS) in this study(Weinstein, 1978).

[3] *Chronic mental stress levels*, which have been shown to influence the mental effects of nature exposure on individuals(Shanahan et al., 2015), were assessed using the Perceived Stress Scale (PSS-10) in this study(Cohen et al., 1983).

2.3 Procedure

As illustrated in Figure 2, the experiment comprises three phases: preparation, testing, and post-testing.

In the preparation period, participants signed written informed consent and were equipped with the VR devices and biomonitoring sensors. Participants were then asked to close eyes and rest for 3 minutes while electro-dermal activity (EDA) data recording commenced. Subsequently, participants completed a self-reported scale to establish psychological baselines.

During the testing period, participants were divided into five groups and randomly assigned to one of five VR scenes. Initially, they were exposed to traffic noise for 5 minutes and completed a self-reported scale. This was followed by a 12-minute viewing of a VR scene along with the collection of eye-tracking data, after which they filled out the same self-reported scale again. Upon completion, all devices were deactivated and removed, and participants rated their level of discomfort during the VR test using a 5-point Likert scale (1 = very slightly or not at all, 5 = extremely).

After VR testing, participants were required to complete post-test surveys. They viewed five videos through an online link and immediately assessed perceived oppressiveness, environmental quality, visual preference, affective experience, and their willingness to engage in various outdoor activities in such environment. The videos were presented in a random order to prevent any sequence effects.

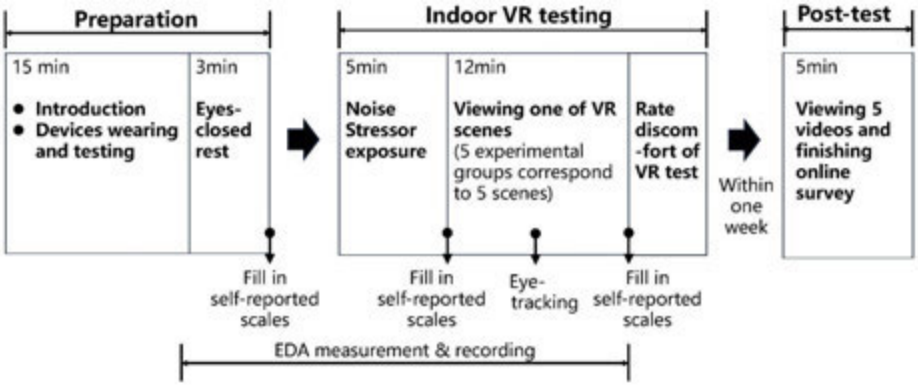

Fig.2. Experimental procedure.

2.4 Measures

2.3.1 Perceived oppressiveness and perceived environmental quality

Perceived oppressiveness (PO) is the subjective experience of feeling overwhelmed or dominated by a physical environment, negatively related to urban environmental quality(Asgarzadeh et al., 2012). Perceived environmental quality (PEQ) involves the subjective evaluation of a physical environment, encompassing an individual's multisensory perception of various environmental attributes. Both PO and PEQ have been identified as mediators in the relationship between an individual's environmental exposure and their psychophysiological responses and behaviours (Luo and Jiang, 2022).

We assessed participants' PO and PEQ in response to online videos by asking, 'Do you feel oppressiveness?' and 'How would you rate the visual quality/ safety level/ economic level of

the street environment depicted in the video?', respectively. An 11-point VAS, ranging from 0 (very low) to 10 (very high), was utilized for these evaluations.

2.3.1 Visual attractiveness

Self-reported visual preferences for online streetscape videos and eye-tracking data collected during VR testing were used to assess the visual attractiveness of the scenes. After viewing the five streetscape videos, participants were asked to rank the videos on a 5-point scale from 1 to 5, where 1 indicates the least liked and 5 indicates the most liked, with scores increasing progressively based on preference. Additionally, eye-tracking data was utilized to analyse visual attention and identify hotspots within the visual stimuli.

2.3.3 Affective experience: psychological and physiological

As detailed in Table 3, the Self-Assessment Manikin (SAM) was employed to assess individuals' affective states through 9-point valence (from 1-unpleasant to 9-pleasant). In addition, individuals' physiological responses were measured using Skin Conductance Level (SCL), which represents individuals' arousal and stress level.

Table 3. Psychological and physiological measures.

Psychological and physiological measures		Description	Relationship with the stress level
SAM	Valence	Affective states	-
EDA	SCL (μS)	Arousal and stress level	Positive

2.3.4 Measures of outdoor behaviours

To measure individuals' outdoor behavioural intent, we asked participants, 'How willing are you to visit, walk, stay, or engage in social activities in the street depicted in the online video?' We utilized an 11-point Visual Analog Scale (VAS) for responses, ranging from 0 (not at all willing) to 10 (very willing).

2.5 Statistical analysis

Environmental perception data, including self-reported Perceived Oppressiveness (PO), Perceived Environmental Quality (PEQ), visual preference, and behavioural intent, were collected via a within-subject online survey. Differences in environmental perception and intent data across the five online videos were compared using one-way repeated measures ANOVA for normally distributed data and the Friedman test for non-normally distributed data.

The affective psychophysiological data collected from a between-subject VR experiment design were analysed using one-way ANOVA for normally distributed data and the Kruskal-Wallis H test for non-normally distributed data to compare differences across five VR groups. Additionally, two-way ANOVA models with post-hoc pairwise comparisons were conducted to examine per-minute Skin Conductance Level (SCL) responses to the five VR scenes.

All data were presented as means, and for all comparisons, a p-value of less than 0.05 was considered statistically significant.

3 Results and discussion

3.1 Perceived oppressiveness (PO) and perceived environmental quality (PEQ)

As shown in Figure 3, the post-hoc tests indicated that the PO of V1, which had no VGS coverage, was significantly higher compared to V2 and V3. Conversely, the Perceived Environmental Quality (PEQ) of V1 was significantly lower than that of V2, V3, V4, and V5. This suggests that VGS can significantly enhance people's perceptions of street quality and reduce the oppressiveness of high-density streetscapes. However, it is important to note that when VGS coverage is excessively high, as in V4 and V5, the beneficial effects of reducing perceived oppressiveness in high-density streetscapes may diminish. As shown in Figure 4, the relationship between VGS coverage and PO is depicted by a U-shaped curve. Conversely, the relationship between VGS coverage and PEQ is represented by an inverted U-shaped curve.

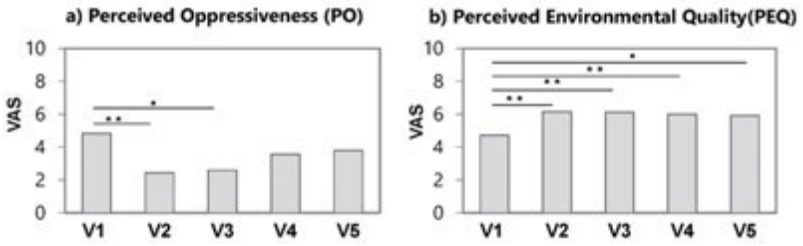

Fig.3. Participants' PO and PEQ across 5 streetscape videos, *p < 0.05, **p < 0.01, ***p < 0.001.

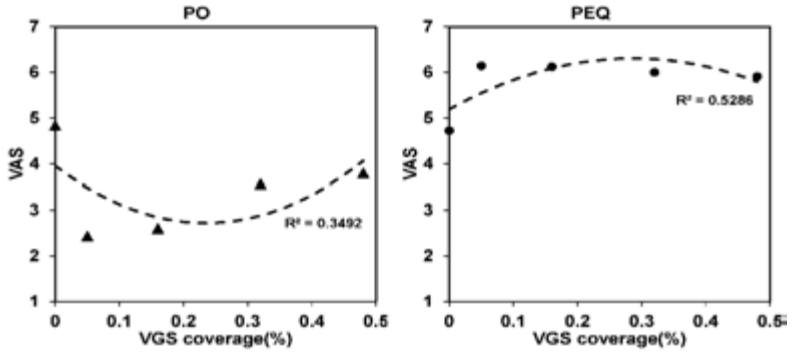

Fig.4. Patterns between VGS coverage and participants' PO & PEQ.

3.2 Visual attractiveness: visual preference and eye-catching factors

As shown in Figure 5, the coverage-response curve between VGS coverage and individuals' visual preference is depicted by an inverted U-shaped curve. Significant differences were observed in participants' visual preferences across five online streetscape videos with varying levels of VGS coverage. Specifically, preferences for V1, which had no VGS coverage, were lower compared to those with VGS coverage in V2, V3, V4, and V5. Statistically significant differences were noted between V1 and V2, V3, and V4. V3, which had the highest visual preference scores, also showing a statistically significant difference from V5, which had the second-lowest scores.

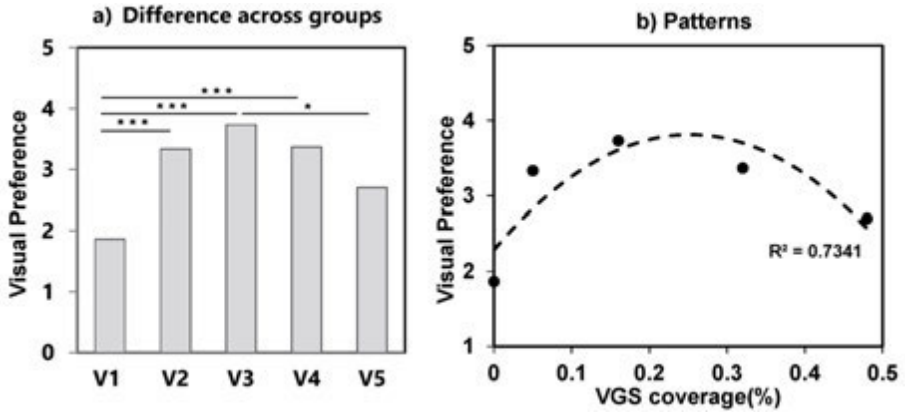

Fig.5. Participants' visual preference across 5 streetscape videos and its relationship with VGS coverage, *p < 0.05, **p < 0.01, ***p < 0.001.

After VR testing, eye-tracking hotspots were generated for five VR scene groups, namely, G1 to G5. As illustrated in Figure 6, participants in groups G1 (with no VGS) and G5 (with very high VGS coverage) tended to look straight ahead. They reported feeling oppressed by facades either devoid of greenery or heavily covered in greenery, mentioning that looking forward allowed them to see more sky. Conversely, in groups G2, G3, and G4—where vertical greening coverage was moderate—participants often turned their heads to appreciate the street facades, especially in G2 and G3, which had higher visual preference scores. This suggests that moderate VGS coverage can significantly enhance the visual appeal and of street facades.

G1 G2 G3 G4 G5

Fig.6. Participants' eye-catching factors across 5 VR scenes.

3.3 Affective experience

In this study, we utilized traffic noise to simulate the mental stress commonly experienced by pedestrians in high-density urban areas, where exposure to environmental stressors like heat and noise is prevalent. We specifically investigated how streetscapes with varying levels of VGS coverage influence the affective experiences of pedestrians after these stressor exposures.

Changes in psychological data (*Δ*Valence) and physiological data (*Δ*SCL) before and after experiencing VR scenes were used to assess the effects of VGS on the affective states of stressed participants. *Δ*valence and *Δ*SCL were calculated using equations (1) and (2) respectively and are summarized in Table 4.

Table 4. Measures of the effects of VGS on participants' affective state

Measures	Calculation
*Δ*Valence	(1) *Δ*Valence = Valence $_{\text{scene experience}}$ - Valence $_{\text{noise experience}}$ '+' represents affective improvement
*Δ*SCL (μS)	(2) *Δ*SCL = SCL $_{\text{scene experience}}$ - SCL $_{\text{noise experience}}$

'+' represents arousal and stress Increasing

3.3.1 Physiological data

Our analyses using paired t-tests and Wilcoxon signed-rank tests indicate a significant increase in participants' physiological stress levels following noise exposure. Additionally, ANOVA results reveal no statistically significant differences in physiological data among the five groups after exposure to the stressor. Participants' mean ΔSCL across five groups during are displayed in Figure 7and Figure 8. As Figure 7 indicates, statistically significant differences in ΔSCL across VR scenes begin to manifest after 6 minutes of exposure. Consequently, as illustrated in Figure 8, we compared the average ΔSCL after 6 minutes. The post-hoc tests reveal that the ΔSCL of G1 was significantly higher than those of G2, G3, and G4. The relationship between VGS coverage and ΔSCL is characterized by a U-shaped curve, suggesting that moderate VGS coverage can significantly enhance pedestrians' affective states.

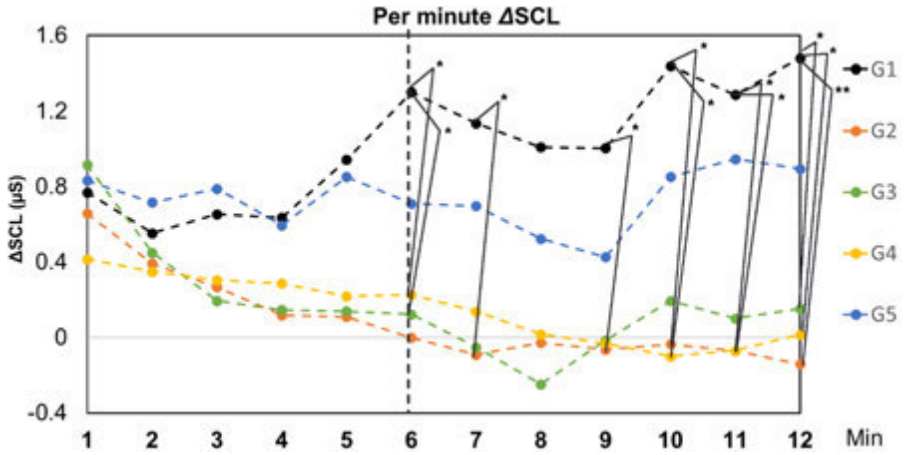

Fig.7. Pairwise comparisons of the estimated marginal means of per minute ΔSCL during VR scenes experiencing. *p < 0.05, **p < 0.01, ***p < 0.001.

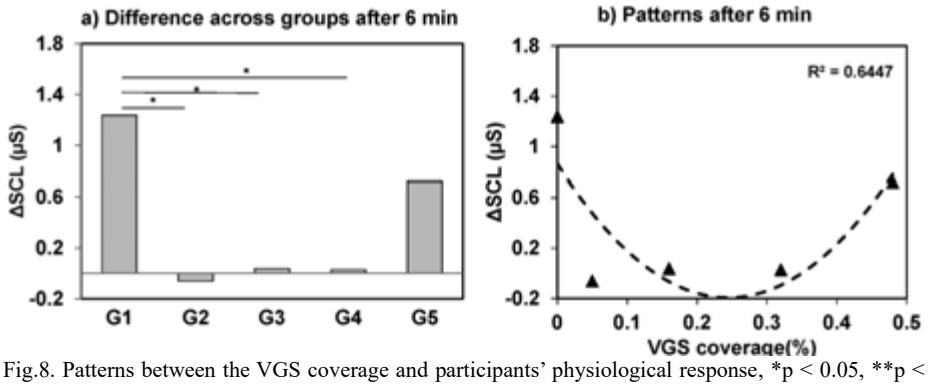

Fig.8. Patterns between the VGS coverage and participants' physiological response, *p < 0.05, **p < 0.01, ***p < 0.001.

3.3.2 Psychological data

As shown in Figure 9, although there were no statistically significant differences of psychological data. comparison between scenes still reflected important trends. The relationship between VGS coverage and Δvalence is characterized by an inverted U-shaped curve.

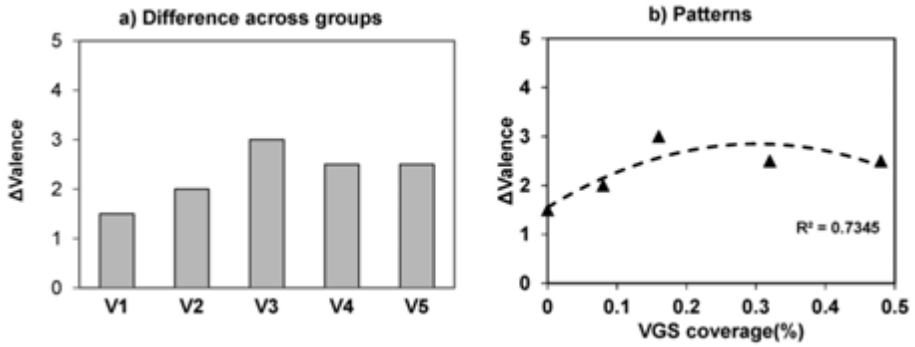

Fig.9. Participants' psychological effect across 5 streetscape videos and its relationship with VGS coverage, *p < 0.05, **p < 0.01, ***p < 0.001.

3.4 Outdoor behavioural intent

As depicted in Figures 10 and 11, individuals' willingness to visit, walk, and stay in V1 was significantly lower compared to V2, V3, and V4. Furthermore, the willingness to socialize in G1 was significantly lower than in V2 and V3. The relationship between VGS coverage and individuals' outdoor behavioural intent is characterized by an inverted U-shaped curve, indicating that both very low and very high levels of VGS coverage may decrease the desire to engage in outdoor activities, with moderate levels proving more conducive to positive behavioural intentions.

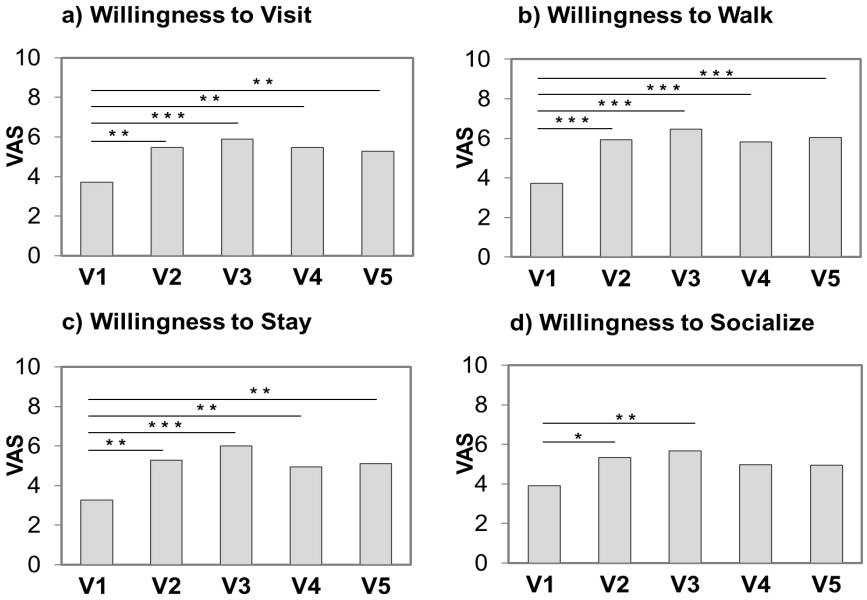

Fig.10. Participants' outdoor behavioural intent across 5 streetscape videos, *p < 0.05, **p < 0.01, ***p < 0.001.

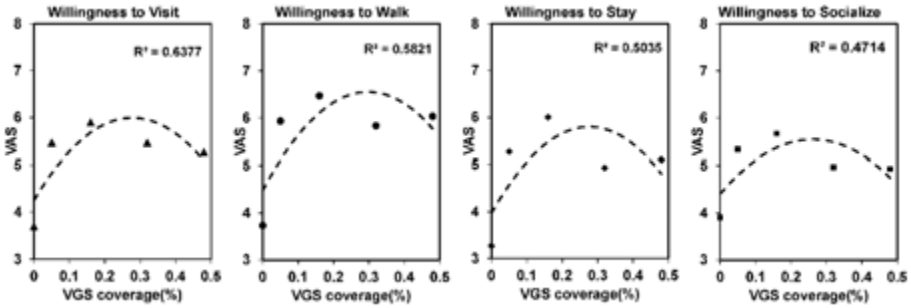

Fig.11. Patterns between the VGS coverage and participants' outdoor behavioural intent.

4. Conclusion

This study explored the potential of Vertical Greening Systems (VGS) to enhance urban space attractiveness and facilitate social interactions. Results indicate that VGS significantly enhance the visual appeal of high-density urban areas, thereby improving environmental quality perceptions. Such enhancements positively influence pedestrians' affective experiences, creating an inviting atmosphere that encourages walking, lingering, and socializing.

The relationship between VGS coverage and visual preference, perceived environmental quality, and outdoor behavioural intent is characterized by an inverted U-shaped curve, suggesting that both insufficient and excessive greenery can diminish these positive effects. The relationship between VGS coverage and perceived oppressiveness and stress levels is described by a U-

shaped curve. Eye-tracking data confirm that green elements are key visual attractors, underlining the importance of their strategic placement in urban design to enhance social interactions.

Acknowledgements

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Enhancing Social Interaction in Urban Spaces: The Role of Vertical Greening Systems in High-Density Areas

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Abstract: The critical role of nature exposure in fostering prosocial behaviour and social connectedness is well-established in existing research, while intensifying urbanization presents growing challenges to the development of the nature in urban areas. The Vertical Greening System (VGS), an innovative approach that conserves land, emerges as a creative solution. However, its potential in enhancing social interactions remains under-explored. To bridge this gap, experiments were conducted to assess the impact of VGS on improving spatial quality, enhancing space attractiveness, and increasing pedestrians' willingness to walk, stay, and engage in social interactions. Results indicate that VGS serve as important visual attractors and significantly enhances the visual attractiveness of urban spaces, leading to improved perceptions of environmental quality. This enhancement positively affects the affective experience of pedestrians, creating a more inviting atmosphere conducive to walk, stay, and socialize. Eye-tracking data shows that green elements serve as important visual attractors, suggesting that their strategic placement in urban design is critical to promoting social interaction.

Keywords: Vertical greening system, Environmental perception, Affective experience, Social interaction.

1 Introduction

Continues urbanization has shaped oppressive streetscapes, leading to increased urban population and pressures of city life. The perceived overcrowding and increasing exposure to environmental stressors can significantly diminish individuals' evaluations of the built environment and their willingness to engage in outdoor activities. This, in turn, adversely affects both physical and mental health and reduces opportunities for social interaction, which are crucial for societal health(Zijlema et al., 2024, Luo and Jiang, 2022, Eizenberg and Jabareen, 2017).

The critical role of nature exposure in fostering prosocial behaviour and social connectedness is well-established in existing research. Nature environments not only provide necessary relief from urban stress but also serve as catalysts for social interaction by offering welcoming and livelihood communal spaces for gatherings and recreational activities(Hartig et al., 2014, Kaźmierczak, 2013).

However, intensifying urbanization presents significant challenges to the development and maintenance of natural environments within urban areas, leading to their decline and uneven distribution across cityscapes. Additionally, changes in lifestyle and the accelerated pace of modern life increasingly restrict the time people spend in nature. As Fuller and Gaston (2009) noted, interactions between urban residents and nature are increasingly mediated by informal green spaces, such as streetscape greening and pocket gardens, rather than traditional, large green networks.

In this context, the Vertical Greening System (VGS) emerges as an innovative solution that conservatively uses land while integrating accessible green infrastructure within high-density areas. Several empirical and experimental studies have highlighted the psychophysiological benefits of VGS in urban settings(Chan et al., 2021, Elsadek et al., 2019). Also, the potential of VGS to enhance the attractiveness of urban spaces, increase footfall, and promote social

interactions has garnered increasing attention(Goel et al., 2022), while it remains under-researched and requires further scientific validation.

To address the existing knowledge gap, this study utilized a virtual reality (VR) experiment to evaluate the effects of various streetscape scenes, featuring different coverages of VGS, on individuals' environmental perception, affective experiences, and behaviours. The primary research questions explored were: 1) How does VGS in high-density open spaces affect perceived environmental quality and visual attraction? 2) How does VGS influences pedestrians' affective experiences in urban settings? 3) Does vertical greening enhance pedestrians' willingness to walk, stay, and participate in social activities within these environments?

2 Methods

2.1 Experiment design

A total of 5 streetscape VR scenes were created, each featuring the same building form but varying coverages of VGS, as detailed in Table 1. Each scene comprised 6 panoramic photographs rendered from different positions along the street model to comprehensively depict the street's characteristics. Each photograph was displayed for one minute and shown twice in VR experiment, as shown in Fig.1. Finally, rendered sequence frame images were used to create five 40-second streetscape video segments for post-experiment surveys.

Table 1. Characteristics of streetscape scenes in the 5 experimental groups(G) and 5 videos(V).

Experiment groups	G1/V1	G2/V2	G3/V3	G4/V4	G5/V5
Coverages of VGS in VR scenes (%)[1]	0	8	16	32	48

[1] The coverage of VG in streetscape scenes was quantified by calculating the percentage of the façade covered by VGS relative to the total façade area of the street block.

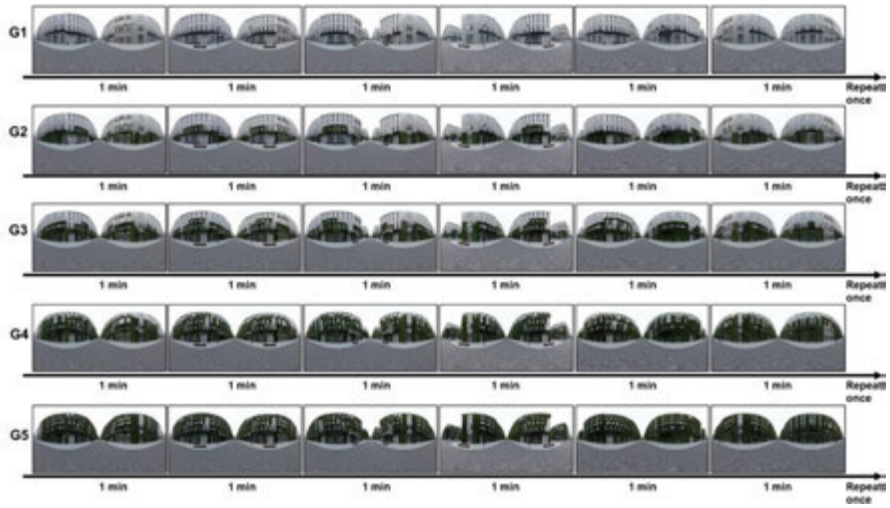

Fig.1. VR experimental stimulation design.

2.2 Participants

We recruited 30 healthy adults from Tongji University to participate in the study. Eligibility criteria required participants to be aged between 18 and 35. Individuals who had consumed tobacco, alcohol, drugs, or caffeinated beverages within 24 hours prior to the experiment, or who had engaged in intensive exercise within 6 hours of the experiment, were excluded. The study received approval from the Science and Ethics Committee of Tongji University, and all participants provided written informed consent before participating.

Prior to the experiment, we collected data on participants' socio-demographic background, chronic mental stress levels, nature connectedness, noise sensitivity, and other relevant covariates through a questionnaire. Participants were then approximately assigned to one of five experimental groups based on their survey responses, allowing for a rough control of these covariates across the groups. The descriptive statistics of their background information are presented in Table 2, and there were no statistically significant differences between 5 VR experiment groups.

Table 2. Descriptive statistics of the participants' background information.

Measures		Participants Mean (± SD) or Number (percent, %)					
		G1	G2	G3	G4	G5	V1 to V5
Gender	Male	4	3	3	3	3	16
	Female	2	3	3	2	3	14
Education	Bachelor	3	2	4	3	4	16
	Master	1	3	2	2	2	11
	Doctorate	2	1	0	0	0	3
Place of upbringing	Central urban district	4	3	2	3	2	15
	Suburbs or townships	2	2	4	2	4	14
	Rural area	0	1	0	0	0	1
Nature connectedness[1]		4.9 (±0.8)	5 (±1.31)	5.3 (±0.84)	5.4 (±0.67)	5.5 (±0.54)	5.27 (±0.85)
Noise sensitivity[2]		92.5 (±6.8)	88.5 (±18)	91.5 (±11)	78.6 (±12.8)	99.3 (±14)	91 (±14)
Chronic mental stress levels[3]		17.5 (±5)	14.2 (±6)	13.7 (±4.8)	12.2 (±7.7)	15.0 (±8.4)	15 (±6)

[1] *Nature connectedness*, describes a psychological state where individuals deeply care for and feel connected to nature, reflecting their innate biophilic tendencies(Capaldi et al., 2014). It serves as an indicator of the extent to which these tendencies are fostered or suppressed(Nisbet and Zelenski, 2013). Research shows that nature connectedness affects, moderates, and mediates the impact of nature exposure on mental health(Liu et al., 2022). In this study, we used 6-iterm and 7-point Nature-Relatedness Scale to measure an individuals' nature connectedness(Gong et al., 2024).

[2] *Noise sensitivity*, which refers to an individual's susceptibility and degree of reaction to everyday noises, was evaluated using the Weinstein Noise Sensitivity Scale (WNSS) in this study(Weinstein, 1978).

[3] *Chronic mental stress levels*, which have been shown to influence the mental effects of nature exposure on individuals(Shanahan et al., 2015), were assessed using the Perceived Stress Scale (PSS-10) in this study(Cohen et al., 1983).

2.3 Procedure

As illustrated in Figure 2, the experiment comprises three phases: preparation, testing, and post-testing.

In the preparation period, participants signed written informed consent and were equipped with the VR devices and biomonitoring sensors. Participants were then asked to close eyes and rest for 3 minutes while electro-dermal activity (EDA) data recording commenced. Subsequently, participants completed a self-reported scale to establish psychological baselines.

During the testing period, participants were divided into five groups and randomly assigned to one of five VR scenes. Initially, they were exposed to traffic noise for 5 minutes and completed a self-reported scale. This was followed by a 12-minute viewing of a VR scene along with the collection of eye-tracking data, after which they filled out the same self-reported scale again. Upon completion, all devices were deactivated and removed, and participants rated their level of discomfort during the VR test using a 5-point Likert scale (1 = very slightly or not at all, 5 = extremely).

After VR testing, participants were required to complete post-test surveys. They viewed five videos through an online link and immediately assessed perceived oppressiveness, environmental quality, visual preference, affective experience, and their willingness to engage in various outdoor activities in such environment. The videos were presented in a random order to prevent any sequence effects.

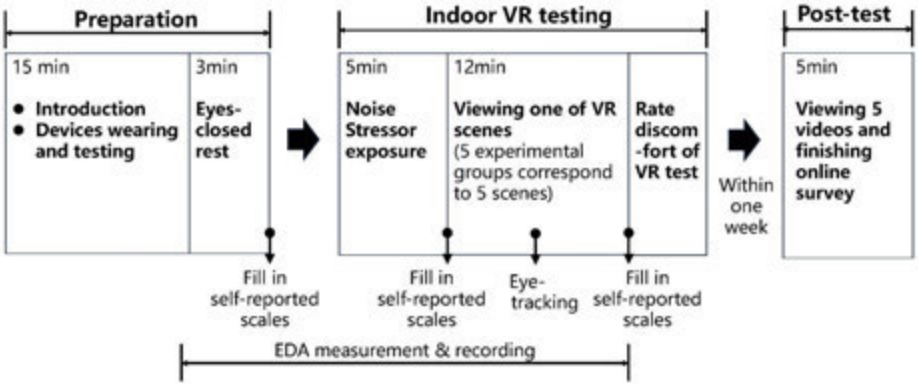

Fig.2. Experimental procedure.

2.4 Measures

2.3.1 Perceived oppressiveness and perceived environmental quality

Perceived oppressiveness (PO) is the subjective experience of feeling overwhelmed or dominated by a physical environment, negatively related to urban environmental quality(Asgarzadeh et al., 2012). Perceived environmental quality (PEQ) involves the subjective evaluation of a physical environment, encompassing an individual's multisensory perception of various environmental attributes. Both PO and PEQ have been identified as mediators in the relationship between an individual's environmental exposure and their psychophysiological responses and behaviours (Luo and Jiang, 2022).

We assessed participants' PO and PEQ in response to online videos by asking, 'Do you feel oppressiveness?' and 'How would you rate the visual quality/ safety level/ economic level of

the street environment depicted in the video?', respectively. An 11-point VAS, ranging from 0 (very low) to 10 (very high), was utilized for these evaluations.

2.3.1 Visual attractiveness

Self-reported visual preferences for online streetscape videos and eye-tracking data collected during VR testing were used to assess the visual attractiveness of the scenes. After viewing the five streetscape videos, participants were asked to rank the videos on a 5-point scale from 1 to 5, where 1 indicates the least liked and 5 indicates the most liked, with scores increasing progressively based on preference. Additionally, eye-tracking data collected during VR testing was utilized to analyse visual attention and identify hotspots within the visual stimuli.

2.3.3 Affective experience: psychological and physiological

As detailed in Table 3, the Self-Assessment Manikin (SAM) was employed to assess individuals' affective states through 9-point valence (from 1-unpleasant to 9-pleasant). In addition, individuals' physiological responses were measured using Skin Conductance Level (SCL), which represents individuals' arousal and stress level.

Table 3. Psychological and physiological measures.

Psychological and physiological measures		Description	Relationship with the stress level
SAM	Valence	Affective states	-
EDA	SCL (μS)	Arousal and stress level	Positive

2.3.4 Measures of outdoor behaviours

To measure individuals' outdoor behavioural intent, we asked participants, 'How willing are you to visit, walk, stay, or engage in social activities in the street depicted in the online video?' We utilized an 11-point Visual Analog Scale (VAS) for responses, ranging from 0 (not at all willing) to 10 (very willing).

2.5 Statistical analysis

Environmental perception data, including self-reported Perceived Oppressiveness (PO), Perceived Environmental Quality (PEQ), visual preference, and behavioural intent, were collected via a within-subject online survey. Differences in environmental perception and intent data across the five online videos were compared using one-way repeated measures ANOVA for normally distributed data and the Friedman test for non-normally distributed data.

The affective psychophysiological data collected from a between-subjects VR experiment design were analyzed using one-way ANOVA for normally distributed data and the Kruskal-Wallis H test for non-normally distributed data to identify differences across five VR groups. Additionally, two-way ANOVA models with post-hoc pairwise comparisons were employed to assess per-minute Skin Conductance Level (SCL) responses to the five VR scenes.

All data were presented as means, and for all comparisons, a p-value of less than 0.05 was considered statistically significant.

3 Results and discussion

3.1 Perceived oppressiveness (PO) and perceived environmental quality (PEQ)

As shown in Figure 3, the post-hoc tests indicated that the PO of V1, which had no VGS coverage, was significantly higher compared to V2 and V3. Conversely, the Perceived Environmental Quality (PEQ) of V1 was significantly lower than that of V2, V3, V4, and V5. This suggests that VGS can significantly enhance people's perceptions of street quality and reduce the oppressiveness of high-density streetscapes. However, it is important to note that when VGS coverage is excessively high, as in V4 and V5, the beneficial effects of reducing perceived oppressiveness in high-density streetscapes may diminish. As shown in Figure 4, the relationship between VGS coverage and PO is depicted by a U-shaped curve. Conversely, the relationship between VGS coverage and PEQ is represented by an inverted U-shaped curve.

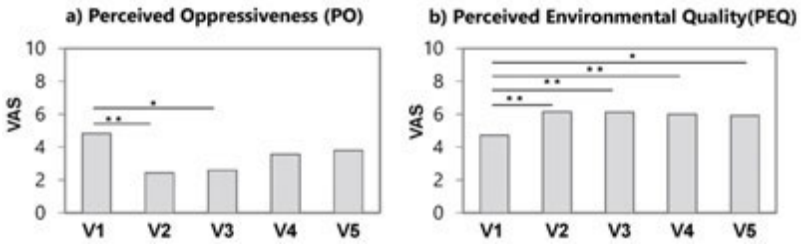

Fig.3. Participants' PO and PEQ across 5 streetscape videos, *p < 0.05, **p < 0.01, ***p < 0.001.

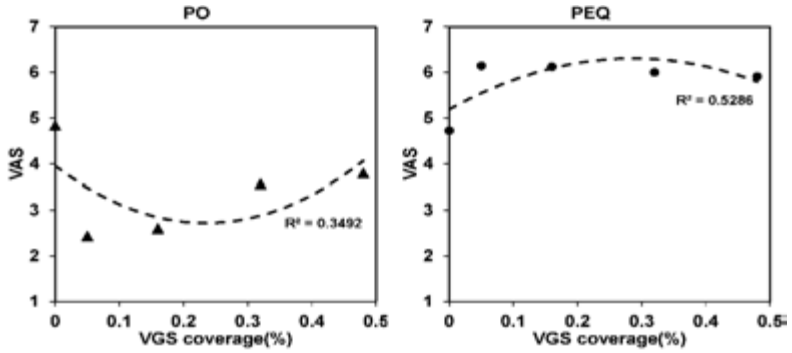

Fig.4. Patterns between VGS coverage and participants' PO & PEQ.

3.2 Visual attractiveness: visual preference and eye-catching factors

As shown in Figure 5, the coverage-response curve between VGS coverage and individuals' visual preference is depicted by an inverted U-shaped curve. Significant differences were observed in participants' visual preferences across five online streetscape videos with varying levels of VGS coverage. Specifically, preferences for V1, which had no VGS coverage, were lower compared to those with VGS coverage in V2, V3, V4, and V5. Statistically significant differences were noted between V1 and V2, V3, and V4. V3, which had the highest visual preference scores, also showing a statistically significant difference from V5, which had the second-lowest scores.

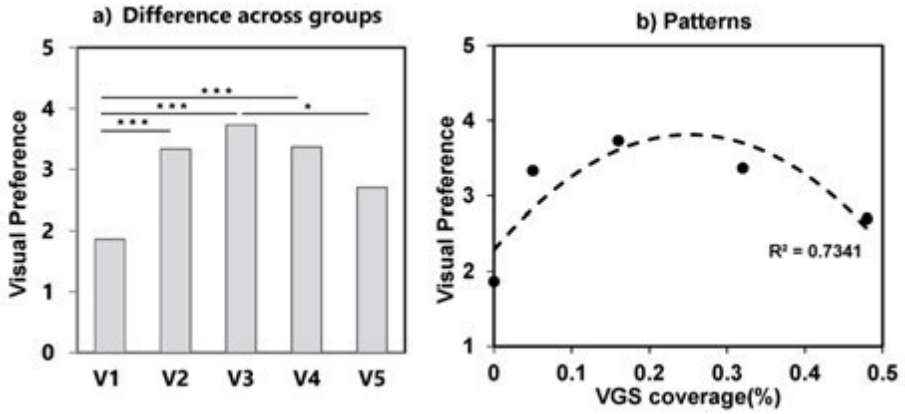

Fig.5. Participants' visual preference across 5 streetscape videos and its relationship with VGS coverage, *p < 0.05, **p < 0.01, ***p < 0.001.

After VR testing, eye-tracking hotspots were generated for five VR scene groups, namely, G1 to G5. As illustrated in Figure 6, participants in groups G1 (with no VGS) and G5 (with very high VGS coverage) tended to look straight ahead. They reported feeling oppressed by facades either devoid of greenery or heavily covered in greenery, mentioning that looking forward allowed them to see more sky. Conversely, in groups G2, G3, and G4—where vertical greening coverage was moderate—participants often turned their heads to appreciate the street facades, especially in G2 and G3, which had higher visual preference scores. This suggests that moderate VGS coverage can significantly enhance the visual appeal and of street facades.

G1 G2 G3 G4 G5

Fig.6. Participants' eye-catching factors across 5 VR scenes.

3.3 Affective experience

In this study, we utilized traffic noise to simulate the mental stress commonly experienced by pedestrians in high-density urban areas, where exposure to environmental stressors like heat and noise is prevalent. We specifically investigated how streetscapes with varying levels of VGS coverage influence the affective experiences of pedestrians after these stressor exposures.

Changes in psychological data (*Δ*Valence) and physiological data (*Δ*SCL) before and after experiencing VR scenes were used to assess the effects of VGS on the affective states of stressed participants. *Δ*valence and *Δ*SCL were calculated using equations (1) and (2) respectively and are summarized in Table 4.

Table 4. Measures of the effects of VGS on participants' affective state

Measures	Calculation
*Δ*Valence	(1) *Δ*Valence = Valence $_{\text{scene experience}}$ - Valence $_{\text{noise experience}}$ '+' represents affective improvement
*Δ*SCL (μS)	(2) *Δ*SCL = SCL $_{\text{scene experience}}$ - SCL $_{\text{noise experience}}$

'+' represents arousal and stress Increasing

3.3.1 Physiological data

Our analyses using paired t-tests and Wilcoxon signed-rank tests indicate a significant increase in participants' physiological stress levels following noise exposure. Additionally, ANOVA results reveal no statistically significant differences in physiological data among the five groups after exposure to the stressor. Participants' mean ΔSCL across five groups during are displayed in Figure 7and Figure 8.

As Figure 7 indicates, statistically significant differences in ΔSCL across VR scenes begin to manifest after 6 minutes of exposure. Consequently, as illustrated in Figure 8, we compared the average ΔSCL after 6 minutes. The post-hoc tests reveal that the ΔSCL of G1 was significantly higher than those of G2, G3, and G4. The relationship between VGS coverage and ΔSCL is characterized by a U-shaped curve, suggesting that moderate VGS coverage can significantly enhance pedestrians' affective states.

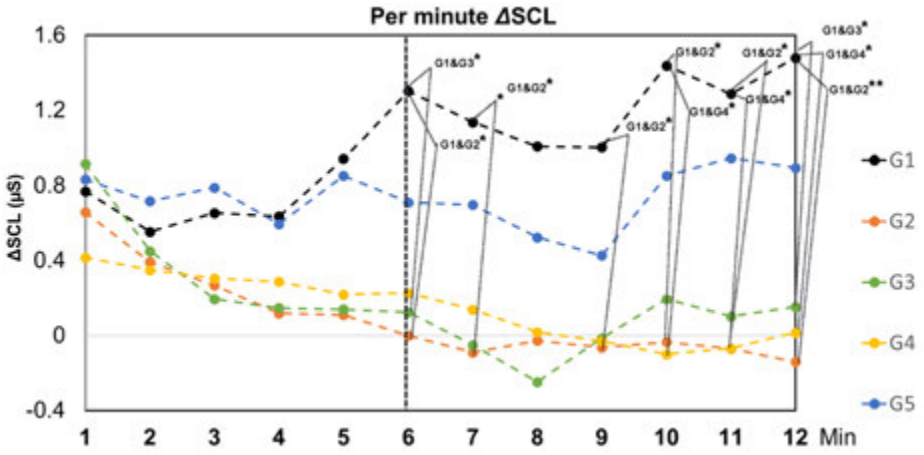

Fig.7. Pairwise comparisons of the estimated marginal means of per minute ΔSCL during VR scenes experiencing. *p < 0.05, **p < 0.01, ***p < 0.001.

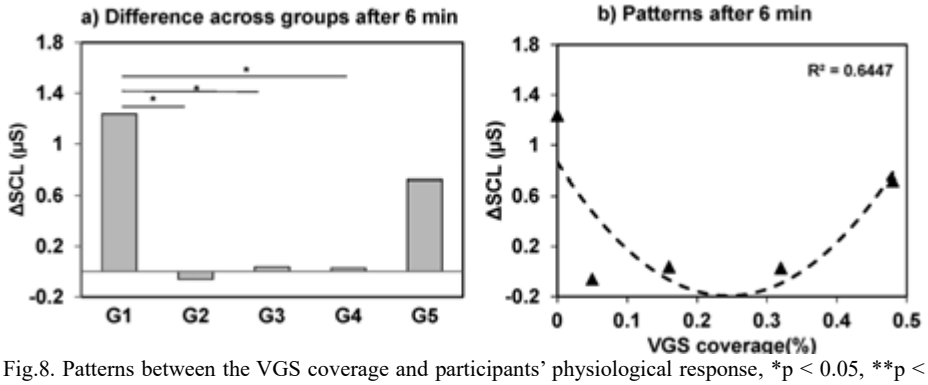

Fig.8. Patterns between the VGS coverage and participants' physiological response, *p < 0.05, **p < 0.01, ***p < 0.001.

3.3.2 Psychological data

As shown in Figure 9, although there were no statistically significant differences of psychological data. comparison between scenes still reflected important trends. The relationship between VGS coverage and Δvalence is characterized by an inverted U-shaped curve.

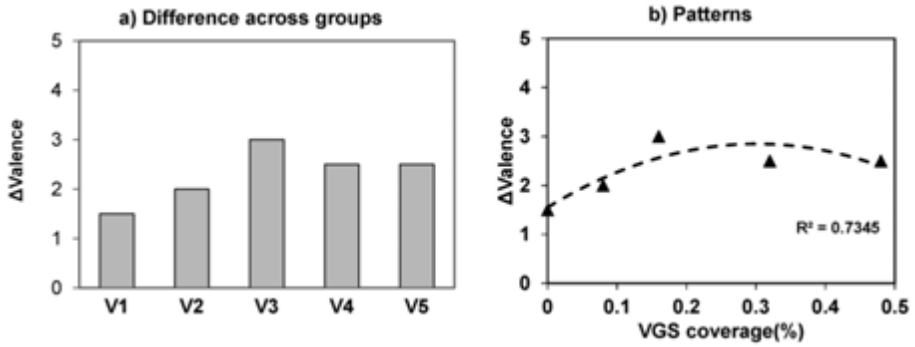

Fig.9. Participants' psychological effect across 5 streetscape videos and its relationship with VGS coverage, *p < 0.05, **p < 0.01, ***p < 0.001.

3.4 Outdoor behavioural intent

As depicted in Figures 10 and 11, individuals' willingness to visit, walk, and stay in V1 was significantly lower compared to V2, V3, and V4. Furthermore, the willingness to socialize in G1 was significantly lower than in V2 and V3. The relationship between VGS coverage and individuals' outdoor behavioural intent is characterized by an inverted U-shaped curve, indicating that both very low and very high levels of VGS coverage may decrease the desire to engage in outdoor activities, with moderate levels proving more conducive to positive behavioural intentions.

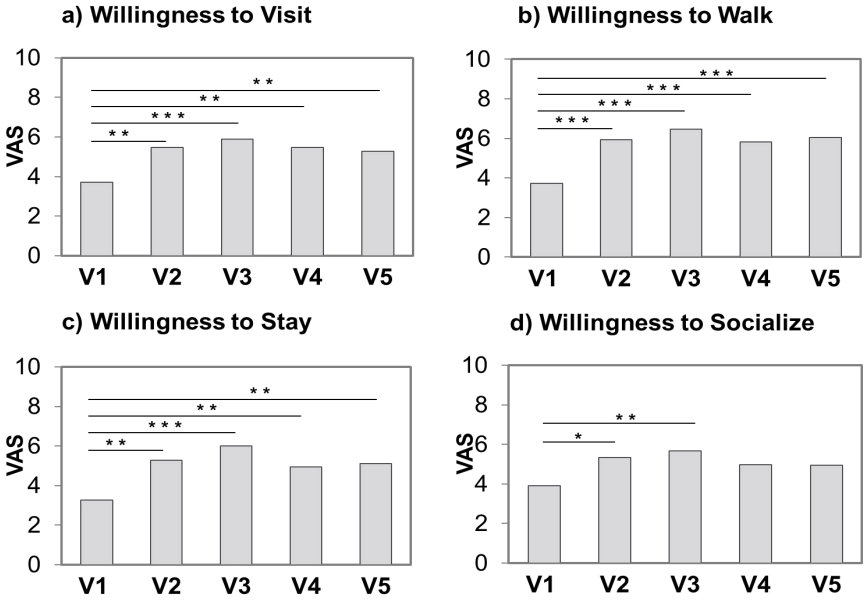

Fig.10. Participants' outdoor behavioural intent across 5 streetscape videos, *p < 0.05, **p < 0.01, ***p < 0.001.

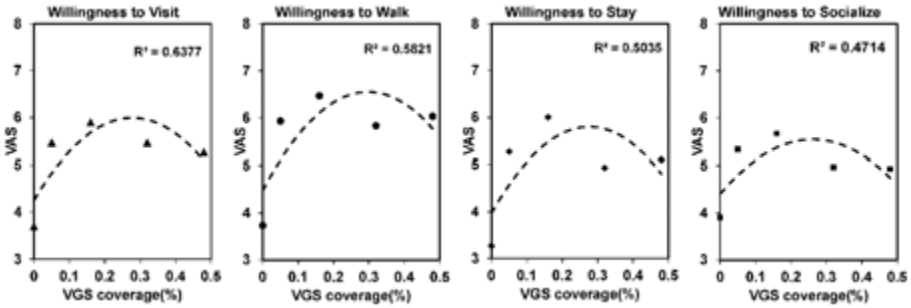

Fig.11. Patterns between the VGS coverage and participants' outdoor behavioural intent.

4. Conclusion

This study explored the potential of Vertical Greening Systems (VGS) to enhance urban space attractiveness and facilitate social interactions. Results indicate that VGS significantly enhance the visual appeal of high-density urban areas, thereby improving environmental quality perceptions. Such enhancements positively influence pedestrians' affective experiences, creating an inviting atmosphere that encourages walking, lingering, and socializing.

The relationship between VGS coverage and visual preference, perceived environmental quality, and outdoor behavioural intent is characterized by an inverted U-shaped curve, suggesting that both insufficient and excessive greenery can diminish these positive effects. The relationship between VGS coverage and perceived oppressiveness and stress levels is described by a U-

shaped curve. Eye-tracking data confirm that green elements are key visual attractors, underlining the importance of their strategic placement in urban design to enhance social interactions.

Acknowledgements

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Exploring new methodological approaches to mapping socio-spatial mobilities

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Abstract
This paper highlights mobility as a methods paradigm by reviewing mobile methods from a theoretical and empirical perspective, i.e., adopted for a study focused on socio-spatial mobilities of urban marginalised women (UMW) in peri-urban areas of New Delhi, India. The article discusses the approach and design of mobile methods for this case study, including mobile ethnography using new technologies like GPS. We highlight that mobile methods enable the study of significant elements like scale and everyday mobilities. We discuss the challenges and opportunities for researchers that come with the use new technologies within mobile methods. By doing so we highlight the significance of using mobile methods to explore new research techniques that present a holistic perspective towards understanding mobility.

Keywords: Mobile methods, Socio-spatial mobility, Scale, New technologies, GPS

Introduction
It can be said that the peripheries of society hold the capacity to transform their limited resources and barriers into settings for various kinds of opportunities. Despite the social and economic problems of the peripheral segment of the society, this study highlights their capability of self-organisation towards the potential to activate the mobility of women especially, towards more equitable mobilities. However, this discussion on opportunities of peripheries includes theorising and must offer a point of view. It is important to understand how this opportunity of peripheries for (urban marginalised) women in terms of spatial and social mobility be approached in scientific terms. In this context, what kind of methodology is suitable to facilitate the conformation of social connections and to recognise them for urban systems?

Mobilities are understood as a mesh of movement, meaning and practice (Salazar, Elliot and Norum, 2017). This complex juxtaposition opens the dialogue toward the multiple effects and approaches to understanding mobilities. Several scholars describe mobility as polymorphic and diversified concept that requires reaffirmation of theories related to culture, identity and transnational relationships (Salazar and Smart, 2011; Glick Schiller and Salazar, 2013). Besides mappable and calculated geographical movements, mobility is about interpretations and meanings that highlight ethical and political concerns along with certain practical issues. Mobility, as a concept

cuts through and links across various scales of movement, namely, from small-scale bodily movements to infrastructure or transport-related movements, to a non-physical type of movement such as global flows of finance or labour. Mobilities research considers the movement of not only people but also information and goods along with their impact on each other (facilitate or hinder).

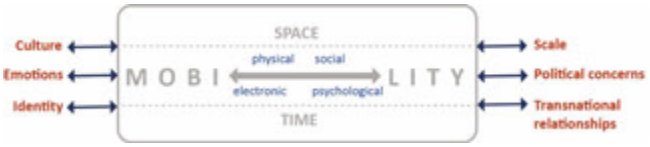

Figure 1: Mobility as a mesh of various types of movements.
Source: Adapted from Salazar et al.(2017); Svašek (2013); Ziegler & Schwanen (2011)

Mobilities research is multi-dimensional and interdisciplinary in nature that intersects with theoretical, social, technical and political constructs (Cresswell and Uteng, 2016). Most studies focusing on mobilities have dealt with different aspects of mobility separately. Several theorists argue that considering mobility in separate spheres may lead to a lack of interdisciplinary approaches (Sheller and Urry, 2006). The research on mobilities has generated links across different scales that connect different disciplines of humanities with sciences to produce a holistic and meaningful analysis, which is possible through an investigation of experiences created while moving (Sheller and Urry, 2016). This paper highlights mobility as a methods paradigm in a study investigating daily survival mobilities of urban poor women who are at social and spatial peripheries of the society and the city. The existing research methods do not do justice to the studies relating to the aspects of everyday mobility (Law and Urry, 2004). To understand the complexities of social, economic and political relations it is critical to not only investigate the movement of people, objects, information and ideas but also how they get mobilised when they interact with others (Garfinkel, 1967; Wittgenstein, 2009). This paper presents an in-depth understanding of the methods adopted in a study related to social and spatial mobilities of UMW residing in the peri-urban areas of New Delhi i.e., mobile methodology including mobile ethnography wirth new technologies like GPS. By doing so this paper highlights the significance of using mobile methods to explore new research techniques that present a holistic perspective towards understanding mobility.

Mobile Methodology

A growing interest in everyday life practices and their further investigation has brought mobility from merely being limited to a research field to the methods paradigm. According to Law and Urry (Law and Urry, 2004), the existing research methods do not do justice to the studies relating to the aspects of everyday mobility. To understand the complexities of social, economic and political relations it is critical to not only investigate the movement of people, objects, information and ideas but also how they get mobilised when they interact with others (Garfinkel, 1967; Wittgenstein, 2009). According to Laurier and Philo (2003), within the broader spectrum of society, relationships and networks emerge while people are on the move. They emphasise on the study of these micro-worlds that crop up as an impact of automobility on social relations and activity (Laurier and Philo, 2003; Laurier *et al.*, 2008). Various studies on mobility underpin the fact that there is a difference in the kinds of interactions that happen when a person is in motion than when stationary. Moreover, being mobile

brings about a different set of knowledge and identities to people who experience it (Hein, Evans and Jones, 2008). Thus, to understand and analyse the consequences of socio-spatial mobilities and its multi-disciplinarity, the following sections discuss the methodological considerations adopted for this research.

Weisner (1996) argues that research questions that engender the complexity pertaining to multi-disciplinary (mobility studies, urban informality, gender studies) research areas cannot be dealt with in one single method. In studies related to understanding the mobility of people, the strengths of both types of approaches (quantitative as well as qualitative) would provide to be beneficial in covering the width and depth of the research area. Moreover, Johnson et al. (2007) state that an effective mixed methods approach enhances the basic principle of validity of research findings. This concept of validation is termed *methodological triangulation* by Denzin (1989). Using a combination of multiple methods helps in utilising the strength of each method while overcoming their deficiencies (Denzin, 1989).

This research uses a combination of new technologies along with mobile methods and ethnography to reveal the inter-relationship between social and spatial mobility of UMW. According to Law and Urry (2004), the existing research methods reflect their insufficiency to understand the social aspects of movement particularly those characterised with complexity and elements of multiple chaos. To address this gap, it becomes essential to develop research methods that are 'on the move' and allow the researcher to focus on the social organisations that appear during various kinds of movements (Büscher and Urry, 2009). Combining mobile methods with new technologies allows researchers for applying cutting edge theory in geography and social sciences (Christensen *et al.*, 2011). Besides being of interest to academics, the mobile methods present their relevance to various public organisations in policy planning (Hein, Evans and Jones, 2008).

The methods are chosen considering the objectives of the study, i.e., to understand the consequences of relationship between social and spatial mobility of UMW. The research analyses the social structures or networks formed while performing the act of travel as a part of the daily routine of the UMW. It involves the study of everyday life or daily mobilities of these women in diverse social contexts. Following the elements of qualitative research, this study analyses the construction of social realities along with the social relationships that connect people. According to Miller and Dingwall (1997), social structures are a consequence of the 'bottom up' processes that take place within the society. Thus, to analyse these bottom-up processes, the research demands an in-depth investigation into the participants' daily mobilities. Moreover, the issues pertaining to scale and ethics, geographical boundaries and social imagination, class and gender, material culture and interdisciplinarity are all revealed through innovative mobile methodologies (Tarrius, 2000).

Understanding scale in mobility studies

In the studies related to mobilities, the scale does not only span across the geographic and demographic boundaries but incorporates all other macro-processes that describes the interconnectedness and visible and hidden networks of the society. These phenomena are termed *glocal ethnography* (Salazar, 2010), *global ethnography* (Burawoy, 2000*)* or as D'Andrea (2007) defines as *nomadic ethnography*. D'Andrea's (2007) further description of the concept elaborates upon the

nomadic approach that is required for the journeys and activities performed along the routes. According to Molland (2013), the methodology needs to accommodate the switch between the policy and the social world and terms it *tandem ethnography*. Multi-scalar ethnography addresses the issues related to change and focuses on the interfaces between mobility and institutions (society). It does this by understanding the concerns that people may have, by making certain interconnections and strategies between various aspects related to the daily activities of the people.
For studies that are concerned with following the patterns of movement (and not fixed to a particular site), it calls for *deterritorialised ethnography* (Merry, 2000) which entails a set of collaborative and interdisciplinary research methods producing a complex web for analysis (Coleman and Von Hellermann, 2012). The majority of mobility-related studies have focused on qualitative methods with a few examples of quantitative or mixed-method studies (Hein, Evans and Jones, 2008).

Mobility of UMW in New Delhi, India

Figure 2: Context map of Delhi showing the area where the participants live. These areas lie on the periphery of the metropolitan region of Delhi and fall outside the limits of the planned transportation system.

This study focuses on urban marginalized women living in the peri-urban areas of New Delhi in India. Most people living in the informal settlements of these peri-urban areas are migrant poor who have travelled from neighbouring states of Delhi like Uttar Pradesh and Haryana in search of employment opportunities. Among the various groups of women in India, the most vulnerable are the UMW. This group of women are marginalized from two perspectives. First, because they belong to the socio-economically weaker section of society and second, they are women. These are marginalized people whose rights have been violated and those who possess an insignificant amount of economic and political power (Massey, 2013). Due to various kinds of discrimination at socio-cultural and spatial levels, the UMW in Delhi face forced eviction with respect to the right to property and access to various other household assets. These exclusions, in addition to the greater share of household

responsibilities, have a significant effect on their travel choices and status (Anand and Tiwari, 2006).

Besides experiencing exclusions at a household level, women from marginalized communities also face several other challenges at the city level. Among the many cities in India, Delhi's reputation with respect to crimes against women is the lowest. Moreover, from a spatial perspective, the existing infrastructure of the city does not address safety concerns and thus restricts their movement to the interior of the house. These women are primarily employed in the semi-formal or informal sector[1] and often cannot afford to use any transport mode but walking. A study conducted by Bostock (2001) on low-income women also presents the numerous problems women face while walking, including fatigue, stress and psycho-social effects. According to Uteng (2012), the cultural aspect plays a crucial role in the positioning of gender with respect to mobility, namely, access to outer space and kinds of activities. Several studies highlight the impact of risks associated with travelling on public transport modes, such as sexual harassment and travel behaviour of women, where women tend to self-exclude themselves from certain activities hence limiting access to social, leisure and economic activities (Anand and Tiwari, 2006; Murray, 2016). Fear of space is one aspect of risk aversion that is related to the interaction of women with urban space (Pain, 1994). Due to this reason, they tend to return home early (to avoid risks like sexual harassment), and thus they lose out on employment opportunities (Tanzarn, 2008). However, Tulloch (2000) states that many factors contribute to risk experience and depend on spatial and social contexts. Thus, through the study of daily mobilities of UMW, this paper presents insights to inform the designing and planning of street experiments that facilitate enhanced access.

Methods

This research uses mobile methods like digital and mobile ethnography to focus on the daily mobilities of UMW. The study is divided into two main phases (Study I and Study II). The first part of Study I requires understanding the socio-demographic conditions of the participants through the means of unstructured ethnographic interviews. The second part of this study shifts the focus of the interviews towards developing a cohesive understanding of their daily routines. In-depth interviews were used as a preliminary method to understand the socio-demographic characteristics of the participants living in urban peripheral settlements of New Delhi. Subjective and experience-related questions, such as the description of their daily routines, travel experiences and incidents of sexual harassment, were asked during the ethnographic interviews. It was ensured that the interviews were conducted one-on-one and in private to make the participants feel comfortable so that they could share their experiences freely. These interviews also included a detailed explanation of their daily travel patterns. Through this description, information regarding their travel patterns was extracted for further inquiry. Along with this, travel diaries were also filled out for each participant[2]. These methods would help to identify the characteristics, motivations and barriers that affected the movement patterns of the participants. This

[1] The formal economy is marked by regular work, is legally sanctioned and is regulated through state intervention (Hart, 2006; Portes & Schauffler, 1992). Institutions that do not fall in the formal policy regulated environments and are more ephemeral and, not easy to categorise or define (Frederiksen, 2015; Kelsall, 2011) may be called the informal sector, informal arrangements or informal economy.

[2] In this case, there were limitations concerning the literacy level of the participants and thus the researcher filled out the travel diary during face-to-face interaction with the participants.

process gave the researcher a broad idea of the different journeys performed by the participants.

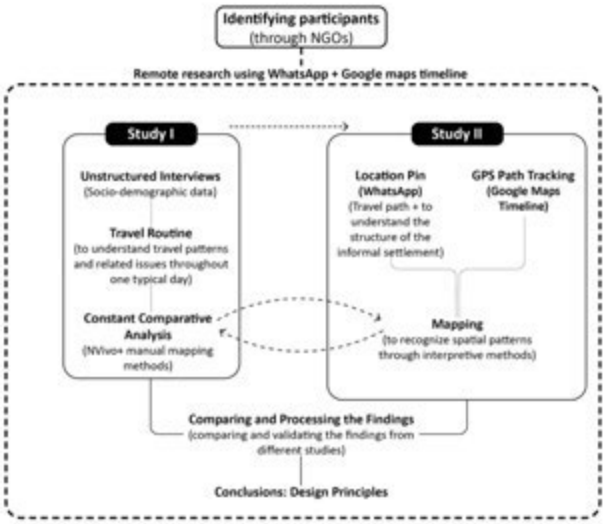

Figure 3 Methods adopted for the study.

Further, in Study II, mobile methodology is used for collecting information about the participants' daily movement through GPS technology. Hence, the second part of the study required collecting data about the path travelled by the participants for two weeks. This study adopted the use of phone GPS and Google maps timeline. This study was conducted during the Pandemic, with restrictions on mobility and social gathering. Thus, based on the availability and knowledge of the participants, appropriate tools (WhatsApp and Google Maps Timeline) were used for the ethnographic research[3].

The participants for the study were recruited by establishing contacts with two NGOs in Delhi that work with issues related to women or women empowerment[4]. Data collection was conducted through both face-to-face interviews and voice calls using WhatsApp[5]. The participants with smartphones were given detailed explanations about the entire process. Conducting remote ethnographic surveys with marginalized communities through digital means presents other challenges, such as dealing with technology handicaps. The researcher was required to educate the participants step-by-step with the help of screenshots along with voice calls on how to turn on the GPS location on their smartphones and how to share their current location on WhatsApp.

[3] While conducting preliminary research it was found that not all UMW owned a smartphone. Thus, the selection of participants was based on the availability and access to smartphones (with Internet and WhatsApp).
[4] Azad Foundation is an NGO that mainly works towards the capacity building by providing driving training to women from resource-poor communities. It has its centres in north, south and east Delhi. The other NGO is CEQUIN India, located in southeast Delhi in Jamia Nagar and promotes equal rights for women and girls.
[5] The data collection process began in February 2020 through face-to-face interviews. After interviewing fourteen participants and obtaining GPS data for five participants, the field study came to a halt in the second week of March 2020. During the total lockdown in New Delhi, India, people's mobility was affected the most and thus it was difficult to pursue data collection with the existing approach involving face-to-face interactions.

Particular instructions and guidance were provided to them, such as keeping their location setting turned on at all times for two weeks. Travel diary, along with the GPS tracking method, helped in the data triangulation that allowed the study to investigate small but important factors related to the daily travel routines of the participants.
To identify underlying themes and categories abductive approach (where codes emerge gradually) to constant comparative analysis or coding is applied for unstructured interviews. However, manual mapping is integrated into the analysis method to avoid overshadowing the computer software, which may lead towards missing finer details of the data (Silverman, 2015) and specificities of the phenomena. Mapping is used as an interpretive analysis method for GPS travel path data. The interpretive evaluation of the mapping process can help to demonstrate spatial patterns and provoke contextual queries (Hsu, 2014).

Reasons for adopting mobile ethnography

Based on the objectives of the research it is required to gather data that reports about issues related to accessibility, skills or competence and appropriation of the resources by the participants. It is suggested by Srinivasan (2008) that to measure accessibility it is required by the planners and designers to collect data that focuses on individual travel patterns. It is difficult to collect such data as it is not routinely collected in most countries. There is also a general understanding that to avoid relating mobility to fixity, it is required to focus on empirical mobilities that in turn calls for mobile theorisation and mobile methodologies (Büscher & Urry, 2009; Büscher et al., 2011; Cresswell, 2006; Urry, 2007). This research focuses on the investigation of social phenomena along with the movement through the lens of gender. Several scholars from the field of the mobilities paradigm advocate the use of atypical research methods that, along with the subject of research, are 'on the move' to capture intermittent mobility patterns (Cresswell, 2006; Urry, 2007; Büscher and Urry, 2009; Büscher, Urry and Witchger, 2011). According to Sheller (2010), these methods include analysis of people's interactions and conversations along their journeys, a mobile ethnography that involves movement with people and objects, observing transfer points, time-space diaries, textual or pictorial diaries, cyber research methods and cyber ethnography, and so forth. In recent years, mobile ethnography has been adopted in several studies related to mobilities. Transfer points, passages, stations, waiting rooms and baggage systems are a few examples of such sites of movement (Andersson, 2017). Although Sheller and Urry (2006) describe transfer points as immobile places that are necessary for mobility which include waiting rooms, cafés and airports. However, it would be suitable to situate other types of waiting areas like bus stops and other inter-change stations or places in this category. An important component of this research is the study of such 'places of in-between-ness' or 'inter-spaces' that are created through multiple mobilities while travelling, in-between events or in-between points of origins and destinations (Hulme and Truch, 2005). According to Watts and Urry (2008), travelling with the subjects of study and being a part of their routine journeys characterises the basic elements of mobile ethnography. This type of study that elaborates upon tracing the path travelled by the individuals is termed multi-sited ethnography (Marcus, 1998).

In-depth unstructured interviews

This research develops an understanding through the daily travel experiences of the participants to reveal the factors that have an impact on the mobility of UMW. It did so

by generating in-depth insights into participants' descriptions of their daily travel patterns (pre-Covid times) along with their socio-demographic information. Data collection was conducted through voice calls using WhatsApp (remote research). In-depth interviews were used as a primary method to understand the socio-demographic characteristics of the participants living in informal settlements of New Delhi.
Although remote research can be used as alternative to traditional data collection methods, it needs to be understood that it is heavily dependent on access and availability of technology to the participants and researcher. In this study, the socio-economic status of the participants did not allow them to make use of certain online methods such as emails or online surveys. Thus, the selection of the relevant technology that was available and easy to use for the participants became an important and challenging criteria (Ardévol & Gómez-Cruz, 2012). Based on this aspect, WhatsApp was selected as a research tool to conduct unstructured ethnographic interviews. During the first stage of research, it was found that not all women belonging to the studied marginalised group owned a smartphone. Hence, for the purpose of the study only those women were contacted and recruited who either owned or had access to a smartphone (along with internet and WhatsApp). However, that meant leaving certain women out of the study group either because of their inaccessibility to smartphones or technological handicaps or unavailability of internet data for using WhatsApp.

To recruit participants for the study, contacts were established with two NGOs in Delhi that work with issues related to women or women empowerment. With the initial reference from the two NGOs and through engaging in conversations in their local language (which is the same as that of the researcher herself), it became possible for the researcher to build connections and rapport with the participants which led towards conducting more interviews within a short period. This also meant that at the end of it the researcher might find herself overwhelmed with the amount of empirical data collected. Thus, it becomes important for the researcher to patiently sort and catalogue this data.[6] This approach to data collection revealed that the digital medium provided the participants with more confidence and control over what they wanted to share and discuss. If some participants did not feel comfortable using typing function, they had an option to send voice messages, which some of them found easy to use and less time-consuming. It was observed that due to the low literacy level of the participants, in some cases, the typing function acted as a barrier and thus required multiple rounds of communication using a combination of voice calls and voice messages, screenshots, and so forth. Also, in the case of text and voice messages, the digital medium provided them with an option to reply at their own pace. These factors gave them more control and privacy. This aspect enabled the researcher to establish a social bond with the participants without having any physical meetings with them even once.

GPS data collection
To obtain information that is based on the actual movement of the participants, GPS tracking was used in this study. According to Schlich and Axhausen (2003), a minimum

[6] This process of handling and processing the raw data eventually became very time consuming. Thus, it becomes important for the researcher to not get disoriented in the process of collecting data through digital means.

survey period of two weeks is required to have a longitudinal perspective focusing on the spatial behaviour of individuals. It is argued that for a survey that needs information on habitual and repetitive activities and travel patterns, a shorter period may yield appropriate data (Christensen *et al.*, 2011). The data recorded through GPS will be objective; however, it may have an objective or subjective meaning ascribed or that can be derived from it.

Hence, the second part of the study required collection of data about the path travelled by the participants for two weeks continuously. Conducting remote ethnographic surveys with marginalised communities through digital means presents other challenges, such as dealing with technology handicaps. Depending on the nature of the research and the type of data to be collected, the researcher may need to explain to the participants how to use certain functions or share certain data through digital means. For instance, in this study, this issue was specifically experienced while obtaining information about their daily travel paths. The researcher was required to educate the participants step-by-step with the help of screenshots along with voice calls on how to turn on the GPS location on their smartphones and how to share their current location on WhatsApp. The participants were reassured by the researcher about maintaining their privacy at any given time during and after the research. Besides challenges like building trust and maintaining the privacy of the participants, there appeared many other factors that made collecting this data remotely very difficult or limiting. For instance, many participants did not own a smartphone by themselves and were sharing the phone within their household. This meant that certain participants did not carry a mobile phone with them all the time (wherever they went) and thus it was not possible to get information on their travel patterns. Second, in some cases where the researcher was successful to educate and make specific settings on their personal mobile phones, there was no way for the participants to share their two-week travel data with the researcher due to the inaccessibility of a computer or laptop. Due to these limitations posed by the Pandemic and remote research, it was not possible to collect GPS data for all participants.

Figure 4: Google Maps Timeline data of two participants for one day.Source: Data extracted by Author

The participant data for each day was extracted separately as individual files. The data was extracted in KML (Keyhole Markup language) format for further analysis. During the process of GPS data collection, certain flaws and limitations also came to the forefront. For instance, for one participant the data for a particular day was missing. After following it up with her, it was found that the GPS location was unknowingly turned off for that particular day. In another incidence, an unusual travel path revealed that one of the family members had carried the participant's mobile phone on that day. It is understood that GPS data has certain shortcomings and at times may not provide a true picture of actual movements performed. Thus, the acquisition of data through other methods (ethnographic interviews, in this case) helps in overcoming these deficiencies and helps in data triangulation.

Mapping for visualisation of GPS data

Maps help in presenting a holistic picture of the case and are a great means of visual representation. Shadon and Dudek (2013) mention that maps help to reveal answers to how and what questions. After plotting the movement pattern on maps, the study followed up further by using ethnographic methods to get a better explanation of why questions. Mapping can help to recognise spatial patterns through its interpretive practice and provoke context-based questions. According to Hsu (2014), maps can introduce a completely new line of inquiry by making invisible patterns visible. For this research, QGIS will be used to visualise the collected data. GIS has the potential to respond to a more critical and qualitative research method. With the help of GIS, it is possible to visually represent the spatial nature of social processes, facilitate critical thinking and construct a theory based on qualitative and quantitative data (Kwan and Knigge, 2006). However, Pavlovskaya (2006, 2016) argues that although GIS holds the capacity to deal with complex relationships, non-quantifiable properties, unprivileged ontologies, and fluid human worlds, they cannot be used to represent either quantitative or qualitative studies.

The next step involved the mapping of the travel patterns of the participants using QGIS, understanding the context and their motivations. The purpose of the data generated through GPS is to scaffold or frame the ethnographic interviews, travel diary data and the interpretative analysis of the participants' movements. With the help of the GPS data, two kinds of maps are generated- the itinerary map showing the continuous movement of the participants and the sojourn map that highlights the places where most or least time is spent. In this study, the itinerary map generated by using GPS data was used for follow-up questions as an object of further enquiry into participants' everyday mobility that includes the places they visited and any additional information or experience they want to share related to their travel journeys.

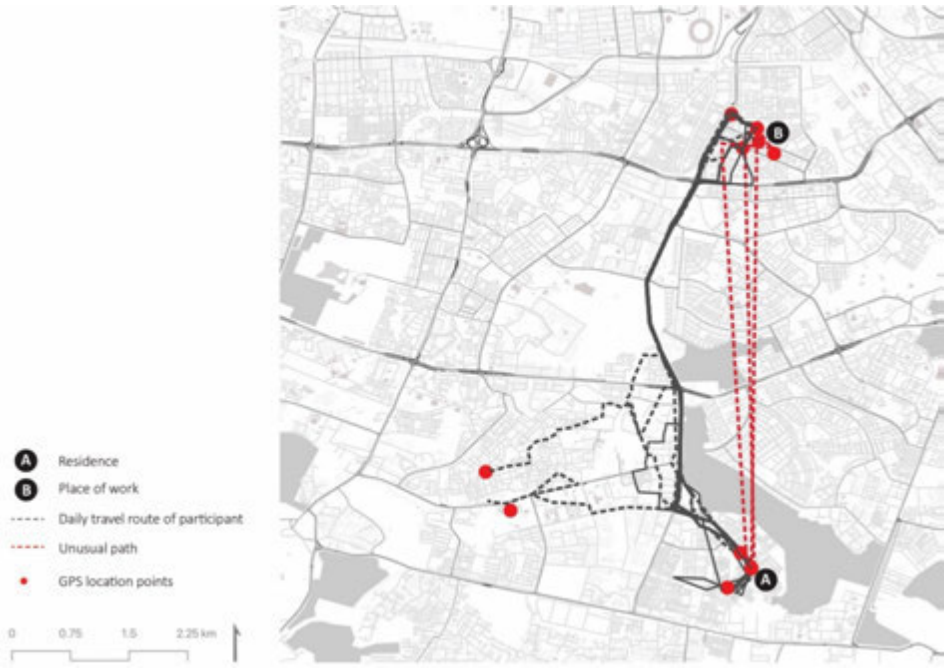

Figure 5: Map representing the two-week GPS data from Google Maps Timeline of one of the participants

The next step that followed the initial interviews with the participants involved getting to know specificities about their daily travel patterns. Time-geography diagrams were developed based on the mapped survey information which formed a layer over the base map of Delhi (Figure 6). Time geography refers to the representations of the paths travelled through space and time that are plotted along two spatial axes and one temporal axis. Time-geography is often used as a tool to explore mechanisms of societal change (1970). Developing on the work of Hägerstrand (2005), Thrift (2005) reflects upon the existence of human action in time and space. Thrift (Gell, 2021) highlights the relevance of time-geography within the realm of social theory. Time-geography is considered to be a strong visual representation of 'thereness'. Moreover, time-geography goes beyond social constructionism to highlight the physical constraints on human activity (2020). An overview of the variation in the movements of the participants is depicted through these time-geography diagrams.

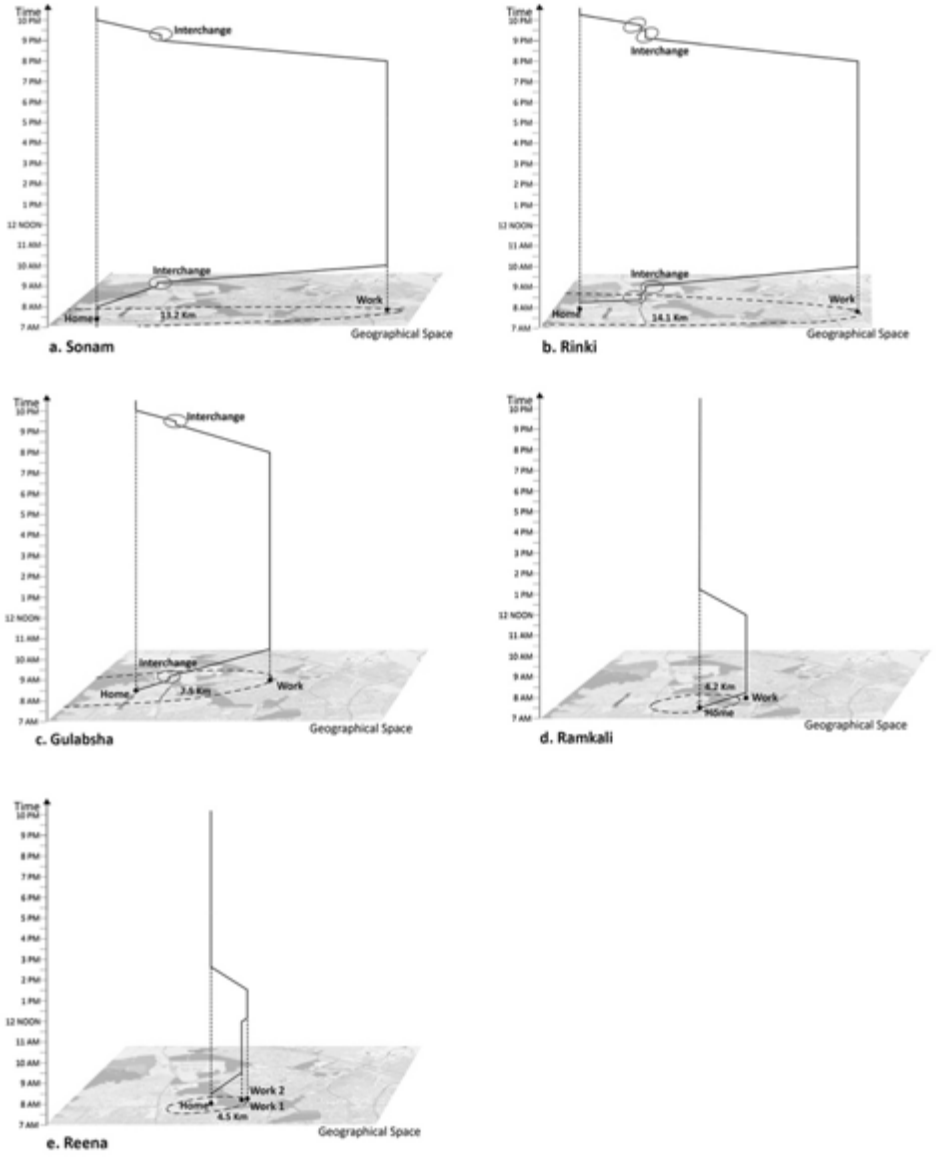

Figure 6: Travel patterns of the five participants are shown with the help of time geography diagrams. These are exemplified with elementary events, such as, travel; inter-change; arrive; stay; leave. Source: Gera & Hasdell (2020)

Discussion

More recently, there has been a focus on studying different types of mobility in reference to the society itself. This brings attention to investigating hidden meanings

associated with mobility that are related to socio-cultural factors, identities, informal networks within specific contexts. Mobile methods help Using mobile methods for a study related to mobility focusing on urban marginalised women and urban informality helps to highlight these concepts and presents a holistic perspective towards mobility. Supported by the literature the mobile methods approach for data collection helped to understand the interconnected socio-spatial factors that impact (enable or hinder) the overall mobility of UMW / people. Mobile methods enable to investigate and understand small and mundane everyday mobilities or immobilities that otherwise are ignored or taken for granted. Moreover, feminist researchers also highlight the importance of the analysis of daily mobility patterns (Hanson and Johnston, 1985; Butler and Bowlby, 1997; Law, 1999; Hanson, 2010).

These methods help to reflect on new perspectives that include socio-political inquiries besides focusing on spatial environments. Studying everyday mobilities using mobile methods presents a relational perspective by considering 'scale' as a significant factor. That is, it enables to understand the relationship of micro-level movements associated with the actor itself to those associated with mobile and immobile co-travellers and infrastructures. Besides 'scale' mobile methods bring attention to the aspect of temporality in mobilities study. For example, studying an actor on the move will also highlight other activities, conversations and non-movements and thus enables the researcher to discard the notion of linearity in studies on mobility. Mobile methods go beyond understanding mere spatial mobilities. They reveal interconnected factors which may occur on the move and help them to form temporal connections with social and spatial infrastructures to gain knowledge which may impact their mobility. It opens a dialogue towards multiple effects of mobilities.
Mobile methods enable the use of new technologies like the GPS to study and analyse mobilities of different entities. It enables to scale-up the investigation to reveal common patterns. Conducting the field study with a traditional ethnographic approach, the researcher is constrained by the physical fact that she can only be present in one place at a time. There may be instances when critical interactions take place at a time when the researcher is not around. Mobile methods help to take care of such situations and enables data collection with multiple participants at the same time. Using mobile methods also enables active participation of people within the process which gives them agency to share the required information with the researcher. Besides GPS, the use of ICT and social media platforms enable sharing of reliable data (from the participants) in real-time. These tools used as a part of mobile methods give a sense of trust and control to the participants. The participants feel more comfortable using these tools as compared to a device given to them by the researcher to carry with them. However, using new technologies within mobile methods present a challenge to engage and study mobilities of marginalised groups such as socio-economically weaker groups, especially women and children. Although the case study presented in this paper has used mobile methods with UMW, it highlights that there exist barriers in terms of ownership of new technology research tools, such as smartphones due to financial and social exclusions with respect to such groups. Also, a lack of technological know-how among these groups impacts data collection and sharing with the researchers. Thus, it is required to conduct more comprehensive mobility studies using mobile methods with marginalised populations to understand the potential of new technologies within this context.

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How are youth living in ageing neighbourhoods?

A Case Study in the Central District of Shanghai

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Abstract
With the construction of youth development-oriented cities, the phenomenon of housing/community youthification has emerged in the central districts of mega-cities. Communities in central mega-cities, which used to be mature, tend to have a significant ageing population and have formed their own cultural atmosphere and social relations. The living conditions of young people in these communities need to be studied. Taking Chuangyu 228, a youth-oriented guaranteed rental housing in Yangpu, Shanghai, as an example, the living conditions and satisfaction of young people are surveyed and analysed based on both the supply-side and demand-side perspectives from the physical, social, and cultural dimensions. The research provides empirical evidence of housing/community youthification in Chinese mega-cities and offers insights for optimising youth housing policies and community planning.

Keywords
youth apartment, youth community, affordable rental housing, youthification, youth-friendly city

1 Research Context

1.1 Real-world Context: Construction of Youth Development-oriented Cities and Youth Housing in China

In China, as innovation has become an increasingly important driver of urban development, young talent has also become the mainstay of urban social development. In January 2021, the Chinese government proposed to build youth development-oriented cities, and currently 60% of Chinese cities have proposed to build youth-friendly cities and communities. One of the most important strategies is the provision of youth-oriented affordable rental housing.

Although many youth housing units have been built in the suburbs, a significant proportion of them are located in the city centre in the context of urban renewal. On the one hand, the central urban area attracts young people because of its abundant job opportunities and great amenities. On the other hand, some communities in the central city have been built for a long time and are in urgent need of renewal, which can be seen as the frontiers of gentrification according to Neil Smith's rent gap theory. The government carries out a series of urban regeneration activities to re-invigorate the land's value and the city's vitality, of which the youthification of houses and neighbourhoods is one form.

1.2 Theoretical Context: Youthification Phenomenon in Housing/Communities in China's Mega-City Central Areas

Youthification is the contemporary lifestyle, demography, and socio-economic condition of the young ‘playing out in the landscape’ (Moos, 2016). From a spatial perspective, youthification

is manifested in the aggregation of the youth population in a given space. From a social perspective, youthification refers to the increase in youth discourse and youth cultural influence. Studies on gentrification often consider youthification as an indicator of gentrification, but Revington et al. (2023) argue that youthification is a different process from gentrification because youth include not only the middle class but also those in ordinary economic conditions. Research on age-based sociospatial differences has not been emphasised. In recent years, although there has been an increase in the literature on youthification, most of the studies explore the settlement patterns of young people at the macro city scale, and there is a lack of studies that explore youth residential characteristics from the micro block scale. At the same time, there is also a lack of empirical support for the possible neighbourhood effects of youthification. On the one hand, youth population aggregation may influence the values and behaviours of other age groups to have the status and qualities that young people have, thus making society more dynamic and creative. On the other hand, it may also lead to age-based spatial segregation and age discrimination (Luo, 2017). As for the mature neighbourhoods in the city centre, they usually have an ageing population and have developed their own cultural atmosphere and social relations. How young people live in these ageing neighbourhoods and whether they can integrate or not need to be examined. In addition, research on youthification based on the Chinese context is a relatively blank area. China's unique political system and economic and social background will further enrich the theory of youthification.

1.3 Research Question: Issues of Youth Living Conditions in Youthified Housing and Communities

Therefore, this study takes the youthification of housing in ageing communities as the research theme. Based on a dual perspective from both the supply side and the demand side, the article examines the living situations of youth from physical, social, and cultural dimensions, investigates the youth's satisfaction with their living conditions, analyses the problems therein, and proposes corresponding strategies. The study provides an empirical case of the phenomenon of youthification of housing from a Chinese megacity and enriches the theory of youthification. It also provides references for optimising youth housing policies and neighbourhood planning.

2 Research Design

2.1 Research Subject

Chuangyu 228, an affordable youth rental apartment within 228 Block is selected as the research subject.

228 Block is located in the Changbai Xincun Subdistrict of Yangpu District, Shanghai. Originally constructed in 1952, it was one of the first batch of "Twenty Thousand Households" worker housing projects in Shanghai, aimed at addressing housing difficulties for industrial workers. However, the "economical and practical" housing built under limited economic conditions at that time could no longer meet contemporary residential needs. From 2016 to 2023, the government carried out an urban renewal project in the 228 Block, constructing 450 sets of affordable rental housing targeted at youth, namely Chuangyu 228. Additionally, a series of community commercial and service facilities were established (Lacime Architects, 2023). As of December 2023, 426 households had moved in, with an occupancy rate of 96%. The residents include young talents from various industries such as the Internet, finance, and entertainment, mainly from nearby areas such as Wujiaochang, B-Link, Changyang Campus, and Fudan Software Park. The traditional worker's new village has been upgraded to the new generation of young achievers' community ecosystem.

Figure 1. Location of Chuangyu 228

The Second Residential Area of Changbai Road, where Chuangyu 228 is located, is a neighbourhood characterised by a significant elderly population. According to data from the Seventh National Population Census of China, in 2020, the proportion of elderly people aged 60 and above in the community was 33 %, with those aged 65 and above accounting for 22%, both higher than the average levels of 24% and 16% in Shanghai. Therefore, Chuangyu 228 serves as a representative case for studying youth housing and community in ageing neighbourhoods.

Table 1. Proportion of Elderly Population

	Aged 60 and Over.	Aged 65 and Over.
Shanghai	24%	16%
Yangpu District	32%	22%
Changbai Xincun Subdistrict	24%	34%
The second Residential Area of Changbai Road	22%	33%

2.2 Research Methods

A combination of questionnaire surveys, in-depth interviews, and on-site surveys is employed by the study to analyse the housing and community characteristics of Chuangyu 228 and the living conditions of its residents. The questionnaire survey is mainly utilised to understand the composition of young residents, the use of community places and facilities, social interaction within the community, and the community identity and residential satisfaction of the youth. In-depth interviews target both the staff of Changbai Xincun Subdistrict, Second Residential Area of Changbai Road, and Shanghai Yangpu Technology & Innovation Group to comprehend the renewal process and management of the Chuangyu 228, and the residents of Chuangyu 228 to achieve a deeper understanding of the questionnaire content. On-site surveys are mainly conducted to understand the housing conditions, distribution, and utilisation of surrounding public service facilities.

3 Youth Community Provision

3.1 Physical Dimension: Building a Home-Centred Residential Life Circle

3.1.1 Small-Scale, Sophisticated Housing Units

Chuangyu 228 provides small-scale housing units of approximately 40 square meters for young families of 1-2 people. These units possess balconies and private bathrooms and are fully furnished with high-quality wooden furniture (bedside tables, wardrobes, desks, sofas, double beds), and equipped with branded appliances (air conditioning, refrigerators, water heaters, televisions, washing machines, range hoods, induction stoves), as well as modular bathroom

systems and other furniture facilities. Surveys among tenants show that favourable living conditions are a significant factor that attracts them to choose Chuangyu 228 as their residence.

Table 2. Unit Types of Chuangyu 228
Source: Promotional materials for Chuangyu 228

Unit type	A	B
Floor Area	35-40 ㎡	40-45m²
Floor Plan		

Figure 2. Interior Rendering of Chuangyu 228
Source: promotional materials for Chuangyu 228

3.1.2 Comprehensive Public Service Facilities

The apartment is located 800 meters from the Yingji Middle Road Station on Metro Line 8. Within a radius of 500 meters, there are 13 bus stops, making transportation extremely convenient. At the same time, through the provision of facilities at the levels of subdistrict, block and apartments simultaneously, a 15-minute community life circle centred around the apartment for young residents has been established.

At the apartment level, relying on the innovation and entrepreneurship resources of Shanghai Yangpu Technology & Innovation Group, the brand "Create+" is implanted into the apartment, providing office workstations, multi-functional halls, meeting rooms, and other shared space carriers, which can carry the functions of office negotiation, book reading, and socialising. A rooftop garden is built on the 12th-floor terrace of the apartment, where public activities such as camping and planting can be carried out. Provide a pet boarding warehouse to provide tenants with pet boarding services. The apartment also provides pet boarding facilities, offering pet boarding services to tenants.

Figure 3. Key Public Facilities in the apartment
Source: https://www.jfdaily.com/sgh/detail?id=1086968

At the block level, the 228 Block is positioned as a community commercial and service centre during the renewal, focusing on the complementary provision of the original surrounding living service facilities and configured with public facilities such as community canteens, fast-food stores, convenience stores, fresh food supermarkets, and municipal facilities such as public parking lots. In particular, it focuses on the needs of youth groups, introducing cafes, bars, fitness centres, boutique supermarkets and other businesses that attract young people. At the same time, 228 Block merchants offer a series of tenant-oriented discounts so that youth can access convenient, discounted services.

At the subdistrict level, the 15-minute living circle of Chuangyu 228 covers Changbai Xincun and Yanji Xincun Subdistrict. The mature neighbourhoods of the two subdistricts provide convenient basic living service facilities for the young tenants.

Figure 4. Functional Distribution of 228 BLock
Source: drawn on the image from https://finance.sina.com.cn/jjxw/2024-01-28/doc-inaezyzi2164839.shtml

3.2 Social Dimension: Implementing Admission Mechanisms to Screen Residents

Chuangyu 228 offers 450 sets of standardised guaranteed rental apartments targeted at young people. Through entry policies, apartment types, and rental rates, it selects a homogeneous and stable tenant group.

3.2.1 Entry Policies

Chuangyu 228 is included in Shanghai's guaranteed rental housing management system and adheres to a unified admission system. Applicants are required to fulfil two basic requirements. First, they should be in-service personnel legally employed in Shanghai and their spouses or children. Second, they must not own any property in Shanghai. Alternatively, if the applicants, their spouse, or children own property or lease public housing within the seven central districts of Yangpu, Hongkou, Huangpu, Jing'an, Xuhui, Putuo, Changning, and Pudong New Area (inside the outer ring), the per capita residential floor area should be less than 15 square meters.

3.2.2 Rental Rates

The apartment rent is paid either with a one-month security deposit and one month's rent upfront or with a one-month security deposit and three months' rent upfront. Different from market-rate apartments, the unit prices for water and electricity are based on the standard rates for residential use. The apartment rent strictly follows the evaluation of relevant municipal departments, with a one-price-per-room policy. Rentals are offered at less than 90% of the evaluated price. For rooms with a floor area ranging from 30 to 45 square meters, the average monthly rent falls within the range of 3200 to 4600 yuan. The rent includes property management fees. Internet access is provided for free.

The lease contract period is typically not less than 1 year and not longer than 3 years. After the lease contract expires, if the occupants still meet the admission criteria after undergoing reevaluation, they may renew the lease. However, if they no longer meet the admission criteria, they should vacate the premises.

As a result, tenants of the apartment are mostly new white-collar workers with stable incomes but shorter working years and limited savings.

3.2.3 Unit Types

The apartment mainly provides one-bedroom units, and occupants must be the lessee themselves, along with their spouses and children. Therefore, the majority of tenants are young singles and married couples without children.

3.3 Cultural Dimension: Cultivating a Cultural Atmosphere for the Youth Community

3.3.1 Internal: Community Building

Chuangyu 228 actively carries out diversified and youthful community activities, such as regularly organising leisure and entertainment activities loved by young people such as board games and script-based role play games, as well as festive and holiday-themed events such as Women's Day Tulip Handicrafts and the Anniversary Carnival. These efforts aim to enrich the tenants' leisure time, foster a sense of community, and enhance young adults' sense of belonging and identity with the apartment's youthful culture.

In addition, spaces like the community service centre and the central lawn within the 228 Block regularly host various events organised by the street and city authorities, such as park fairs, lawn concerts, outdoor movie screenings, and community health clinics. These events encourage the young residents living in the apartment to participate.

3.3.2 External: Activity Constraint

Chuangyu 228 is a centralised living space for youth and is located in the northwest corner of the site. The spatial isolation from other residential buildings somewhat limits the interaction of youth with other age groups. Also, the tenants' social behaviour is subject to certain constraints by the leasing regulations established by the apartment. For example, Chaungyu 228, being a tightly managed gated apartment, is equipped with a facial recognition access system, allowing only residents to enter. Visitors are required to register at the lobby and are not allowed to stay overnight. It has been shown that gated management can provide tenants with discreet and secure private spaces, but may also reinforce the segregation of residents from other members of the community (Roitman, 2005; Wu, 2005).

4 Youth Community Living

4.1 Physical Dimension

4.1.1 Commuting

（1）Mainly Public Transit

Young tenants of Chuangyu 228 mainly commute by a combination of "walking/cycling + subway" and "walking + bus". The subway and cycling were the most popular modes of travel, both chosen by more than half of the respondents. Walking and buses were also chosen by about 30% each. In contrast, cabs and private cars were chosen by a lower percentage. This reflects the accessibility of public transportation around Chuangyu 228.

（2）Mainly Short Commutes

Overall, the daily commuting time of young tenants is relatively suitable, and the balance between work and residence is relatively good. The survey shows that 82% of the respondents have a one-way commuting time of less than half an hour. Among them, 55% of people have a one-way commute time between 15 and 30 minutes, while 27% have a one-way commute time

of less than 15 minutes. 18% of people have a one-way commuting time of between 30 and 45 minutes, which is relatively low. No one has a one-way commute time exceeding 45 minutes.

4.1.2 Use Frequency of Places and Facilities

（1）Within apartments: low use frequency of places and facilities

The results of the questionnaire show that the intelligent boarding kennel, VIP reception room, and shared meeting room are hardly being used. While some users opted for "at least once a week" or "at least once every two weeks" for the shared hall and rooftop garden, the majority still chose "less than once a month," at 64% and 73%, respectively. Apartment managers need to adapt and optimise the function and orientation of their facilities to better meet the needs of their residents. Apartment managers need to adapt and optimise the function and positioning of these facilities to better meet the needs of their residents.

（2）Inside the 228 Block: high variation in use frequency of places and facilities

According to the survey results, residents exhibit varying frequencies of use across different types of life service facilities and places within the 228 Block. Tenants most often use bars, cafes, milk tea stores and other space facilities that provide beverage vending and third-place functions, and more than 80% of tenants use them at least once a week. The use frequency of activity places and facilities, including outdoor public spaces (such as central lawn, small squares, vacant lots, etc.), and the 228 Sports and Health Centre, is also relatively high, with over 45% of tenants using them at least once a week. There are differences in the use frequency of dining facilities. Commercial snack shops, fast food restaurants, and branded dining establishments have higher use frequencies, with most people using them once every two weeks to once a week. However, nonprofit community canteens, which are popular among the elderly, are not very popular among young people, with most people using them once a month. In terms of shopping facilities, branded supermarkets and ordinary convenience stores have similar use frequencies, with most people using them once every two weeks to once a week. Other convenient commercial facilities, such as hair salons, eyewear stores, and nail salons, have lower use frequencies, with 64% of respondents using them once a month or less. The use frequencies of service facilities (community public health service station, community party service centre, union service station, etc.) and children's facilities are also low, indicating that the tenants of Chuangyu 228 are not the primary service clientele for these two types of facilities.

（3）Outside the 228 Block: low use frequency of places and facilities

Similarly, young residents exhibit relatively low use frequencies for external life service facilities and places. Among these, dining facilities (such as restaurants, cafes, beverage shops), shopping facilities (such as convenience stores and markets), and public spaces (such as parks, squares, fitness trails) have relatively high use frequencies, with over 46% of tenants using them at least once a week. Furthermore, leisure facilities (such as KTVs, bookstores, cinemas) also have relatively high use frequencies, with 36% of residents using them at least once every two weeks. The use frequencies of community cultural activity facilities (community cultural activity centres, cultural activity rooms) and medical facilities (hospitals, community public health service centres, and public health service stations) are relatively low. Specifically, 36% of tenants use these facilities at least once a month. The lowest use frequencies are observed for employment facilities and parent-child facilities, with less than 10% of tenants using them at least once a month.

4.1.3 Usage Hours of Places and Facilities

（1）Weekdays: usage hours tend to concentrate

The majority of respondents indicated that the most common period for using public service facilities and places is from 18:00 to 22:00 after work. Additionally, approximately 30% of respondents selected 14:00 to 18:00, while 20% opted for 8:00 to 11:00.

（2）Weekends: usage hours tend to disperse

The usage time of facilities and places on weekends is concentrated primarily in the noon and afternoon periods. In the survey, the highest proportion, 64%, selected the time range from 12:00 to 18:00. Following that, 55% of respondents selected the time range from 11:00 to 14:00. The third most popular option was "18:00-22:00," selected by 46% of respondents.

4.2 Social dimension

4.2.1 Resident Population

（1）Mainly highly educated single youth or young couples

The surveyed population all have a bachelor's degree or higher, with over 80% of respondents aged between 25 and 30, indicating that the majority are university graduates of about five years. Most of the respondents live alone, accounting for approximately 64%, followed by living with a spouse, with very few living with children. Overall, the residents of Chuangyu 228 are mostly single young adults or young couples aged 20 to 35, with an annual income of over 100,000 yuan and holding a bachelor's degree or higher.

（2）Mainly transitional living

The surveyed population is comprised of individuals with bachelor's degrees or higher. Over eighty per cent of respondents are between the ages of 25 and 30, indicating that the majority are university graduates who have been out of school for approximately five years. Most respondents live alone, accounting for approximately 64%, followed by those who live with a spouse, with very few living with children. In summary, the residents of Chuangyu 228 are mostly young singles or couples aged 20 to 35, with an annual income of over 100,000 yuan and a bachelor's degree or higher.

4.2.2 Neighborhood Interactions

Low frequency and shallow levels.

The study investigates the frequency of interaction between tenants and other residents in the community, including "greeting each other when meeting," "visiting or engaging in activities together," and "engaging in deep conversations or discussing intimate topics." The results show that the majority of respondents rarely engage in these three types of interactions. The percentages reached for each of the three interactions were 55%, 73%, and 82%, respectively. This indicates that young tenants at Chuangyu 228 tend to be conservative and cautious in their social interactions, with a lack of deeper connections.

4.2.3 Activity Participation

（1）Low participation in all types of activities

The study examined tenants' participation and willingness to participate in volunteer activities, community cultural activities, and interest-based clubs or groups. In general, residents exhibit low levels of involvement in all three types of activities. The results indicate that a negligible proportion of respondents participate in volunteer service activities, with only 19% having experience in interest-based clubs or groups. The number of individuals who participate in community cultural events is the highest, yet still less than 30%.

（2）Differential willingness to participate in various types of activities.

The proportion of individuals willing to participate in community cultural activities and interest-based clubs or groups is relatively high (over 45%), whereas the proportion willing to participate in volunteer service activities is low (9%).

4.3 Cultural Dimension

4.3.1 Perception of Community Boundary

Young tenants of Chuangyu 228 perceive the boundary of the community mainly based on their own daily activities, with less overlap with the boundary of community management. The majority of respondents (82%) perceive the boundary of the community to be that of 228 Block, while a smaller proportion (18%) view the boundary of the community as that of apartments. The area of Changbai Xincun Subdistrict and the area of the Second Residential Area of Changbai Road are not included in the youth's perception of the community.

4.3.2 Perception of Community Function

The function of 228 Block as perceived by the young tenants of Chuangyu 228 is firstly a place for leisure and entertainment, with a score of 3.18. Secondly, it is a place for consumption and shopping, with a score of 2.64 points. The third and final category is that of a place for community interaction, with a score of 2.36. Finally, it is a place for history and culture, with a score of 1.82.

4.3.3 Identity of Community Culture

The survey of young tenants of Chuangyu 228 reveals a low level of identification with the original culture of the community. Over half (55%) indicate that they know little or nothing about the history and culture of the 228 Block, while only a small proportion (18%) demonstrate a more extensive knowledge of it.

4.3.4 Sense of Community Belonging

The majority of young tenants (55%) surveyed exhibit a strong sense of belonging to their community. However, a notable proportion (36%) express uncertainty about their sense of belonging, while a smaller group (9%) report a "weak sense of belonging." No respondents indicate a lack of belonging or a strong sense of belonging.

5 Youth Residential Satisfaction

5.1 Overall Satisfaction

The survey indicates that the majority of Chuangyu 228 residents are either relatively or very satisfied with their living situation, representing over 90% of the total.

5.2 advantages of Living

Better housing conditions and more complete community service facilities are the main advantages of living in Chuanyu 228, recognised by over 75% of respondents. This demonstrates the importance young people place on housing and community hardware facilities. Three potential advantages of Chuanyu 228, including better value for money, easier commuting, and closer proximity to commercial centres, are also recognised by over 30% of respondents. In contrast, the option of having more peers only received 11.11% agreement, indicating that this does not seem to be a major factor influencing young people's housing choices.

5.3 Youth Development Support

（1）Primary support for basic living

The support in "meeting housing needs" and "providing diverse and convenient daily life services and facilities" is universally recognised by respondents, with over 70% of individuals considering the help "very significant" or "quite significant".

（2）More support for leisure and culture

The support in "obtaining rest and relaxation, maintaining physical and mental health" and "enriching spiritual and cultural life, showcasing cultural personality" receives considerable recognition, with over half considering the help "very significant" or "quite significant".

（3）Less support for socialisation and skill enhancement

The support in "expanding social circles, improving social skills," "acquiring life skills, enhancing social adaptability," and "providing opportunities to participate in public affairs, enhancing urban integration" is acknowledged by some respondents, with approximately 10% choosing "very significant" or "quite significant" help for each of the three aspects.

（4）Least support for work and family-related matters

In terms of "increasing employment opportunities, improving work efficiency, and obtaining economic benefits" and "providing elderly care and childcare services, sharing family care responsibilities," respondents' satisfaction is relatively low, with over half considering the help "very little" or "quite little". This result may be related to the residents' relatively stable employment and the minimal pressures of elderly care and childcare within their life cycle.

6 Conclusion

6.1 Boundaries between Young and Old Individuals' Lives are Clear.

There are notable contrasts between younger and older individuals in their utilisation of community facilities and space. In terms of temporal patterns, younger individuals tend to utilise community facilities in the evenings or on weekends, while older individuals are more active during the day. In terms of spatial preferences, younger individuals prioritise freedom and privacy, as well as consumer-oriented facilities, while older individuals tend to prioritise public outdoor spaces and facilities for public welfare. The young and the old share space and facilities to a certain extent, but they have few and shallow communications and are isolated from each other in terms of social relations. It can be seen that, as a form of housing supply for young people, concentrated rental housing aimed at young people inserted into communities has a limited short-term impact on the original spatial social structure.

6.2 Neighborhood Interactions Insufficiently Predict Youth Community Identity.

It is generally believed that positive interactions between neighbours can contribute to the formation of a sense of community identity. However, the findings of this study indicate that, despite a reduction in the frequency of interactions among young people in their neighbourhoods, their sense of community identity remains high. The reason lies in the pursuit of high living quality and the emphasis on privacy among young residents of Chuangyu 228. They collectively establish boundaries to maintain their personal daily life domains. By creating aesthetically pleasing and comfortable living environments, and enhancing the quality of life, they turn the community into a shared living space. This result reminds planners to reconceptualise the community lifestyle of youth. The creation of free, private and personalised spaces may be more important in youth housing construction and youth community planning.

6.3 Residential Expectations Influence Residential Satisfaction.

Due to housing size and residency rules, the majority of tenants in Chuangyu 228 are young, unmarried and living alone, viewing it primarily as a temporary residence. They predominantly

perceive it as a place to meet basic life needs, rather than fulfilling deeper needs such as skill acquirement or expanding social circles. Consequently, despite the community's inadequate support in these aspects, overall residential satisfaction among young residents remains relatively high. For youth housing and community planning, it is essential to enhance infrastructure and service levels to meet residents' basic life needs maximally. Additionally, providing diverse and flexible housing options and fostering a rich, vibrant community environment is crucial.

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Embracing Diversity: Ararat's Role in Inclusive Urban Development and Migration in Rome

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Abstract
This paper aims to contribute by spotlighting an example of inclusive practices aligned with the principles of open city, specifically focusing on a migrant community who have established a socio-cultural centre in Rome, called Ararat. Ararat nestled in Testaccio neighbourhood with its enduring presence, stands as a testament to the resistance and vibrancy of the Kurdish community, particularly noteworthy as the neighbourhood undergoes development and renewal as part of the National Recovery and Resilience Plan. By examining Ararat's journey, this paper seeks to extract valuable insights and lessons that can inform urban planners and policymakers engaged in inclusive urban development projects. The longevity and vitality of Ararat underscore the importance of incorporating the unique perspectives and contributions of migrants communities in the urban renewal process.

Keywords: Migration, Rome, Participation, urban renewal

Introduction

Migrations are widely acknowledged to be the main vector of change in cities. Nicholas De Genova (2015) argues that transnational migrations are the primary drivers of the transformation of urban space and social production in contemporary cities. Italy, and particularly its capital Rome, has always been reshaped by migrations. The Shish Mahal, for instance, the first migrant occupation experience between 1990 and 1991, marked a significant moment in the city's migration history. In recent decades, the policies of the European Union and right-wing governments have forced migrants into precarious and dangerous urban situations. The structures meant to support and integrate migrants have proven inadequate, either unable or unwilling to address their recurrent problems (Ambrosini, 2011). Italy is significantly impacted by 'secondary movements' of migrants—those attempting to reach other parts of Europe but who are either stuck in Italy or forced to return because it is their initial point of entry and the place where they can process their documents. Often secondary migration is described as the act of individuals seeking improved conditions (Wagner et al. 2019) outside the confines of legal migration channels, contrary to the stipulations of EU migration and asylum laws.

According to the 2021 Migration Report by the Metropolitan City of Rome, the city has historically served as a destination for internal migration and currently serves as the primary departure point for illegalized migration in Italy. This influx of people has generated various informal spatializations as individuals seek shelter during their transition period in Rome—some more stable, others highly temporary.

This paper focuses on a community in Rome primarily composed of 'secondary movement' migrants who regularly gather at a socio-cultural centre: the Kurdish socio-cultural centre of Ararat, situated in Testaccio, a historic and central neighbourhood of Rome. Campo Boario, the section of the former slaughterhouse where Ararat is located, was a significant point of shelter for migrants from diverse backgrounds. Although it was unorganized and perceived as dangerous, Campo Boario was one of the most cosmopolitan places in the city, embodying the surreal urban imagination of Pasolini and Fellini (Careri and Romito, 2005). Today, it largely reflects the impacts of globalization. Ararat remains the only enduring 'migrant' entity and

legacy within Campo Boario, now threatened by various PNRR (National Recovery and Resilience Plan) plans and projects surrounding the entire area and neighbourhood, despite no official communication or eviction notice being issued to the centre.
This paper aims to reflect on the possibilities for Ararat to establish a participatory process with the administration of Rome, emphasizing the 'on the move' component of its community. Situating the discussion within the literature on planning and migration, it explores how a migrant community can assert the right to speak for themselves, protect their presence in the space, and affirm their right to the city, as a concept based more on urban presence than ownership (Allon, 2013; Purcell, 2002, 2013). This study highlights the potential for migrant experiences to inform urban renewal and integration practices, presenting Ararat as a model for creating inclusive and participatory urban spaces.

Migrations and Planning

In recent years, urban and migration studies have addressed the migration-city nexus from many perspectives. The 'local turn' has highlighted the centrality of cities in migration studies (Briata, 2014; Çağlar and Glick Schiller, 2018). Cities are widely acknowledged as fundamental nodes of planetary fluxes (Brenner, 2013; Sassen, 2008) and are central to bridging together transnational political movements and migrations. International migration can have different impacts on cities: they can serve as arrival points for migrant communities aiming to settle (Saunders, 2010) or function as spaces of transition and stopover points (Iranzo, 2021).
The literature, especially in critical geography, has extensively explored the forms of inhabitation of people on the move (Bonfanti et al., 2022), generating by temporary, 'liquid' migrations (Black et al., 2010). These processes are sometimes not temporary but become extended periods of waiting (Bernardie-Tahir and Schmoll, 2018), which can occur multiple times during the migration journey. Scholars have addressed the spatialization of migration processes such as makeshift camps (Katz, 2017; Oesch, 2017), informal settlements, humanitarian camps, and squatting practices (Raimondi, 2019). Katz (2023) highlights how the EU's bordering regime creates urban border zones where migrants, aiming to move but forced to stay due to restrictive policies, generate temporary urban realities. These policies aim to illegalize migration, closing all legal avenues for individuals to move (Aru, 2022). Along with those explorations, scholars have highlighted how migrants and local activists create grassroots experiences to cope with the lack of an effective reception system (Caponio, 2005; Benson, 2019; Swerts & Nicholls, 2020; Tsavdaroglou et al., 2024). While informal formations in planning have gained significant relevance worldwide (Roy, 2005), attention to these informal practices is relatively recent in Western countries (Cremaschi et al., 2020). In planning studies about migration more research has been done on policy (Murillo, 2017), governance (Maptisa, 2019), and institutions (Landau, 2013; Barbarino et al., 2021). Another strand focuses on city-level policies that counteract national policies, creating grassroots solidarity experiences (Mitchell and Spake, 2018; Bauder, 2019; Bauder, 2021). Despite the growing interest in migration within urban planning (Bernt, 2019), migration is rarely addressed as a central strategic line or concrete policy in urban plans. Instead, it is often used as a demographic description tool (Skeldon, 2013). The literature provides few examples of how the participation of migrant communities can achieve long-term integration (Bessho et al., 2020). What remains highly underdeveloped is the participation of migrant communities in the planning process (Zhang et al., 2023), even less has been said concerning migrant communities that aren't settled but 'on the move' or about 'secondary movement'. This paper presents an experience of a migrant community that asserted their right to stay due to their continuative presence, as community not single members, in the space and acquired recognition opening a dialogue with the municipality members underling the potential of inclusivity in the urban landscape. In the next section, I will outline the methodology and present the early results of the research. This

includes contextualizing the presence of Ararat in Rome and reflecting on the possibilities this experience can add to the literature underlined above about 'people on the move' and planning.

Methodology

This study is based on ongoing ethnographic research in Rome. For this paper, a multi-methodological approach was employed, combining archive analysis, document analysis, and interviews to ensure a comprehensive examination of the research topic.

The archive analysis involved a systematic review of historical records and documents preserved in the archives of Stalker and Villaggio Globale. This allowed for the exploration of primary data that shed light on past events, organizational histories, and contextual backgrounds. The historical context provided by these archives is crucial for understanding the evolution and significance of spaces like Ararat in Rome's social and cultural landscape.

Document analysis complemented the archival work by critically examining various texts, including reports, memos, policy documents, plans, projects, newspaper articles, and other written materials. This method helped identify patterns, themes, and insights relevant to the research, facilitating an understanding of the formal and informal structures, processes, and communications within the studied context. Analysing these documents (with particular attention to resolution n104 and the subsequent regulation of the municipality of Rome) enabled a deeper insight into the policies and administrative decisions that have impacted the operation and existence of socio-cultural centres like Ararat.

Additionally, semi-structured interviews were conducted with key informants, providing firsthand insights and perspectives that enriched the data gathered from archival and document analyses. Twenty interviews were conducted with Kurds and Italians who engage with the space of Ararat, including municipality members. The interviews enabled the collection of nuanced, subjective experiences and interpretations that might not be evident in written records. These interviews were pivotal in capturing the perspectives of the Kurdish community and understanding their interactions with the broader urban environment of Rome.

Moreover, valuable information was gathered through participation in public events at Ararat, where members of the administration were involved. These events provided opportunities for informal conversations, which proved fundamental in gaining insights that might not surface in official meetings, interviews, or archival records. This informal dialogue helped fill in gaps and added depth to the understanding of the dynamics at play.

The triangulation of data from these various sources—archival records, document analysis, interviews, and participant observation—ensured a robust and comprehensive approach to the research. This method allowed for cross-verification of information, enhancing the reliability and validity of the findings. By relying on multiple data sources, the study could present a well-rounded narrative of Ararat's role in integrating migrant communities and its potential as a model for urban renewal and social inclusion in contemporary cities.

Ararat and Rome

Rome has traditionally been an immigrant city; throughout the entire 20th century, it welcomed a flux of people from southern Italy. In the 1970s, it recorded a growth in immigration from foreign countries mainly from the EU. By 2003, approximately 10% of all foreign residents in Italy lived in Rome. Today, Rome can be considered a departure city, according to Katz's definition: "a specific urban spatiotemporal typology emerging in particular geopolitical contexts of cities located just ahead of fortified and hostile border zones, where stranded migrants reluctantly remain while attempting to continue their journey" (Katz, 2023:2).

Due to the Dublin Regulation, many people are forced to stay in Italy to seek asylum, leading to a very complex and violent situation for those who must seek protection in Rome. The reception system is inadequate, involved in illegal practices, and run by a far-right government

that aims to prevent people from arriving in the country through exclusion, illegalization, and violence. This political situation makes life very difficult for people on the move in Rome. Throughout Italy today, migrants are often treated as intruders and threats to security due to anti-migration policies and political propaganda. Despite the presence of some non-governmental organizations and voluntary religious associations, there are not enough places in Rome that guarantee asylum and protection for refugees. The tragic news about the CPR (Repatriation Detention Centres) of Ponte Galeria in Rome perfectly describes the inhumane conditions that migrants face in the city.

In this complex landscape, a positive reality like Ararat emerges for the Kurdish migrant community. Despite Rome was never a settlement place for Kurds, the Kurdish migration it's relatively young in Italy. Until 1997, the influx of people from Kurdistan trying to reach families in Germany, France, and the Netherlands went almost unnoticed by the institutions. In 1997, the transit of Kurds was quite consistent for the time (4,500 between January and October 1997). The movement from southern regions of Italy towards those countries provoked the enforcement of the Dublin Convention. During this period, the so-called 'Kurdish emergency' erupted. Also, on December 27, 1997, 837 Kurdish refugees disembarked from the cargo boat named Ararat on the Calabrian coast - Ararat took its name from this boat and Mount Ararat, which, along with other mountains in Kurdistan, is considered the only safe place for Kurds, as in the famous novel *No Friends but the Mountain* by the Kurdish writer Behrouz Boochani.

With the arrival of Öcalan (the leader of the Kurdish freedom movement) seeking asylum in Europe and Rome, many Kurds came to the city. After Öcalan was arrested, the Kurds built a small village made of papers called "Cartonia" in Piazza Celio, which was later renamed Piazza Kurdistan. In 1999, with the support of associations, they occupied the building that is now Ararat. Even today, Rome, due to the lack of opportunities (work, housing, services), isn't the place where Kurds decide to settle. Currently, there are around 200 Kurds in Rome; a larger community can be found in the Grosseto area and in the industrial areas between Turin and Milan. The main occupation of Kurds in Rome is in restaurants, mainly kebab places. Despite this, Rome is a transit point in the movement within Italy and abroad; moreover, Ararat is the place where the community, including those from outside Rome, gathers for traditional events. According to Kurds in Rome, Newroz (the annual celebration of the spring equinox meaning freedom and liberation) celebrated in Ararat is the biggest and most beautiful celebration among other celebrations in Europe. Ararat is a relatively small building with an outdoor area. Ararat today serves as the 'cultural home' for Kurds in Italy. Kurds who have just arrived in Italy find shelter, support, and help there, along with Kurds coming from all over Europe who have no place to stay in Rome. It's a place where the community can share food, be together, and be in contact with political movements and cultural traditions.

Ararat in the "City of Arts" context

Testaccio, like many other neighbourhoods in Rome, is undergoing a significant renewal process. Known for being one of the most working-class districts in Rome, today it is undergoing profound change due to the influx of tourists and students. The neighbourhood hosts one of the biggest industrial archaeologies in the city, the ex-Mattatoio (former slaughterhouse) of Rome. It covers 107 square meters and is divided into two main areas: the Campo Boario, an open part consisting of stables for animals, and another section for the actual slaughtering. From an architectural perspective, the composition of the two spaces differs: the first is a vast open space surrounded by buildings, while the second consists of a series of parallel industrial sheds. Today, the entire complex is recognized as an industrial archaeological site and is under the protection of the Soprintendenza, the institution that manages and controls all historic sites in Italy, while the property remains under the Municipality of Rome, which can assign the space with the Soprintendenza's approval.

The complex is situated at the border of the neighbourhood near the Tiber River, the Monte dei Cocci (a small hill made of ancient amphorae thrown away during the Augustan period), and the Aurelian ancient city wall (272 BC – 279 BC).

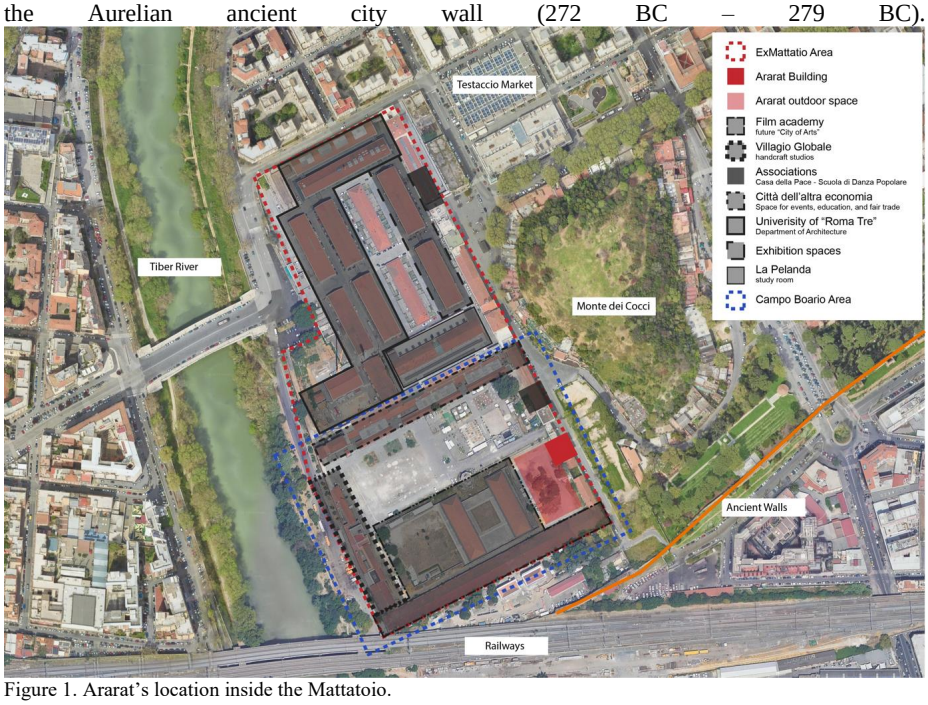

Figure 1. Ararat's location inside the Mattatoio.

Since the Mattatoio ceased operations as a slaughterhouse in 1975, the community has mobilized to prevent its acquisition by private companies. This space was left without any designated use in Rome's city plan until 2000 when the first comprehensive plan to keep the ex-Mattatoio public was presented. The first public institution to occupy the Mattatoio was the University of Roma Tre with its architecture department, followed by the Modern Art Museum of Rome (Macro). While these transformations began in the Mattatoio, a parallel spontaneous use of the space was going on in the Campo Boario side, the area of the complex more hidden from the neighbourhood that allowed various occupations to settle there. The space allowed migrants to find shelter as the issue of hospitality gained prominence in public debate. During the '90s, the Campo Boario was inhabited by different migrant communities, including the Kalderash (a nomad community skilled in working with raw iron), a Senegalese community, and other groups, especially from North Africa. These communities received support from one of Rome's longest-standing occupations in the Mattatoio, Villaggio Globale, which this year celebrates 34 years of activities. Villaggio Globale is one of the oldest occupations in Rome, established in 1990. Since then, it has played a pivotal role in the city's history of manifestations, integration, arts, and underground culture. By organizing events and concerts for cultural integration, it served as a sort of 'keeper' of Campo Boario at the time, according to activists and Municipality representatives.

The socio-cultural centre of Ararat is also situated on the Campo Boario side. In 1999, the building where Ararat stands today was reclaimed and occupied by the association Azad, Stalker, and Villaggio Globale in a collective endeavour. This collaboration marked the beginning of the socio-cultural activities that continue to shape the identity and use of the

Campo Boario area today. That year, the Biennale of Young Artists was taking place on the other side of the Mattatoio. The artist association Stalker was invited to the Biennale, and as a performative act, they decided to reclaim a space for Kurdish migrants who had recently arrived in Rome, within the already multicultural landscape of the Campo Boario. The workshop "From Cartonia to Piazza Kurdistan" saw the participation of architecture students, Kurds, and artists. During this time, they freed and took control of the space, which at the time was occupied by drug dealers and users, at the time the space was dangerous and decaying. Initially, Ararat was a space for Kurds and artists living together until the habitation needs of the Kurds became more crucial. The artists decided to leave the space to the Kurds seeking a place to stay in Rome, but over the years, this legacy and collaboration have remained.

Campo Boario began to change between 2004 and 2007 when the migrants communities were evicted to make space for the opening of the *Città dell'altra Economia* (CAE). CAE was supposed to be a space for the circular economy, grassroots initiatives, and sustainable economy. However, according to several activists and association members, it has lost its primary aim and now hosts events every weekend, such as food fairs and concerts, but has strayed from its initial goal of promoting a circular economy and fair market. Following CAE, the Academy of Arts opened in 2011, spaces for students in two pavilions in the area and built a wall to enclose the space. Today, the Academy is the main actor in the renewal of the Campo Boario, and much of the future of the space will be decided by their interventions. The Municipality's aim is to create the City of Arts, following the example of the *Matadero* in Madrid, an ex-slaughterhouse that became a multidisciplinary space for art creation. This will be implemented with the work of the Academy, the University of Roma Tre, and *Macro* (contemporary museum of Rome). Recently, May 2024, the open space of *La Pelanda* opened, it is a huge multifunctional study room that aims to be an aggregation point for students. Along with the projects that have seen the collaboration of the municipality and institutions and were already programmed, we must add the new projects financed by the PNRR general program *Roma Caput Mundi*. This program includes various projects around the entire metropolitan area, with five of the 335 projects planned just for the Mattatoio. These projects mainly focus on restoration and functionalisation, and one directly affects the space of Ararat – the perimetral walls. What's unclear right now is the destination that these spaces will have once restored. An informal process of participation has already started to ensure the permanence of Ararat in the building. The activists have repeatedly inquired with the Academy and the administration for an official statement on the safety of Ararat, but this hasn't happened yet.

Adding another level of complexity to the process are the requirements of Resolution n104 of the Municipality of Rome, approved in 2015. This resolution stated the total reconfiguration of any autonomously occupied space by associations and organizations situated on municipal property. The resolution suspended all previous concessions that need to apply according to regulations to be reassigned. It also stated that to reapply for the concession of municipal spaces, the occupants must continue to pay rent to maintain the advantage of reapplying. The regulation referred to in the resolution was published only in January 2023, leaving Ararat and many other associations in a state of limbo. In this regard Ararat holds a privileged position since, between 2006 and 2015, they signed an official concession with the administration, and when it wasn't renewed due to Resolution n104, they kept paying rent to not lose any privileged on the space. Moreover, during its 25 years of presence, Ararat has proved to be one of the most recognized and longstanding presences in the Mattatoio and in Rome by municipal members. While the call for assigning the spaces is open to the public, no participatory processes have been initiated to determine the use of the unassigned spaces in the city. An informal dialogue has started since the regulations and projects were presented, but no official communication has been given regarding the stay or eviction.

What's important to take into account along with political activism and its role in the migratory process of the Kurdish community, is that Ararat is the last 'open space' in the Mattatoio. Ararat is open every hour for everyone, maintaining a continuous presence during the day and night, even when there aren't events, recently in collaboration with the architects of *ARCHa* they set-up an open space for study inside Ararat garden always open. Ararat has been able to reclaim its presence in the space forcefully thought activism and collaboration, opening a dialogue with the administration of the city of Rome. Representative were also involved in public events at the anniversary of the centre on May 17-18 2024, to discuss its future and hopefully to reinforce the dialogue in order to find a solution beneficial for both the Ararat community and the Municipality.

Since its opening, the centre has maintained all collaborative solutions with the neighbourhood of Testaccio. Initiatives like "Noialtri Kurdi di Testaccio" in the Mercato Testaccio, a very famous and popular market in the neighbourhood, have strengthened their presence in the area. Additionally, architecture students from Roma Tre, under the Civic Arts program by Professor Francesco Careri, come back to Ararat every year to help set up the manifestation of Newroz (the Kurdish celebration of the spring equinox), which brings together the dispersed Kurdish community living outside Rome. According to Ararat's members, the 2024 event gathered around 3000 people.

To keep the connection with other realities around the city, Ararat often serves food at events as a way to both collect money and spread information about the Kurdish cause, creating points of connection with other freedom struggles and revolutionary forces.

What future for Ararat?

What is certain is that the Ararat centre is far from being a marginalized, closed circuit; it actively engages in collaboration with a broad network within the city of Rome. The work of local activists is crucial for the centre's functioning and success. Since the Kurdish community is not permanently settled in Rome, these activists serve as mediators and custodians of the centre's legacy, facilitating its operations and outreach efforts.

It remains unclear whether an actual participatory process will take place with the Municipality to ensure the continuous presence of Ararat. This uncertainty presents significant challenges, particularly concerning the sustainability of the centre's operations. In all the possibilities presented by the new regulation for Ararat, a compromise must be reached. One major problem they may face is the increase in rent, which could force them to vacate the premises. The regulation outlines several possibilities for Ararat to remain, but the most attractive solution, which would also ensure a high level of autonomy, appears to be finding a collaborative partner. An institution like a university or an academy could serve as a guarantor and help reduce the rent.

Despite the uncertain future of Ararat, the experience of migrants engaging in a process with institutions offers valuable insights. This can help us rethink how we conceive migration in contemporary cities. Migrants are not the problem; they can be the solution. The space of Ararat represents a potential model for the entire Mattatoio renewal, exemplifying the concept of an 'open city' and integration. This is not with a settled community of individuals, but with a community that is continually remade over time by people who stay in Ararat for varying periods, and that make the experience more interesting. During their waiting period for documents (which can sometimes last over a year), these individuals have the opportunity to engage with a thriving environment, connect with their culture, and participate in collective political mobilization. This helps them overcome the marginalization that illegalized migrants systematically face during their stopover process from one city to another. These achievements are largely due to the strong involvement and support of a group of dedicated activists who, for various reasons, find solidarity with the Kurdish community.

Ararat's experience demonstrates that migrants can be integrated into the urban renewal process in meaningful ways. By involving migrants in the planning and decision-making processes, cities can create more inclusive and dynamic urban environments. The ongoing informal dialogue between Ararat, the Academy, and the administration highlights the potential for collaborative solutions that respect the needs and contributions of migrant communities. The future of Ararat, while uncertain, is a testament to the resistance and adaptability of migrant communities. Their ability to form alliances with local institutions and activists underscores the importance of grassroots initiatives in shaping urban policies. As we observe the developments in Ararat, we can learn valuable lessons about the role of migrant communities in urban renewal and the creation of inclusive cities.

Ararat's integration efforts go beyond mere coexistence; they actively contribute to the cultural and social fabric of the city. As underlined by Homi Bhabha in his work *The Location of Culture* (1994), these efforts create spaces where cultural translation occurs, allowing for the negotiation of meanings, the creation of new cultural forms, and the navigation of power dynamics. The Kurdish socio-cultural centre shows that migrant communities, when given the opportunity, can significantly contribute to the vibrancy and inclusivity of urban spaces.

In conclusion, the Ararat centre's journey illustrates the potential of integrating migrant communities into urban renewal projects. Through collaboration with local institutions and activists, migrants can help create more inclusive and dynamic cities. As cities around the world face increasing migration, the lessons learned from Ararat's experience can guide the development of more effective and humane urban policies. The ongoing efforts to secure Ararat's future highlight the importance of participatory processes and the need for flexible, supportive frameworks that recognize the contributions of all community members.

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All-round walkability condition to primary school in Milan

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Abstract (up to 125 words)
As part of the wider debate on social justice and the right to the city, the research addresses the fundamental and everyday issue of accessibility to services, through slow mobility, for the most vulnerable populations, and highlights how certain inequalities take shape in public space. Therefore, an analysis of the accessibility of a specific and prototypical service, primary schools, is proposed in three exemplary cases located in different districts of the city of Milan, studying the accessibility at different scales and for different user profiles (in particular, a comparison was made between vulnerable and able-bodied people).

Keywords
Walkability assessment; profiled pedestrian network; accessibility of primary schools; disabled people; Milan

Main text

Schools' accessibility

The issue of 'access' to the school, or rather of its reachability, has been the subject of much debate. This is not understood from the point of view of criteria and policies enabling student enrolment, but considered in relation to the spatial dimension, and thus assessed as the necessary movement to reach the school complex. This has been addressed for some time and studied in different ways.
The first issue to consider is the ideal distance between home and the service itself. This is a dimension that falls within the sphere of proximity, or even the 15-minute city.

Service proximity

When discussing the proximity of services, it is essential to consider the findings of several major studies that have examined their role. In this paper, we present a hypothesis that attempts to integrate various aspects of planning that may have influenced these concepts.
In the planning of Barcelona, Cerdà had identified the modular structure as the key to composing the relationship between inhabitants and their services[1]. It began with the distribution of services with respect to residential lots and somehow indirectly hypothesised an ideal distance between them. The engineer defined the radius of action for each type of service (including green spaces) across the entire city, and then defined the corresponding catchment area, starting from the minimum unit of the city, i.e. the neighbourhood[2]. For example, the plan was to have at least one school in each neighbourhood. Since the second half of the 19th century, there have been other experiments that have refined the concept. However, we can already

[1] In Italy, the relationship between inhabitants and their services was established by urban standards. They were defined with Law 1444/68, through an ideal ratio of square meters of services, divided by type, per inhabitant.
[2] In his design, the city was structured with an orthogonal grid divided by a few large infrastructural axes. The structure included square-shaped blocks with rounded corners, with a side length of 113 meters. In its logic, a neighbourhood consisted of 25 blocks.

identify a precursor of what is known today as the 15-minute city in Carlos Moreno's theory in this hypothesis. The theory rethought planning by focusing on the proximity relationship between home and services. This was done to improve quality of life and reduce environmental impacts, with an increase in cycling and walking. From this core concept, various theories of chrono-urbanism developed.

School

Among the fundamental services to be considered in the conceptual field of proximity is schooling. The school plays a role in our lives at different stages, from the early years as students to adulthood as a waiting place for children/grandchildren, and also as the hub of a community of citizens that is structured around the school building object. The school has evolved into a hub for community interaction, serving as a gathering point for parents and neighbourhood residents of all ages. This is due in part to the introduction of extracurricular activities. It should be noted that this is not a uniform phenomenon across all schools. However, the introduction of non-educational activities, in the extracurricular time, is already having a significant impact on the role of schools, even if it is not yet at the same level as in the open schools network in Rome, where schools are becoming true civic centres with the community at the centre as the in the Di Donato primary school.

In light of the above, this contribution, the result of a master's thesis, addresses the issue of walkability conditions in the city of Milan, intending to understand them in the most inclusive sense possible. It considers the role of school routes in offering opportunities to the city's population.

In Italy, two fundamental regulations concerning schools and their relationship with the built-up area must be considered when contextualising the relationship between home and school.

Until the 1990s, the obligation to attend a specific school (usually corresponds with the nearest school) according to address of residence was in place, in line with the division of the territory into catchment areas. The definition of catchment areas, as areas of redistribution of inhabitants between the different school centres, resulted in the direct relationship between parts of the city and neighbouring educational institutions. The abolition of catchment areas allowed students to choose their preferred school. In addition, the introduction of school autonomy (law 59/1997 and D.P.R 275/1999) led to the delegation of criteria for accepting student applications to school boards and gave schools the opportunity to customise their educational offerings. This also created a system of competition between individual educational institutions. (Pacchi, Ranci, 2017)

In 1962, with the implementation of Law No. 1895, middle school became part of the compulsory education system. To meet the increased demand for space and classrooms, new schools were constructed in urban areas. At the same time, the most significant internal migration was occurring, with people moving from southern regions to northern Italy and to cities. This migration resulted in an immediate need for new housing. To meet these demands, new neighbourhoods were often constructed, often autonomous or self-sufficient, in which the educational service was also present. In other words, neighbourhoods were planned in a unified manner, not only providing new residential volumes but also different kind of services within the new neighbourhoods (educational, religious, commercial, etc).

Finally, in 1975, Decree Law 18 established the optimal location of schools in relation to their context, defining the ideal distance and maximum time to be used to reach the school according to different modes of transport. The regulation stipulated that the maximum distance to be covered on foot to reach primary schools was 500 metres, while the maximum distance for secondary schools was 1,000 metres. In the case of public transport, the times were approximated to a maximum of 15 minutes and 30 minutes respectively.

It is evident that these values are indicative of an optimal condition and not representative of reality. Therefore, it would be prudent to consider additional dimensions for assessing spatial dimensions and distances of access to school. As school choice is more freely available, it cannot be assumed that enrollees are resident only within the catchment area, let alone within 500 metres. Therefore, it is necessary to consider a proximity dimension that can be evaluated in relation to the time required to reach the service. The isochrones of 5, 10 and 15 minutes, respectively, should be considered with different modes of travel depending on the school grade in question, as this provides further support to the argument. It can be reasonably assumed that students in lower grade schools (kindergarten and primary) are more likely to walk to school than those in higher grade schools. Nevertheless, there are numerous instances in which the selection of an educational institution is influenced by factors such as familial convenience, often determined by the parents' commuting route, or other considerations related to the specific type of school, such as private institutions or other factors. This can result in children not attending schools that are geographically closer to their residences. In addition, at middle and secondary level, the increasing autonomy of students contributes to the choice (especially at the high school level) of schools further away from their homes and consequently the mode of travel may be by bicycle, public transport or private car.

Walkability

With regard to the issue of walkability, a number of proposals and forms of analysis have been put forward. One can discern a number of components that are more objectifiable, relating to the design of the space and the degree of effectiveness or efficiency with respect to the type of uses for which it is intended. In contrast, there are other components that are more subjective, strongly linked to individual experience. It is evident that both dimensions must be considered when analysing walkability. The objective components encompass all aspects pertinent to the design of the street section, which facilitates the use of the space by the widest possible range of users and citizens. Additionally, they include aspects related to the context, such as the elements facing the latter, not only in relation to the function they host but also to the design of the façades, among other considerations.

One challenge is determining which elements are to be assessed in the field of walkability and which can be quantified. It is also necessary to determine which of these aspects contribute to making a street ‘walkable’. This should be done not only to facilitate the route, but also to favour an all-round, wider and more comfortable use, thus mobilising and arranging the elements that potentially make a street lively, comfortable, safe and so on. In this context, the assessment of walkability is a complex issue that requires the development of a variety of measuring instruments. Furthermore, to consider the various aspects listed above, it is necessary to move from a broader scale of analysis to a micro-level scale, which allows all the components involved to be considered. (Boyce 2010, Blečić et al 2015)

The objective of this research was to assess walkability within the Milanese urban context, with particular emphasis on the objective component. The aim was to verify its usability by all, starting from an analysis of the conditions of the street space object and its characteristics.

It is clear that this is only one of the aspects that could be investigated when talking about walkability. However, it is important to evaluate how this infrastructure performs in terms of the most relevant aspects of movement, which must allow a plurality of people to move from one point to another in the city or territory. In this context, we will focus on aspects of street space use that are easy, comfortable and accessible. We will exclude contextual elements that allow the space to be inhabited, as well as those that only allow it to be used.

In this sense, when designed from the perspective of universal design, the street object represents an instrument of inclusion, or rather a potential instrument of integration, in several respects. If its use is guaranteed for all, the pedestrian space represents an area in which real

social inclusion can be established. In fact, it's the infrastructure on which various positive practices (such as the possibility of physical activity or community building) are based, but above all, it is the infrastructure that accommodates the most democratic and inclusive - theoretically within everyone's reach - and at the same time sustainable mode of transport: walking. For this to be feasible, however, it is necessary to ensure that the space is designed in such a way that people with different disabilities can enjoy the public space independently, without having to rely on other people. It can therefore be said that the design of the space is fundamental and necessary, but not sufficient for true inclusion, which only occurs under certain conditions. (Azzolino Lacirignola, 2011 and Conti, Garofalo, 2013)
In this study, the term 'walkability' is used to refer to a broad concept that encompasses the design structure of the space in order to ensure that it can be used by all, safely and comfortably. However, it also extends to certain contextual conditions such as the attractiveness and vitality of spaces, which depend not only on the conformation of the road infrastructure but also on what is around it.

All-round walkability in Milan
In light of the above, the Milan survey proposes an analysis that addresses walkability in relation to the school service and approach routes. It also examines all those aspects of space design that represent limitations to use by all users, with a focus on those with disabilities or the most fragile populations. We therefore adopted the perspective of universal and inclusive design, and then deepened the study, taking the same phenomenon to a finer scale.
Although a limited view of the phenomenon has been adopted (ignoring the context with regard to the attractiveness and vitality of spaces) and an attempt has been made to define the relationship with neighbouring services solely on the basis of pedestrian accessibility, it is possible and useful to identify those elements that may represent problematic elements in the movements of persons with disabilities, based on the data available at the various scales. For instance, the presence of accessible crossings, wide pedestrian paths, and signage for users with sensory disabilities are examples of elements that may require attention.
The municipal level analysis was represented by the construction of a walkability graph, weighted on a number of factors. This was done in the wake of the evaluation of the IAPI indicator developed by Pucci, Lanza and Carboni within the research EXTRA - Experimenting with City Streets to Transform Urban Mobility. This aimed to improve accessibility through forms of active mobility. The initial investigation within this evaluation focused on the elaboration and evaluation of walkability according to different indicators. Some indicators were related to the technical performance of routes, while others were related to the relationship with vehicular spaces (number of lanes, limited traffic zones).

A new and distinct version of the analysis model is proposed here, which focuses solely on the characteristics of pedestrian spaces. The list of factors taken into consideration has been modified and implemented with new parameters characterising the space, with the objective of enhancing usability and sharing for all. In addition to evaluating certain aspects of the space that are important in the walkability of able-bodied people, such as width, lighting, the presence of trees, etc., other fundamental elements for use by disabled users were identified from the literature and interviews conducted with experts who deal with disabilities. For instance, the presence of steps at crossings, the width of pavements, their paving, the existence of posts or vertical signs that can reduce the useful width, whether they are positioned in a central location, and so on.
It was therefore decided that the walkability of the area should be assessed in two different ways: for those who are able-bodied and for those who have mobility difficulties.

Two user profiles were therefore selected for assessment: the able-bodied and the mobility-impaired. The following table (Table 1) highlights the selected factors, including those that were included precisely to recognise accessible routes. Each indicator is assigned a value, which is either positive or negative. This reflects the relative ease or difficulty of the route compared to others. The values were selected from certain ranges or from the selection of certain performances considered to be good or average. For example, as far as the width of pavements is concerned, the reference value indicated is 2 metres, a value that greatly increases the quality of the space. This is a value that can be used by two disabled people at the same time. With regard to street furniture and orientation for people with disabilities (such as street lamps and trees), their presence or absence was simply recorded. However, account was taken of the different relevance of the conditions highlighted during the interviews or deduced from scientific texts. For example, the obstacle constituted by steps as opposed to ramps is a more relevant element than the presence of trees or road markings.
In each arc of the graph, a different value, between 0 and 1, was associated with each indicator: low the value, higher the impact on our experience of walking. If the indicator did not affect the conditions of the space, the value assigned was 1. Once all 11 elements considered had been evaluated[3], the average of the indicators was multiplied by a different average speed, depending on the profiles evaluated. The average speed used for the first profile (able-bodied) was around 3 km/h, while with reference to frail or disabled users, a speed of 2 km/h was chosen. The values selected were derived from existing literature, which typically exhibits somewhat elevated values (around 4 km/h for walking). Additionally, the necessity to halt and recuperate or to terminate at an intersection was also considered.

[3] The values chosen were derived from some information in the literature and then verified empirically through some interviews. A calibration of the impedance factor on the basis of user preferences would have been important and would have added more detail to the survey. In the IAPI index, for example, these values are determined from information provided by the residents themselves, for different profiles, through a questionnaire. In addition to the greater relevance of the data to the conditions and habits of the inhabitants, this information can be read in different contexts. In fact, if one imagines that the same questionnaire is proposed to different neighbourhoods in cities with different orography and morphology, it will be possible to identify variations in values depending on the context. Think trivially of the slope data in cities near headlands, or the difference in the assessment of certain obstacles (such as the high presence of bicycles leaning against the wall in some cities).

Urban elements	Indicator	Explanation	Source	Impedance factor - profile 1	Impedance factor - profile 2
Quality and performance of pedestrian path	Width of the sidewalk	The width of the sidewalk affects the walkability of spaces, particularly if it is less than 2 meters	DBT Milano Municipality	0,25	0,25
	Sidewalk material	The type of pedestrian path material (asphalt, cobblestone) affects the ease and continuity of walking	OSM	0,5	0,5
	Absence of trees	The presence of trees can be an element that brings environmental comfort	DBT Milano Municipality	0,5	0,5
	Absence of lighting systems / streetlights	The absence of lighting may affect the perception of safety.	DBT Milano Municipality	0,5	0,5
	Presence of tunnels or bridges	The presence of tunnels or bridges represent elements of potential insecurity and obstacles	OSM	0,25	0,25
	Presence of steps	The presence of stairs or steps makes movement more difficult and is a potential obstacle	OSM	0,25	0,25
Impact of the road	Hierarchy of the road	Roads with increased traffic may represent an element of discomfort	OSM	0,5	0,5
Quality and performance of path	Presence of dehor on sidewalk with width less than 4 meters	Dehors that occupy sidewalks less than 4 meters wide make the usable width of the sidewalks less than a comfortable condition.	DBT Milano Municipality and open data municipality	1	0,25
Zebra crossing	Absence of regulatory systems for crossings	The absence of regulation systems at intersections could be a reason for unsafe conditions.	OSM*	1	0,5
	Absence of ramps (kerb)	The absence of ramps could be such an obstacle as to make it impossible to use the pathway	OSM*	1	0,25
	Absence of podactyl systems	The absence of podiatric systems could be such an obstacle as to make it impossible to use the pathway	OSM*	1	0,25
	Absence of vibration systems	The absence of vibration systems could be such an obstacle as to make it impossible to use the pathway	OSM*	1	0,25

Table 1 - Indicators of walkability and related impedance factors. Highlighted in blue are the most important indicators for assessing walkability conditions for people with disabilities, the elderly, care givers, etc.
Source: author

Alongside the analysis of walkability for frail persons, the investigation of the quality of the space for a hypothetical normally able-bodied user was carried out, thus considering a generic

user with no particular needs. In this case some of the information previously evaluated, i.e. those describing performance qualities that make the use of the pedestrian space more pleasant, but do not condition its use, have assumed different weights depending on the relevance of the factors for the users considered. For example, the presence of a ramp for a person without motor or sensory difficulties is as indifferent or as relevant a factor as the width of pavements or the presence of trees providing shade. Certainly this image is reductive from the perspective of inclusive design, but it is important in order to have a term of comparison in relation to the state of the art and a touchstone for comparing the two profiles.

This hypothesis does not consider the subjective preferences of inhabitants with different needs who live in the city. This aspect is fundamental and should be juxtaposed with the objective conditions of space (density of obstacles), since inhabitants with different needs and in different territories perceive the same elements differently. For example, one factor that could not be considered in this study concerns the continuity of natural guides (walls) for people with visual impairments.

However, it is important to point out that certain circumstances that are common to all cities, such as the presence of lamp-posts and other obstructions, can be accompanied by other elements - just think of the bicycles that lean against walls in many cities in Emilia - which can become obstacles of a certain weight. Or, to take another example, the presence of cobblestones in a city like Milan, where the pavement outside the historic centre is almost entirely asphalt, is secondary to other obstacles. Narrow pavements or pavements without ramps at the ends make walking difficult.
The assessment of walkability according to these parameters allows us to study its possibile usability, at least in terms of the design aspects of the space, for the entire population. This could therefore be a useful tool for the municipality in order to identify priorities for intervention in public space, starting from a study of the physical conditions of pedestrian areas, which could be flanked by other levels of analysis (taking into account subjective perception, level of accessibility and some socio-demographic evalutation). It is also important to consider the needs of vulnerable groups, including people with disabilities, older people living alone, and those with income issues. Indeed, it is crucial to assess accessibility and accessibility to different services, including transportation and the buildings themselves. This is particularly important when identifying clusters of services for different populations.

Walkability toward primary schools
This analysis yielded an initial general cognitive picture of the walkability condition within the Milanese municipal territory. Based on this overall picture of the city of Milan, it was decided to focus on a specific service and study its walkability in the traditional 5, 10 and 15 minutes for one and the other user profile (figure 1 and figure 2), taking into account the characteristics of the pedestrian space. All public primary schools in the territory of the municipality of Milan were therefore examined.
A visual analysis allows us to identify the most problematic areas of the city. The resulting graph is therefore no longer 'neutral', as it is marked by the parameters selected above. Instead, it can be considered a weighted graph, in which catchment areas are considerably reduced. Put another way, a comparison between the isochrones developed on a clean graph and those calculated on the weighted graph shows a clear shrinkage in the size of the different isochrones, which are a reflection of the numerical data (walkable metres). As Pileri (2023) notes in his essay, echoing Socco's insight, the ‘small pervasive problems’ that arise in cities become more widespread over time, conditioning those who live in them from an early age. For this reason, it is crucial to consider the safety and quality of the routes people take from an early age, as

well as the construction of an imaginary of the city's spaces, which makes the inhabitants aware of the criticalities and opportunities it offers. Additionally, this approach aims to enhance the liveability of the locations frequented by the public.
It should not be concealed at this point that, although it was essential to obtain a snapshot on an urban scale of the current condition of walkability (also in order to provide a tool to be included in that list of toolkits that the administration uses to decide where to intervene), this is not sufficient to describe the public space in an exhaustive form.

Figure 1 illustrates the accessibility of primary schools in terms of the time required to reach the service. From the images, it is evident that profiles with varying needs, in terms of speed of travel and factors to be considered in the practice of walking, result in a more or less limited ability to reach a certain number of spaces. It can be reasonably concluded that the primary factor is the variation in walking speed. However, the reduction in catchment area is more pronounced due to the multitude of variables that must be taken into account.
Furthermore, the image illustrates the significant variation in the size of the isochrones across municipal boundaries. In the outermost contexts, the catchment areas are reduced due to either lower population density or the presence of substantial physical barriers, such as transportation infrastructure or significant green spaces.

In fact, it should be pointed out that the data available on a municipal scale are only partly representative of urban mobility conditions. It would be beneficial to conduct further research through the implementation of targeted surveys at the municipal level. This could involve integrating data on population density and the vitality of contexts, among other factors. Additionally, some aspects may only be discernible through field studies, which could serve to enhance the accuracy and reliability of the research.

And in order to test this more concrete perspective, a finer-grained survey was juxtaposed to the large-scale analysis, which also involved the redesigning of a number of pedestrian routes approaching a service, within a radius of 500m, routes selected from the assessments of catchment areas.

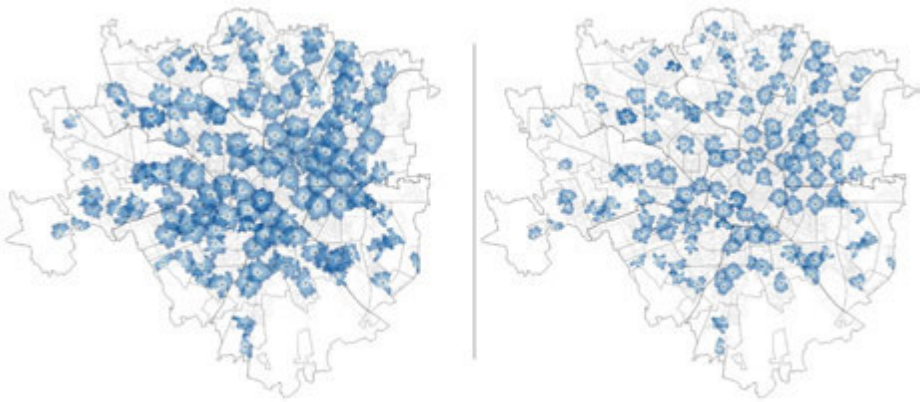

Figure 1 - The catchment areas were delineated at five, 10, and 15 minutes from the school, within walking distance for an average speed for the two profiles: the left profile represents an able-bodied individual and the right profile represents a profile with a fragile constitution. The first profile is

evaluated at a speed of 3 km/h, weighed against the conditions of walkability on the left. The second profile is evaluated at a speed of 2 km/h, weighed against the conditions of walkability from the access of primary schools on the right. The different shades of blue indicate the different thresholds of the walking isochrones: light blue 5 min, light blue 10 min, dark blue 15 min.
Source: author

Precisely in view of these conclusions and the important role that schools play, and could play in the future, with more flexible opening hours and increased activities aimed at the closer community (e.g. hosting services 'scattered' around the city), it was decided to focus on the presidia of education, particularly primary schools.
In order to sample varied and exemplary situations, three schools located in very different contexts were chosen; and three stretches of approximately 500 metres were obtained (by redesigning the public space, figure 2), the ideal average distance to travel to school from home or back. This operation made it possible to lay bare the limits of the analysis at an urban scale, due to the lack of detailed data, but also to highlight the presence of certain customs that are difficult to map, since they vary over the course of the day or in the short to medium term. Through redesigning, in fact, it was possible to record the presence of obstacles not highlighted at the urban scale. To give just a few examples, the placement of vertical signs, positioned in such a way as to make it difficult to pass, the existence of arches at driveways, but also the presence of street furniture placed in the pedestrian context by nearby businesses (figure 2).
This type of investigation, carried out at different times of the day, makes it possible both to witness social practices taking place in public spaces, and to record illicit uses of the pedestrian environment, linked to the illegal parking of cars on pavements, green spaces or pedestrian crossings, as well as the high use of outdoor areas at certain times of the day. These are all situations that make passing very difficult.
Finally, it should be considered that - as Pileri also discloses - a careful examination of this type makes it possible to study the frequency of appearance of obstacles or crossings encountered, and to identify their average value (Pileri, 2023) From these measurements, it is in fact possible to identify every how many metres the attention threshold must be activated to dodge an obstacle or to cross a road. The greater the distance, the better the perception of the space that the user will be able to enjoy in its continuity, in various activities and dimensions (chatting with friends, observing the landscape, etc.); if, on the other hand, this were very low, the enjoyment would be partial.
This line of reasoning, applied by Pileri to home-school routes, identifying critical points in children's walkability, can also be developed in relation to people with disabilities and highlight conditions that make walking fatiguing and frustrating (Pileri, 2023). If on an urban scale one can therefore measure the density of obstacles along an arc of a route, but without having information on their concentration, moving to the micro level one can perceive the weight of certain objective conditions: when walking through a certain space one is preoccupied by its conditions, to the detriment of other actions that the user could or would like to carry out at the same time (chatting, calling, etc.) and that could be disturbed or impeded.
In the case of schools, the elaboration carried out on a municipal scale, by means of isochrones, on the reachability of schools, could or, better, should be coupled with the consideration of other data (the number of students present in the school, the coexistence of several schools or other services in the same lots, the effects of interventions already carried out on the public space), and in this way one could better define the routes on which to intervene as a priority.

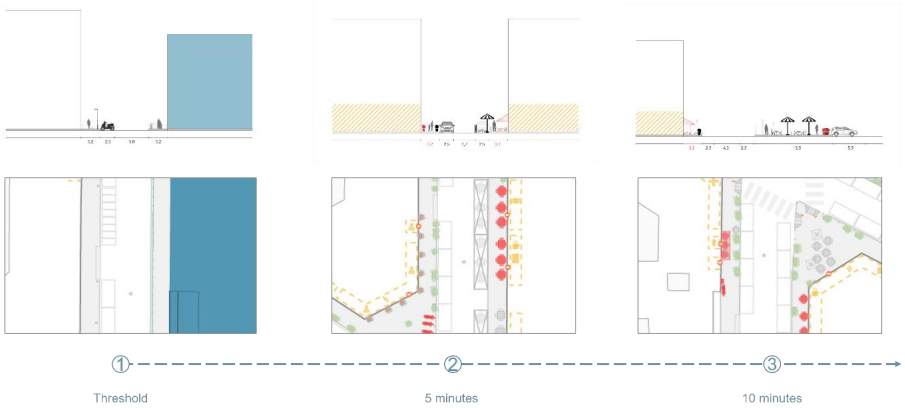

Figure 2 - Analysis of pedestrian conditions in the 500-metre approach, in an example case, the Stoppani primary school. All obstacles that can be seen along the route and that are not registered on the municipal scale are marked in red.

What's next

This type of research, which is increasingly being carried out on several user profiles, see the STEP UP project - Walkability for Women in Milan, is becoming an important resource for guiding interventions in public spaces. Indeed, depending on the profile and the service in question, they make it possible to assess its accessibility and also to identify, by theme, the spaces on which to intervene. One could also hypothesise the juxtaposition of this information with others related to the conditions of the service, the internal and relevant spaces of the latter, as well as others. Imagine, for example, in the case of schools, intervening in those contexts where the school has few spaces dedicated to the courtyard, restoring some of them by working on the threshold spaces. However, if these are mainly spatial aspects, there are other equally important aspects that could be taken into account. As explained by Paola Savoldi (2024), when choosing where to intervene from the point of view of proximity and spatial justice, it is also right to take into account other information, such as the socio-demographic conditions of the context or of the school's own users.

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Innovative Tools For Building Child-Friendly Communities: The Development And Application Of Child-Friendly Neighbourhood (CFN) Built Environment Audit Tools, Insights From Shanghai

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Abstract
Neighbourhood environment is an important carrier of children's daily activities, but traditional urban planning and design often ignore the impact of micro-scale built environment on children's environmental perception. In the central urban area of Shanghai, which is characterised by high-density human settlements, integrating child-friendly concepts to carry out community renewal requires more consideration of the actual basis and renewal results. This study innovatively developed a "Child-Friendly Neighbourhood (CFN) Built Environment Audit Tools" that can systematically evaluate the micro-spatial elements in the three types of spaces within the 5-10 minute living circle of the community, including community streets, outdoor public spaces, and residential environments, to finely identify community space problems and help formulate special renewal plans for child-friendly communities.

Keywords
Child-friendly, Child-friendly Neighborhood, Built environment audit, Micro-scale

1.Introduction

In order to protect children's vulnerability in the built environment, the United Nations Children's Fund (UNICEF) and the United Nations Human Settlements Program (UN-Habitat) jointly launched the "Child-Friendly Cities Initiative (CFCI)". The initiative points out that the level of children's welfare protection is the ultimate indicator of healthy settlements, democratic society and good governance. In China, child-friendly cities and community construction have also become increasingly hot topics. In 2021, China's "14th Five-Year Plan" clearly proposed to comprehensively promote the concept of child-friendly in-depth urban planning and build 100 child-friendly cities. At present, the focus of China's urban planning work has shifted from incremental construction to stock renewal, focusing more on the optimal allocation of spatial resources and the improvement of residents' quality of life.

In the context of urban renewal, it is very important to carry out the practice of child-friendly environment construction, especially the community built environment at the community scale. The quality and spatial characteristics of the community built environment are most closely related to children's daily activities and environmental perception, and are also the last link that has been ignored by planning and design for a long time. At present, there is little systematic problem diagnosis and practical guidance in the construction of child-friendly urban spaces in China at the micro-scale, especially in the design of community spaces at the human scale.
The insecurity of children's travel, lack of physical activities, and reduction of games and social activities involve many built environment elements in various spaces such as streets, public spaces, and comprehensive environments in the community, especially the built environment elements at the meso-micro scale.

Therefore, the significance of this study is to fill the gap in the identification and definition of micro elements at the human scale in the community from a child-friendly perspective in the context of high-density human settlements. This study aims to structurally determine which built environment elements should be identified and evaluated as components of child-friendly

community environments based on the existing research and practical experience of international child-friendly community environments and the local practices of typical communities in Shanghai. The research results are the development of technical tools that can comprehensively and concisely identify the built environment elements (especially the meso-micro scale) issues that are most closely related to children in the community. The improvement and enhancement of this part of the built environment can bring more tangible sense of gain to children. Through structured evaluation and diagnostic tools, the community can systematically sort out the numerous built environment problems from a child-friendly perspective. At the same time, it helps communities make renewal decisions under conditions of limited funding and space resources. In areas where professional forces are scarce, universal decision-making basis will help local and grassroots community practices and even the long-term tracking and supervision of the effectiveness of built environment renewal.

2.Method

2.1. Methodological framework

The main research steps of this study are as follows:

(1) Structural definition of built environment elements of child-friendly communities, determine which built environment elements at the micro-scale are closely related to the quality of children's living and should be identified and reviewed as elements of child-friendly community environment.

(2) Based on the review of domestic and foreign child-friendly environment research and practical experience, develop Child-Friendly Neighbourhood (CFN) Built Environment Audit Tools that can structure and systematically identify problems of built environment elements at the micro-scale (human scale) and support community child-friendly renewal decisions in a refined and concise manner.

(3) Based on the local practice of Jiangpu Road Street, Yangpu District, Shanghai, the child-friendly community built environment audit tool is applied to conduct community built environment audits from a child-friendly perspective. With the context of Shanghai's high-density human settlement environment as the background, the shortcomings of existing community built environment elements at the human scale are analyzed, and spatial problems are diagnosed and warned. Then, planning intervention tools are provided to customize corresponding spatial decisions and support the implementation of child-friendly concepts at the community level.

2.2 Development of the CFN Tools

2.2.1 Assessment Principles and Subjects

What kind of community environment should be created for children to meet the specific needs of children is the first question that CFN responds to. Through a review of the characteristics and practice focus of child-friendly environments at home and abroad, it can be seen that the rights of children to health, nutrition, education, child protection, social inclusion, water, sanitation and personal hygiene proposed by UNICEF in the Child-Friendly Cities Initiative (1996) correspond to the five child-friendly environmental interest frameworks of "health, safety, citizenship, environment and prosperity" proposed in the Handbook on Building Child-Friendly Cities and Communities (2017) and the Handbook on Child-Friendly City Planning (2018). Combined with the elaboration of the goals of child-friendly city construction in China's "14th Five-Year Plan Outline", the guiding ideology and basic principles of child-friendly cities clearly put forward in the "Guiding Opinions on Promoting Child-Friendly City Fitness" issued by 23 departments including the National Development and Reform Commission, it is

concluded that "safety, health and inclusion" are the characteristics of international child-friendly environment consensus (Figure 2.1).

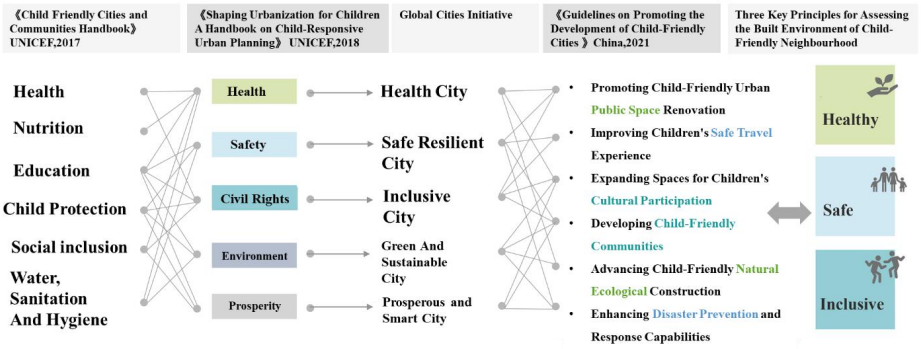


Figure 2.1

Therefore, based on the characteristics of international child-friendly environment consensus, this study proposes three principles for conducting child-friendly built environment assessment at the community level: (1) Safety principle: child-friendly environment can indicate various potential risks and provide children with material space elements and social supervision to ensure safety; (2) Health principle: reduce children's exposure to dangerous environments and provide children with environmental facilities to increase physical activities and participate in social life; (3) Inclusive principle: provide children with diverse services, fully respond to children's behavioral characteristics and activity needs at different ages, respect children's aesthetics and preferences, and create a spatial environment of appropriate scale, pleasant and comfortable for children.

The "Child-Friendly Community Built Environment Assessment Tool" (CFN Assessment Tool) proposed in this study is applied at the community level, with a special focus on the built environment within a 5-10 minute walking circle for children. In terms of assessment objects, it covers community streets and sections in areas frequently visited by children, outdoor public spaces, and residential environments in areas familiar to children. By stacking the three levels of community streets and sections, outdoor public spaces, and residential environments, the built environment elements within a 5-10 minute walking circle for children are comprehensively assessed from a child-friendly perspective. The construction system is shown in Figure 2.2, where community streets and sections are spaces where children's various travel activities take place. Outdoor activity spaces are places where children's recreational activities take place with certain spatial limitations, site designs, or activity facilities. Residential environment refers to the familiar area of children near their homes, usually within 100-200 meters of their homes, and no more than 300-400 meters (about 5 minutes for children to walk). In this study, residential area is a relative concept, referring to the environment composed of residential groups and surrounding environments that are similar in location or administrative affiliation to the residence of the child's family, and is physically or non-physically distinguished from the relatively complex external community environment.

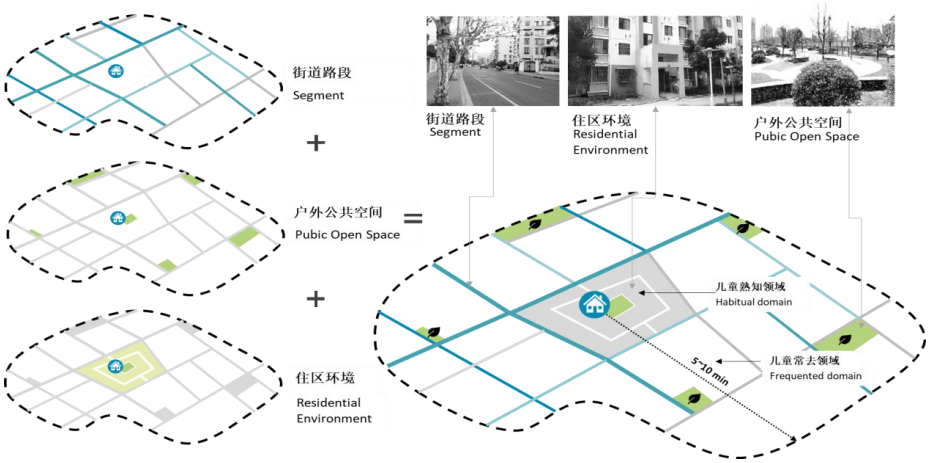


Figure 2.2

2.2.2 Review of Built Environment Audit Elements for Child-Friendly Neighbourhood Streets

In the field of child-friendly practice and research, this study selected the most representative policies and action plans of various countries, relevant design guidelines of international organizations, existing street built environment assessment tools and relevant policies and standards in my country for horizontal disassembly and comparison. It includes action plans and relevant policies related to child-friendly streets in different regions of eight countries, including Quebec, Canada, the United States, the Netherlands, and Australia, where in-depth practices have been carried out in the field of child-friendly; six design guidelines and guidelines related to streets from influential international organizations in the field of child-friendly: UNICEF, Bernard Foundation (BvLF), etc.; three street built environment assessment scales used in academic research and community practice; and five relevant guidelines and design standards issued by authoritative departments in China. Through disassembly and analysis, it is clear which street built environment elements are closely related to and cannot be ignored from the perspective of child-friendly, especially identifying the micro-elements that are easier to be improved in the context of stock renewal at the community human scale, so as to construct the evaluation content of child-friendly streets. The focus of child-friendly streets and traffic environments in terms of child safety, health and inclusion is sorted out. The complete scale is divided into 7 assessment dimensions and 17 assessment items, involving a total of 58 micro-built environment elements (Table 2.1). At the safety level, the focus is mainly on the stability of the motor traffic environment, providing a safe environment for children to walk and ride, ensuring the safety of children crossing the street, ensuring the safety of street ancillary facilities and barrier-free facilities, and providing street supervision and defense support for children's travel. At the health level, it includes providing children with clean and green street spaces, supporting and promoting children's walking, riding and other physical activities. At the inclusion level, it provides children with diversified and shared public services while ensuring the convenience of special services. Provide children with a comfortable and barrier-free environment for travel and the beauty and attractiveness of the street interface.

2.2.3 Review of Built Environment Audit Elements for Outdoor Public Spaces in Child-Friendly Neighbourhoods

The elements of this part of the scale are derived from action plans and related policies related to children's playgrounds and outdoor public spaces in different regions of seven countries,

including the United Kingdom, Wales, the Netherlands, Japan, and Australia, where in-depth practices have been carried out in the design of children's playgrounds and outdoor public spaces; and six design guidelines and guidelines issued by influential international organizations in the field of child-friendly design, such as UNICEF and the Play England Group. The complete scale is divided into 9 evaluation dimensions, involving a total of 30 micro-built environment elements. In terms of children's safety, it mainly involves three aspects: the surrounding environment safety of children's activity space, the safety of activity facilities, and the safety of landscape design. At the level of health principle, it mainly focuses on the potential of outdoor public space to promote the healthy growth of children, focusing on the support of outdoor activity venues for children's games, sports and other leisure physical activities, and the promotion and support of walking and cycling activities. At the level of inclusive principle, it mainly evaluates the comfort of outdoor activity space design for children, the diversified and convenient services, the slow accessibility of space and the attractiveness of design.

2.2.4 Review of Built Environment Audit Elements for Child-Friendly Neighbourhoods Residential Areas

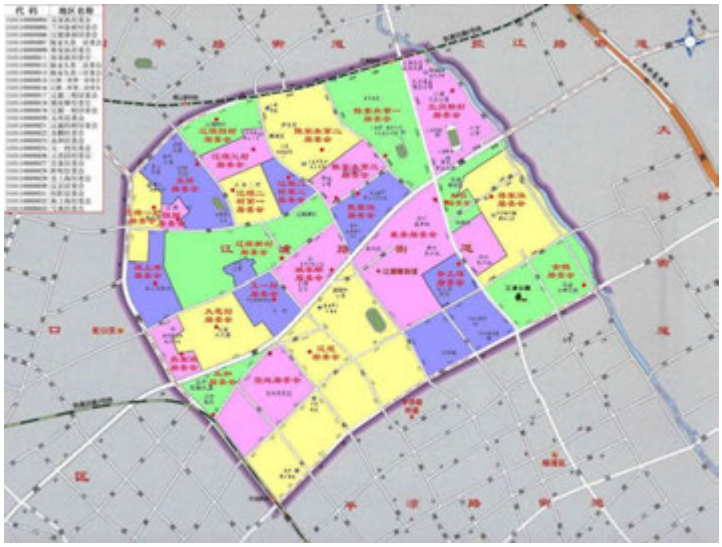
Through the analysis of domestic and foreign experience, it is found that residential areas are familiar areas for children's daily activities, and the built environment elements involved cover both transportation space and recreational space. Therefore, the unit of the CFN tool review and statistics in this study is the residential environment, but the specific objects of the outdoor space reviewed can be divided into sections between residential buildings, outdoor public spaces in residential areas and comprehensive levels of residential areas according to the nature of activities supported by the built environment elements. The specific evaluation elements are composed of these three parts. The complete scale is divided into 7 evaluation dimensions and 18 evaluation items, involving a total of 55 micro-built environment elements. The assessment is conducted from the perspective of child safety, involving aspects such as traffic safety between residential buildings and children's travel safety between residential buildings. The traffic safety between residential buildings is examined from three dimensions: traffic organization between motor residential buildings, motor traffic stability and parking facilities. The travel safety between residential buildings is examined from three dimensions: walking and cycling organization, children's travel guide sign setting and residential safety facilities setting. The assessment is conducted from the perspective of child health, involving aspects such as space support for children's physical activities and facilities support for children's physical activities. The spatial support capacity of children's physical activity venues is examined from four dimensions: venue selection, functional zoning, venue design and landscape aesthetics. The facility support capacity of children's physical activity venues is examined from three dimensions: safety facility setting, activity facility setting and service facility setting. The assessment is conducted from the perspective of child inclusion, involving aspects such as the diversity and convenience of public services, the comfort of children's travel environment and the attractiveness of the environment. The convenience of public services in residential areas is examined from the configuration of children's life services and education services. The comfort of children's travel environment is examined from the comfort of walking and cycling roads and facilities. The attractiveness of residential environments for children's activities is examined from three dimensions: green space landscape between residential buildings, public art and architectural interfaces between residential buildings.

Table 2.1

	Neighbourhood Street Segments	***Neighbourhood Public Open Space***	***Residential Area Environmental***
A01 Safe	B01 Safety of Travel Spaces	B01 Safety of Surrounding Environment	B01: Safety of Traffic Systems Between Residential Buildings
	B02 Safety of Auxiliary Facilities	B02 Safety of Activity Facilities	B02: Child Travel Safety Between Residential Buildings
		B03 Safety of Landscape Design	
A02 Healthy	B03 Physical Environment for Promoting Children's Health	B04 Support for Recreational Physical Activities Space	B03: Support for Children's Physical Activity Spaces
	B04 Social Activity Environment for Promoting Children's Health	B05 Support for Recreational Physical Activity Facilities	B04: Support for Children's Physical Activity Facilities
A03 Inclusive	B05 Diversity in Public Services	B06 Accessibility for Children's Active Travel	B05: Diversity in Public Services
	B06 Comfort of Travel	B07 Comfort of Site Design	B06: Comfort Between Residential Buildings
	B07 Attractiveness of the Environment	B08 Convenience of Service Facilities	B07: Environmental Attractiveness
		B09 Attractiveness of Space Design	

2.3 Application Practice of the CFN Tools

In order to test the applicability of the built environment assessment tool for child-friendly communities, the author conducted a built environment assessment of child-friendly communities in Jiangpu Road, Yangpu District, Shanghai. Jiangpu Road is located in the southwest of Yangpu District, Shanghai, from Lanzhou River to Kongjiang Road in the east, and from Dalian Road to Hongkou District in the west. It starts from Changyang Road in the



south and ends at Kongjiang Road in the north. The area under its jurisdiction is about 2.39 square kilometers, with 24 neighborhood committees (Figure 2.2). Based on the theory of urban residential morphology, Shanghai residential areas are divided into lanes, public housing and commercial housing areas. Among them, the residential types of lanes are Shikumen lanes or new lanes, which were mostly built in the 1930s and 1940s, and are generally row-style, two- or three-story residential buildings. Today's lanes are mostly characterized by small and compact outdoor spaces and old supporting facilities. Public housing refers to welfare housing developed and built by the government or state-owned enterprises and institutions for a large number of workers, which was built in the 1970s and 1980s. Commercial housing residential areas are the product of the rise of real estate development. The residential organization is no longer limited to the determinant type, and the point type and free type organization are rising. At the same time, residential buildings are no longer low-rise or multi-story, and the number of small high-rise and high-rise residential buildings is gradually increasing. At present, the Jiangpu Road area has formed a situation of multiple textures of public housing, lanes and commercial housing. The environmental characteristics of these three main types of residential areas in the area can reflect the characteristics of Shanghai's high-density human settlement environment to a certain extent. These three types of residential environments are also the main positions for child-friendly practices in the context of Shanghai's urban renewal. Therefore, this study will conduct a child-friendly community built environment assessment and review based on the selected Jiangpu Road area in Yangpu District. The review objects include 131*2 (both sides) street segments, 60 outdoor public spaces and 28 residential areas.

Figure 2.3

In order to interpret the CFN assessment results in a concise and intuitive way, the on-site review data is aligned and visualized with the geographic space in ArcGIS software. This includes constructing a double-sided assessment street segment line dataset to visualize the street segment assessment results, constructing an outdoor public space point dataset to visualize the outdoor public space assessment results, and constructing a residential area face dataset to visualize the residential environment assessment results and the community comprehensive assessment results (Figure 2.4).

Figure 2.4

3.Results

3.1 Comprehensive Evaluation Results of Child-Friendly Neighbourhood in Jiangpu Road Area

Taking the geometric center of each assessed residential area as the starting point and the 5-minute walk distance (400 meters) for children as the radius, the community life circle unit range of the assessment is delineated, and the street section assessment results, outdoor public space assessment results and residential environment assessment results within the assessment range are superimposed. From a child-friendly perspective, the micro- and medium-scale built environment elements of each community unit are comprehensively assessed.

Based on the comprehensive assessment results, horizontal and vertical comparisons between communities in the area can be carried out one by one to identify and judge common or differentiated built environment status issues. The on-site assessment was carried out in 28 communities in the Jiangpu Road area, including 2 lane residential areas, 10 public housing residential areas and 16 commercial housing residential areas. (Among them, the number of lane residential areas is relatively small, and they are collectively referred to as lane and public housing residential areas in the following classification). The evaluation results are divided into the upper quartile, median, and lower quartile of the overall score. Among the 28 evaluated community units (composed of the main residential area and surrounding streets and outdoor public spaces), 35.7% of the community units have relatively good child-friendly evaluation results (child-friendly comprehensive scores) based on the actual built environment, 20.7% and 34.5% of the community units have good and medium child-friendly evaluation results, and 6.9% of the community units have relatively poor evaluation results. In terms of the main residential area type attributes, the overall child-friendly evaluation results of the evaluated community units composed of public housing and lane residential areas and their surrounding environments are poorer than those of commercial housing residential areas. Only 8.3% of the community units have excellent child-friendly evaluation results, while this proportion is 56.3% in the evaluated community units with commercial housing residential areas as the main residential area type (Figure 3.1).

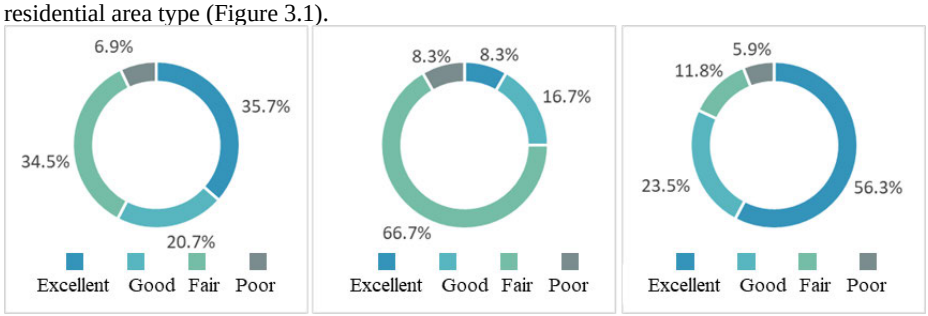


图 Figure 3.1 （Left: Overall communities Middle: Lanes and public housing communities Right: Commercial housing communities）

Through the geographic spatial visualization of the evaluation results in ArcGIS software, the spatial distribution of the evaluation results can be intuitively analyzed. In addition to helping the district to simply identify the comprehensive evaluation of the community, based on the sub-item evaluation results, the advantages and disadvantages of the three spatial dimensions of street sections, outdoor public spaces and residential environment can be further examined. In terms of the comprehensive evaluation results of child-friendly, the communities with relatively good practical foundations are concentrated in the west of Jiangpu Road District (east of Dalian Road) and the south of Zhoujiazui Road (Figure 3.2), and most of them are commercial housing communities (assessment units consisting of commercial housing residential areas as the main residential type and their surrounding environment). Communities with relatively poor practical foundations are concentrated in the north of Jiangpu Road District, and most of them are public housing and lane communities.

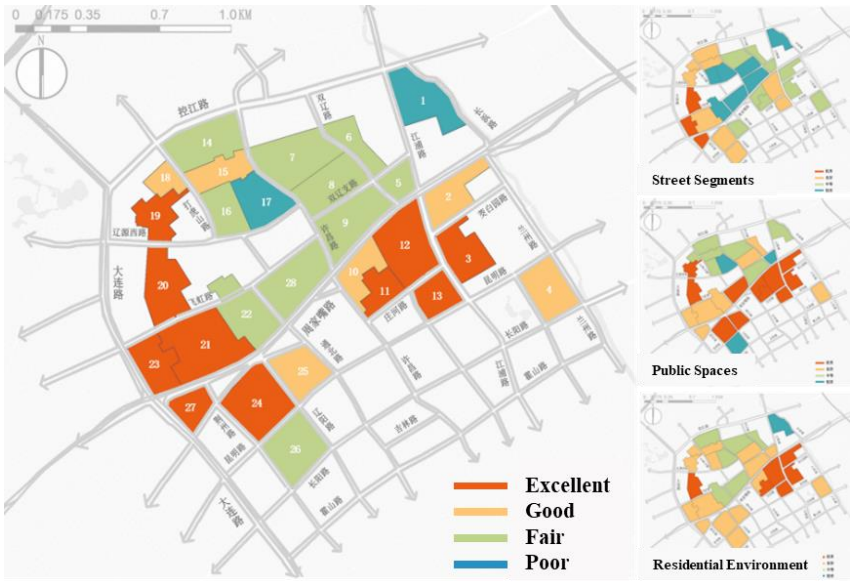


Figure 3.2

According to the CFN evaluation results, in the next step of the community environment adaptation and renewal decision-making, refer to the distribution of the "poor-excellent" situation on the actual basis, and divide the comprehensive child-friendly renewal of the community from level I (urgently in need of improvement) to level IV (optimization and improvement), child-friendly renewal of street sections, child-friendly renewal of outdoor public spaces and the order of child-friendly renewal of residential environment (Figure 3.3). According to the requirements of the evaluation items, the community built environment is gradually and targetedly rectified. Prioritize the rectification of the community built environment in the area in urgent need of improvement, which is an important bottom-line action. Improve and optimize the community built environment in the area with the highest evaluation standards, build a child-friendly community, and play a strong demonstration role.

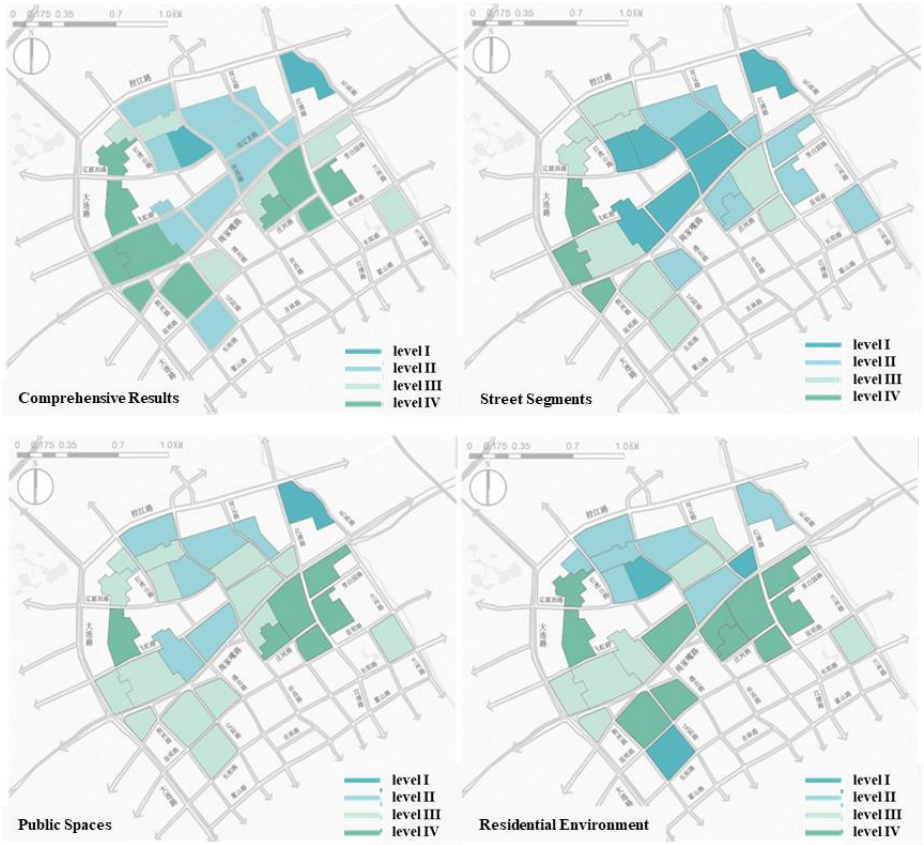


Figure 3.3

3.2 Evaluation Results of Street Segments in Child-Friendly Neighbourhood in Jiangpu Road Area

3.2.1 Child Safety Perspective

In terms of travel space safety, the area with good children's travel safety accounts for 25.8% overall, mainly located in the southern part of Jiangpu Road area (Figure 3.4), and the poor configuration area is mainly located in the middle and eastern part of Jiangpu Road area, accounting for 21.2%. Compared with the distribution of residential communities in Jiangpu Road area, it can be found that there is a certain misalignment between the areas where residential communities are concentrated in Jiangpu Road area and the areas with better configuration of travel space safety elements, which to a certain extent reveals the mismatch between children's travel safety needs and the actual basis, especially the road sections around the areas where alleys and public housing communities are concentrated in the middle of Jiangpu Road area have poor built-up environment, which should be paid attention to in the community child-friendly environment improvement action.

In terms of pedestrian space safety, the review indicators include the setting of pedestrian paths, the quality of pedestrian paths, and the standardization of temporary parking settings. As shown in Figure 3.5, in Jiangpu Road Subdistrict, the pedestrian space safety around the older communities in the north is poor, while the newly built blocks in the south are more complete. The southern section of Xuchang Road, Tongbei Road, and the southern section of Jiangpu Road are better equipped, while the eastern section of Feihong Road, Changbang Road, and Shuangliao Branch Road are poorly equipped, with major damage to the road surface, obvious traffic obstacles, and many other problems (Figure 3.6). During the assessment process, it was found that many non-motor vehicles or motor vehicles parked on sidewalks or non-motor vehicle lanes (Figure 3.7), which seriously affected normal traffic and brought safety hazards to children's travel. Similarly, at the level of cycling space safety, CFN road section assessment can help communities comprehensively review cycling space safety, including the setting of non-motor vehicle lanes, the gap between the actual basis of non-motor vehicle lane quality and the level of child-friendly cycling space safety configuration that should be achieved.

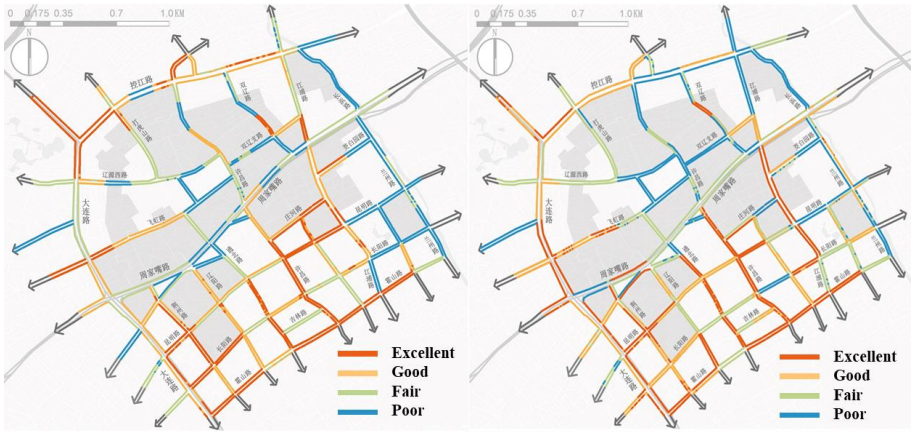


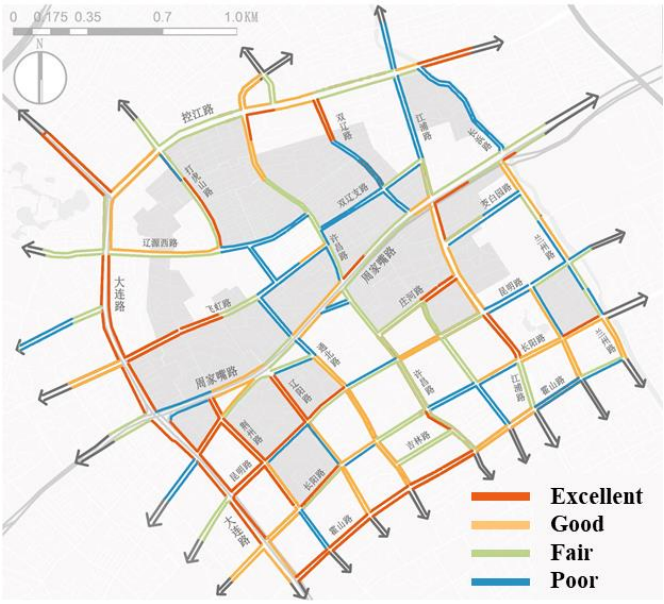
Figure 3.6

Figure 3.7

3.2.2 Child Health Perspective

The community should provide children with a clean and tidy street material space environment, which is closely related to children's health. In this section, the CFN tool mainly evaluates the material space environment elements that promote children's health, including the cleanliness of travel space (including cleanliness of walking and cycling space, cleanliness of resident activity places) and street greening conditions (including greening planting conditions and street greening maintenance quality elements). Overall, the comprehensive score is divided into quartiles, and the area with relatively good configuration accounts for 21.1% (Figure 3.8), which is concentrated in the southwest corner of Jiangpu Road Street, the southern section of Dalian Road, Jingzhou Road, Kunming Road, and the western section of Huoshan Road. Combined with the distribution of community types, it is found that this is an area where some commercial housing residential areas are concentrated. The proportion of relatively poor configuration is 20.3%, which is concentrated in the middle of Jiangpu Road Street. The area around the road section is the area where the central lanes and public housing communities of Jiangpu Road Street are concentrated.

Figure 3.8



3.2.2 Child Inclusion Perspective

Whether children enjoy various and convenient public services in urban street life is an important aspect of measuring the inclusiveness of children in the community. In the evaluation, the level of public services along the street is mainly evaluated from two aspects: public service facilities shared by all ages and special service facilities focusing on children. The evaluation of community street public service facilities shared by all ages includes five service elements: commercial services, cultural activities, daily travel, sports and fitness, and park green space. Special service facilities focusing on children include three service elements: growth education, child welfare, and maternal and child care. When the CFN evaluation tool was designed, the evaluation requirements for the configuration of public services and special service elements for children were formulated based on relevant practices and standards, and the evaluation was carried out accordingly, focusing on the accessibility of street public service configuration on sections covered by the five-minute walking circle of children. Overall, the configuration of

public services shared by all ages is better in the community living circle along Kongjiang Road, and the configuration of special service facilities for children is better in the places where the lanes and public housing communities in the north are concentrated (Figure 3.9; Figure 3.10).

Figure 3.9

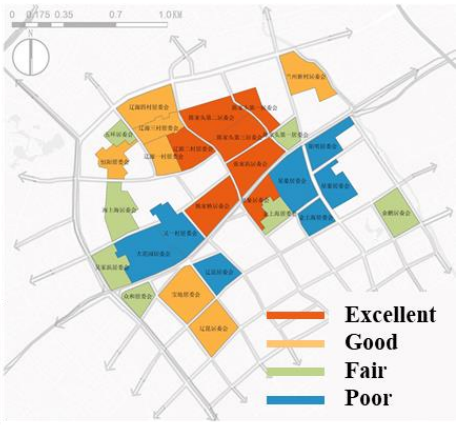


Figure 3.10

3.3 Evaluation Results of Child-Friendly Public Open Spaces in the Jiangpu Road Area

In this evaluation, a total of 60 community outdoor public spaces were evaluated (Figure 5.64). From the overall configuration (Figure 3.11), based on the upper quartile, median, and lower quartile of the overall score, 17% of the public spaces in Jiangpu Road Street were relatively well configured, and Yangming Jiangpu Point, Haishang Commercial Point, Liaoyuan Huayuan Point, Puhaoyuan Point, and Jinshanghai Public Space were well configured. Another 20% of public spaces were well configured, and 38% and 25% of public spaces were medium and poorly configured. In terms of the distribution of evaluation results of different types of public spaces (Figure 3.12), the public spaces in commercial housing residential areas had the best configuration of child-friendly elements, with 28% and 33% of public spaces being well configured overall, and only 6% of public spaces being poorly configured overall. Public spaces outside residential areas were second, with 22% and 17% of public spaces being well configured overall, 56% of public spaces being medium configured, and only 5% of public spaces being poorly configured. The actual foundation of public spaces in alleys and public housing residential areas is poor overall, with 54% of public space infrastructure items poorly configured, and only 4% and 13% of public space configurations being excellent and good overall.

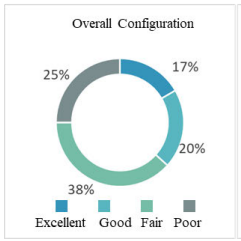


Figure 3.11

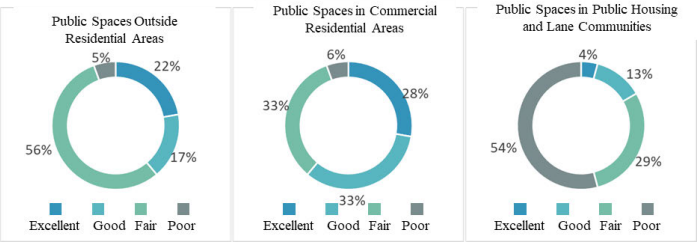


Figure 3.12

3.3.1 Child safety perspective

The assessment tool helps the community focus on the specific configuration shortcomings of outdoor public spaces from a child-friendly perspective, and examine them from a child safety perspective. The assessment dimensions include the safety of the surrounding environment, the safety of activity facilities and the safety of landscape design. The overall public space is best configured in terms of surrounding environment safety (Figure 3.13). 70% of the public space scores excellent in this dimension, and 61.7% of the public space configuration meets the evaluation requirements of the CFN tool (i.e. "setting location" and " Both sub-elements of "enclosed interface" are set for safety), and secondly, the configuration of landscape design safety is better, with 68.3% of the public space configuration scoring excellent. Overall, the safety of activity facilities is poor, with only 28.3% of public spaces configured as excellent. Judging from the configuration of different types of residential areas (Figure 3.14), the safety of the surrounding environment is the shortcoming of the allocation of public spaces outside the residential areas. Compared with the public spaces of commercial housing areas, lanes and public housing areas, only 50% of the public spaces are The proportions of the configuration being excellent and the other two types of configuration being excellent are 83.3% and 75% respectively. In terms of the safety of activity facilities and landscape design, the order of better allocation is public space outside the district, public space in commercial housing areas, and public spaces in alleys and public housing areas.

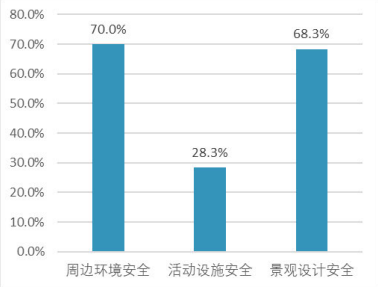


Figure 3.13

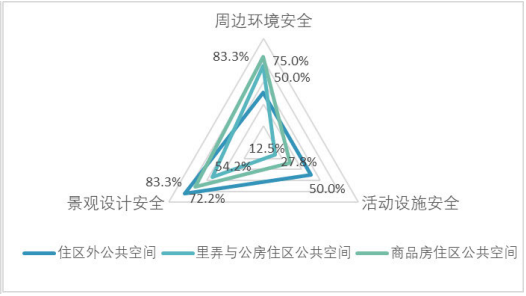


Figure 3.14

3.2.2 Child Health Perspective

At the level of children's health, the CFN outdoor public space assessment dimensions include three dimensions: support for walking and cycling activities, support for children's leisure physical activity space, and support for leisure physical activity facilities. At the level of children's health, the CFN outdoor public space assessment dimensions include three dimensions: support for walking and cycling activities, support for children's leisure physical activity space, and support for leisure physical activity facilities. Among them, the walking and cycling support assessment factors include whether there are facilities to promote walking and awake activities, such as fitness trails and cycling trails. In the leisure physical activity space dimension, the support provided at the venue space level is assessed, including the area of the activity area, the cleanliness of the venue, and whether there are corresponding support venues for leisure physical activities such as children's games and sports, including children's game space, children's ball or track and field sports space, and playable natural space. From the overall assessment data analysis (Figure 3.15), the public space in the entire Jiangpu Road area performed relatively average in the three dimensions of children's health. Among them, the assessment results of leisure physical activity space support were relatively good, with 33.3% of public spaces performing well, but only 3.3% of public spaces performing well. The second is walking and cycling support, with 11.7% of public spaces performing well and 1.7%

performing well. The support for public space leisure and physical activity facilities is relatively poor, with only 8.3% and 5% of public spaces being well and well configured.

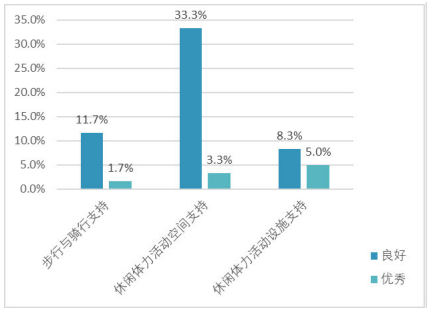


Figure 3.15

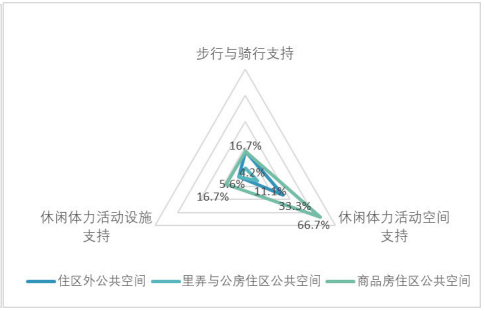
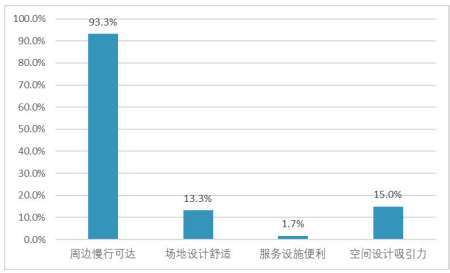


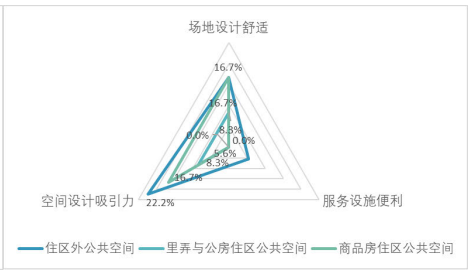
Figure 3.16

From the evaluation results of different types of residential environments (Figure 3.16), the configuration of public spaces in commercial housing residential areas in three dimensions is relatively good overall, especially in the dimension of children's leisure and physical activity space support, with 66.7% of public spaces being well configured. However, the public spaces in lanes and commercial housing residential areas are relatively poor in terms of children's leisure and physical activity space and facility support. Overall, it can be seen that there is a mismatch between "space" and "facilities" in the public space of Jiangpu Road Street. There is also a large gap in the configuration of public spaces in different types of residential areas. The main problem of public spaces in commercial housing residential areas is "there is space, but no facilities", while in the public spaces of lanes and commercial housing residential areas, children's activity support facilities and space are very scarce, which is manifested as "neither space nor facilities".

3.2.3 Child Inclusion Perspective

Child-friendly public spaces should be inclusive, so that all children can reach and use the space in a positive way, and the space design should respect children's preferences, provide children with comfortable, barrier-free venues and various convenient service facilities. Overall, 93.3% of the public spaces in Jiangpu Road are equipped with sufficient and reasonably located entrances and exits, and the surrounding areas can be reached by walking, cycling or public transportation. In terms of the comfort of children using public spaces, the performance is relatively poor in terms of the comfort of the site design and the attractiveness of the space design. Only 13.3% and 15% of the public space configurations can meet the CFN assessment requirements. The performance is the worst in the setting of convenient service facilities. Only 1.7% of the public space configurations can meet the CFN assessment requirements (Figure 3.17). Focusing on the shortcomings of the configuration of public spaces in different types of





residential areas, because the three types of public spaces perform well in the dimension of surrounding slow-moving accessibility, and are quite different from the requirements of several other dimensions, this item is excluded for analysis. The results show (Figure 3.18) that the status quo of the three types of public spaces at the level of inclusiveness has certain similarities. Overall, the public spaces outside residential areas performed well in terms of spatial attractiveness and convenient service facilities, with 22.2% and 5.6% of public space configurations meeting the assessment requirements for child-friendly communities. The public spaces in lanes and public housing performed poorly in terms of site design comfort, convenient service facilities, and spatial design attractiveness.

Figure 3.17 Figure 3.18

3.4 Evaluation Results of Child-Friendly Residential Area Environment in the Jiangpu Road Area

3.4.1 Child Safety Perspective

From the perspective of child safety, residential built environment should be evaluated. Residential areas should create a stable traffic environment for children, encourage children to walk and ride, and reduce travel injuries. The evaluation content mainly focuses on the safety environment between residential buildings in terms of traffic safety between residential buildings and travel safety between residential buildings for children at the micro-scale. Overall, no residential environment fully meets the evaluation requirements. The scores are divided into upper quartile, median and lower quartile. 34% of residential areas have excellent status in terms of child safety (Figure 3.19), 28% and 24% of residential environments have good and medium performance, and another 14% of residential environments have poor performance. Furthermore, there are obvious or even extreme differences in different types of residential

environments (Figure 3.20; Figure 3.21). The status quo of child safety factors in lanes and public housing residential areas is relatively poor. There is no residential area with excellent performance, 17% and 50% of residential environments have good and medium performance, and 33% of residential environments have poor performance. In the commercial housing residential areas, there are no residential areas with poor performance, 59% of the residential areas have excellent environmental performance, and 35% and 6% of the residential areas have good and medium environmental performance. Compared with commercial housing communities, the improvement of the built environment in the lanes and public housing communities in terms of children's safety is very urgent.

Figure 3.19 Figure 3.20 Figure 3.21

3.4.2 Child Health Perspective

Residential areas should support children's diverse physical activities and create a healthy physical activity environment for children in residential areas. Therefore, we focus on the design of public spaces in residential areas and examine the support for children's physical

activity spaces and physical activity facilities in residential areas. To ensure the consistency of the assessment, the detailed assessment elements in this part are the same as the CFN outdoor public space assessment elements. Only a brief description of the assessment results of residential public spaces and the gaps and shortcomings in the actual foundation between different types of residential areas is given. The above quartile, median, and lower quartile assessment results show that, at the level of children's health, 17.24% of the residential areas in the Jiangpu Road area have a relatively good environmental status configuration (Figure 3.22), 27.59% and 31.03% of the residential areas have a good and medium status, and another 24.14% of the residential areas have a poor actual foundation. There are obvious differences in quality based on reality between different types of residential areas (Figure3.23; Figure 3.24). In terms of children's health, only 8.33% of the residential environments in alleys and public housing areas are excellent, and 41.67% of the residential environments are poor. In commercial housing areas, 23.53% of the residential environments are excellent, and only 11.76% of the residential environments are relatively poor.

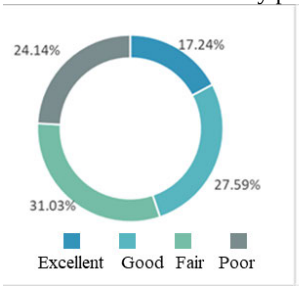


Figure 3.22

Figure 3.23

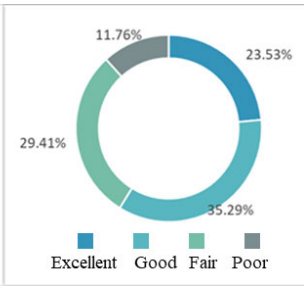


Figure 3.24

3.4.3 Child Inclusion Perspective

Compare the five dimensions of diverse and convenient public services, comfortable children's travel environment, and attractive environment, including green landscape between residential buildings, public art between residential buildings, and architectural interface between residential buildings, to better focus on the shortcomings of community built environment configuration. From the evaluation results, the overall performance of the comfortable children's travel environment in the residential area is relatively good, while the performance of the public art element between residential buildings is relatively poor (Figure 5.143). There is also a clear dislocation and difference in the configuration of good and bad elements between different types of residential areas (Figure 5.144). Lanes and public housing residential areas are better than commercial housing residential areas in terms of diverse and convenient public services, but are significantly inferior to commercial housing residential areas in other dimensions.

Figure 3.25

Figure 3.26

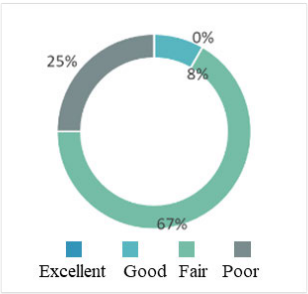


Figure 3.27

4.Ddiscussion

4.1 Assessment Aspects of Child-Friendly Neighbourhood Street Segments

In terms of safety, the speed limit area of the motor traffic calming design is insufficient and the design is simple. The safety of walking and cycling space is affected by problems such as road damage and traffic obstacles. There is a lack of child-friendly measures such as painted crosswalks for children to cross the street. There are safety hazards in the auxiliary facilities, and the common boards for humans and machines are not separated. The design of children's guide signs to improve readability and easy recognition is insufficient.

In terms of health, there are problems such as garbage dumping around the alleys and public housing communities, and some sections of the road are not greened. The width of the cycling path in the social activity environment is insufficient, and the design of street resident activity venues is not enough to support children's activities.

In terms of inclusion, the configuration of children's special service facilities around commercial housing communities is poor. In terms of children's travel comfort, some streets are equipped with child-friendly, brightly colored soft pavements that are easy to identify (Figure 4.1). There are few colorful soft pavements for children's travel comfort, and public transportation transfer facilities lack detailed child-friendly designs. The environmental attractiveness lacks child-friendly design, and there are messy electric poles, graffiti and other influences.

Figure 4.1

In general, in the subsequent child-friendly renewal of the community, the improvement measures can be roughly divided into five categories: first, to adjust the cross-section of the street pavement, such as widening the walking and cycling space; second, to add various child-

friendly street facilities, such as traffic calming measures, child-friendly travel guide signs, child-friendly crossing facilities, etc.; third, to optimize the child-friendly design of street landscapes, such as street greening, child-friendly street public art design, etc.; fourth, to enhance the various service functions of street children, such as life convenience, leisure activities, etc.; fifth, to formulate corresponding management measures. In particular, compared with some street built environment element updates involving limited resources and complex measures (such as street cross-section adjustments, etc.), some flexible and simple ones, such as adding various child-friendly street facilities, are often also the "shortcomings" that are in short supply in the actual basis.

4.2 Assessment Aspects of Child-Friendly Neighbourhood Public Open Spaces

In terms of safety, the safety assessment of the surrounding environment and landscape design of outdoor public spaces is good, but the safety assessment of activity facilities is relatively poor. The enclosure interface safety, landscaping and activity facilities are well maintained, but the lack of vehicle-ban facilities leads to random vehicle entry, and children's playgrounds are used as parking lots, especially in lanes and public housing communities. Instructions and information signs lack child-friendly design, and insufficient lighting facilities pose safety hazards.

In terms of health, the area of public space available for activities and the cleanliness of the venue are good, but the support for children's games and sports spaces is insufficient, especially in lanes and public housing communities. Children's game facilities, preschool game facilities, ball and track and field sports facilities are insufficient, and fitness facilities are not suitable for young children. There is a mismatch between "space" and "facilities", especially the problem of insufficient configuration of children's game facilities is more prominent.

In terms of inclusiveness, the surrounding slow-moving accessibility is good, but the venue design is comfortable, the space design is attractive, and the convenience service facilities are the worst. In terms of site design comfort, more than 70% of public spaces can meet the assessment requirements of site flatness, but only 30% of public spaces are paved with soft pavement suitable for children, and only 10% of public spaces are designed based on site color guidance (Figure 4.2). The recreational facilities are well-equipped, but the space design is not attractive enough, and there are problems with water management and safety protection.

Figure 4.2

4.3 Assessment Aspects of Child-Friendly Residential Area Environment

In terms of safety, the traffic organization between residential buildings in lanes and public housing areas is chaotic, and insufficient parking facilities for motor vehicles lead to messy parking, obstructing traffic and occupying children's activity space. The road surface is often high-difference, end cracks, and damage. There is a lack of special cycling organizations and facilities, which leads to interference between cycling, walking and driving. There are few child-friendly facilities in child-oriented signs, and there is no barrier-free design at the entrance and exit of the residential area.

In terms of health, the physical activity space for children in lanes and public housing areas is poorly configured, and the functional space and venue design of game space and sports space are insufficient. Only a few residential areas are equipped with complete safety facilities and children's activity facilities, and there are fewer children's game facilities and sports facilities.

In terms of inclusiveness, the children's travel environment is comfortable, public services are diverse and convenient, and the green landscape and building interface are good, but the public art elements are poor. Public services are richer in lanes and public housing areas, but other aspects are inferior to commercial housing areas. Commercial housing areas have better rest facilities and sunshade facilities, and green spaces and greening beside houses are common, while there are problems such as garbage and parking encroachment in green spaces beside houses in lanes and public housing communities.

Cluster green space provides environmental support for children in residential areas to contact nature. In the practice of international child-friendly communities, more emphasis is placed on the "playability" and "play value" of outdoor spaces such as open green space. Unlike traditional children's playgrounds, nature-based construction methods can allow children to interact more with nature. Based on this, the CFN residential audit reminds the community to pay attention to the playability of cluster green space and green space next to houses. The on-site audit results show that 64.71% of the cluster green spaces in commercial housing residential areas have designs that enhance children's "playability". The main construction method is to lay paths in the green landscape and place recreational facilities and fragmented venues (Figure 4.3).

Figure 4.3

5.Conclusion

By combing through the relevant policies, action plans and design guidelines for child-friendly construction at home and abroad, this study constructs a "child-friendly community built environment assessment technical tool" suitable for China's stock renewal background, covering multi-level spaces such as community streets, outdoor public spaces and residential environments. At the same time, relevant application methods are proposed, including development models, statistical and visualization methods and technical results. The application example of on-site assessment in the Jiangpu Road area of Shanghai shows to a certain extent that the constructed innovative tool has application value in community space problem diagnosis and planning decision-making intervention. Compared with the renewal of some community built environment elements involving limited resources and complex measures, some flexible and micro-community built environment elements are more scarce in the reality. The renewal of these elements is an important potential part for effectively exerting governance results and enhancing children's sense of gain.

After conducting on-site assessments from a child-friendly perspective, it is found that there is still a lot of room for the improvement of the child-friendly micro-scale built environment in existing communities. Taking street improvement as an example, it is very important to adjust the cross section of the street pavement, such as widening the walking and cycling space, but the implementation cost also increases accordingly. In particular, compared with the cross section adjustment, adding various child-friendly street facilities, such as traffic calming measures, child-friendly travel guide signs, and child-friendly crossing facilities, is more flexible and effective. The evaluation found that these are also the important parts missing from the existing built environment. Similarly, taking the improvement of outdoor public space as an example, there is a general mismatch between "space" and "facilities" in existing communities. Compared with the past, the problem of tight stock land resources has been deeply understood. In fact, the problem of insufficient configuration of children's play facilities in public spaces is also prominent, which is manifested as "there is space but no facilities" or "there is neither space nor facilities". Focusing on these important potential parts in child-friendly renewal can effectively play the renewal effect and enhance children's sense of gain in the practice of child-friendly communities.

In this study, only the common parts of the micro-built environment elements in the community involved in the relevant materials of child-friendly practices at home and abroad are sorted out and reviewed. In fact, due to unavoidable objective factors such as differences in national development levels and the diversity of existing built environments, it is very important to localize the evaluation tools for different built environment contexts. The system constructed in this study is only applied in the Jiangpu Road area, which has certain limitations. Furthermore, by expanding the application sample, expert review and interviews in the child-friendly field, the evaluation elements and evaluation rules can be iteratively updated, and the evaluation content can be dynamically adjusted, which can improve the reliability and universality of the evaluation tools. With the intelligentization of data collection methods, it provides the possibility of extensive and continuous environmental evaluation, which has further exploration significance for continuously improving the quality of life of children in the community and supervising the built environment of children's lives.

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Track 10: Education

EDUCATION - Interdisciplinary planning education: challenges, dialogues, innovations

Chairs:

- Jean Michel Roux, Université Bordeaux Montaigne
- Joanne Tippett, University of Manchester
- Lisa Marie Brunner, Norwegian University of Science and University

Keywords: *Planning education, pedagogy, planning curricula, community engagement skills, sustainability skills, cross-disciplinary learning, trans-disciplinary learning*

We are in a time of major upheaval and change, including net zero ambitions and new approaches to seeing nature as having rights, such as rivers as stakeholders in decisions about the future. Planning has always involved working across disciplines, with engineering and economics as well as spatial analysis, but we now need to work more closely with ecology, natural science and landscape planners. The planning profession has an opportunity to make a game-changing contribution to shifts to a sustainable and just society, but this will require very different skills from those of the past.

Teaching about climate change and biodiversity loss can induce a great sense of eco-anxiety and anguish. As educators, we must consider how to balance optimism and eco-anxiety for ourselves and our students. At the same time as considering the voices of local communities and the natural world, we are tasked with delivering major infrastructure projects and events. What is our role as educators in helping students to navigate these tensions?

This track invites theoretical, methodological and empirical contributions on the role of planning education in helping secure sustainable and just futures, innovative pedagogical approaches to developing the necessary skills and competencies and navigating the tensions involved. The track also invites consideration of alternative routes for planning education, such as apprenticeships and real-life projects, and novel ways to encourage cross-disciplinary and trans-disciplinary learning.

Deep Learning-Driven Morphological Dataset and Analysis Methods for Chinese Campuses

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Abstract

Modern campuses in China display distinct morphological characteristics, evolving to form unique patterns as subsystems within the urban environment. Hence, the approaches for comprehensive analysis for those urbanized Chinese campus morphology (UCCM) are important. This study proposes a framework for dataset construction and morphology recognition of UCCM, using visual representing learning methods. Computer vision technologies are used to acquire the morphology patches of 1257 campuses. We analyse the campus morphology with our proposed multi-dimensional morphometrics. Then, we constructed multiple morphological cluster maps for UCCM in terms of road, building and landscape, respectively. The cluster maps show significant compliance with human visual perception. Compared with classic morphometrics, our approach excels in learning implicit morphological characteristics with lower data processing demands and less reliance on expert experience.

Keywords: Urbanized Chinese campus morphology, Morphometric, Visual Representation, Self-organizing Map, Unsupervised learning

Abstract

Modern campuses in China display distinct morphological characteristics, evolving to form unique patterns as subsystems within the urban environment. Hence, the approaches for comprehensive analysis for those urbanized Chinese campus morphology (UCCM) are important. This study proposes a framework for dataset construction and morphology recognition of UCCM, using visual representing learning methods. Computer vision technologies are used to acquire the morphology patches of 1257 campuses. We analyse the campus morphology with our proposed multi-dimensional morphometrics. Then, we constructed multiple morphological cluster maps for UCCM in terms of road, building and landscape, respectively. The cluster maps show significant compliance with human visual perception. Compared with classic morphometrics, our approach excels in learning implicit morphological characteristics with lower data processing demands and less reliance on expert experience.

Keywords Urbanized Chinese campus morphology, Morphometric, Visual Representation, Self-organizing Map, Unsupervised learning

1. Introduction

With the expansion of higher education in this century, more universities and campuses have been established in Chinese cities, especially in suburban and nascent urban areas. These new campuses occupying larger footprints than their initial forms, responding to expanding enrolment and diversified functions. These urbanized Chinese campus morphology (UCCM) are often isolated from surrounding urban areas, evolving into a distinct subsystem within the broader urban network. They have changed the pre-existing urban fabric and ecological landscape to a significant extend.

A comprehensive recognition about morphology of those urbanized campus is required, since their form not only contributes to the shape of the city but also links to the efficiency of teaching and learning (Kenney, Dumont and Kenney, 2005). At the master planning level, modern campus morphology study involves various aspects such as campus circulation, built environment, spatial compactness, contextual responsiveness, and increasingly, landscape ecological patterning (Dalton, Hajrasouliha and Riggs, 2018). Most studies proposed strategies for campus urbanization based on practical experiences or comparative analyses of various campuses (Xu, Zhang and Rong, 2012; Zhang, Fisher, and Gang Feng, 2020; Meng *et al.*, 2023). There is a lack of specific classification criteria and a comprehensive morphological recognition framework, especially for these newly urbanized campuses in China. Urban morphology characteristics are twofold, encompassing both measurable and immeasurable aspects, such as quantifiable metrics and abstract prototypes. This complexity adds significant challenges to digital morphological classification for campus.

In this context, this study proposes an approach of the dataset construction and morphology recognition based on visual representation learning approach for the new urbanized campus form in China. We gather images and data on 1257 medium to large-scale higher education campuses in China from open-source mapping platforms. Image processing techniques are applied on high-resolution map tiles to address the challenge of incomplete data on campus, converting them into vector geographic graphics. Based on the dataset, we firstly analyse the UCCM with morphometrics in multiple dimensions, including site and context, roads, buildings and density, and landscape ecology. Furthermore, we deploy deep learning techniques to deal with visual features which are challenging-to-quantify. Utilizing the unsupervised Self Organizing Map (SOM), morphological cluster maps for Chinese campus are constructed, which facilitate to discover similarities and characteristic among campuses. Our research offers insights into the understanding of the morphology of campuses in China in two different ways, morphometrics and visual representation using deep learning. Morphological recognition based on visual representation methods has unique advantages, and integrating the two methods will be the focus of subsequent research.

Related work

Representing Campus Form

The Morphometrics approach has gained strong momentum in urban research, with the advent of new geospatial data and tools. It dedicates to describe the form through the quantification of geometry and relationship of urban elements. Separated dimensions are considered in multi-scale urban form, which often includes intensity, distribution, proximity, connectivity, complexity, diversity and form, etc. (Salat, 2011). Existing studies have proposed multiple metrics through interdisciplinary approaches and validated their effectiveness in characterizing urban form (Clark, Martin and March, 1975; Marshall, 2004; Berghauser Pont and Haupt, 2005). Morphometric on blocks and blocks assemblage hierarchies inform medium to large scale campus morphology studies, for their similar scales.

Researches on campus form focus more on the certain elements like buildings, roads or open space, using case studies and comparative studies (Dalton, Hajrasouliha and Riggs, 2018). Hajrasouliha proposed a framework for campus form dimension and campus score, based on the dataset of campuses in the United States. The form dimensions of campus can be categorized into seven: land use, compactness, connectivity, configuration, habitability, greenness, and cultural heritage, which are summarized in the three perspective of urbanity, greenness, and habitability of the campus(A. H. Hajrasouliha, 2017(a)). It was confirmed that campus scores based on morphometrics were associated with the quality of teaching and learning (A. Hajrasouliha, 2017(b)). As for campus planning in China, the Architectural Design Sourcebook (Volume 4, 2017) summarizes exemplary campus designs and standards, serving as a pivotal reference. The sourcebook provides a qualitative categorization of certain dimensions of campus morphology, while does not address the quantification of morphology or provide comprehensive data support.

Unsupervised Learning and Clustering

Morphological features are those connected with human visual and can usually be easily understood through visual interpretation (Wang, Huang and Biljecki, 2024). The recognition of images is highly inspired thanks to advances in computer vision (CV), while convolutional neural networks (CNN) led breakthroughs on learning features that entail the intrinsic characteristics from imagery data. The visual representation learning facilitates the simulation of human visual interpretation of morphology patches based on sample training with provided training objective. Based on figure-ground maps, unsupervised learning has been applied on morphological feature extraction and clustering of residential plots (Cai *et al.*, 2021) and village patterns (Wang, Tang and Cai, 2023), as well as retrieval of urban blocks (Mo *et al.*, 2024). The recognition of urban network is also widely studied based on images or graphs (Kempinska and Murcio, 2019; He and Aliaga, 2023).

SOM is a general-purpose nonlinear data clustering and visualization method, which creates continuous visual patterns on top of high-dimensional data (Vahid Moosavi, 2015). It has been

proved with high efficiency in architectural form clustering (Jiang *et al.*, 2023). A structured form-map is output, in which each grid unit represents a cluster of similar data, and the spatial distance between the grids expresses the distance of the feature embeddings of the data. It has been applied on the construction of structure form map (Fuhrimann et al., 2018), as well as retrieval of residential based on multimodal features (Cai, Zaghloul and Li, 2022). Considering there is no consensus in the categorization of Chinese campus morphology, unsupervised learning is applied and an atlas of campuses are constructed with SOM.

2. Morphological Dataset Construction

We comprehensively gather images and data on 1257 medium to large-scale higher education campuses in China from open-source mapping platforms (Figure 1). The amalgamation of graphical, imagery, and quantitative data is constructed and processed for four aspects: context, roads, buildings, and green spaces.

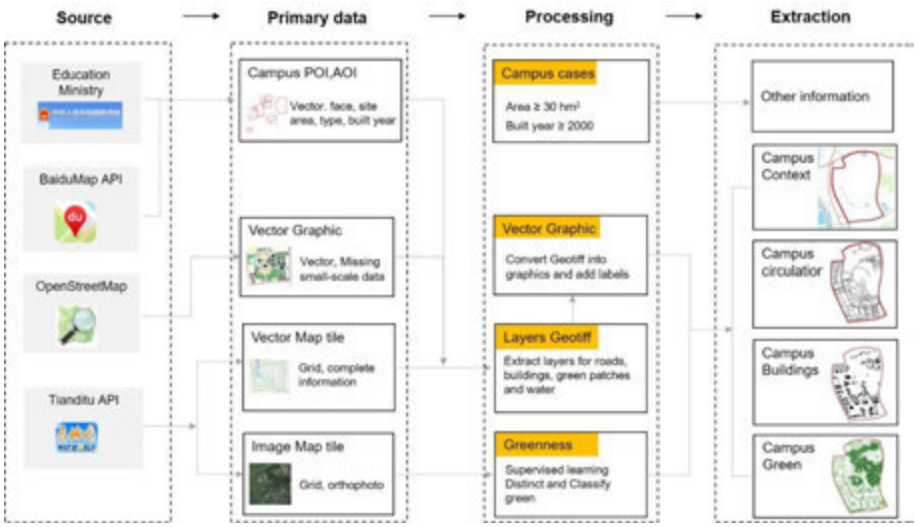

Figure1 Morphological Dataset Construction framework for urbanized Chinese university campus morphology.

2.1 Campus Selection

China's higher education institutions include both higher universities and higher vocational and technical colleges, which include private or public, vary in size, and have one or more campuses. In China's campus construction standards, campuses are classified as small, medium, large and extra-large according to their size (Figure 2). Among them, small campuses are those under 30 hectares, most of which were constructed earlier, with simple road networks and consist of a limited number of buildings. This study focuses on medium-sized campuses and above, which

have a certain complexity in their spatial organization and are more similar to urban forms at the neighbourhood level.

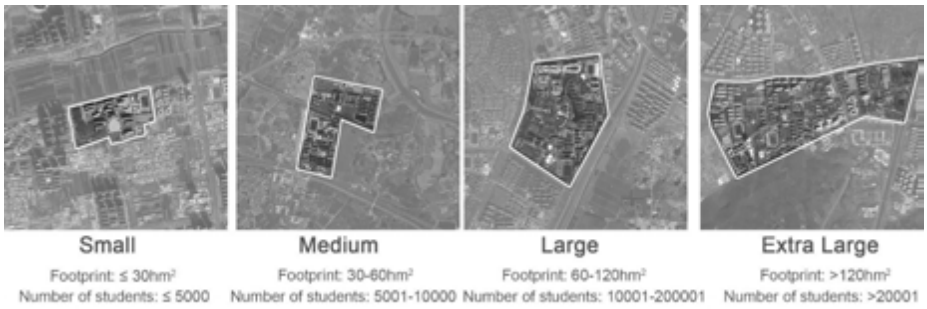

Figure2 Showcases of multiple scales of Chinese university campus from small to extra-large.

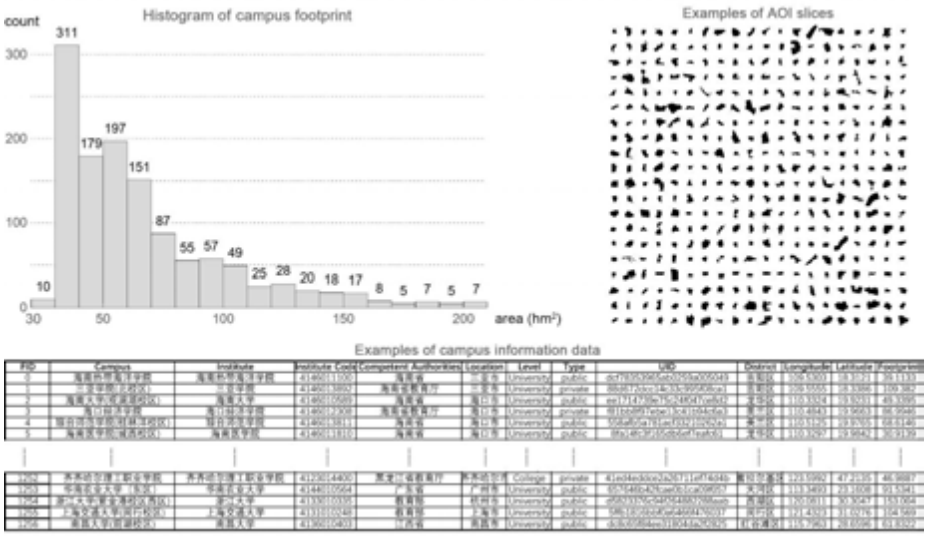

Figure3 Examples of the campus data in the dataset, including campus footprint (top left), AOI slices (top right), and GIS information (bottom).

In order to filter the campuses that match the size and further obtain their morphological data, it is first necessary to obtain the geographic data of campuses and their boundaries. With a list of 2756 higher education institutes from Chinese Education Ministry, the Points of Interest (POI) data for each school are query by school names. Each school may correspond to multiple campuses, while abundant POIs can be obtained through the institute names, including campuses, entrances, dormitory areas, etc. Screened by their name and type, 3442 POIs of university campus and 1044 POIs for college campus with UID code are obtained. Next, 3760 campus AOIs (area of interest) information are got by the UID code and processed on ArcGIS.

Among them, the campus divided by a county road with functionally intact parts will be treated as two. As a result, 1257 campus with area larger than 30hm^2 are selected (Figure 3).

2.2 Imagery Data Acquisition and Processing

There is a significant missing for geometric data of campuses in China, especially those located in suburbs or new towns, on widely-used open map platforms like open Street Map(OSM). To address this issue, we propose a method to extract information from map tiles acquired from online map platforms. After comparing different map platforms through experiments, it is founded that the Map World API provided by CNGISP (China National Geographic Information Public Service Platform: World Map, no date) excels for high timeliness and comprehensive data with zoom level up to 17.

The exact map tiles for campus are pinpointed and crawled with their geometrical information. Specifically, the column and row indexes of map tiles are calculated by longitude and latitude, according to the rules of Mercator projection transformations:

$$
\begin{aligned}
I_{row} &= Floor[2^{zoom} \cdot ((lon + 180)/360)]; \\
I_{col} &= Floor\left[2^{zoom-1} \cdot \left(1 - \frac{1}{\pi}\log(a)\right)\right] \\
a &= tan(lat \cdot \pi/180) + 1/cos(lat \cdot \pi/180);
\end{aligned}
$$

In which the value of zoom is 17. A 9*9 matrix of tiles around the centre point of each campus is crawled, which covers exactly the largest campuses.

The imagery data are then converted to GeoTiff format attached with geography data using GDAL, in order to interact with geographic elements, such as being clipped by campus boundary. Image processing techniques are applied to classify and extract data from them. From the vector map, roads, buildings, green and river regions are extracted by colour and converted to binary image using OpenCV separately. They also support further vectorization and analysis on ArcGIS. Meanwhile, the plant types are roughly distinct from the image map by mature supervised classification tool, labelling part of each type manually and then generating the whole results. Overall, our campus morphology patched consists of geometric elements of boundary, roads, buildings, water systems, and green spaces in and around the campus. (Figure 4)

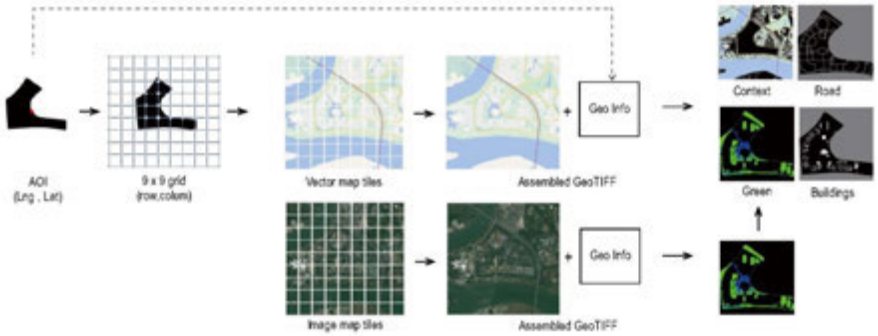

Figure 4 The acquisition and combination process of campus tiles, constructing the campus geometric data with multiple layers

3. Morphometrics for Campus

3.1 Dimensions and Metrics

Based on the characteristics of campuses in Chinese cities, this study attempts to focus on the campus form from four perspectives: site and context, roads, buildings and density and landscape ecology. Medium-and large-scale campuses in China are usually clustered, with a clear demarcation from the city. With the expansion of cities, neighbourhood of early campuses have developed into high-density region, while the new campuses built in this century, due to the tight urban land use, are mostly located in the outskirts of the city with more natural landscape. As a result, the site forms and contextual elements are quite different. Despite continued advocacy for school-city integration, most campuses have separate road systems which support vehicular traffic but not directly connected to urban roads. The buildings are laid out according to functional zoning, with the teaching area, dormitory area and sports area forming the core functions of the campus. At the same time, ecology is gradually being paid attention to in campus planning, considering the organization of green patches, the configuration of plants, and the relationship between green spaces and buildings. Therefore, from the four perspectives proposed in the previous section, nine dimensions of campus morphology can be delineated as shown in Figure 5.

Referring the method of urban morphometric, we summarize the metrics corresponding to each dimension as well as their calculations and the morphology element data required for the analysis. A case study has been conducted to verify the representation of this metrics.

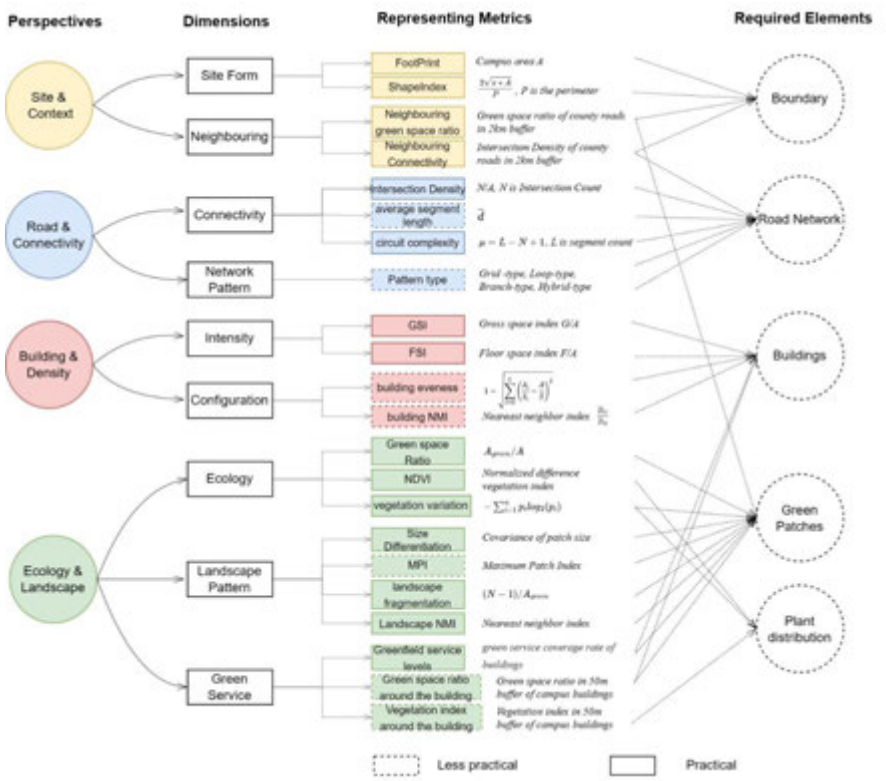

Figure 5 Morphometrics for Chinese university campus with multiple dimensions.

3.2 A case-study of Nanjing

For case study, 38 Campuses in Nanjing are selected to practice the analysis approach applying morphometrics (Figure 6). In order to obtain the geometry for the analysis, the binary image data of the various elements in the dataset are vectorized and assigned with attributes on ArcGIS. It is necessary to classify the road elements according to their width, to integrate water areas with green space patches and to give them a type definition, as well as to extract urban roads and landscapes within a certain range around the campus. Possible missing parts are supplemented and elemental attributes are refined in conjunction with the vector data acquired by OSM.

Figure 7 illustrates the ordering of morphological elements according to morphological metrics, which shows the coincidence of the metrics with human cognition.

Figure 6 The results of morphometrics of the 37 campuses in Nanjing

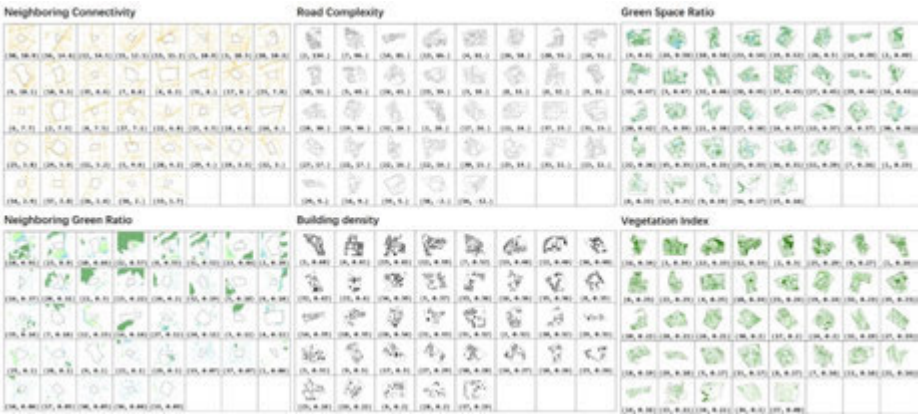

Figure 7 Sorting the selected 37 cases according to the morphological metrics, with the visualizations of corresponding geometric data.

The result implies that intensity-related metrics such as building density, road density, and green space rate are usually consistent with human cognition, while those related to spatial

distribution are relatively ambiguous. The calculation results of shows significant differences and some errors due to the choice of calculation units, differences in campus sizes, and localized missing data. Meanwhile, there are still some implicit features difficult to quantified, such as street pattern, and porosity of building groups, which are usually summarized qualitatively into categories with visual inspection by experts. Though some researches attempt to integrate them into the score system by assigning points, there is no uniform standard and requires considerable human labour.

4. Visual Representing Learning and Clustering

4.1 Visual Representing and data space

In contrast to 3.2 which vectorizes geographic images into geometric data, this section uses neural networks to extract features from morphological patches containing a single type of elements in image format. Among the four types of image patches of the campus, the cultural patches reflect the information of the campus site boundaries and the surrounding urban environment at a uniform scale, while the road, building, and landscape patches are scaled to fill the image at different scales to reduce the distraction of the campus scale and focus on the distribution of the elements. All image patches were scaled down to 256 x 256 pixels. We train feature extractors to extract high dimensional vectors from images for each type of campus patches separately, applying the neural network model. The training data is augmented with affine transformations including rotation and mirroring, resulting in eight times the amount of data compared to the original dataset.

The data space is visualized in 2-D with dimension reduction methods (Figure 8). Nonlinear dimension reduction methods, which have been proven to be efficient for high dimensional features, including UMAP, TSNE and Autoencoder, are tested separately to visualize extracted features. The results exhibit that the campus form gradients rather than falling into simplistic categories, which can be explained by the gradient distribution of both the size and form of Chinese campus. Therefore, compared with classic linear clustering methods like k-means, SOM is applied to achieve continuous visualization as a spectrum in a 2D space.

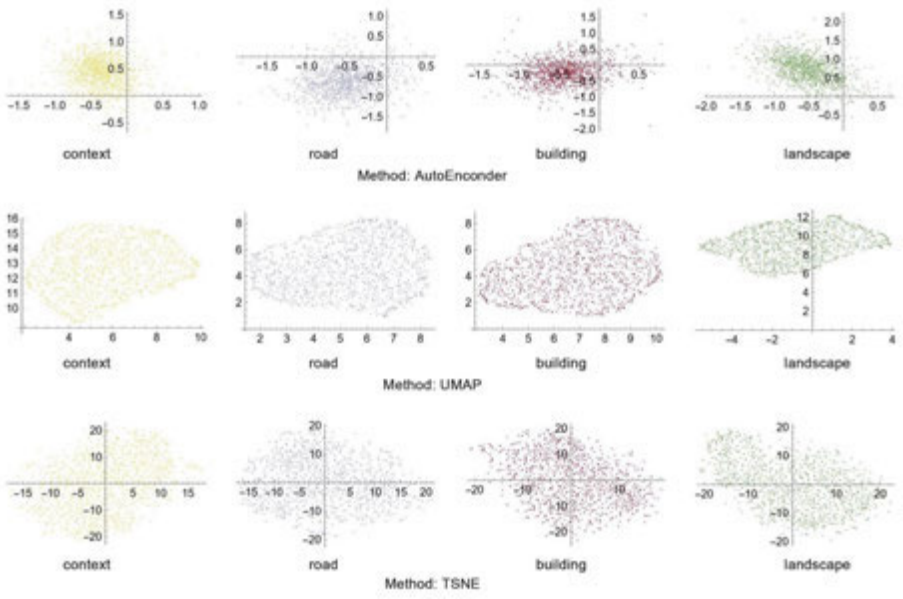

Figure 8 Visualization of High-dimensional vectors in 2D space after dimension reduction using 'Autoencoder' (top), 'UMAP'(middle), and 'TSNE' method (bottom).

4.2 Data Clustering using SOM

To achieve it, a fixed grid is first initialized with random real weights for each node. Then, the SOM is trained with randomly selected examples in the dataset. For each turn of the irritation, the best-matching unit (BMU) of each example is searched, which has a minimum Euclidean distance between its weight to the vector of example. Then the weight of BMU and its neighbours are updated according to Gaussian Neighbourhood Function, and the neighbourhood radius σ shrinks as iteration increasing:

$$g(i,j) = e^{-\frac{(c_x-i)^2+(c_y-j)^2}{2\sigma^2}};$$

$$\sigma = \left(1-\frac{u}{ite+1}\right) \times 0.6 \times d/2;$$

where c is the coordinates of BMU, u is the current generation and d is the counts of nodes in each dimension.

For our study, we build SOM for contexts, road, green and building configuration separately. After several parameter tests, a 15*15 SOM is trained by 12 iterations and 40000 examples are

selected for each turn. Then, we represent each grid cell with its most representative sample, to form a morphological cluster map. As a result, the characteristic distribution of UCCM is visualized.

In the campus context map, the combined effects of site scale, surrounding road distribution, and the distribution of natural and artificial landscapes on similarity can be observed. From left to right, there is a trend of increasing road network density and decreasing campus size, reflecting that large-scale campuses are more commonly situated in low-density urban areas. Several typical clusters and corresponding campus cases are extracted, with characteristics including: (1) adjacent to extensive natural landscapes, (2) situated in high-density urban environments with regular boundaries formed by orthogonal road networks, (3) with low surrounding development intensity and absence of natural landscapes, (4) relatively high development intensity with rich urban landscapes and irregular campus boundaries, and (5) coexistence of high-density urban landscapes and surrounding natural landscapes.

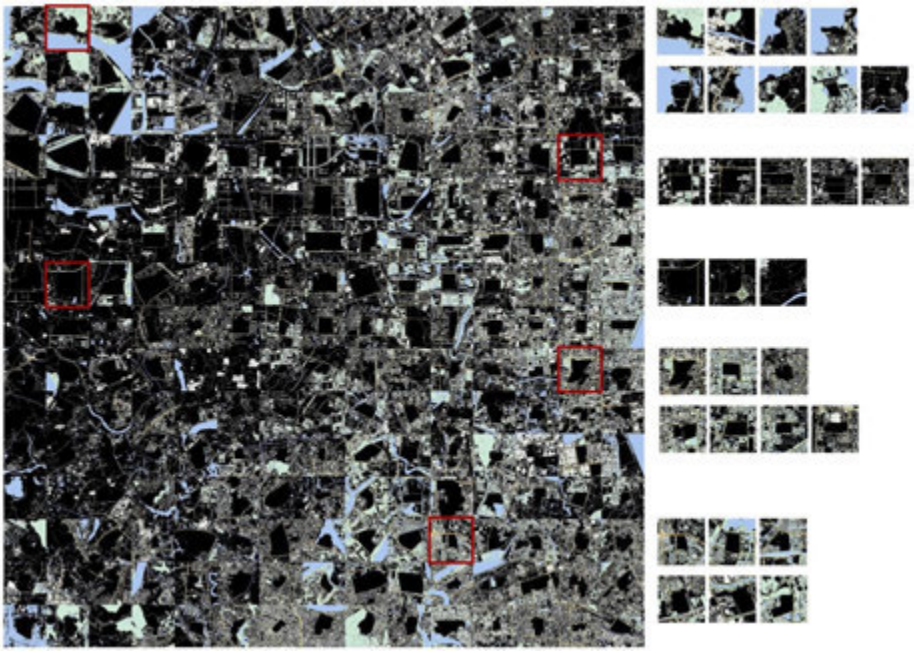

Figure 9 Representation of campus context cluster map and exemplary clusters selected from the map.

The cluster maps, reflecting the morphology of the campus park, are trained with uniformly sized masterplans in order to concentrate on learning of the structure. In the road map (Figure 10), there is a trend of transition from structured to natural from left to right. Grid and ring roads are commonly used features in organized campuses, with grid features particularly prominent

in large-scale campuses. In natural campuses, some exhibit branching structures, while others form irregular campus loops, showing a greater degree of freedom in form. The distribution of data in the building map is associated with both campus shape and building density, although differences in building distribution characteristics are not yet clear (Figure 11). From left to right, there is a trend of gradually regularizing campus shapes, while from top to bottom, there is a trend of decreasing density and organization. In the landscape map (Figure 12), campus landscapes become increasingly rich from top to bottom, while designed landscape water bodies is quite common in the overall campus layout. The campus in the upper-left corner of the map providing valuable references on landscape organization, with high diversity, fragmentation and equilibrium.

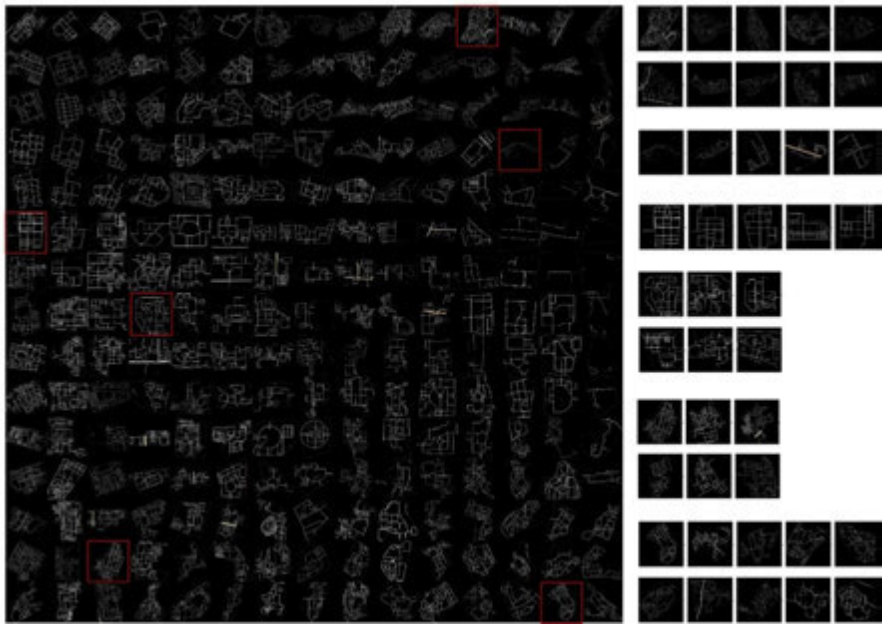

Figure 10 Representation of campus road cluster map and exemplary clusters selected from the map.

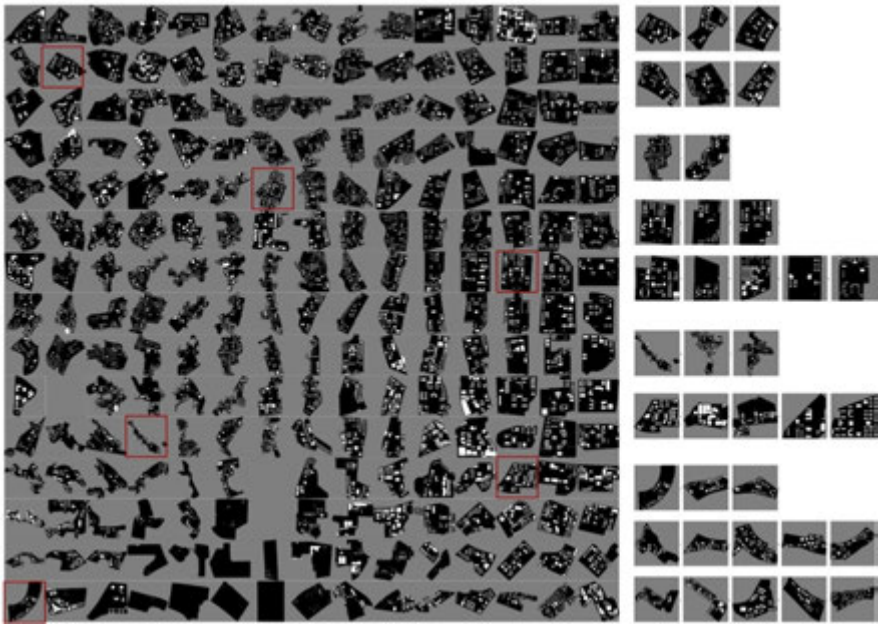

Figure 11 Representation of campus building cluster map and exemplary clusters selected from the map.

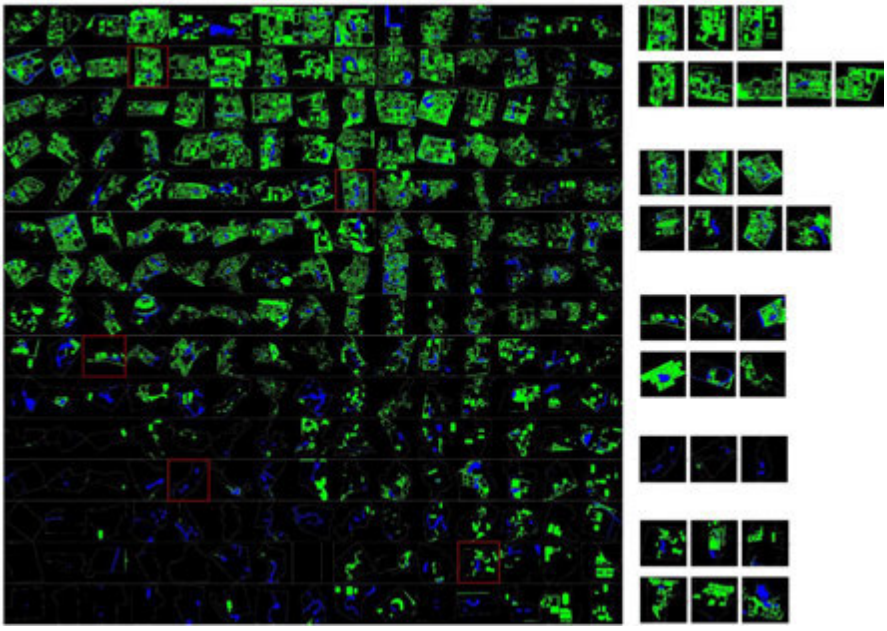

Figure 12 Representation of campus landscape cluster map and exemplary clusters selected

from the map.

Furthermore, these four morphological cluster maps can be correlated with campus objects, enabling multi-perspective linked analysis. For instance, the retrieval of corresponding morphology patches for campuses with similar context is supported.

5. Discussion

5.1 Comparison and Discussion

This study summarizes perspectives and form dimensions of Chinese campus and proposes a framework for morphology recognition based on deep learning. Through case studies, a comparison between visual representation learning methods and classical morphometric methods reveals the advantages and challenges of this framework.

Data Requirements and Technical Difficulty: Traditional morphometric methods rely on geometric data for specific algorithms, necessitating high accuracy and involving complex pre-processing. However, there is a notable deficiency in vector data availability for Chinese campuses on open-source platforms like OSM, while nationwide vectorization of geographical imagery poses significant challenges. Additionally, errors, omissions, or improper unit selection can result in substantial inaccuracies, as evidenced by our experiments. In contrast, visual representation learning extracts intricate knowledge from extensive image datasets, requiring lower data processing demands and exhibiting greater tolerance to data imperfections. Therefore, achieving a comprehensive understanding of nationwide campus morphology is more attainable through visual representation learning.

Representation Advantages of High-dimensional Features: The high-dimensional features extracted through visual representation learning cover multiple form dimensions of campus morphology, resulting in morphological cluster maps that align with human visual perception. This approach excels in capturing intricate feature characteristics such as structure, patterns, and shapes, which are often challenging to quantify. Furthermore, it reduces the dependency on expert experience and minimizes redundancies and incompleteness in indicator representations. However, classical morphometrics, as a foundational approach in morphological research, continues to play an essential role. Its algorithms are grounded in extensive human experience and have been empirically validated in numerous studies. Classical morphometrics advances in the assessment and grading of specific dimensions, facilitating the analysis of broader morphological issues spanning demographics, society, economy, and other domains.

Randomness and Interpretability: Traditional morphometrics produces a unique result for each indicator when employing the same data and algorithms. Conversely, variations in feature extraction methods and training parameters result in diverse outcomes during visual feature learning. This approach inherits the typical challenge of unsupervised learning, where training outcomes display a level of randomness, and optimal parameter configurations rely on experimental expertise. Furthermore, unlike single-dimensional indicators, the comparability

and interpretability of the obtained high-dimensional features and cluster maps are relatively constrained.

5.2 Future Opportunities

Inspired by limitations mentioned above, we proposed several directions for future work.

Integrating visual representing learning and morphometric methods. Classic morphometrics relies on human ingenuity and prior knowledge, among which manually selected metrics representing different dimensional features are integrated into multidimensional vectors. In contrast, visual representation learning relies on machine learning to extract high-dimensional embeddings from images. While these two approaches offer distinct advantages in morphological quantification, merging the two types of vectors is not straightforward. Exploring the integration of metrics and image feature extraction methods is also a significant focus in the current trajectory of urban morphology research (Cai *et al.*, 2021; Qin and Zheng, 2023).

Improving Feature Extraction Methods. Image features extraction based on neutral network has been widely applied in various fields. However, compared to common real-world photos, feature extraction for campus patches requires additional understanding of campus morphology. Therefore, fine-tuning and refining neural networks to address specific issues related to campus morphology recognition will significantly enhance the validity of visual representation. Recent studies have endeavoured to enhance models for urban morphology recognition research. For example, SimCLR is employed to guide feature extraction by maximizing mutual information agreement between different versions of the same image (Chen *et al.*, 2020; Wang, Huang and Biljecki, 2024). In subsequent research, we will integrate new model methods to experiment and validate the effectiveness of feature extraction.

Supporting generative design of campus. Existing design principles for campuses are often derived from a limited number of case studies, with the Architectural Design Sourcebook serving as a primary reference. By leveraging the nationwide campus dataset and the morphological analysis conducted in this study, it becomes feasible to systematically compile a set of rules and design methodologies for Chinese campuses. Furthermore, recent researches have been conducted to explore the generation of campus masterplans using advanced deep learning technologies, such as Generative Adversarial Networks (GAN), based on hundreds of Chinese campus cases. (Liu et al., 2021; Chen, Zheng, and Wu, 2022). The efficacy of the generation model could be significantly enhanced by expanding the dataset to encompass a nationwide range. Consequently, future endeavours will focus on integrating rule-based and case-based generative design methods to expedite the process of early-stage campus designs and provide decision-making support.

6. Conclusion

This paper proposes a deep learning driven framework for morphological dataset construction and analysis methods of Chinese Campuses. We compared the differences between deep

learning-based visual representation methods and classical morphometrics methods in the recognition of campus morphology. Firstly, by utilizing web data scraping and computer vision techniques, combined with integrating multiple sources of data such as map tiles and geographic information, we addressed the challenge of obtaining data on the morphology of Chinese university campuses. Secondly, based on the characteristics of Chinese university campus morphology, we integrated campus research with urban morphology indicators and landscape ecological indicators at similar scales. We proposed perspectives, dimensions, and measurement methods for the campus morphology, which were validated across 38 university campuses in Nanjing. In response to the limitations of traditional statistical methods, such as high data processing difficulty and limited visual representation, we introduced deep learning-based visual representation and morphological clustering methods. Using SOM, we developed morphological cluster map of Chinese university campuses, enabling morphological analysis and similarity retrieval across the entire dataset. This method provides important insights into the characteristics and issues of university campus morphology in the context of China's urbanization process, while also offering case support for the construction of new campuses.

However, we also discovered that traditional morphometrics methods still possess advantages that are difficult to replace, while deep learning methods suffer from low interpretability and the need for model optimization. In future research, we will further explore the potential integration of these two types of methods and focus on the discovery of patterns in campus morphology features based on datasets, as well as generative design.

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Dynamic Visual Assessment of Urban Streetscapes: Hengshan Street in Shanghai as a Case Study

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Abstract

Objectives: By investigating the urban street-human perception nexus under "dynamic" walks, this paper aims to enhance urban streetscapes and optimize pedestrian experiences.
Methods: In this study, a dynamic visual assessment system, encompassing objective, subjective, and interactive components, was developed through a combined application of qualitative and quantitative research methods. The computational foundation of this system was strengthened by Geographic Information System (GIS) spatial analysis, image semantic segmentation algorithms, Partial Least Squares Regression in SPSS, and so forth.
Results: Reduced desire for space and pedestrian flow are caused by an increase in dynamic viewing frequency. The public's impression of street space is enhanced in terms of clarity, transparency, ease of use, and richness when there is a greater range of spatial hues within the field of view, a smaller building area, and more translucent and clear spaces.
Conclusion: The research results are of great significance to street spatial design.

Keywords

dynamic viewing, visual assessment of landscapes, interaction between subjects and objects, urban streetscape

1 Introduction

Urban streets are not only crucial carriers of transportation hubs, but also the most fundamental public product of a city, serving as an important slow-moving traffic system for citizens to carry out their daily activities. It holds significant importance for the physical and mental health of the public (Jacobs, 2006). When individuals traverse urban streets, whether they pause momentarily to observe their surroundings or stride rapidly through, they remain in a state of

"dynamic" observation, encompassing even periods of relative stillness (Xiong, 1984). The variations in visual angles and the adaptations in visual behaviors jointly enhance a profound sense of visual artistry within the dynamic urban landscape that is constantly in a "moving" state (Yang, 2019).

In this study, we address the interactive between the observer and the streetscape during the viewing state, specifically termed "dynamic observation," into the landscape visual evaluation index system. This methodology significantly beyond the traditional research, which primarily focused on the static relationship between "observer" and "environment" factors. Instead, it enables a multifaceted, three-dimensional correlation analysis that comprehensively considers the "subjective," the "objective," and the intricate "subject-object interaction." As a result, we derive profound insights into the observer's perception and the salient characteristics of the objective spatial environment, both of which are intimately tied to the dynamic observation state.

There are five sections in this study. A concise overview of the literature on the visual assessment of streetscapes is given in Section 1, which covers three essential aspects: the street's spatial environment, visual perception, and spatial behavior. We create a thorough assessment index system in Section 2 that considering the street spatial context, observer perception, and human behavior. The specific approach for measuring this assessment index system is described in Section 3, with an empirical measurement of Hengshan Road in Shanghai as the study region. A detailed overview of the outcomes of our measurement is given in Section 4. In Section 5, we utilize correlation analysis to derive findings about the complex relationships among the three elements of our assessment index system: behavior, perception, and street environment.

2 Literature review

The current quantitative research on street space predominantly adopts the fundamental logic of constructing an indicator system, which integrates technologies such as geographic information systems (GIS) and 3D software to visualize the morphological measurements of the street environment. In a comprehensive view, the objective index in urban street research generally encompass the urban skyline morphology (Zhang, 2001), degree of visual depth in urban space (NIU, 2013), Hierarchical levels of space (Peng, 2015), vision and spatial openness (Liu, 2009), comprehensive study of vision and space (Wang, 2013)， as well as visual perception with other factor (Cheng, 2017). The foundational data and their sources include: OpenStreetMap data, POI data, streetscape images, positioning system trajectory data, and elevation data (building heights, ground elevations). Specifically, we utilized machine learning algorithms and street-view data to measure the impact of street green view index (GVI) on walking time, and established quantitative evaluation metrics. The comprehensive study incorporated various data sources to gain a deeper understanding of the relationship between urban visual landscapes and pedestrian mobility (KI D, 2002). Utilize the theory of space syntax

to delve into the effects of spatial openness on social interactions, and subsequently establish a comprehensive analysis model that incorporates both two-dimensional and three-dimensional visual (NIU, 2019).

The research on subjective components mainly focuses on aspects such as street spatial safety and perceived scenic beauty, proposing factors such as accessibility, ease of reach, safety, comfort, pleasure, aesthetic appeal, imagery, enclosure, permeability, human-scale design, and cleanliness. Using methods such as questionnaires, data is collected on the public's satisfaction ratings of streetscape images. This data is then combined with the results of objective index of the images to evaluate the public's perception of landscape aesthetics (Shao, 2017).

In the study of the interaction between environments and perception, there is a diversity in data sources, technical approaches, and research focuses. Some scholars have employed qualitative "cognition" analysis, along with quantitative measures of building density and ratio of wall (Zhou, 2012). The research examines the correlation between the subjective and objective factors, focusing on the relationship between street environments and the duration of people's stay as well as their subjective perceptual experiences (Hu, 2009). Wilson et al. (2016) argue that the index of "safety" and "pedestrian-friendliness" play a decisive role in the perception of urban streets. Pyo et al. (2015) discovered that pedestrians on street sidewalks have a higher degree of perception of spatial environmental elements, leading to a corresponding higher level of walking satisfaction. Elements such as the space outside shops, the density of street trees, enclosed spaces, the travers ability of the street space, and space utilization can all affect subjective preferences and feelings. Li Yajuan et al. (2018) used GIS analysis to explore the spatial structural characteristics and external transportation connectivity of historical districts, as well as tourists' perception of the district's image and location. [19] The forementioned studies primarily integrate the derivative terms of perception and sentiment with existing big data, utilizing various scientific software technologies to qualitatively describe relevant index and quantitatively analyze spatial numerical values, ultimately leading to corresponding conclusions.

As individuals continuously move and change their behavior in objective environments, buildings and landscapes emerge or recede in a continuous manner within one's visual field. [20] Some scholars have explored the spatial environmental characteristics in a "dynamic observation" state from the perspectives of behavioral activities, preferences, and spatial vitality. Author Cheng Shi (2021), building on the concept of "landscape," has integrated new technological means and proposed a new method of "dynamic observation evaluation" that aligns with the characteristics of crowd viewing behaviors. Do N (2019) utilized various methods such as questionnaires, scientific observations, and spatial analysis to collect and analyze data, exploring people's activities, preferences, and behavioral patterns within these parks. Fard H R (2014) studied the relationship between the physical characteristics of plazas and behavioral patterns and specific activities through questionnaires and scientific

observations. Carmon (2003) employed case studies and theoretical frameworks to explore the influencing factors of street spatial vitality, including buildings, sidewalks, amenities, and other elements. Ewing R et al. (2014) examined the physical characteristics of urban streets and their edge spaces, focusing on objective index such as window ratios, street frontage ratios, and the number of street furnishings, to explore their impact on pedestrian traffic volumes. Li Y et al. employed a semantic segmentation method to explore the relationship between street width, transparency, and street vitality. Carmelino G et al. (2019) delved into the impact of the built environment on pedestrian vitality, considering key visual characteristics such as architectural form and proportion, streetscapes, materials and colors, spatial layouts and flow, as well as building façades and their elements.

From the perspective of research approaches, current studies have yielded numerous achievements in both objective quantification and subjective perception, and some have begun to explore the correlation between subjective and objective factors. Nevertheless, a thorough investigation that incorporates subjective, objective, and subjective-objective interactions is still absent in the research on index under the interaction between subject and object, which is still limited to the analysis of single-faceted features like human traffic aggregate. Research-wise, most of the studies that have already been done focus on "off-scene" static observations, ignoring the dynamic "in-scene" perception of the three-dimensional "space" that functions as the overall framework. In order to build a multi-dimensional study, they rarely consider the dynamic walking state of persons, such as walking routes and the vitality of walking places. In light of the research topic, this paper intends to investigate the relationship that exists between human perception, walking behavior, and urban streetscapes by means of an interactive study that includes three dimensions: "subjective," "objective," and " interactive components."

3 Establishing of the evaluation index system

Clustering analysis of premier research fields, we screened out the evaluation index of environment-perception that have relevant relationships and compiled an interactive relationship table of subjective and objective evaluation index (Tables 1).

Table 1. Relationship expressions of subjective and objective evaluation index (Liu, 2022)

Objective	The formula for calculating the correlation	R^2
Clarity	2.336 + 0.002×mean horizontal visual depth + 0.045×color richness	0.546
Transparency	2.574 - 1.677×architectural visual proportion + 2.250×sky view factor + 0.001×mean horizontal visual depth + 0.025×color richness	0.775
Relaxation	1.072 + 0.091×color richness + 6.663×green view index	0.641
Richness	0.929 + 0.089×color richness + 6.947×green view index	0.557

3.1 Establishing Objective Indicator System

Based on the analysis, three indexes are established for the objective index system, including spatial elements, spatial structure, and spatial vision. Specifically, spatial elements correspond to the openness of the sky, the visual proportion of buildings, and the green view index. Spatial structure corresponds to the horizontal visibility distance, while spatial vision corresponds to the color richness.

Table 2. Objective index and measurement methods (Huang, 2019. NIU, 2013. Dan, 2008. Li,2020)

Objective	Factor	Concept and formula interpretation	Formula
Spatial elements（B）	sky view factor（B_1）	Refers to the degree of the sky within the human visual field, which is the proportion of the sky within the "sphere of vision." B_1 represents the openness of the sky in a streetscape image, S_1 is the proportion of pixels identified as sky and S_0 represents the total number of pixels in each streetscape image.	$B_1 = S_1 / S_0$
	architectural visual proportion（B_2）	The building proportion of building area within the visual field, primarily including the building facade as well as its affiliated gray infrastructure. B_2 represents the visual proportion of buildings, S_2 is the number of pixels occupied by building facades within the visual field, and S_0 is the total number of pixels in the streetscape.	$B_2 = S_2 / S_0$
	green view index（B_3）	Referring to the proportion of green plants within the visual field. B_3 represents the green view index of a streetscape image, S_3 is the number of pixels representing trees, grass, plants, and other greenery in the image, and S_0 represents the total number of pixels in each streetscape image.	$B_3 = S_3 / S_0$
Spatial structure（C）	mean horizontal visual depth（C1）	Taking the observer's position on the street as the centre, 360° horizontal line of sight is projected around, and the maximum distance that the human eye can observe is limited. The average length of sight lines in all horizontal directions is denoted as C_1, and the length of the nth sight line is denoted as C_n	$C_1 = \frac{1}{n}\sum_{i=1}^{n} C_n (i \epsilon N^*$
Spatial vision（D）	color richness（D_1）	It refers to the richness of color factors. Extracting the brightness values of the color components R (red), G (green), and B (blue) from the streetscape images, and calculate the rg and yb values using the formulas: rg = R – G, yb = (R + G)/2 – B. Calculating the standard deviation σ and average values of rg and yb for pixel.	$D_1 = \sqrt{\sigma_{rg}^2 + \sigma_{yb}^2} + 0.3 \sqrt{\mu_{rg}^2 + \mu_{yb}^2}$

3.2 Establishing subjective index system

Four components of subjective evaluation indexes are selected: clarity (vague-clear), transparency (enclosed-open), richness (monotonous-rich), and relaxation (suppressed-relaxed).

Table 3. Subjective index and measurement methods

Subjective	two-level vocabulary	Concept
Clarity	vague-clear	The degree of sharpness and explicitness that a block's visual environment imparts to people is referred to as clarity. In contrast, pedestrians may need to continuously rotate their line of sight in order to observe and perceive the surrounding spatial structure, which can quickly cause physical and mental fatigue. The better the clarity, the faster pedestrians can perceive the surrounding spatial structure through visual observation.
Transparency	enclosed-open	The phrase refers to the streetscape's power of directional indications and sense of visual permeability. Pedestrians can more easily discern direction and rapidly identify the main forward direction of the roadway and adjacent spaces if the street space has better permeability. On the other hand, disorientation and a loss of orientation can quickly result from uniform obstruction of the field of vision in all directions.
Relaxation	suppressed-relaxed	The phrase describes how at ease pedestrians feel in the streetscape. Pedestrians feel more at peace in a street area the easier it is to navigate. On the other hand, they might feel uneasy.
Richness	monotonous-rich	The phrase describes the level of richness that pedestrians find in the streetscape. Pedestrians are more likely to feel engaged and intrigued about the street and its environs when it is richer, which makes them more receptive to the street. On the other hand, they can experience fatigue and boredom and be unable to enjoy a leisurely stroll down the street.

3.3 Establishing interactive index system

The term "human behaviour based on observation" describes a range of proactive-reactive behavioural patterns that people exhibit when they are in public areas. The spatial nodes that walking traverses are linked together to form a whole observation trail as these behaviours move across the area. The characteristics of spatial human flow distribution, often referred to as spatial vitality, are the dynamic observation states of many people overlapping, converging, and dispersing in the space.

We suggest the objective-subjective interaction index, which includes two indicator levels: the spatial vitality index and the frequency of dynamic observation of subjects in the guest space environment. This indicator serves as an evaluation metric for the dynamic observation of subjects.

When people watch landscapes in a space, their bodies and eyes follow certain trajectories, which are referred to as observation routes. The frequency of dynamic observation paths is defined as the ratio of the total number of observation paths in the neighbourhood to the overlapping times of different users' paths in the same location. The following are the precise steps in measurement: Gather walking trajectory data for the research area from a website (e.g., two-step path trajectory data), import it into a geographic information system (GIS), and overlay it with the spatial locations of observation points. Next, compute the ratio between the frequency of each sample point's path and the total number of paths using inductive statistical methods.

The spatial vitality index refers to the distribution state of spatial human flow formed by the aggregation and dispersion of people due to social, cultural, economic, and environmental activities. It is calculated by averaging the heat values of the same sample point at different time periods, resulting in the spatial vitality value of the sample point.

4 Method

4.1 Study area and sample collection

This study focuses on Hengshan Street in Shanghai as the research area. To ensure the accuracy, operability, and comprehensiveness of the evaluation results, a quasi-experimental simulation was conducted based on real-world conditions. Comprehensive consideration was given to factors such as street spatial elements, spatial structure, and visibility distance. The evaluation was conducted with 50m as a research unit, and the central line of the roadway was used as the dividing line to divide the west and east sidewalks of the block. Combining with the Chinese people's long-standing consciousness of "walking on the right side," we simulated the walking process and collected corresponding streetscape samples. Specifically, the east sidewalk adopted a walking route from south to north, while the west sidewalk adopted a walking route from north to south, simulating the way pedestrians walk in the street. The photos were taken at eye level, approximately 1.6 meters high, with a mobile phone's camera function in 1X zoom mode and full-screen photo ratio, every 50 meters apart[32]. At the same time, the positioning

function of the two-step path APP was activated, and a field photo was taken at each sample point as a reference for observation point location. The observation path files were also preserved, resulting in a total of 80 sample images (Figure 1), two kml file paths, and 80 points.

Figure 1. Schematic Diagram of Sample Images

4.2 Measurement methods for objective index

The calculation methods for objective index include streetscape image semantic segmentation, GIS spatial operation, and Colorimpact color analysis. Semantic segmentation is used to measure three objective indexes of spatial elements: sky view factor, architectural visual proportion and green view index. GIS is used to determine mean horizontal visual depth of the sample spatial structure, while the Colorimpact software is used to analyze the RGB color values in the sample images.

4.2.1 Semantic Segmentation of Streetscape Images

To begin preprocessing, the gathered streetscape image dataset is first imported into Adobe Photoshop. To prevent any potential segmentation errors caused by extremely large image resolutions, the image size is lowered to 1000 x 462 pixels. The processed images are next subjected to analysis using a visual image semantic segmentation, namely the CUG.HPSCIL image recognition tool. To determine the sample image's sky view factor, we segment the spatial elements and then extract the "03_Sky" from the segmentation results. In order to determine the visual percentage of building façades in the sample image, we additionally extract the "02_Buildings". Furthermore, the "05_rees," "10_Grass," and "18_Plants" from the segmentation results were added together.

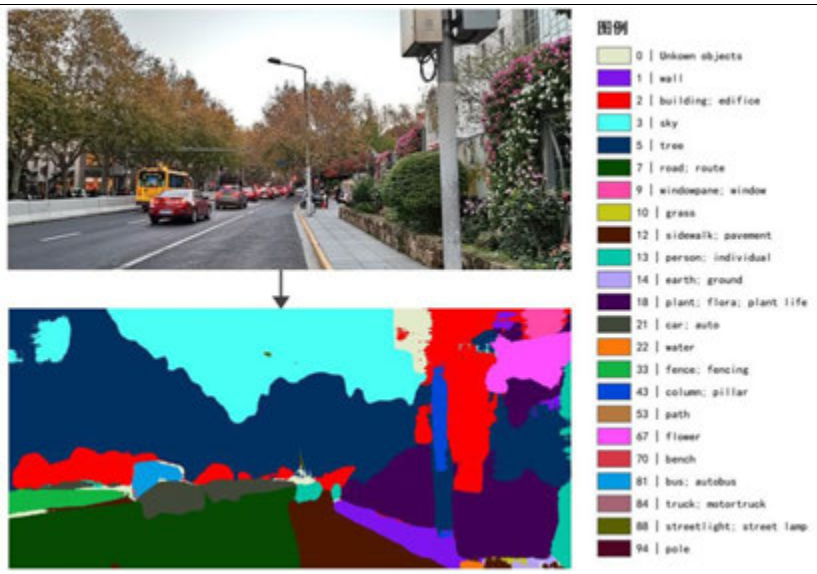
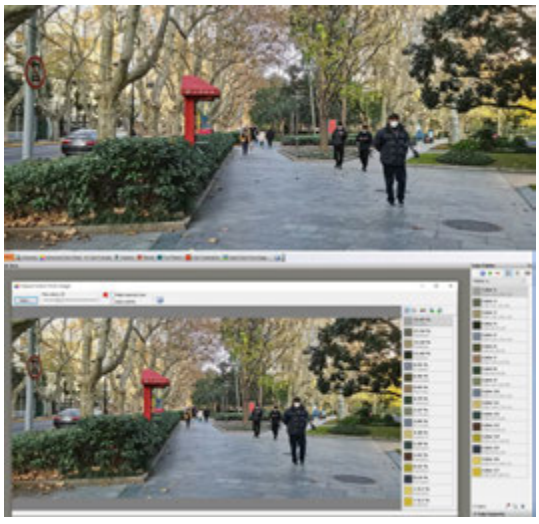


Figure 2. Image and semantic segmentation results for sample point East_02

4.2.2 Colorimpact color analysis

Sample images are imported into Colorimpact, and the RGB color values that account for more than 0.1% of image are exported (Figure 3). These values are then recorded in an Excel document, and the final result is calculated based on the formula for color richness.

Figure 3. Color analysis results by Colorimpact



4.3 Measurement Methods for Interaction Index

4.3.1 Calculation of dynamic observation frequency based on pedestrian trajectories

Pedestrian trajectory data of the street is obtained from the official website of a walking app, and the data is preprocessed and cleaned to filter out valid user walking trajectories. The data is then imported into a GIS system, where it is overlaid with the spatial layout of buildings and other structures in the observed street for data visualization analysis, specifically the visualization of observation paths in the street space (Figure 4). By integrating the spatial data of observation points, the road is divided into two parts, and a buffer zone of 80 sample points is constructed with a buffer radius of half the road width, which is 8 meters. The number of observation paths within each sample point's buffer zone is then calculated and divided by the total number of observation paths in Hengshan Road, resulting in the dynamic observation frequency for that sample point. The relevant expression is:

$$Rx=n_x/N*100\% \quad (1)$$

Rx represents the frequency of observation paths for sample point x. Taking the eastern sample point 1 as an example, where the sample point number x is East_01, nx represents the number of paths passing through that sample point, and N is the total number of paths collected.

Figure 4. Visualization of two-step path trajectory data

4.3.2 Calculation of spatial vitality index based on Baidu heatmap

Based on the principles of randomness and pedestrian crowding degree, a random weekend day (February 12, 2023) and a weekday (February 13, 2023) were selected. The Baidu heatmap data was captured hourly from 8:00 am to 8:00 pm, resulting in a total of 26 heatmaps. Subsequently, the ArcGIS tool was utilized to define the projection and perform georeferencing. Multi-ring buffer zones were processed using half of the road width, which is eight meters, as the buffer radius. Heatmap areas within these buffers were then extracted to generate "street heatmaps."

The heat values were categorized into seven levels from zero to seven, quantized as zero, one, two, three, four, five, and six, with higher values indicating greater vitality in the sample space. The average heat values for different observation points on weekends were then calculated:

$$T_1=\sum_{i=1}^{n} T_n/N \quad (i\epsilon N^*) \qquad (2)$$

Among them, N represents the total number of heatmaps collected on weekends, which is 13, and Tn represents the heat value collected at different time periods on weekends. The average heat value for weekdays is calculated as follows:

$$T_2=\sum_{i=1}^{n} T_n/N \quad (i\epsilon N^*) \qquad (3)$$

N represents the total number of heatmaps collected on weekdays, which is 13, and Tn represents the heat value collected at different time periods on weekdays. Taking a week (5 weekdays and 2 weekends) as a cycle, the average heat value of the sample points is calculated as:

$$T=(T_1*2+T_2*5)/7 \qquad (4)$$

Through the analysis of the heat values of the sample, the spatial distribution patterns and characteristics of street vitality are finally calculated. A higher average heat value of the street indicates greater pedestrian flow and more vitality.

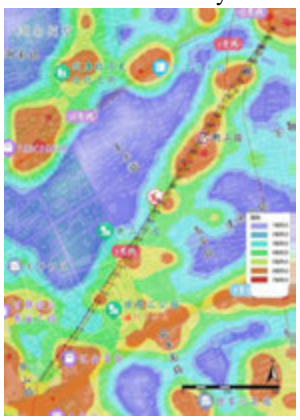


Figure 5 Weekend_13 , 20:00 Baidu heatmap data

5 Results

5.1 The result of objective measurement in Henshan Street

The quantitative results of objective index (Tables 4) show that the spaces with the best sky view are sample point _17 on the east side with view of 23 percent, and sample point _31 on the west side with view of 22 percent. The view of sample point _05 and point_12 on the east side and sample point _20 on the west side are all 17 percent, indicating that these two sample points have the largest area of visible sky.

Compared with the visual proportion of buildings, it is found that the overall visual

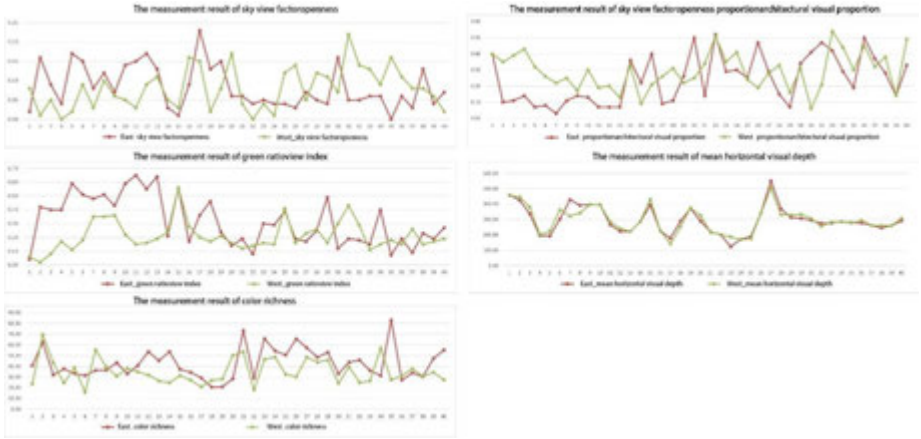
proportion of the sky in Hengshan Road is far lower than that of buildings, indicating that the building density in this area is greater than the sky area. The spaces with the smallest openness are sample point _35 on the east side, sample point _04 on the west side, and sample point _22 on the west side, with a sky visibility area tending to zero, indicating that the spatial closure of these three sample points is too high, and the spatial vision is seriously obstructed.

The fluctuation of horizontal visibility distances on both sides are similar, which may be due to the straightness of Hengshan Street and the similar ground elevations. Among them, the samples with the largest horizontal visibility distances are sample point _27 on the east side with a value of 550.21, and sample point _27 on the west side with a value of 504.82. The smallest ones are sample point _17 on the west side with a value of 141.11, and sample point _23 on the east side with a value of 123.29, showing a significant difference, indicating that the visual length of the studied street varies significantly.

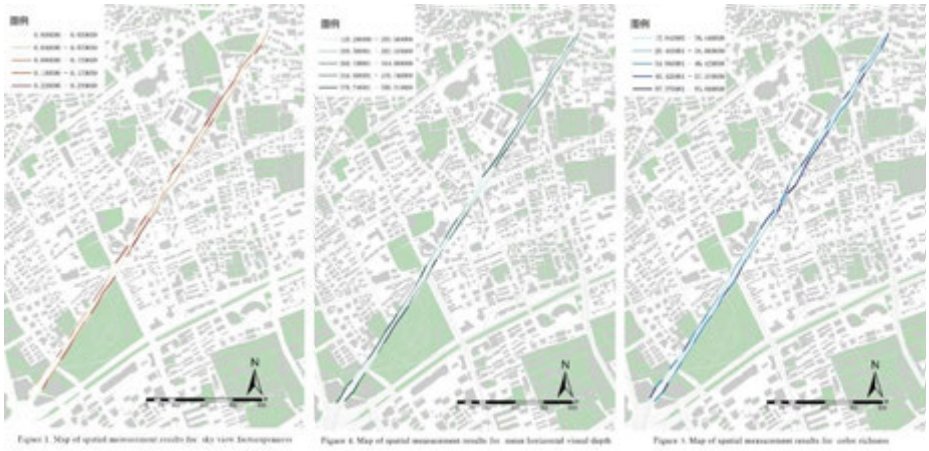
The three points with the highest visual proportion of buildings are sample point _31 on the west side with a visual proportion of up to 58 percent, sample point _22 on the east side with a visual proportion of 52 percent, and sample point _22 on the west side with a visual proportion of buildings at 51 percent. The maximum building area is far higher than the maximum sky area of 23 percent. The lowest building density is sample point _07 on the east side with a value of 3 percent, sample point _31 on the west side with a value of 6 percent, and sample points _05, 11, 12, 13 on the east side, with a visual area proportion of buildings at seven percent.

The three points with the highest green view index are sample point _5, point _11, point _12 on the east side, with green view indexes of 59 percent, 65 percent, and 64 percent in order. The green view index exceeds half of the overall visual proportion of 50 percent, indicating a very high green view index. The lowest green view index is sample point _01 on the east side with a value of four percent, sample point _01 on the west side with a value of 8 percent, and sample point _02 on the west side with a value of 1 percent. The three points with the highest color richness are sample point _35 and 21 on the east side and sample point _2 on the west side, with color richness values of 83.09, 73.21, and 69.51 in order. The lowest color richness is sample point _06 and 22 on the west side, with values of 15.84 and 18.00 respectively.

Tables 4. Objective index calculation results for each sample point on Hengshan Street



Using GIS to visualize the spatial results of the objective evaluation, as shown in Figure 6, the deeper the color, the higher the proportion of the skyline visual area, indicating a more open space. The maximum visual proportion of the skyline is 23 percent, while in some local areas, the skyline area is almost zero. The main reasons for this are two points: firstly, the street has a long history with rows of plane trees, covering most of the street space; secondly, the width of the motor vehicle lane on this street is approximately 16 meters, with buildings



standing on both sides, resulting in limited public space and a relatively crowded environment.

Figure 6. Spatial location map of objective index measurement results

The location of the building visual proportion in the street space shows that the maximum building visual proportion is up to 54 percent, mainly concentrated in the northern area. The southern part is a large commercial district with taller buildings, but they are a certain distance from the street. Additionally, the southeastern part is Xu Jiahui Park, where buildings are sparse.

Therefore, the distribution characteristics of the building visual area in the space are obvious.

The spatial location map of the average horizontal line of sight distance. Since the street is straight and has good permeability, the overall average line of sight distance value is relatively large.

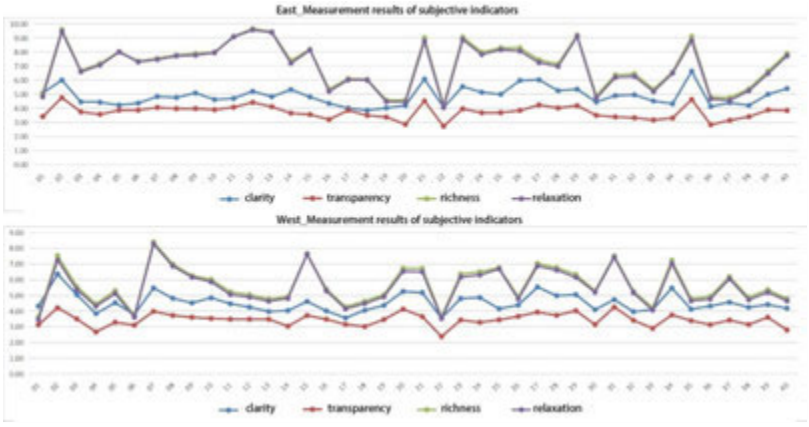
In terms of spatial distribution, it reveals that the green view index is dense in the south and gradually decreases from south to north. Especially along the border of Xu Jiahui Park, the green view index reaches 65 percent. This is because the pedestrian walkway in this area differs from the unilateral planting characteristics of other areas, featuring low hedges and tall plane trees, camphor trees, and other species on both sides. This section of the pedestrian walkway cleverly combines walking and jogging paths, attracting runners and greatly enhancing the spatial vitality of the pedestrian walkway. Furthermore, the hedges separate the pedestrian walkway from the roadway, making human activities less vulnerable and safer.

It expresses the spatial location characteristics of color richness, and the proportion of high-color areas in the entire street space exceeds half. The street district is rich in color variety and locally unified, creating a sense of integrity in the changing spatial vision.

5.2 The result of subjective measurement in Henshan Street

In terms of the correlation equations between environment and perception evaluation index from existing literature research, as well as the analytical results of the spatial environmental index of the sample points, we calculated the subjective index of clarity, transparency, relaxation, and richness. The findings indicate that the values of relaxation and richness in the Hengshan Road district are similar, but there are significant fluctuations in different spaces, resulting in noticeable differences in perception. In contrast, the differences in clarity and transparency are relatively small, resulting in a more homogeneous spatial experience.

Table 5. Subjective Index Calculation Results

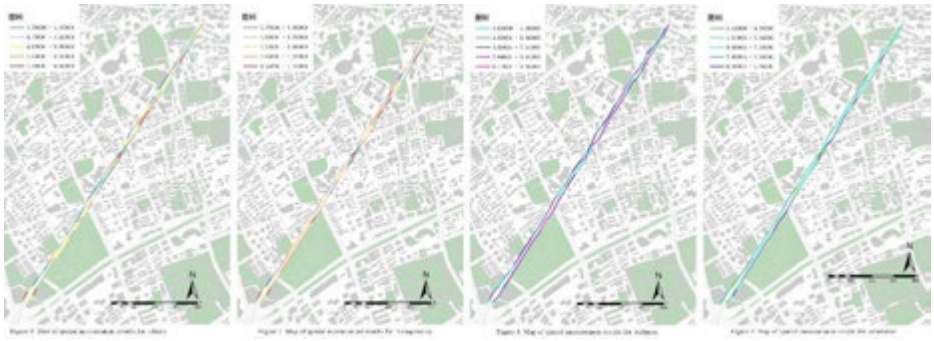


Using GIS to visualization the subjective index results, as shown in Figure 7, the distribution of clarity in the space reveals that areas that tend to create a sense of brightness are relatively scattered. The pedestrian walkway next to Xu Jiahui Park has a lower sense of brightness.

As shown, the darker the color, the better the spatial sense of transparency. The area next to Xu Jiahui Park has a higher sense of transparency, while the transparency of other streets in the area is also good, with few areas having low values.

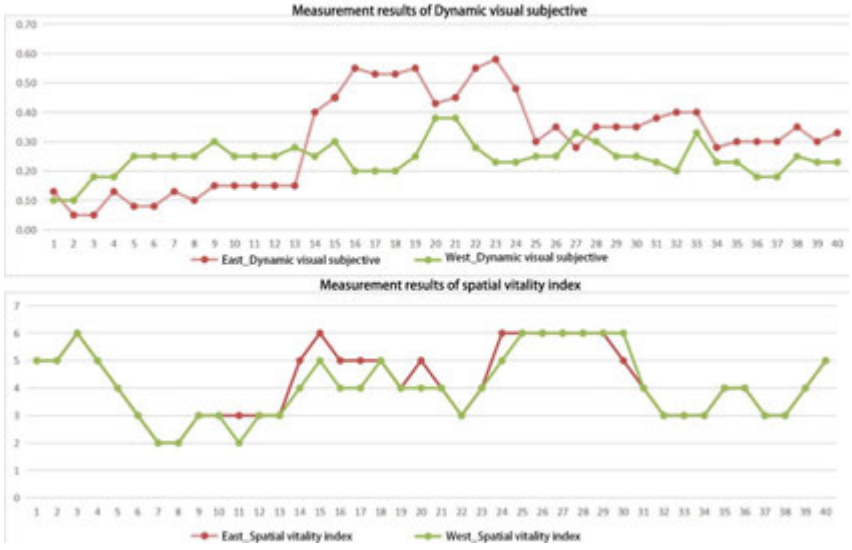
It represents the location maps of the sense of relaxation and richness. The pedestrian spaces close to Xu Jiahui Park tend to evoke a sense of relaxation and have a high spatial richness, indicating that spaces with high vegetation coverage, such as slow-moving pedestrian walkways, provide a positive perceptual experience for people.

Figure 7 Spatial location map of subjective index



5.3 The result of interactive index measurement in Henshan Street

Table 6. Interactive Index Calculation Results

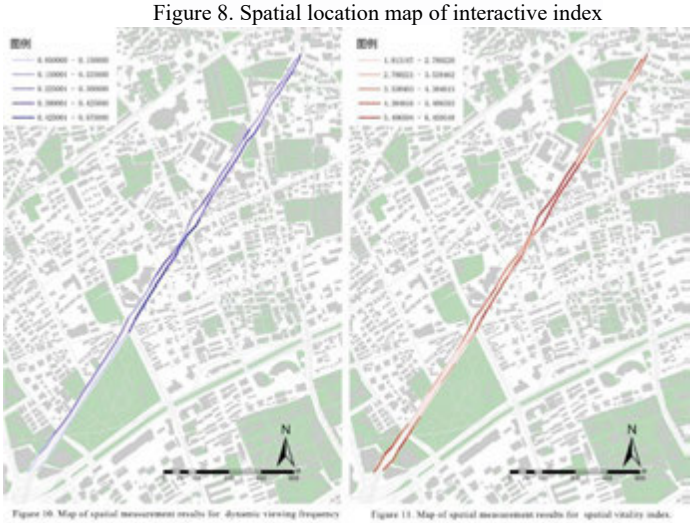


Based on the sample point calculation results, a statistical table of the dynamic viewing frequency for samples on both the east and west sides (Tables 6) have been compiled. The west side shows a relatively balanced spatial distribution of dynamic viewing frequency, while the observation points on the east side near Xu Jiahui Park have a lower pedestrian viewing frequency. As people approach the middle section of the street, the pedestrian viewing frequency increases. The possible reasons for this are as follows: when pedestrians approach Xu Jiahui Park, they may be attracted by the park's internal landscapes and activities. Additionally, this section serves as a jogging track, so to avoid crowding and collisions with other pedestrians, people may choose to change their route and enter the park to walk around.

According to the results of Baidu heatmap, that the high-activity areas are distributed in a "multi-core" point-like pattern in the streets; only eight points have fluctuating spatial heat values in the observation points on both sides of the same serial number; the highest heat value is six which is a high-activity block, and the lowest heat value is two, which includes three points. The maximum difference in heat values for the entire block is four; the areas with the highest heat values are mainly concentrated in serial numbers 24-29, with an average heat value of six, followed by the spatial heat values of serial numbers one-four. The analysis reason is that this area is connected to the Xuhui business district and is relatively easy to attract traffic.

Importing the frequency data of viewing into GIS for data visualization analysis shows that the darker the color, the higher the frequency of people's walking view of the space. Except for the slow-moving path next to Xuhui Park in the south, the frequency of viewing at other locations is high, indicating good utilization of the space for walking. The reason is that this area is connected to Xuhui Park, with multiple locations that can directly access the park. The public who uses walking to tour the streets prefer to enter parks with beautiful scenery, rich vegetation, and diverse spatial activities, which leads to a low frequency of viewing in this area.

Figure 8. Spatial location map of interactive index

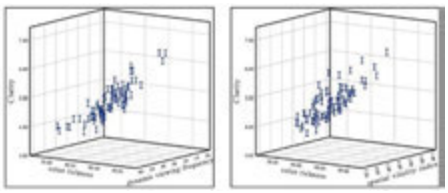


As shown in Figure 8, the darker the color, the higher the spatial vitality index, and the greater the average flow of people in the space. The Hengshan Road block does not have a high density of people throughout the entire route, but there are two distinct low-vitality areas in the middle. The high-vitality area in the middle is mainly due to that it is the entrance and exit of the subway Hengshan Road Station, which has a relatively high flow of people.

5.4 The Mechanism of Urban Street Dynamic Landscape

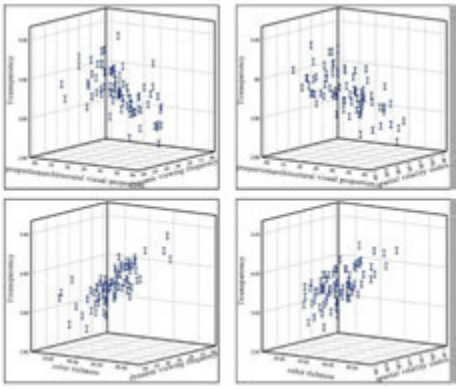
One dependent variable and two independent variables were used in a regression study using SPSS's Partial Least Squares Regression (PLSR) method. To be more precise, the first independent variable consisted of five objective evaluation indexes: sky openness, building visual proportion, green view index, average horizontal visibility distance, and colour richness. The other four subjective evaluation indexes were clarity, transparency, openness, and richness. The second independent variable was the spatial vitality index, dynamic viewing frequency, and landscape choice deviation under the interaction between the subjective and objective components. Sample data were used to explore the correlation between subjective, objective, and interaction index, specifically the subjective sensation characteristics under different "dynamic viewing" states and objective environmental characteristics. The indicator equations with a model fit $R^2 \geq 40\%$ were selected and output.

Figure 9. 3D scatter plot of clarity



The strong correlation results were visualized using a 3D scatter plot in SPSS. As shown in Figure 9, there is a strong correlation between richness, dynamic viewing frequency, landscape preference, and spatial vitality index. The relevant equation expressions are: Clarity = 2.981 + 0.046 * Color Richness - 0.356 * Dynamic Viewing Frequency, Clarity = 2.732 + 0.046 * Color Richness + 5.523 * Landscape Preference, Clarity = 2.834 + 0.046 * Color Richness + 0.017 * Spatial Vitality Index. The results indicate that the more diverse the spatial colors are, the clearer and more easily understood the spatial environment is perceived by people. Clarity has a negative correlation with dynamic viewing frequency, meaning that the higher the frequency of walking in the space, the lower the perception of spatial clarity. At the same time, clarity has a positive correlation with landscape preference deviation and spatial vitality. The more popular

the landscape space is, the lower the clarity is, while the higher the spatial vitality index, the

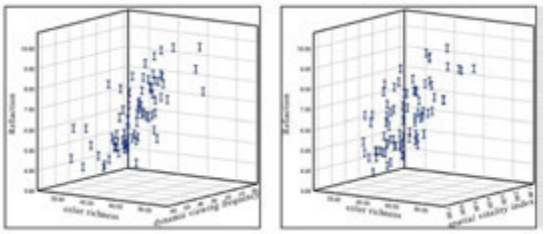


more dynamic and interpretable the space is.

Figure 10. 3D scatter plot of transparency

The sense of transparency has a strong correlation with building visual proportion, color richness, dynamic viewing frequency, landscape preference, and spatial vitality index. The correlation equations are: Transparency = 4.183 - 2.411 * Building Visual Proportion + 0.158 * Dynamic Viewing Frequency, Transparency = 4.208 - 2.370 * Building Visual Proportion + 0.303 * Landscape Preference, and Transparency = 4.018 - 2.406 * Building Visual Proportion + 0.050 * Spatial Vitality Index. These equations suggest that when there is less building volume in the space and a lower proportion of buildings in the visual field, the higher the deviation in people's preference for the spatial landscape, the higher the number of dynamic viewing routes, and the greater the flow of people in the space, indicating a higher sense of transparency and openness.

Figure 11. 3D scatter plot of relaxation



There is a strong correlation between the sense of relaxation and color richness, dynamic viewing frequency, landscape preference, and spatial vitality index. The specific equations are: Ease = 3.369 + 0.090 * Color Richness - 1.791 * Dynamic Viewing Frequency, Ease = 2.323 + 0.091 * Color Richness + 20.765 * Landscape Preference, and Ease = 3.183 + 0.090 * Color Richness - 0.071 * Spatial Vitality Index. These equations suggest that when there is a greater variety of colors in the space, with a decrease in the frequency of walking and viewing, a lower preference for the space, and less foot traffic, people tend to feel more relaxed and focused on

the environment and their own experience.

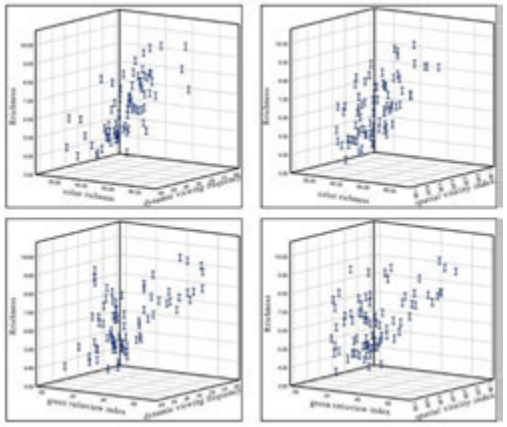


Figure 12. 3D scatter plot of richness

The three-dimensional scatter plot shows that people's sense of richness in spatial environments has a strong correlation with spatial colors, vegetation, walking routes frequency, landscape preference, and spatial vitality index. The specific equations are: Richness = 3.324 + 0.088 * Color Richness - 1.867 * Dynamic Viewing Frequency, Richness = 2.233 + 0.089 * Color Richness + 21.651 * Deviation in Landscape Preference, Richness = 3.130 + 0.088 * Color Richness - 0.074 * Spatial Vitality Index, Richness = 4.223 + 6.829 * Green View Index + 0.789 * Dynamic Viewing Frequency (R2 = 0.401, 0.412), Richness = 5.045 + 6.933 * Green View Index - 25.333 * Landscape Preference, and Richness = 3.745 + 6.812 * Green View Index + 0.167 * Spatial Vitality Index. This indicates that with more color variety in the space, fewer walking passages, lower preference for the space, and less foot traffic, people perceive a higher level of richness in the spatial environment and are better able to experience the objective environmental details. As the amount of green vegetation increases and the frequency of viewing also rises, people's preference for the space and spatial vitality increase, leading to a higher perception of spatial richness, indicating an increased ability to perceive the space.

From the comparative analysis of the images, the top three significant linear correlations are: Clarity - Color Richness - Dynamic Viewing Frequency > Clarity - Color Richness - Landscape Preference > Clarity - Color Richness - Spatial Vitality Index. The objective index of sky view proportion and average horizontal visibility distance have low correlation indices with subjective index and subject-objective index, indicating weak correlations. In urban street spaces, green view index mainly affects people's sense of richness, with a lower impact on subjective index. Among the objective index, building area and color richness significantly influence people's perception, and thus should be given priority consideration in planning and design.

6 Conclusions

The study takes objective urban street environmental index such as sky view factor, architectural visual proportion, green view index, mean horizontal visual depth, and color richness, as well as subjective index like clarity, transparency, richness, and relaxation, as independent variables. It also considers the interactive index between the subjective and objective under dynamic viewing conditions, including dynamic viewing frequency, and spatial vitality index, as dependent variables. The study explores the characteristics of streetscape that significantly influence the viewing behavior in urban street environments, as well as their visual perception features. Based on this, design methods are proposed to enhance the frequency of viewing, spatial vitality, and landscape preference in street spaces. The specific conclusions include the following three aspects:

Establishing interactive evaluation index system. Based on the subjective perceptions stimulated by the "dynamic viewing" mode in the objective environment, the study innovates the evaluation index system by adding index such as dynamic viewing frequency based on spatial positioning trajectory data and spatial vitality index based on pedestrian flow distribution status. These indexes are then combined with the subjective and objective index from previous studies to construct regression equations that are closer to realistic viewing conditions.

Qualitative and quantitative evaluation index system. Through data sources such as sample photo collection, spatial positioning data from the "two-step" app, Baidu Heatmap, OpenStreetMap street, building and road data, and GSCloud, methods like image semantic segmentation, GIS analysis, Colorimpact color analysis, and inductive statistics are employed to quantify the index system.

Summary of subjective and objective regression equations. Through partial least squares analysis in SPSS, the study found significant correlations between clarity, relaxation, and color richness, dynamic viewing frequency, and spatial vitality index; as well as between transparency and color richness, visual proportion of buildings, dynamic viewing frequency, and spatial vitality index.

Due to objective reasons such as weather conditions during photography, camera pixel quality, and seasonal changes, the sample images collected may not reflect the true appearance of the streets throughout the four seasons, and the relatively short time span of the samples may introduce certain experimental errors.

Due to the heavy traffic on the streets, the elements in the 360° panoramic photos collected on-site are severely distorted, with an imbalance in visual area proportion. Therefore, a static photography method was adopted as a second-best option, which may lead to incomplete observation point data and have a certain impact on the experimental results. Future research could incorporate behavioral patterns, such as stationary, mobile, and dynamic viewing speed, during the "dynamic viewing" state, employing methods such as eye-tracking experiments,

scientific observation, and trajectory tracking to expand the evaluation factors of the subjective-objective evaluation system and improve dynamic viewing evaluation index. The use of 360° panoramic photography can also be adopted to capture more comprehensive spatial environmental elements, improving the sustainability of the experiment. Alternatively, advanced technological means such as GoPro and anti-shake cameras can be utilized to collect spatial image samples of basic units for a more comprehensive perceptual evaluation study.

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GeoSpatial Virtual Reality & Planning AR Laboratory for education in spatial planning

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Abstract
This paper presents outcomes from a pioneering educational project funded by Warsaw University of Technology during the 2022/2023 academic year. The project aimed to establish a mobile Virtual Reality (VR) Laboratory supporting teaching in geoinformation, spatial planning, urban planning, and architecture. Leveraging the expertise of the Faculty of Geodesy and Cartography and the Faculty of Architecture, the laboratory promoted an interdisciplinary approach to geospatial analysis and planning. The project comprised six tasks, including organizing the laboratory, conducting pilot implementations, and developing interdisciplinary workshop scenarios. Five pilot implementations utilized VR technology in various aspects of the spatial planning process, receiving positive feedback from students and partners. The project facilitated student engagement, exchange of teaching practices, and expansion of academic offerings.

Keywords: augmented reality, co-creation, collaborative design, geospatial technologies

Full text

1. Introduction

The significance of Virtual Reality (VR) technology in spatial planning education is increasing, aligning with its growing importance in related industries. Higher education serves as the primary application field offering a novel educational environment, an immersive teaching system, and opportunities for remote education. Despite over a hundred publications addressing VR technology applications in education, limited information exists specifically on its use in spatial planning. VR technology presents various opportunities in education, including immersive learning environments for visualization and 3D modeling, as well as creating diverse educational products. (Figure 1, Figure 2). However, challenges remain to be addressed.

VR technologies have the potential to revolutionize spatial and urban planning education by providing enhanced (immersive) learning experiences (Sanchez-Sepulveda et al., 2019, van Leeuwen et al., 2018, Pouke et al., 2019, Vats and Joshi, 2024), improving usability and effectiveness (Sanchez-Sepulveda et al., 2019, Zhang and Moore, 2014, Zuo et al., 2023), promoting stakeholders participation (van Leeuwen et al., 2018, Sabah et al., 2023), and offering realistic visualizations of urban spaces (Pouke et al., 2019, Schauppenlehner et al., 2018). Additionally, it enhances learning outcomes and student interest (Schauppenlehner et al., 2018). According to Vats and Joshi (2024), Wai Yie et al. (2023), Cicek et al. (2021), VR has the potential to engage students on a deeper level, making education more interactive and enjoyable, thus fostering curiosity, creativity, critical thinking, and problem-solving skills.

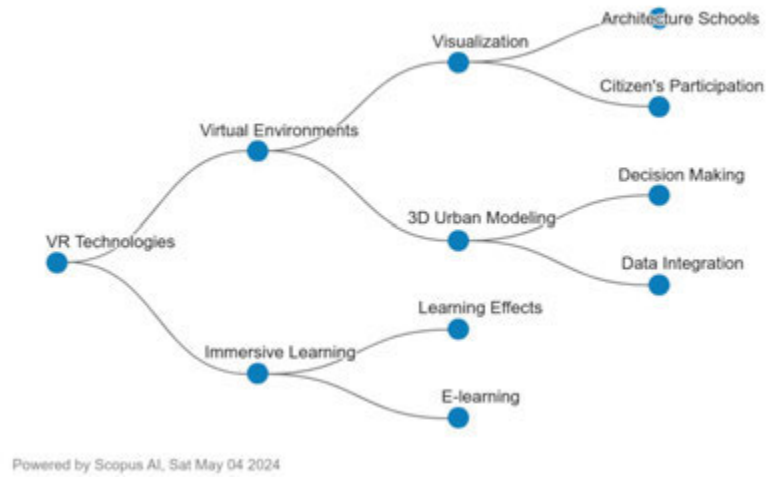

Figure 1. VR technologies applications in planning education

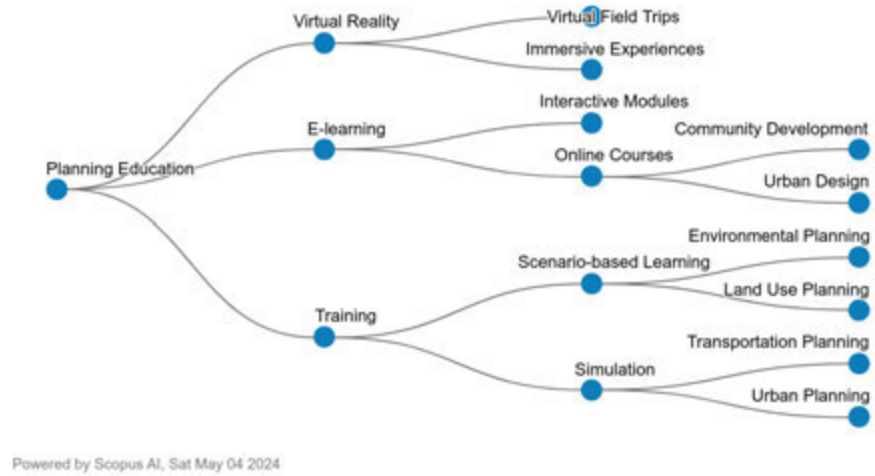

Figure 2. Various educational products using VR technology

As an Active Learning Tool VR involves visualization and interactivity with virtual dynamic and complex systems (Talbi et al., 2023, Vats and Joshi, 2024). Through skill development and training, VR offers opportunities to improve spatial understanding, engagement, motivation, and learning outcomes (Holubinka et al., 2023, Elaish et al., 2024, George et al., 2022). Stewart and Lopez (2021) claim that VR contributes to developing spatial visualization skills with increased student motivation and better performance (Figure 3).

VR supports collaborative design processes in architecture and urban planning education by facilitating remote, real-time collaborative work, and spatial comprehension (Wagemann and

Martínez, 2022, Tran et al., 2024). VR as a communication medium in urban planning and design provides decision-makers with access to a shared virtual space, impacting decision-making processes (Roupé and Gustafsson, 2013, Sanchez-Sepulveda et al., 2019). As such, VR serves as a social participation tool (Figure 4).

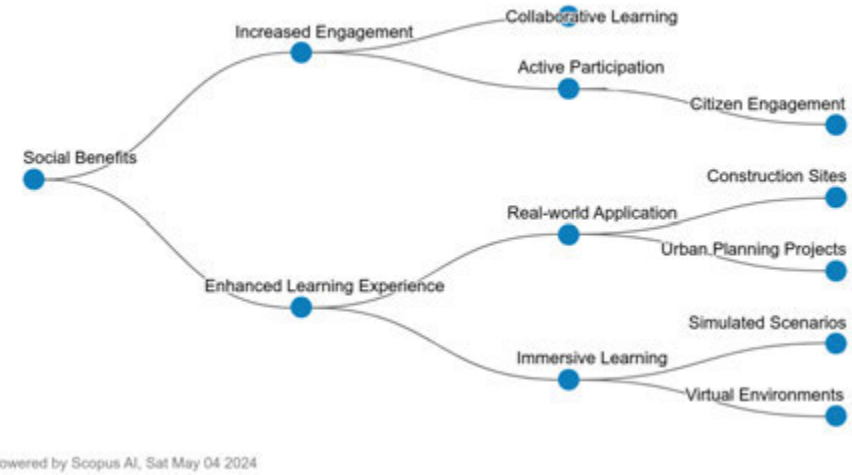

Figure 3. Students engagement in learning process involving VR technology

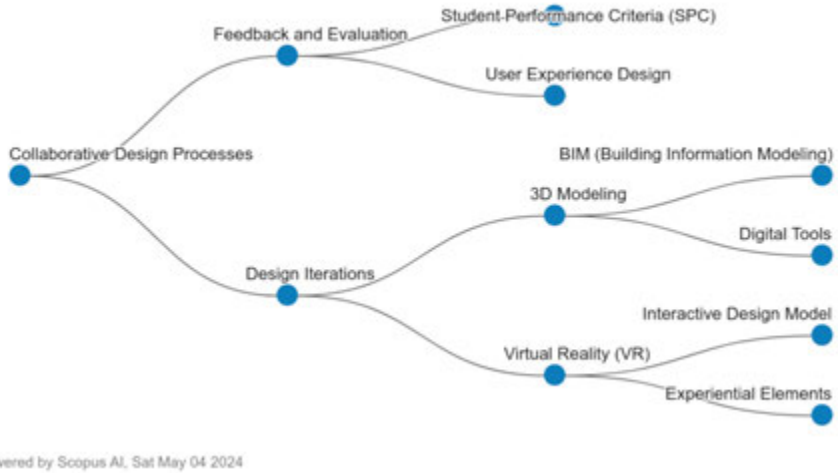

Figure 4. Supporting collaborative design process by VR technology

The interdisciplinary potential of VR technology spans spatial planning, urban planning, architecture, and geoinformation domains (Conesa-Pastor et al., 2022; Wu et al., 2021; Zang et al., 2021; Zhang and Li, 2021).

Regarding challenges in integrating VR technologies into planning education, there is a need to consider economic, technical, and ethical issues.

In terms of economic challenges, the high costs for content development and educator training have been identified as barriers to widespread and effective adoption in educational programs (Kencevski and Zhang, 2019), Additionally, the costs of hardware and software, ongoing maintenance, and the necessity for strategic planning and investment to effectively utilize VR in education pose significant economic challenges (Talbi et al., 2023, Vats and Joshi, 2024, Elaish et al., 2024). However, the potential benefits of improved learning outcomes and increased student engagement may offer a positive return on investment in the long term (Vats and Joshi, 2024, Elaish et al., 2024).

Technical challenges encompass integrating appropriate hardware and software, which can be costly and require regular updates to keep up with technological advancements (Wai Yie et al., 2023). VR equipment needs technical support and maintenance, including troubleshooting and software updates (Holubinka et al., 2023, McGrath, 2019). Moreover, ensuring equal access to VR technologies for all students, regardless of their socioeconomic background, is a significant challenge that needs to be addressed (Talbi et al., 2023, Vats and Joshi, 2024). According to Talbi et al. (2023), Riemann et al. (2020) Vats and Joshi (2024), and Rangarajan et al. (2024), the technological limitations of VR need to be overcome to ensure effective integration into education programs. As using VR requires technical knowledge, individual engagement in urban planning can be limited, and learning costs can hinder citizen participation (Sabah et al., 2023) (Figure 5).

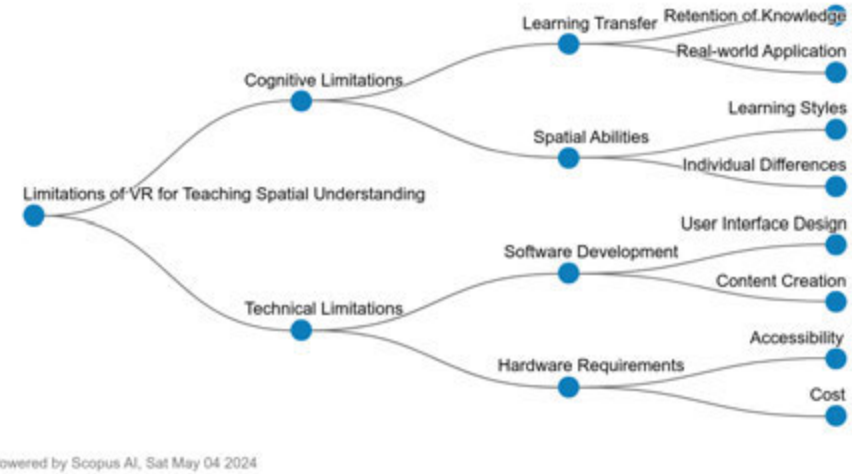

Figure 5. Limitations of VR for teaching spatial understanding

Ethical considerations associated with the use of VR technologies in Urban Planning Education relate to physiological and cognitive impacts, behavioral and social dynamics, and the need for ethics in practice in their use (Kenwright, 2018). Ethical considerations also include ensuring equitable access to VR technologies for all students (Talbi et al., 2023). Moreover, implementing VR in education requires addressing privacy and data security concerns related to collecting and using student data within virtual environments (Wai Yie et al., 2023) (Figure 6 and 7).

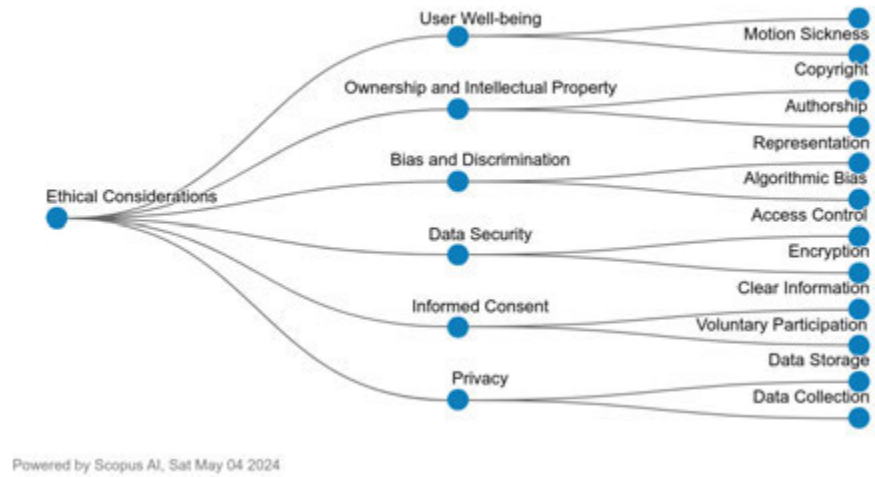

Figure 6. Ethical consideration in VR impemention into didactics

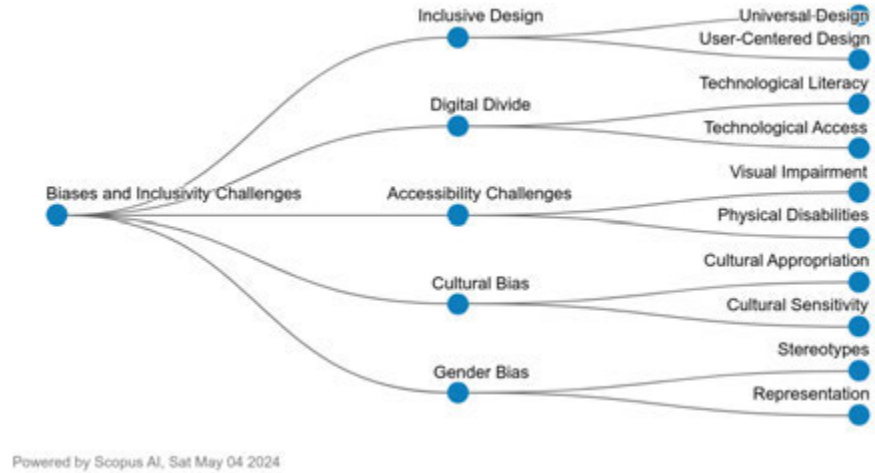

Figure 7. Biases and Inclusivity challenges

Further research is needed to understand the pedagogical effectiveness of VR in education and address associated considerations and challenges (Elaish et al., 2024, Holubinka et al., 2023).

This paper unveils the outcomes of a groundbreaking didactic project funded by Warsaw University of Technology (IDUB - Excellence Initiative - Research University) during the academic year 2022/2023. The project aimed to establish a mobile Virtual Reality Laboratory supporting didactics in geoinformation, spatial planning, urban planning, and architecture. Leveraging the distinct competencies of the Faculty of Geodesy and Cartography and the

Faculty of Architecture, the laboratory fostered an interdisciplinary and comprehensive approach to geospatial analysis and spatial planning. The goal of establishing the VR Laboratory was to enable:

- Activation of students through creative teamwork in solving design problems (spatial planning, urban planning, and architecture) in augmented reality.
- Skills development of geodesy and cartography students in processing geospatial data to create terrain and interior building models for Virtual Reality, and geoinformatics students in creating new geoinformation applications using VR technology (including creating Digital Twins).
- Exchange of good teaching practices through international cooperation by implementing joint, interdisciplinary, remote classes in VR/AR.
- Technological innovations, increasing academic teachers' qualifications in new digital technologies, and modern education methods.

2. Results

The project comprised six tasks: 1) organizing the laboratory; 2) conducting five pilot implementations in teaching; 3) developing an interdisciplinary planning workflow workshop scenario; 4) undertaking science popularization actions; 5) promoting among departments; and 6) formulating a future deployment plan. The pivotal aspect was the execution of five pilot didactic implementations, each employing VR technology for various purposes in varied learning environments and formulas within the spatial planning process. The interdisciplinary team conducted the implementations.

The first implementation was an international and interdisciplinary workshop in collaboration with landscape architecture at the American University of Beirut (AUB), Lebanon. It was integrated into an undergraduate spatial planning course on Revitalization projects led by Dr. Eng. Agnieszka Wendland. The workshop took place on December 15, 2022. It was organized by the Department of Geodesy and Cartography of the Warsaw University of Technology. During the semester, students prepared the study area model in the VR environment and uploaded useful objects to the library. The workshop was held in a VR environment using the GravitySketch® application. During the workshop, spatial planning students (GiK PW - one design group) co-created design solutions in cooperation with landscape architecture students of AUB, The Faculty of Agricultural and Food Sciences, Department of Landscape Design and Ecosystem Management. It was a real-time remote interdisciplinary and multicultural collaboration and co-creation in the VR learning environment. Thirty-five students participated in the workshop (20 online, 15 on-site). The on-site users could observe the workflow on the projector, computer screen, or phone, allowing more participants to engage in the process. Lessons learned regarding the benefits of the deployed workshop formula are: a) VR learning environment enabled a better experience of the space and conscious engagement, b) students have developed effective communication and collaboration skills, utilizing the VR platform for shared experiences, feedback, and collective design exploration; c) through interactive and immersive experiences, VR fostered motivation, participation, and a sense of enjoyment in the learning process, d) through iterative refinement and visualization in VR, students have honed their ability to make informed design decisions, optimizing the visual and functional aspects of the landscape (Dreksler et al., 2023).
The WiFi, Software and Hardware limitations were also observed. Data processing can be challenging on mounted gear with low computing power or low Internet connection. Most

students could only work 30-40 minutes at a time. The process could be chaotic if the group is to big or the students are not properly trained (Dreksler et al., 2023).

The creation of a new facultative course, "Systemic Design for Sustainable Development," was the second implementation. The course is accessible to all Erasmus students under the graduate specialization Mobile Mapping and Navigation Systems by Dr. Eng. Katarzyna Rędzińska. The course was chosen by the students and implemented in the summer semester 22/23. Six international and interdisciplinary students participated in the course. The course was held in the Arkio® software environment. It had a workshop formula using systemic design tools, PBL, and a learning-by-doing method in four-hour modules. The design challenge addressed the possible involvement of Warsaw University of Technology in the NetZero race campaign - redesigning the University Campus (https://unfccc.int/climate-action/race-to-zero-campaign). The Virtual (augmented) reality technology was used in the prototyping phase of the developed design solutions. This implementation provided evidence of the enhancement of student engagement and learning outcomes. Students developed collaboration and communication skills and teamwork. A small group of participants allowed to avoid chaos in the process. Short lectures, on-site teamwork on the systemic design templates (Jones and van Ael, 2022), and design considerations separated the 30-minute VR session. The technical limitations, such as WiFi, software updates, and hardware (battery efficacy), appeared similar to those in the first implementation.

The third implementation involved integrating a VR camera in a landscape planning course for graduate spatial planning students led by Prof. Adrianna Czarnecka. The course assignment was to plan nature-therapy trails in collaboration with the Urban Forests of Warsaw. Through the use of VR technology, students were able to exchange experiences of landscape perception in VR reality. The materials developed by the students will serve for educational purposes, implemented at the Center for Nature and Forestry Education led by the Urban Forests of Warsaw. They will potentially be used as an encouragement to visit Warsaw's forests or as an interactive guide. This implementation is an example of the socioeconomic environment's partner involvement. The above-mentioned benefits and limitations were also confirmed.

Practical testing of VR environment-developed models, including GIS and BIM technology, incorporated into three courses on cartographical modeling for graduate geodesy and cartography students was the focus of the fourth implementation. The implementations covered 46 students and were conducted by Msc Miłosz Gnat. The courses did not involve teamwork and co-creation. VR technology benefits provided enhanced student engagement and learning outcomes. As the headsets were connected to the computers, there were only limitations regarding the students' well-being (30-minute work time sessions).

Last but not least, the implementation allowed students to experience public spaces as blind persons in an undergraduate spatial planning course on Public Spaces Planning and Design. The implementation consisted of an interactive projection of a blind person's experience of public spaces, "Notes on Blindness" by TV Arte. The students were tasked with answering the question of how this experience would contribute to the understanding and consideration of the needs of blind people in the process of designing the spatial development of public spaces. The implementation was optional. The class was carried out in three groups of 10-15 people each. Similar to the previous implementation, it was an individual experience, enriching the urban design studio. It benefited by augmenting students' engagement and a better understanding of the need for universal planning and design.

Four science popularization activities enabled the testing VR technology as a participatory, co-creation tool.

3. Conclusions

The project's VR implementations provided evidence of the benefits of deploying VR technology in spatial planning and urban design education, as mentioned in the literature. The project's realization facilitated the activation of students through creative teamwork, the exchange of good teaching practices, the enhancement of teachers' qualifications in digital technologies, and the expansion of the didactic offer. All implementations received positive evaluations from participating students and partners.

However, the project also encountered challenges. Its outcome was to provide the VR Laboratory to ensure equal accessibility to the novel technology for students. The development of procedures and regulations can address the technological and ethical limitations. While challenges of integrating VR technologies into planning education exist, the opportunities for enhancing the educational experience and developing essential skills are evident from the literature and the project's results.

Implementations two, four, and five will continue in their present form. The international workshop will be embedded into a new optional joint course with AUB. Further research is crucial to understand the pedagogical effectiveness of VR in education and to guide future policy.

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Building Tomorrow's Urban Futures: Reflections on the "BuildDigiCraft" Project and the Pursuit of High-Quality "Baukultur" in Higher Education.

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Abstract
The BuildDigitalCraft project (2019 - 2022) underscores the importance of education in fostering interdisciplinary knowledge exchange for creating high-quality urban spaces. It highlights a shift towards deeply integrating digital tools into professional practices while acknowledging societal concerns about digitalization in education. Findings indicate a significant evolution in our approach, moving from using digital tools as aids to deeply integrating them into professional practices. This article advocates for academia to serve as a facilitator of emerging modes of learning and promote scientific self-reflection. It emphasises the multidisciplinary nature of high-quality Baukultur and advocates for the intertwining of crafting qualities, tacit knowledge, and qualitative immeasurable aspects with digital, quantifiable, and data-driven qualities.

Introduction

Building tomorrow´s urban futures with the global population shifting increasingly towards urban areas, there is immense pressure on higher education institutions to prepare students to design and manage cities that are sustainable, resilient, and inclusive. **Fast-paced urbanisation** brings forth challenges related to infrastructure development, housing, transportation, and environmental sustainability. Higher education institutions, particularly those focusing on fields like architecture, engineering, urban planning, and related disciplines, are encountering a multitude of challenges in adapting to the evolving landscape of the built environment. Schools are facing increasing demands to prepare students for **rapid economic, environmental, and social changes**, for jobs that have not yet been created, for technologies that have not yet been invented, and to solve social problems that have not yet been anticipated (OECD, 2018).

Considering the rapid transformations in society, there's a growing imperative to redefine the broader educational objectives in higher education. This entails prioritising individual and collective well-being, providing tools for navigating complexity and uncertainty, fostering competencies for societal transformation, and guiding principles for moving towards eco-systemic change (OECD, 2018).

Increasingly, it's understood that the rapid pace of scientific and technological advancement demands a broad spectrum of knowledge, skills, attitudes, and values in practical application. This is a complex responsibility of equipping students with the knowledge, skills, and mindset necessary to address the diverse and interconnected challenges and a broad spectrum of issues ranging from engineering, architectural design and urban planning to sustainability, social equity, and technological innovation. Moreover, there is a growing importance of cross-disciplinary efforts in responding to these challenges. Students are those who if equipped in knowledge and skills will actively drive change.

Today higher education institutions are confronted with **increasing demand for digitalisation**. Digital technologies emerged already in the early 1990s, leading to a new era of culture and economics centred around data that has already transformed much of our production methods (Carpio, 2017). Now, they stand poised to revolutionise many aspects of our ways of thinking and doing things to adapt to the ongoing digitally driven transformation. In the rapid urban development and pressures on advancing digitalisation of workflow, there is a risk of neglecting the diverse perspectives necessary for long-term sustainability and well-being in cities.

In the technologically advanced and highly digitally driven professional work **the values and leading principles of traditional craftsmanship in the built environment**, contributing to the construction, design, and preservation of architectural landmarks and structures, need to be reintroduced and validated again (Bögle et al., 2022). There is a need for a fundamental change in the way "we are doing things" and the way "we communicate and collaborate with each other", and digital technologies play a major role in this transformation process. Digitalization is advancing as a fundamental concept also within higher education institutions, which calls for encompassing quality concerns across various dimensions (Tømte et al., 2019).

BuildDigiCraft was a three years´ project (2019-2022) established by eight universities in a Baltic Sea region as a joint research inquiry. Project developed and implemented innovative teaching and training modules for young scientists, PhD candidates and advanced master's level students and was introduced as a collaborative and cross-disciplinary exploration of three important thematic pillars in higher education anchored in the built environment: (i) knowledge, (ii) process and (iii) material. The project aimed to bring an understanding of the changing paradigm of building cultures in the digital age explored in the context of the relation between professional practice and higher education. The project allowed for a joint exploration of the questions related to today's craftsmanship: *how is the ongoing digital revolution affecting the work of designers, architects, engineers, urban planners, and other professionals responsible for the shaping of the built environment, and what opportunities arise from the available digital and data processing technologies for creating innovative solutions for design, construction, maintenance and management of buildings and cities* (Bögle et al., 2022)?

The project aimed for developing a shared understanding among project participants what is the high quality of the built environment in the digital age. And how do we measure and enhance the perception of its quality? It stressed that the common and

ultimate ambition of crafting the built environment and our engagement with it, involving aspects such as planning, constructing, renovating, and preserving should be built on the holistic concept of "Baukultur". The holistic concept of high-quality **Baukultur** encompasses all activities with spatial impact, from craftsmanship details to large-scale urban planning and the development of landscapes. It refers to all activities with spatial impact of all actors involved over time. In Europe Baukultur forms foundations for two key EU initiatives: the Davos Declaration (2018) and the New European Bauhaus- NEB (2020). BuildDigiCraft aimed to explore opportunities to further develop the concept of Baukultur in the context of a highly digitalized world and urgent re-definition of the roles of higher education in training future professionals.

The project collected significant and abundant material. The findings presented in this article were chosen specifically to tackle its primary inquiry: how higher education can facilitate the emergence of new learning methods in the digital age, preparing the next generation of planners and designers to responsibly shape high-quality built environments (Baukultur)? How to better address the need for a professional mindset change regarding digitalisation, the changing professional roles, and the ambition to shape high-quality spaces? How can higher education strengthen collaboration and knowledge exchange between professions of the built environment?

The paper is organised into five sections. The first presents previous studies addressing the digital revolution's impact on reshaping design and planning practices. The second explains the context of high quality Baukultur in the digital age. The third section introduces the BuildDigiCraft project, its aim and role in the development of an innovative higher education module, and the insights gathered from participants during organised training modules. The fourth section presents and discusses the idea of contemporary craftsmanship in the digital building culture (covering material, process, and knowledge). The final section further explores and discusses the role of higher education in training building professions in the digital era.

Digital Revolution and Transforming Design and Planning

Digitalisation is revolutionising our society and all actions related to our professional world, and the way we are dealing with physical space (Bögle, at al. 2022). The digital revolution has profoundly impacted design and planning disciplines across various sectors, reshaping the way professionals conceptualise, create, and implement projects. Carpo (2016) argues in *The Second Digital Turn- Design Beyond Intelligence* that every technological innovation only happens when technical supply pairs with cultural demands. This indicates that today´s building cultures adopted digital technologies in their daily professional work but in different ways over time. Carpo distinguishes the first and second digital turn. The first came in the early 1990´s and was expressed in producing variations, digital fabrication of not identical copies, digital mass customization and visualisation. The old professional knowledge and skills started to be used on new computational platforms. In the second digital turn building cultures have learnt to adjust more work to computers due to faster and better collection, transmission, processing of data, and in general problem solving. With the advanced use of new digital tools today´s computational revolution is begetting a new way of thinking, leaving much scope of work to computers which creates a brand-new science. The new kind of science that is inherent in most today´s AI applications, that are based on random testing, trials, and errors, looking for a precedent. This is a different approach than in traditional building and engineering cultures looking for

formulas and rules to predict desirable solutions. Examples of digital twins gathering data in virtual and augmented realities for collaborative and participatory processes present new possibilities for collaboration but also change perspectives on planning and decision support (Dembski et al., 2020).

In higher education **digitalisation** encompasses how the adoption of digital tools and platforms influences the interactions and operations of individuals and organisations within social and organisational contexts (Pinheiro et al., 2023, as cited in Bloomberg, 2018, p. 4). On the other hand, digital transformation (DT) represents a broader process involving significant organisational adaptation across various domains, in addition to effectively implementing digital platforms and solutions. Consequently, higher education must not only focus on integrating emerging technologies but also address the need to adapt to the increasing demand for digitalization in the workforce and the evolving roles within professions related to the built environment.

Digital technologies bring forth new viewpoints on digital processes, evolving knowledge, and materials/data, and when intertwined with the physical realm, they hold the potential to enhance the qualitative aspects of the built environment (Bögle, at al. 2022). They have not only enhanced the efficiency and effectiveness of design and planning disciplines but have also opened up new possibilities for innovation and creativity. By leveraging digital technologies and embracing interdisciplinary approaches, professionals can continue to shape the built environment in ways that are more sustainable, inclusive, and responsive to the needs of communities and individuals. Consequently, the fundamental mission of design and planning disciplines remains unchanged: shaping the objects we create and the environment we inhabit (Carpo, 2016).

In Europe this mission put an immense emphasis on achieving a higher quality of built environment as in the course of the transformation to a knowledge society, the importance of knowledge and expertise for companies and organisations is crucial.
The UNESCO International Bureau of Education (IBE) distinguishes between vertical and horizontal articulation in education (International Bureau of Education, 2016). Vertical articulation involves organising content within a knowledge domain over time, while horizontal articulation integrates content from different domains within a grade level. Much of the knowledge is "tacit knowledge". Today´s version of vertical and horizontal alignment seems directly linked to the digital and the question arises what happens when people digitalize or digitally share tacit knowledge. The digital transformation of tacit knowledge has a political and democratic dimension (Pedro Esteves Galvão Aibéo, Günther H. Filz, and Vishal Singh 2021), in architecture and planning, spanning from educational questions (Ylirisku and Filz, 2018), to design approaches (Ruan, Filz, and Fink, 2022) to the meaning of material, materiality and the digital for Baukultur (Popovic Larsen and Filz, 2023).

High Quality Baukultur and Digitalisation
The idea of Baukultur put a high-quality built environment in the centre of the work of designers, engineers and urban planners, applying it just as much to craft-related detail as to large-scale urban planning. For higher education in design and engineering schools, it offers a platform for methodologies and tools for future experts in those professions. Two key EU initiatives operationalizing the concept of Baukultur are the

Davos Declaration "Towards a European vision of high-quality Baukultur" from 2018 and the New European Bauhaus (NEB) Initiative 2020.

Those initiatives not only emphasise the need for a fundamental shift of mindset among those professions shaping the built environment, but even more significantly but address society as a whole for the first time focusing on the quality of their living environment. It aims to address pressing global challenges, both societal and climatic through the lenses of the built environment which is one of the key factors influencing those challenges as the Buildings and Construction sector is the largest emitter of greenhouse gases, accounting for 37% of global emissions for over 34 percentage of energy demand in 2022 (UNEP & YCE+A, 2023). To answer those challenges NEB aspires to bring together stakeholders from all domains (Pentahelix) – citizens, experts, designers, businesses, and institutions – to envision more sustainable cities and territories, not just in Europe but globally.

As described in the chapter above digitization is changing the way we are now shaping the built environment. The New European Bauhaus as a guiding framework among its other priorities is pivotal in defining how the ongoing digital revolution is affecting the work of designers, architects, engineers, and urban planners. Within the BuildDigiCraft project, we seek to examine new opportunities that arise from the available digital and data processing technologies for creating innovative solutions for the design, construction, maintenance, and management of buildings and cities (beyond standard workflows and material use). To nurture a high-quality Baukultur the fusion of physical and digital realms is becoming ever more intertwined, mutually fuelling each other. Hence, the craftsmanship qualities, tacit knowledge, and immeasurable nuances have to be interlaced with digital, measurable, and data-centric approaches. This synergy promises to prompt future high-quality Baukultur and the high-quality of spaces.
In January 2018, European Ministers of Culture convened at the Davos Conference on High-quality Baukultur in Europe to explore pathways toward enhancing the quality of the built environment. In pursuit of this goal, measures of the perception of a high-quality built environment were required. In 2020, the identical inquiry gained significance and ascended to the forefront of political discourse in Europe. Consensus was reached that the overall concept of high-quality Baukultur should be embedded in Europe on a political and strategic level. Within the BuildDigiCraft project Baukultur the context of the Davos Declaration was tackled through the following three aspects:

1. The current built environment, encompassing both cultural heritage assets and contemporary creation, should be perceived as a unified entity. Existing constructions serve as an important Baukultur reference for shaping the future design of our built environment.
2. All endeavours affecting the built environment, from detailed craftsmanship to the planning and implementation of infrastructure projects having an impact on the landscape, are manifestations of Baukultur.
3. Baukultur extends beyond physical structures to encompass the processes involved in its creation (Bögle, at al. 2022)

Most importantly, the concept of Baukultur transcended its niche among built environment experts but was officially endorsed at a political level, which happened together with the understanding that the built environment is not only the collection of the existing and newly designed building stock and infrastructure but also encompasses all the processes and activities required for its creation.

Based on such an understanding, the Davos Declaration gives further incentives to society, politics and science to rethink the current situation which is marked through disciplinary blinkers, ephemeral profit maximisation and digital automation, as well as confronted by major ecological and climatic challenges which may jeopardise the future of our planet. In terms of BuildDigiCraft Baukultur quality was measured against eight major criteria from the Davos System: Governance, Functionality, Environment, Economy, Diversity, Context, Sense of Place, and Beauty, giving a comprehension framework to measure the quality of the built environment.

BuildDigiCraft Project (2019-2022)

The BuildDigiCraft project aimed to develop and implement innovative educational training module tailored for young scientists, PhD candidates, and advanced Master's level students, focusing on both teaching and training aspects (Bögle et al., 2022). It allowed students and experts trained in design, architecture, engineering, urban planning, and related fields to focus together on the question of how to create high-quality Baukultur in the digital age. The program was part of a long-term partnership between eight universities in the Baltic Sea region. They share similarities in history, climate, landscape, and craftsmanship traditions. Despite these shared traits, each place and university has its own unique character and educational culture. In a joint collaboration, the represented research and educational departments of the eight universities managed to develop and realise a one year online training program, funded by the Erasmus+ strategic partnerships program.

The starting point of the program was the examination of new possibilities arising from the use of digital technologies for innovation in building design, construction, maintenance, and city management. It evolved then to a higher education discourse on the future of the professions of the building and planning sector, emphasising the need for a new work ethos and a more craftsmanship-oriented approach in a digitally impacted work environment.

The project builds on two leading concepts. First, "craftsmanship" is identified and introduced as a main guiding principle in the context of the ongoing digital transformation of the planning, design, and construction sector. Then, the concept of Baukultur is used to refer not only to the existing and contemporary building stock and infrastructure but also to the processes and activities required for their creation. The German term Baukultur was introduced by the Davos Declaration (2018) as an official term in the international professional language of the specialists of the built environment. With the help of the Davos Baukultur Quality System (2021), the high-quality Baukultur level of places can be defined based on eight criteria, which the BuildDigiCraft project takes reference.

The project brings these two concepts together by arguing that craftsmanship is essential for setting up the framework for designing a new path leading to a high-quality Baukultur in the digital age. The values and leading principles of traditional craftsmanship, such as dedication, pride in one's own work, and mindful and sustainable dealing with the building material, need to be re-introduced and validated in the context of the ever-growing digitally driven work environment. Moreover, they are highly needed for the creation and shaping of high-quality built spaces, which protect the environment, fit their purpose, add economic value, result in spatial coherence, connect people, create a sense of space, and are also aesthetically designed (based on the Davos Baukultur Quality System).

The exploration of the concepts of craftsmanship, Baukultur and digitalisation creates the holistic project framework of the project, calling for "high-quality Baukultur in the digital age through craftsmanship". This framework allows for knowledge integration between the interdisciplinary backgrounds of the participants of the BuildDigiCraft training program. Thus, different research questions, methodologies, design principles and theories as well as the different scales of the built environment – from the structural and architectural detail through the building to the urban level – can find common ground to mutually benefit each other. Hence, the project addressed a growing gap in the higher-education curricula of design and engineering schools, which indicates a clear need for more reflection space and interdisciplinary discussion on joint professional approaches for solving fundamental societal challenges. Within the training program, advanced students, and young researchers, as well as experienced teachers, were given a common platform to mutually elaborate on the core values and leading professional principles for achieving high-quality spaces. At the same time, the exchange and peer-review with other specialists of the built environment allowed them to get to know new professional perspectives, work methods and scale of interventions applied in other closely related disciplines. Participants gained new skills and competencies for navigating and collaborating with professionals of other disciplinary fields, with whom in the future they will be jointly responsible for shaping buildings, spaces, and also work processes. An exchange that is imminent once real projects are being developed.

What is the BuildDigiCraft´s training approach and how does the training work? BuildDigiCraft equips future professionals with a method for an intellectual reflection on any physical intervention in the built environment. With the help of the BuildDigiCraft scientific model experts of the built environment can better assess the quality of their work process as well as the quality of their intervention (Bögle, at al. 2022)- The model allowed the participants of the BuildDigiCraft training program to set their individual research within the holistic framework of "high-quality Baukultur in the digital age through craftsmanship."

The concept of Baukultur is deconstructed in the project down to its three core elements: the Process, the Knowledge and the Material (Fig 1]). Shaping and maintainance of the built environment results in complex and diverse processes and includes design, planning, construction, maintenance, and as well as end of use phase. In broader terms, these Processes are influenced by the available Knowledge and understanding of Material.

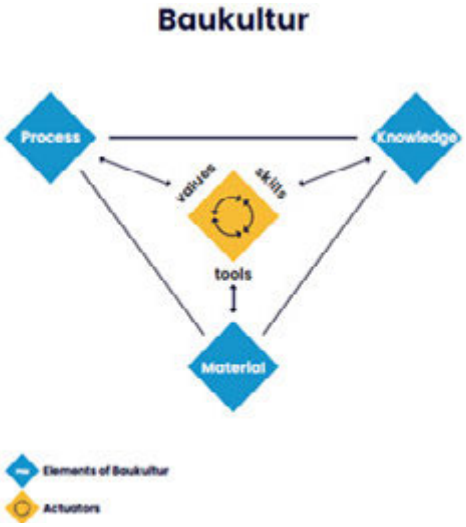

Fig. 1. BuildDigiCraft project triad model

The values, skills and tools serve to actuate the Baukultur developments and to carry out the Process (Bögle, at al. 2022).

Structurally the training programme was organised around four thematic blocks (Intensive Study Programmes - ISP), starting with the "Concepts and Fundamentals" going through to the "Digital Futures" and "Craft and Craftsmanship", culminating in a joint reflection on "Rethinking the Baukultur in the Digital Age" (Fig.2). Each training block built thematically on the previous one, at the same time in every block a new aspect was added, and a new work organisation was introduced. This allowed also for a non-consecutive participation in the separate program blocks. Each participant entered the interdisciplinary training program wearing their own "digital," "disciplinary," and "ethical" glasses ranging between a broad variety of thematic issues and questions related to the future of the built environment.
Prior to the beginning of each training block, selected participants received a set of preparatory tasks. The aim of these tasks was on the one hand to help participants present themselves at the beginning of the course, and on the other, to offer them guidelines for setting their individual research work within the scope of the BuildDigiCraft project. During the whole training program, three major sources of input were collected: (a) individual input by the participants, (b) input from the scientific team - in the form of supervision of the group work as well as contribution to the joint discussion rounds - and (c) external input coming from invited experts and renowned keynote speakers. The work formats which were used during the training range between individual presentations, supervised group work formats, intermediate and final group presentations, all accompanied by joint discussion rounds. Throughout each training block, the processes, knowledge, and material aspects in the individual projects were explored on the intersection level with the holistic framework of "high-quality Baukultur in the digital age through craftsmanship".

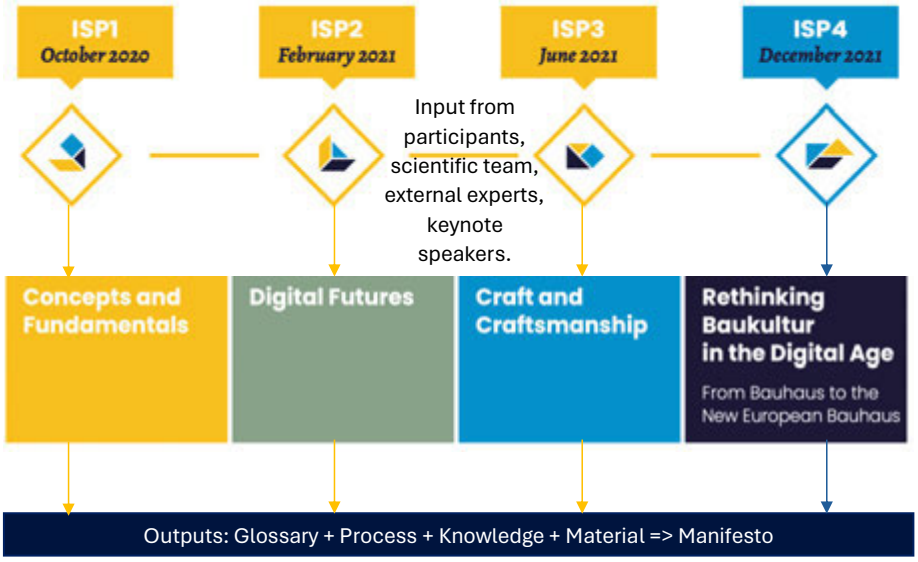

Fig. 2. Thematic framework and outcomes in the BuildDigiCraft project.

The BuildDigiCraft project also devised its own glossary, as highlighted in Figure 3. This glossary serves as an efficient tool for collaborative reflection on intricate research inquiries (Bögle et al., 2022). It offers an open methodological framework aimed at fostering a shared comprehension among project participants, achieved through a thorough exploration of concepts and ideas across different temporal and scale dimensions throughout the project's duration.

In the training program, participants were urged to continuously delve into the concepts and notions raised during discussions using a two-dimensional matrix model. This model encompasses the "focus" and "time" dimensions. The "focus" dimension, depicted on the x-axis, spans from "general" - accessible to a broad audience including non-specialists, to "specific" - utilised by professionals within their respective fields, and further to "narrow" - tailored specifically to the challenges of individual research projects like PhD or Master's theses of the training participants. On the other hand, the "time" dimension, represented on the y-axis, facilitates temporal analysis and interpretation of the evolving meanings and manifestations of notions and ideas across past, present, and future contexts.

The BuildDigiCraft matrix model generally built on the two-dimensional intersection of the main BuildDigiCraft concepts: Digital(isation), Craftsmanship and Baukultur on the "y" axis and the "Process", "Knowledge" and "Material" on the "x" axis (fig. 4). This allowed the participants of the training programme to explore the notions and concepts they posed both inwards - within their own focus and temporal scale, and outwards - within the overall project framework.

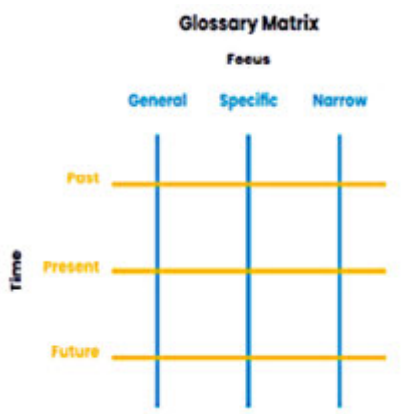

Fig. 3. Glossary matrix tool (Bögle at al., 2022)

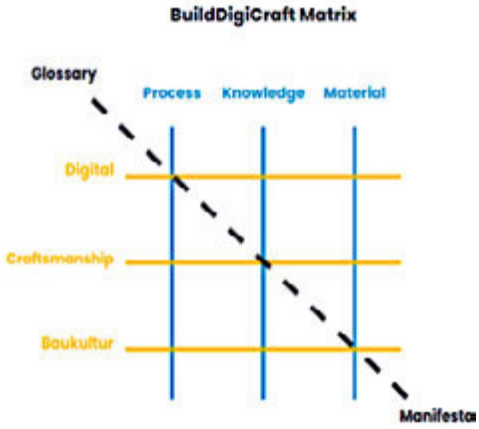

Fig. 4. BuildDigiCraft matrix model (Bögle at al., 2022)

The discussion outcomes of the BuildDigiCraft training programme together with the collected material from the two matrix models, as well as the material collected from the preparatory assignment tasks before each training block, were carefully post-processed and evaluated by the teaching scientific team. The collected material was explored, assessed, and classified using the BuildDigiCraft matrix model (Fig. 4). The project's involvement in discussions about contemporary craftsmanship in the digital era illuminated three essential professional domains: process, knowledge, and material. This understanding is vital for enhancing the role of higher education in preparing professionals for the digital age.

Redefining Today's Craftsmanship in the Digital Building Culture

BuildDigiCraft project aimed to broaden the understanding of the idea of craftsmanship in the digital building culture. Results from ISP3 presents that input on a wide range of topics in relation to the concept of craftsmanship in the digital age is introduced through the training, covering topics from digital disruption and the digital twin, through spatial planning, design, and construction, to the right to design, the link to heritage, and the fusion of arts and craft. Craftsmanship addresses in its essence quality, beauty, and resource efficiency. Craft values are deeply sustainable as their core value is quality and reducing wasteful approaches. It promotes a relation to sustainable material and techniques and offers tangible experiences through synergies of mind and hand while intimating satisfaction in achieving a level of mastery and highest quality.

Craftsmanship is associated with being humanistic and having artistic values that stand behind the work and the "material." Material is understood as both traditional building materials like "wood," but also data, emotions, and information from a community. Craftsmanship is thus transformed into the digital realm as representing, for instance, uninterrupted experiments, a special time quality as well as artistic quality.

The insights from project participants acknowledged that craftsmanship ethos in planning, designing, building projects is essential for strengthening the sense of belonging and commitment to the surrounding space. Digital technologies and "new" digital forms of material when linked to the onsite planning, design, construction process and knowledge production enable us to handle complexities of efforts.

There is a necessity of re-identification of the designer's work with the work of a craftsperson in the digital era (Caldenby, 2021). Digitalization highlights the importance of data and evidence-based knowledge, where the experience and place-based work of the designer need to be promoted. In the digital era, the qualities of craftsmanship that need to be sustained should include: "Materiality" (being real, not virtual), "Location" (being grounded), "Sustainability" (being adapted to nature), "Diligence" (being passive and professional), "Openness" (being vague), "Good life" (being human).

The BuildDigiCraft project generated an in-depth exploration of the fundamental aspects crucial in delineating contemporary professional domains for building cultures: Process, Knowledge, and Material, which participants addressed over the project's duration.

From the **Processes** identified as important for shaping and maintaining the built environment the project team chose to focus on the initial one - the design process (Bögle, at al. 2022). The design process is often overlooked as something invisible, not tangible. However, it is this series of decisions made in a design process that will eventually lead to poor or high-quality Baukultur. Designers involved in design processes of Baukultur have now access to new digitised, visualised and AI-processed information that was not accessible just a few years ago. If properly used, ideally it can help create a design process leading to higher levels of sustainability and cultural appreciation. However, digitalization also poses considerable risk, because design processes used to be regulated by industry standards and tradition. Those processes are now much freer, untransparent and less or not at all regulated. Therefore, the designers of today and tomorrow urgently need new type of design guidelines. BuildDigiCraft proposes such type of design process guidelines, that help designers reflect on the quality and values behind the performed by them design process in the digital context.

Knowledge and skills are key human capital elements of building a sustainable environment. This project guides and reflects on the important role of higher education in preparing the future generation of designers to take responsibility for shaping high-quality built environments, sharing knowledge and values of good craftsmanship. Moreover, exemplified results from the project show that in the age of digitalization and globalisation, there is an opportunity to use a wide set of digital tools for knowledge production and exchange.

The notion of **Material** and materiality was explored in the project beyond its pure and only physical form (Bögle, at al. 2022). Typically, physical material with all its characteristics/performance is described through data that is detailed, complex, and derived and presented in digital form. Whereas the (physical) material possesses the workability and formability that has historically been developed through tacit

knowledge and the craft of making. Currently, this is supplemented by material as data (data about the material) that facilitates better/more sustainable/ higher-quality design, architecture and building design. The two – the physical material and the digital material – are inseparable and without either of them, we would not be able to discuss material and materiality.

Higher Education in Training Professions for High-Quality Baukultur in the Digital Age

The contemporary role of academia has changed as it serves as a facilitator of emerging modes of learning, both knowledge production and knowledge exchange as described by Smith & Hairstans (2017). The new role of universities in advancing technological innovation and economic development as a "knowledge hub" defines a change for many universities from the late 20th century playing the role of "knowledge factory" for research, training, and commercialization until now. It seeks to animate indigenous development and innovation, spanning between industry, the government and society. High-performing institutions are those which effectively advance, distribute and recombine tacit knowledge. Some universities in parallel also serve as a 19th century "storehouse of knowledge," or a "knowledge factory" for research, training, and commercialization (late 19th century to the end of the 20th century). Community and non-governmental organisations (NGOs) play a special role in knowledge exchange fostering innovation in a particular sector or interest area.

The role and purpose of higher education in the built environment has increasingly come to be the preparation of young people across society to take on highly skilled positions in industry and society. The perspectives on knowledge production have evolved a lot, especially over the last decades when science faced growing demands for collaboration between researchers, and new research questions going beyond one discipline. Here more than ever, collaborating communities, researchers and decision-makers in building professions seek to tackle problems that require both specialised knowledge and integrative skills to cope with complexity.

In higher education, individuals should learn to grow in one's own work as professionals. Education and research should be directed toward how we can prepare individuals to grow in all of Aristotle's three categories of knowledge – episteme (scientific knowledge), techne (knowledge of craft) and phronesis (ethical knowledge). "Evidence-based design" is important but not always the right answer to wicked design problems in the built environment. The knowledge of the designer needs training to learn and implement the craftsman's practical knowledge: techne and evidence-based assessment related to episteme. Evidence-based learning is only a part of knowledge generation in higher education – the other involves individual learning.

The goal of the university is to create opportunities for students to make informed design decisions and explore phenomena-based knowledge. This includes learning about cultural values like the history of architecture and built environment (old and contemporary), humanistic understanding of design questions, state of the art and an awareness that every problem is unique involving phronesis. Students reflected on the "metacognitive knowledge" (Krathwohl, 2002) and learning to gain knowledge of general cognition as well as self-knowledge and awareness.

High-performing higher education institutions are those that effectively advance, distribute, and recombine tacit knowledge. The current role of the university as a facilitator of emerging modes of learning, knowledge production and information transfer embodies the necessity to combine all types of knowledge: explicit, implicit and tacit into the formal, semi-formal and non-formal tools of education, including the shift from teaching to learning. There is much explicit knowledge found in codes, and publications embedded within people and organisations. Still, the majority of knowledge regarding the built environment, including construction, is tacit or implicit. In academia, explicit knowledge in the form of data, records and documents (present in journal publications, databases, books, websites and videos) is relatively easy to disseminate. On the contrary, tacit knowledge is difficult to transfer by means of writing or speaking. It is embedded in people, organisations, societies, and cultures. It comes from experience, thinking, competence and commitment. In academia, tacit knowledge can be found in workshops, conference discussions, internships and exchanges.

Architecture, planning, engineering, etc. are professions where knowledge is about the ability of make well-grounded design decisions in complex situations. In the Reflective Practitioner (1983), the design theorist Donald Schön formulates the two fundamental concepts "reflection-in-action" (reflecting on the process) and "repertoire" (impressions, ideas, examples, and events) as essential elements of design /problem-solving work. It's individual and a result of experience, an extensive design practice based on reflection-in-action and a lifelong build of a personal repertoire.

The thorough examination of the project material through the lenses of Process, Knowledge, and Material - the foundational elements of Baukultur - marked a significant milestone in crafting a unified declaration of principles advocating for a fresh professional paradigm for superior built environments and work methodologies. In this context, the role of higher education for future professionals emerges as pivotal. The BuildDigiCraft scientific team's **Manifesto** not only provides contemporary and future professionals with both a methodological and contextual framework but also underscores the importance of higher education in shaping the next generation's understanding and practice. With actionable steps outlined in the Manifesto, higher education institutions can play a crucial role in equipping future professionals with the necessary skills and insights to navigate and contribute effectively to the evolution of high-quality Baukultur in the digital era (see Fig. 5).

The Manifesto for the BuildDigiCraft teaching method outlines six essential steps to enhance craftsmanship in the digital work environment of architects, engineers, and urban planners:

1. Acknowledge Elements Understand the components of Baukultur : Analyse your project by answering questions about the process, knowledge, and material you're using, as well as the values, skills, and tools involved.

2. Structure Your Project: Use the BuildDigiCraft matrix to organise your project along the axes of digitalization, craftsmanship, and Baukultur, as well as process, knowledge, and material.

3. Apply Glossary Matrix: Utilise the Glossary Matrix tool for your project.

4. Understand the Context: Recognize the changing paradigm of Baukultur in the digital age, considering aspects like the relationship between design and realisation, digital twin representation, and dealing with data.

5. Explore the context of Craftsmanship: Embrace craftsmanship's focus on quality, beauty, and resource efficiency, connecting with sustainable materials and techniques. Craftsmanship enhances the sense of belonging and commitment to a space and values humanistic and artistic qualities.

6. Make Tacit Knowledge Explicit: Share the symbiosis of material, design, and construction knowledge with others, bridging the gap between digital data and craftsmanship. Integrate craftsmanship skills into digitally driven projects for high-quality Baukultur in the digital age.

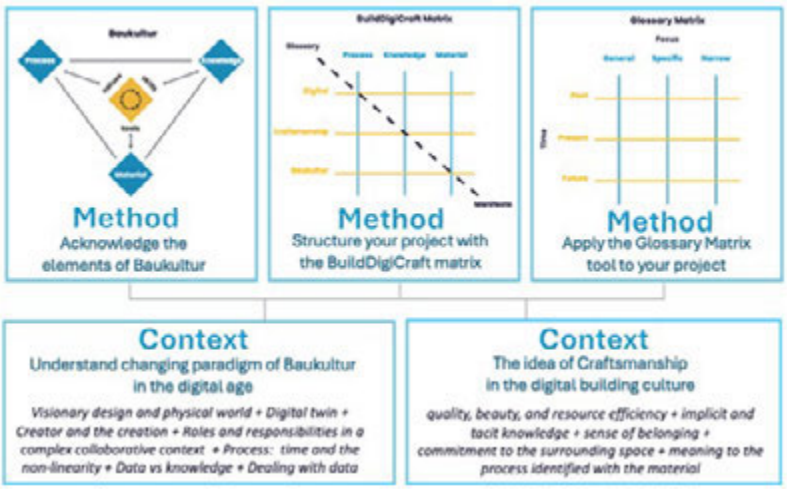

Fig. 5: The Manifesto as a "self- reflection model" and a user guide for the BuildDigiCraft interdisciplinary teaching method (Bögle, at al. 2022)

Discussion

The BuildDigitalCraft project developed between the years 2019 and 2022, overlapping with the beginning of COVID-19, presented an opportune moment to test digital platforms and discuss the utilisation of digital technologies for enhancing the shaping of the built environment. The BuildDigiCraft project findings demonstrate that our understanding of shaping the built environment has significantly evolved. The digital revolution is transforming our society and professional endeavours, profoundly impacting how we interact with physical space. Building on Carpo's (2016) distinction between the first and second digital turns, we see a shift from using digital tools merely as aids to integrating them more deeply into professional practices. This shift is driven by advancements in data collection, processing, and problem-solving, ushering in a new era where computers play a significant role in design and planning processes.

Digital twins, virtual and augmented realities, and collaborative platforms are examples of how digital technologies are changing perspectives on planning and decision-

making processes. They offer new possibilities for collaboration and participatory design, empowering stakeholders to engage more actively in shaping their environments. Despite these advancements, the fundamental mission of design and planning disciplines remains unchanged: to shape the built environment in ways that enhance quality and respond to the needs of communities and individuals. By leveraging digital technologies and interdisciplinary approaches, professionals can continue to innovate and create more sustainable, inclusive, and responsive built environments. This emphasis on achieving higher quality in the built environment is particularly pronounced in Europe.

The concept of high-quality Baukultur adopted by the Davos Declaration (2021), New European Bauhaus (2020) manifests itself in a multidisciplinary approach, encompassing notions such as built environment, cultural heritage, quality of life, social cohesion, well-being, resilience, and others. The impact factors, the areas affected, and the people involved form a complex set of units, the development into a holistic targeted system which is directly linked to the transfer of knowledge in a multidisciplinary environment. Principles defined for successful knowledge transfer – i.e., the provision of the horizontal flow of information, the rating and feedback, the time resource factor – can form the basis of an approach to building a high-quality Baukultur process

Knowledge, Process and Material became core elements of the thematic structure of the BuildDigiCraft project and much relevant for all design and planning work of disciplines anchored in architecture, urban planning, engineering. Additionally, the Glossary was co-created and discussed by project participants. These elements are considered very important for building a common platform for discussions and reflections among project participants representing different disciplines shaping built environment.

The results from the BuildDigiCraft project highlighted that the complex concept of shaping the built environment has evolved meaningfully due to the necessity of rethinking the role of science and its relationship to society and building cultures. As real-world problems become more complex, there's a growing demand for collaboration among various stakeholders, including academic and non-academic entities, to address interdisciplinary research questions. This interdisciplinary approach helped to realise that design, and planning professions may have different skills, and use different tools, but still can be unified by representing the same values. The essay "The many faces of knowledge" by Bernt Gustavsson (2000) gives an overview of concepts of knowledge that span from the three forms of knowledge formulated by Aristotle to contemporary discourses. He shows how Aristotle's three categories of knowledge – episteme (scientific knowledge), techne (knowledge of craft) and phronesis (ethical knowledge) – still hold relevance, not least for the application of knowledge in practice. In the higher education system these three forms of knowledge have been the framework for defining the criteria to be fulfilled for different academic exams.

Material in the digital era broadens the spectrum of purposes. Students and young researchers approach digital technologies easily and see them as promising endeavours for solving complex problems. There was a broad understanding among students that future building cultures will work on building models in the virtual world

to gather greater knowledge about the real world from simulations of data variables in these models. While technical and methodological skills are crucial, there's also room to explore broader themes and foster collaboration with emerging technologies like GPT, DALL-E, and others from OpenAI. By integrating these tools into the educational curriculum, students can gain a deeper understanding of how technology intersects with design, sustainability, and societal needs, preparing them for a more holistic approach to their profession. Moreover, the project reveals a shift in knowledge distribution, with a wider array of organisations and stakeholders contributing their expertise to problem-solving efforts.

In higher education, there's significant potential to incorporate overarching concepts like interdisciplinary training towards the goal of creating a high-quality built environment as a common value. The Manifesto arising from the BuildDigiCraft project encapsulated meaningful insights on navigating the complexity of professional craftsmanship in the digital era, while also emphasising the responsibility of shaping the built environment towards the creation of high-quality spaces (Baukultur). This emphasis is particularly vital when considering the diverse, intricate, and rapidly evolving urban landscapes of today. In higher education, our mission reaches far beyond the mere development of technical and methodological skills for self-reflection. Essentially, technical and methodological skills are crucial, but they should be seen as just the starting point. They lay the foundation for a broader educational experience that delves into understanding the complexities of one's professional field and the challenges posed by digitalization.

Conclusions

Higher education plays an indispensable role today in melding the intricate artistry of craftsmanship, tacit knowledge anchored in professional experience, and qualitative nuances with the precision of digital tools, quantifiable metrics, and data-driven insights. This synthesis is fundamental for nurturing the advancement of superior architectural and planning spaces through innovative processes aimed at cultivating a future defined by exemplary "Baukultur." In the end the fundamental mission of design and planning disciplines remains unchanged: shaping the objects we create and the environment we inhabit (Carpo, 2016). Advocates argue that interdisciplinary teaching and research leverage collaborative and creative strategies utilising digital mediums as a shared language. However, the digital realm encompasses more than just software; it encompasses methods of analysis, transformation, generation, fabrication, and monitoring.

Furthermore, digital data is heralded as tomorrow's essential material. Digitalization enables the development of new skills working with the complexity of data in the built environment and can provide efficient digital tools for seeking new research issues. Digital tools allow collecting of large amounts of qualitative data and working with different data sets. By merging data from several qualitative studies (metadata), research can pose questions that individual projects cannot raise.

Concurrently, the significance of preserving the essence of good craftsmanship in the digital age is underscored, entailing the collection, dissemination, and conversion of professional tacit knowledge into explicit knowledge. This entails creating design processes intertwined with a deep comprehension of physical materiality in architecture and urban planning. In the future, much more attention will be paid to

knowledge production and management in higher education supporting the transfer and creation of cultural values expressed in the Davos Declaration toward the vision of high-quality Baukultur. This involves learning how to apply conscious and well-debated design/problem solving, maintain and improve the qualities of places by construction, build social cohesion, promote environmental sustainability, or maintain and protect our cultural heritage.

In building tomorrow's urban futures higher education will need to strengthen training the skills of professional self-reflection that can only be done by interdisciplinary dialogue, intertwining of crafting qualities, tacit knowledge, and qualitative immeasurable aspects with digital, quantifiable, and data-driven qualities. This interweaving is seen as essential for fostering the creation of high-quality architectural spaces through creative processes aiming for a future high-quality "Baukultur". By adapting their curricula, fostering interdisciplinary collaboration, and promoting innovative thinking, these institutions can prepare future professionals to tackle the evolving challenges of urbanisation, sustainability, and social equity.

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Embracing The Green Curricula? The New European Bauhaus as a Driver of Environmental Change in the University Education

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Abstract
The education of future urban planners and architect has been exposed to various global trends which influence our environment. Nowadays, the imperatives embedded into the 2030 Agenda, the European Green Agenda and the New European Bauhaus (NEB) represent a starting point for the preferred green transition which should contribute to the sustainable urban future. The University of Belgrade - Faculty of Architecture has been strengthening the environmental dimension on all levels of studies, and this paper will focus on the case of the Master program in Architecture_ Module Urbanism. The thematic and structural modifications will be discussed on the level of three courses - Sustainable City (obligatory), Ecopolis (elective) and the final/graduation work (Thematic research, Master Thesis, Master Project studio), also considering their results and public outreach.

Keywords: education, green transition, urban planning, architecture, Green Agenda, New European Bauhaus.

1 Introduction

The context of the contemporary life strongly affects our living environment, especially cities, as the major hubs of interaction, innovation and exchange. Urban nodes have always represented a spatial reflexion of our needs and aspirations, but also a setting in which emerging problems and conflicts have been displayed. Consequently, the importance of cities in the loop of socio-economic, technological and ecological changes has always been emphasised, while the role of urban planning and design, as well as architecture, has been recognised, tested, praised or criticised. In order to meet the latest challenges, some efforts have been made to create a solid global framework of action, synchronised with the 2030 Agenda for Sustainable Development and its goals (UN, 2015). On the European level, three documents were adopted in 2020: the New European Bauhaus (NEB), the Green Deal - a vision of Europe as the first climate-neutral continent (EU, 2020a) and the New Leipzig Charter - the broadest European policy for sustainable urban development (EU, 2020b).

The NEB initiative revolves around urban settlements, as the main generators of both global difficulties and solutions, while SDG 11 represents its starting point for building a resilient society. Based on the premises of new working possibilities, safe and affordable housing, efficient public transportation and green public spaces, the NEB program also underlines the principles of inclusiveness and participation (NEB, 2021). All these postulates are of crucial importance for the future generations of planners and architects and have to be included into the education process in order to ensure understanding and appropriate (re)action when facing urban reality and the accelerated dynamic of its change. Therefore, universities have had to strengthen their role in the environmental transition directed by the SDGs and the NEB objectives and intensify their application in the teaching process. The up-to-date models of learning have been introduced in order to ensure the harmonisation of the latest ecological trends, the adopted international declarations, ongoing research and professional practice.

In line with these activities and imperatives, the University of Belgrade - Faculty of Architecture has introduced a set of curricula modifications during the latest accreditation cycle (finalised in 2021/22), verified by both the National Entity for Accreditation and Quality Assurance in Higher Education (NEAQA) and the Royal Institute of British Architects (RIBA). Based on the 2030 SDGs and the NEB agenda, these changes contribute to the anticipated ecological transition of both the planning and architectural profession and have been positively validated by students, educators and practitioners.

In order to provide a better insight into these program changes, the paper will consider the development and application of three green-driven curricula for the courses conducted within the Master program in Architecture_ Module Urbanism: Sustainable City (obligatory), Ecopolis (elective) and the final/graduation work (Thematic research, Master Thesis, Master Project studio). The link between their content, global environmental agendas and the EU frameworks of/for sustainability will be established, while providing an insight into the results of their pedagogical process and public outreach.

2 New European Bauhaus vs. Educational Paradigms

Since 2018 and the adoption of the Davos Declaration, the environmental discourse of building and constructions has been gradually incorporated in many EU documents, as a signpost for the protection of our habitats. Due to this shift, the importance of architectural and planning profession was stressed, causing further changes in the strategical thinking focused on the sustainability and resilience of our future. The NEB initiative, essentially conceptualised as a culture-oriented EU policy, also follows this direction via the lenses of architecture and urbanism, merging the themes of sustainable development, aesthetics and inclusiveness. The prerogatives of multileveled integrative approach are considered within the social, ecological and technological spheres of future actions focused on the problems of intensified climate extremes, degraded environment and the consequences of COVID-19 (NEB, 2021).

Although the necessity to incorporate environmental imperatives into university curricula has already been addressed by various pedagogical initiatives since the mid 1960s, the rigid frameworks of inherited pedagogical approaches have frequently represented a serious obstacle to the updating of educational content and methodologies (Salama, 2009). Consequently, the planning and architectural schools have had to innovate their outdated programs, providing knowledge and skills adjusted to the needs of both the society and the profession, while continuously evaluating their real impact on society, space and overall sustainable development.

During the last 60 years, universities have been discussing and practicing various models of critical thinking in order to tackle a wide spectrum of ecological and social problems - from the New Design Pedagogy (mid 1960s - late 1990s), which focused on sustainable urban communities through the application of case studies, community-based design and participative curriculum models, over the impact of architectural education on society, urban/architectural space and its transformations (Beinart, 1981; Dutton et al., 1991; Crinson and Lubbock, 1994), to the role of architectural education for international practice/global exchange (Teymur, 1992) and the innovative methods used in design studios (Salama, 1995). The next period (mid 1990s - mid 2010s) was marked by the approaches related to the Critical inquiry and the Process-oriented design pedagogy (Salama, 2016), emphasising the role of flexible, integrated and evidence-based curriculum directed to contemporary problems and professional challenges (Boyer and Mitgang, 1996; Pilling and Nicol, 2000; Harriss and Widder, 2014). During the 2020s, the university programs were updated through the implementation of the

Interchangeable design pedagogies, the Community based design pedagogy and live project studios, also stimulated by the NEB platform (2021). All these steps, additionally supported by the latest digital tools, lead toward environmentally driven practice, based on global imperatives, inventive solutions and emerging theoretical frameworks.

3 Channelling the Action

The multiplying problems in/of our living environment, especially those concentrated or triggered by urban setting, have been thoroughly studied since the late 1980s, when the concept of sustainability was defined. Nowadays, the idea of sustainability is often accompanied by the concept of resilience, while their iterations and interpretations are included into contemporary theory and practice, strategies, policies and action frameworks. The NEB platform, as a specific stimulus for environmental transition, is also based on the ideas of sustainability and resilience, addressing them in an integrated manner, embraced by the schools of planning and architecture. On the theoretical level, the notion of sustainable development has been modified under the influence of the resilience theory (Holling, 2001; Folke et al., 2010; McPhearson, 2015), while its application in the sphere of urban systems has been gradually redefined, in accordance with their complex nature and the unpredictability of external influences. In line with this, the university programs have included the studies of many complementing, environmentally-driven concepts and principles - e.g. circular economy, green infrastructure or energy efficiency - which directly or indirectly address problems of cities, as the major nodes of global exchange and the unique testing grounds for innovative ideas oriented toward general well-being, economic growth and environmental quality. Since their importance has been recognised by various documents, their application could be considered as a necessity in the domain of spatial intervention and societal changes. Consequently, the actions highlighted by OECD (2020) instruct professionals to Rethink (stimulate local communities and raise their awareness), Regenerate (by increasing green infrastructure), Reduce (via strategies focused on resource footprint reduction), Reuse (by establishing sharing platforms) and Recover (resources and landfills). The application of these steps in education programs (and in practice) is usually directed to local public services (e.g. transport, waste, water and energy systems), while their real impact should be readable in the anticipated regeneration of natural environment.

The role of green infrastructure has also been tackled by a number of the EU documents and strategies anticipating a new development vision for the networks of natural and semi-natural areas. Able to provide ecosystem services and enhance biodiversity, green infrastructure, and its multi-scalar effect on space, stimulate social and territorial cohesion, sustainable development and overall human well-being (EU Commission, 2013; Simić et al., 2017). Therefore, its design should be considered in the process of architectural and urban conceptualisation and the introduction of upgraded typologies.

In line with these emphasised features and concepts, the NEB framework highlights their impact on built environment through the processes of co-creation, inclusion and cohesion, as well as three main pillars - design, delivery and dissemination. The interdisciplinary approach is favoured, while planners and architects should ensure the spatial manifestation of sustainability and resilience, also addressing the imperatives related to the sense of belonging, accessibility (both physical and digital), circularity, affordability and zero pollution (EU, 2022).

4 Introducing the Change, Implementing the Curricula

With the tradition of over 170 years, the education of architects and urban planners at the University of Belgrade - Faculty of Architecture has always been influenced by the unique context of Belgrade, the capital of Serbia and ex-Yugoslavia, an important node in Southeast

Europe. The current studies conducted at the Faculty are based on an integrated approach implemented by four departments (Architecture, Urbanism, Architectural Technologies, and History and Theory of Architecture and Art), providing a wide scope of knowledge and practical skills derived from technical and technological sciences, arts and humanities and social sciences. One of provided Master programs - Master studies in Architecture, consists of four modules (Architecture, Urbanism, Architectural Technology, Structural Engineering), all leading to the Master of Architecture title (M.Arch, with a reference to a selected module), also validated for RIBA Part 2 Status (since 2015).

The structure of studies is composed of several study units - Studios (design project, seminar), Module compulsory courses, Elective courses and Theoretical discourse (provided by all departments), Common compulsory courses (sociology/philosophy/economy) and Master diploma project (consisting of Thematic research, Master thesis, Master design and Master final project) and all of them integrate the NEB framework.

In the module Master in Architecture_Urbanism, entitled Sustainable City, both the theoretical/research-oriented courses and the design-studio underline connections between people and built environment while considering a number of topics related to sustainable and resilient development. The corses and studios are problem-based, facilitating the understanding of natural and socio-spatial phenomena, spatial typologies, processes and policies. The courses presented in the paper follow the same framework, although they belong to three different modes of educational curricula. The compulsory course Sustainable City 1 - Transformations is located in the first semester, Ecopolis is an elective course positioned in the second semester, while the Master diploma project is positioned in the fourth semester.

The first two courses are theoretical and research/project based, while the third one combines these approaches with the design-driven method in different phases. Due to the project orientation, the active participation of students is enabled, tackling a variety of location-specific problems though the experimental and innovative game-based curriculum (Chen and Hoffman, 2017) and the reflexive thinking and journaling (Kelly, 2006, 2010). Simultaneously, all three curricula apply predictive learning and future design while estimating the environmental impact of anticipated/planned changes.

Sustainable City 1 - Transformations represents a course which enlightens the trajectories of urban transformations used as the main stimuli of urban development. Conducted by Associate Professor Dr. Vladimir Mihajlov and Assistant Professor Dr. Ivan Simić, it considers the process of adaptation leading toward a sustainable urban future, as well as the contributing premisses. During the course, the importance and effects of SDGs and the NEB postulates are continuously emphasised, especially the topics of green urban transformation. Consequently, students are directed to critically perceive origins and effects of occurring problems, apply theoretical knowledge on urban design and the conceptualisation of urban communities, while considering planning policies and legislation influencing a final result. The course also introduces the relevant models of sustainable cities and lifestyles, greening strategies, resilient urban practices, as well as the use of sustainable materials. The curriculum is structured around ex-cathedra lectures, students' research (group work) and a pilot project proposal.

In line with the integral, multidisciplinary approach promoted by the NEB, the lectures include presentations of experts from various fields (e.g. landscape ecology, urbanism, biology, hydrology, geology, transportation, social sciences etc.), elucidating their professional insights. Students focus on different phenomena discussed by groups through a critical-argumentative

debates, and the course outcome is defined as a Civil Initiative Project Proposal. It is developed in a format which could be applicable for different funding options, potentially leading to the improvement of selected urban environments through the implementation of public innovations, tactical urbanism or business-driven sustainable solutions. The final assessment is based on the NEB criteria.

The inspiring example of this practice was implemented through the participation of Marina Papović, the operation development manager in CirEkon, who held two lectures on the application of circular economy in building process, emphasising several elements:

- the growing awareness related to the use of circularity,
- the need for a holistic approach to circularity in architecture,
- the focus on the process of recycling and circular economy during the design of buildings,
- the presence of inadequate product standardisation as a drawback for the transition into circular economy,
- consideration of building optimisation and the operational aspects of circular economy.

These lectures had two successful educational impacts. The first one was the participation of student teams in the 2021 CirEkon and EIT Food Competition for Engaging Citizens in Circular Economy, where one of the teams won the 1st award (Figure 1), while the second one was a workshop during the 2022 Balkans Go Circular international conference, where the most important experts in the field of circular economy presented various solutions for the regional and global challenges (Figure 2).

Figure 1: The project proposal for improving the sustainability of urban environment in Pancevo (Students: Emilija Drndarski and Sara Brkić. Supervisor: Associate Professor Dr. Vladimir Mihajlov) - 1st award at the 2021 CirEkon and EIT Food Competition for Engaging Citizens in Circular Economy.

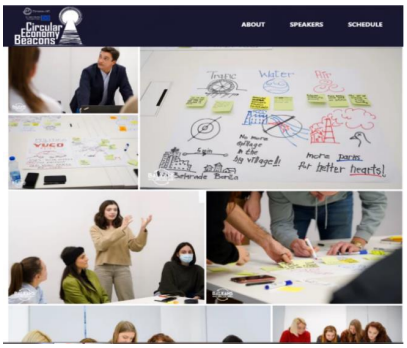

Figure 2: The workshop Balkans Go Circular: The database support to the Civil Initiative Project Proposals, organised by the EIT Climate KIC and CirEkon d.o.o. (Serbian Chamber of Commerce, 2022). The participants were students from the course Sustainable City (Source: https://circular-beacons.net/wrapping-up-the-year-with-balkans-go-circular-conference/)

The curriculum of the course **Ecopolis** encompasses diverse aspects of the ecological resilience of cities, their urban design, planning, adaptation and mitigation by introducing the contemporary ecological concepts of urban resilience which have significantly changed urban theory and practice over the last few decades. The students also learn about the vital role of green infrastructure in creating resilient urban environments, focusing on nature-based solutions (NBS) and addressing social, economic, and ecological challenges effectively. The analysis of the selected NBS projects, particularly those recognised as the finalists of the "Reconnection With Nature" category of the NEB Awards, enables students to gain an insight into the integration of natural, social and built components. Additionally, the course emphasises the role of biophilic design, circular economy and urban recycling, as well as the adaptive reuse of buildings, shifting the focus toward the efficient utilisation of resources and encouraging innovative design approaches to new purposes. The second part of the course is directed toward the application of presented models and strategies across the selected case studies in Belgrade or other Serbian cities.

The case selected for the 2024 spring semester is the area of Reva wetlands on the left bank of the river Danube, in the central Belgrade municipality of Palilula. This area is exceptionally important due to the wet habitats and marsh ecosystems created along the left bank of the river, on its course through Belgrade (Figure 3). Their role is multiple - in addition to being part of the flood protection system, these areas have rich biodiversity and a number of protected species of amphibians and birds. There are three nests of the white-tailed eagles in the area, representing an exceptional value for the urban ecosystem. In the context of climate change, this type of area could be considered as a carbon sink.

Figure 3: Bara Reva wetland (Source: Authors)

Due to the specificities of the curriculum and the selected case study, the teaching methodology of this course is also based on interdisciplinarity and the engagement of various actors - visiting scholars and practitioners (biologists, hydrologists, climatologists etc.), participating in both the theoretical and the applicative segment. The various local stakeholders, living and working in the area, or actively engaged in nature conservation, also play an important role. Consequently, the main local stakeholder is the White Heron association, which brings together the local residents from the settlements located in the hinterland of the Reva wetland and the banks of the Danube. Being actively engaged in protecting this area from excessive and unplanned urbanisation, they represent the most important source of information on the area and its problems. The association presented the genesis of settlements on the left bank of the Danube, mapped important spatial determinants during a workshop (Figure 4) and provided an insight into their vision of development - the Danube Park. This project envisages the rehabilitation of the Reva reservoir and the introduction of various contents - such as the Danube Park building, a network of pedestrian paths, a bird observatory, but also a cycling infrastructure as a part of the international routes Eurovelo 7 and 11, passing through this area. The students critically considered the proposed program of activities for the Danube Park, which was the starting point for their intervention proposals.

Figure 4: Meeting with the members of the local association White Heron (Source: Authors)

The theoretical part of the course provided basic theoretical principles of urban ecology and its links to urban design. The experts from various fields were invited as guest lecturers, while some of them also participated in several workshops with students, supporting their research and project ideas. One of them highlighted the role of nature based solutions in flood management (Dr. Ratko Bajčetić, Faculty of Environmental Management in Novi Sad) and contributed to the design phase of the Master plan of the Reva wetland. Additionally, the workshop held by Dr. Tanja Vukov and her colleagues from the Institute for Biological Research, opened the topics of mapping and description of the wetlands system in the case area (the boundaries of habitats, plant and animal species, zones of human intervention), supporting the further process of environmentally acceptable planning and design (Figure 5).

Figure 5: Workshop with the biologists from the Institute of Biological Research (Source: Authors)

The final step of the education process conducted during the program Master in Architecture_Urbanism represents a set of courses within the **Master diploma project**. The main idea of its complex task is to summarise the knowledge obtained during four semesters while applying various methods of research, formulation, conceptualisation, design and materialisation on a comprehensive urban and architectural program. The work during Thematic research, Master thesis, Master design and Master final project is individual, although supported by a mentoring committee and a supervisor, while the general framework and the focus area are predefined on the level of each studio. In line with the sustainability imperatives of the whole program, the objectives embedded in the NEB initiative are integrated into a thematic scope and further developed by students/candidates.

The example of the studio entitled NS 2030: ECO-HORIZONS (supervised by Professor Dr. Aleksandra Stupar in 2021/22) demonstrates this practice on several levels, simultaneously triggering environmental, social and technological manifestations of sustainable and resilient transformations. The students initiated the process by studying selected themes related to urban regeneration, industrial archeology, regenerative architecture, climate adaptation, flexible space or nature based solutions. The concepts of circular economy and energy transition were also taken into consideration, along with more specific themes (e.g. the integration of animals and insects into living and working environment). After the thematic research, their thesis used the general framework/topic as an initiator of both further research on the proposed site and the preferred concept of transformation, highlighting the identified urban phenomena, analysing representative cases, and finally defining a program for a project. The course is concluded by a public defence, which elaborates a concept, regulation and design of an urban area and its specific content.

The studio used a part of the industrial zone of Novi Sad as a polygon for intervention, focusing on the abandoned site of Agrohem, a fertiliser manufacturer, previously exposed to a significant pollution. The site is situated at the city entrance, nearby the connection of the Danube River and the Danube-Tisa-Danube canal. Taking into consideration the SDGs and the NEB principles, the anticipated transformation was also guided by the ideas of the Gaia hypothesis, supporting the setting of a new sustainable node, based on the active use of recycling, innovative business models and activities, green regeneration through biophilia and the reduction of carbon footprint.

The park of ecological and psychological renewal_biophilic design, by Milica Brajović, is a project driven by biophilia on all levels, merging the context, natural cycles and existential principles in order to regenerate the site, preserve resources and develop environmental awareness (Figure 6). The community cohesion is supported by the introduced activities, ensuring integration, increasing the interest for natural environment and, consequently, contributing to the sustainability of a created mini-ecosystem. The phases of the implementation are also planned in line with the imperatives of economic, social and environmental sustainability. This project later received the prize of the 2022 International Urban Planner Exhibition of Serbia (student category) and the annual award 'Milorad Macura', granted by the Institute for Architecture and Urbanism of Serbia for the best master diploma project in architecture (2023).

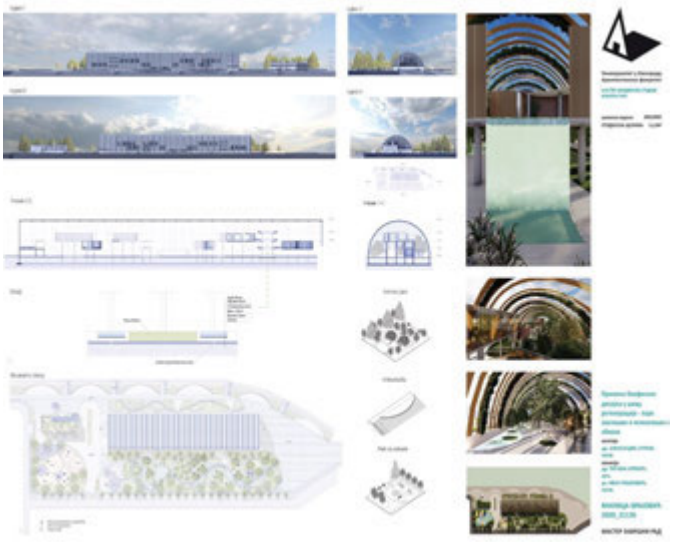

Figure 6: NS 2030: ECO-HORIZONS. The park of ecological and psychological renewal_biophilic design (Student: Milica Brajović. Supervisor: Professor Dr. Aleksandra Stupar)

The general framework of the ongoing Master studio project (also supervised by Professor Dr. Aleksandra Stupar, 2023/2024) uses the elements of the same environmental paradigm, included in the NEB agenda. Entitled Vista Alegre: The Kaleidoscope of Urban Innovation, the studio continues to explore the broad spectre of innovation - spatial, social and technological, highly integrated with ecological principles. During the Thematic research, students explored the general topics of sustainable transformations, focusing on more specific aspects according to their preferences - from urban regeneration, climate adaptation and alternative energy integration, to biophilic and biomimetic design. Due to project location being in Madrid, the students had several online workshops with local experts and guest professor Dr. Manuel Collado Arpia, discussing their research. The selected aspects and phenomena were developed in their theses, shaping the specificities of future project programs adjusted to the local context.

The selected area of Vista Alegre, within the Carabanchel district of Madrid, provided an interesting polygon due to its history dating back to the 18th century, when it appears in plans as a rural estate. Since then, the character, activities and ownership of the space have been transformed several times, leading to a state-owned, fragmented area, with multiple activities related to health, education, institutional services, as well as a botanical garden and public green spaces. Bearing in mind the unique physical, functional and natural characteristics, as well as the recognisability of this unit and its environmental potential, possible interventions could stimulate its opening toward the city, while respecting its inherited historical and social values. Based on the 2030 UN SDG goals and the current paradigms of resilient, eco, creative and healthy city - a city of well-being open to all - the possible interventions could target the landscape, public spaces and built fabric, a total or partial transformation and regeneration, as well as the (re)consideration of continuity and discontinuity.

Among the programs formulated within the theses - highlighting the concepts of learning cities, regenerative healing spaces, biophilic/nature inspired design, urban acupuncture and local

community activism - the project entitled Vista Alegre: Resilient ConnectScape (by Tamara Mladenović) could be distinguished as an inventive approach to urban resilience though socio-spatial defragmentation and connectivity. Inspired by the concepts of integral urbanism and the idea of learning from nature, the socio-ecological diversity is explored in order to enhance urban system resilience to various challenges. Examining the related theories and boundary perception, the complexity of urban space is determined, as well as the main problems and potentials. The project focuses on the development of a new social centre and a Resilient Hub, supporting long-term sustainability and adaptability, while instigating social cohesion. With an innovative combination of content and spatial units, relying on the natural elements of the site, the project aims to achieve a comprehensive resilience of the area and its neighbourhood (Figure 7).

Figure 7: Vista Alegre: Resilient ConnectScape (Student: Tamara Mladenović. Supervisor: Professor Dr. Aleksandra Stupar)

5 Conclusion

The presented courses support the ideas included into the 2030 SDGs and the NEB initiative, creating a stimulating learning environment focused on the occurring contradictions and uncertainties of contemporary urban life. The general ideas of sustainability and resilience are

tested on different spatial levels and scales, instigating the interaction between society, space and technology and potentially contributing to the increased environmental awareness of all involved stakeholders while increasing the general wellbeing.

The continuous upgrading and modernisation of university curricula is a necessity in a hyper-dynamic world, in which planners and architects could have an important role in transmitting the ideas of sustainability. The green transition should not be included only in the catchy titles of design courses but studied on both the theoretical and practical level, influencing the generations of future professionals whose ideas will shape urban reality in the years to come. At the same time, introducing the most recent topics and paradigms stimulated by the NEB ideas, global and local strategies and up-to-date visions and projects, certainly has an impact on the students' perception of emerging problems, the conceptualisation and evaluation of proposed solutions and the personal and collective responsibilities. Directing a path to eco-friendly actions, the master program Sustainable City highlights the key features of environmental change. Therefore, it could be also seen as a unique medium of networking, interchange and integration, providing a fertile ground for a crossover between the formal and informal flows of knowledge, supported by multidisciplinary experts and open to local specificities.

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Track 11: Housing

HOUSING - Planning for affordable cities and new models of living

Chairs:

- Massimo Bricocoli, Politecnico di Milano
- Bruno Marot, Union sociale pour l'habitat
- Francesca Ferlicca, Sciences Po Paris

Keywords: *housing, housing inequalities, greening buildings, housing renovation, demolition policies, housing renovation; urban densification*

Housing has long been overlooked in the policies of most countries, but lately, the housing crisis has once again become a prominent issue. Could housing become a pivotal focus of policies once more? The shortage of affordable, secure, and high-quality housing for the working and middle-class population has had far-reaching consequences on their overall well-being, living standards, and fundamental rights. Housing is particularly susceptible to climate-related challenges and represents a substantial energy consumer. This creates an immediate dilemma, as eco-friendly housing solutions may unintentionally lead to social exclusion. The growing disparities in housing within Europe have the potential to undermine the progress achieved in green transition initiatives. Meanwhile, individuals with higher incomes have reaped financial rewards and benefited from favourable fiscal and economic conditions.

These factors have exacerbated the gap between property owners and income earners or recipients of social assistance, further intensifying the socio-economic exclusion faced by marginalised communities, such as migrants, refugees, racial and ethnic minorities, as well as other disadvantaged groups like low-income working-class individuals and the elderly. This has led to an increase in segregation, with socio-spatial divisions likely intensifying even further since 2011 due to the impact of various crises, including the climate crisis, the global financial crisis, challenges related to immigrant integration, the COVID-19 pandemic, and energy crises, all of which have exacerbated global housing inequalities.

This call will focus on housing as a game-changer. Topics include a recognition of new issues, actors and policies. Some examples may be the European Union's (EU) initiatives for a green transition and their effects on housing inequalities and the EU's strategy for adapting to climate change; the adoption of nature-based solutions to safeguard ecosystems; the impact of policies for greening buildings and housing renovation; the outcome of demolition policies and housing renovation; the Just Transition initiative potential innovations; more equitable policies on distributing benefits from the green economy; impacts of broader policies on urban densification and hub-based development…

Housing improvement in historic districts oriented towards the people's "sense of gain": A case of Shanghai, China

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Abstract

In recent years, China proposed the concept of people's "sense of gain" as the highest criterion for measuring urban development. This paper explains the connotation of the concept and suggests it emphasizes comprehensive material and spiritual development, promotion of fairness and justice through community participation, and mechanism and policy innovation. In Shanghai's practices of housing improvement in historic residential districts, how does it foster a "sense of gain" among the communities? The paper reviews three housing improvement methods in Shanghai since the 1990s and examines their changes, efforts, experiences, and shortcomings from the aspects of the content of housing improvement, the degree and frequency of residents' participation, and mechanism and policy innovation. The paper suggests, that in Shanghai's housing improvement practices, the goals are shifting from the mere expansion of living space to considering spiritual aspects such as social relationships and place attachment, and active and deep community involvement enhances residents' satisfaction and the fairness of the renewal outcomes. All these contribute to increasing disadvantaged groups' "sense of gain".

Keywords: people's sense of gain, housing improvement, historic preservation, urban regeneration, Shanghai

0. Introduction

The people's "sense of gain" has emerged as a central concept in China's recent urban development. In 2014, China introduced the notion that the primary criterion for evaluating the effect of urban development should be whether the people experience a "sense of gain". This term embodies vital principles of fairness and inclusivity, aiming to ensure that disadvantaged groups share the fruits of urban development.

In historic districts, such as the historic center of Shanghai, live many disadvantaged groups, including the elderly, domestic migrants, and low-income individuals. Due to historical factors, they were "left behind" amid rapid economic development and significant social change following the Chinese reform in 1979. Their immediate aspiration is to improve old housing conditions, have private bathrooms and kitchens, and elevate overall quality of life. How does Shanghai address this issue and foster a "sense of gain" among these communities?

1. Concept of people's "sense of gain"

This paper begins by elucidating the genesis, context, and essence of the concept of people's "sense of gain". Originating from a directive issued by the Chinese central government during a 2014 conference, it emphasized the necessity of implementing a series of politically viable reform measures to effectively showcase the value of the reform agenda, thereby enhancing the public's "sense of gain". Subsequently, the concept of "sense of gain" gained widespread traction, featuring prominently in numerous official reports and formal discourse of the Chinese government. For instance, phrases such as "'Sense of gain is the ultimate test standard for government work and the ultimate goal of all work,'" and "'Sense of gain' has emerged as the litmus test for assessing the effectiveness of reforms," underscore its pivotal role in evaluating governance efficacy.

The term "sense of gain" primarily refers to the positive sentiment experienced by individuals following the dividends of political and economic reforms. It underscores the importance of ensuring that "everyone," particularly marginalized groups, perceives tangible material and spiritual benefits arising from social and economic advancements in their daily lives. Furthermore, this concept advocates for active public engagement in national or municipal development endeavors, enabling individuals to contribute to and partake in the resulting benefits. It bears resemblance to the proverbial notion of "no pain, no gain."

This concept reflects three shifts in China's current development:

1). Transitioning from a focus solely on economic growth and material infrastructure, such as GDP expansion and urban CBD construction, to a more holistic approach that emphasizes the sustainability and integration of economic, social, cultural, and environmental development. Evaluation of development now centers on whether everyone has access to essential resources like healthcare, education, employment opportunities, green spaces, and housing, rather than merely relying on economic indicators.

2). Increasing emphasis on fairness, justice, and inclusive development. Historically, China concentrated resources in certain regions, groups and industries to spur rapid economic growth, hoping to drive nationwide development. However, this approach often excluded disadvantaged groups, leading to their "sense of deprivation." For instance, urban renewal projects resulted in the demolition of older housing in city centers, replaced by upscale high-rise houses, office complexes, or Disneyfied historical tourist attractions. Yet, original residents had to leave their homes and move to remote suburbs, highlighting the need for a broader societal benefit. Hence, the concept of "sense of gain" underscores the importance of benefiting all, especially marginalized groups, through targeted social resource allocation, rectifying decades of neglect.

3). Reforming institutions and mechanisms to solidify the comprehensiveness, sustainability, inclusiveness, fairness, and justice of development efforts. The concept of the "sense of gain" aligns with the current trends in historical preservation and urban regeneration, which emphasizes protecting the daily lives of ordinary people in historic districts and encouraging residents' participation in community governance. In the realm of historical preservation, decades of development, influenced by concepts such as the Charter of Athens, the Charter of Venice, "historic urban landscape," and "urban living heritage," have led to a consensus: preservation efforts should extend beyond grand monuments to include "secondary" heritage closely linked to ordinary people's everyday lives, such as historical residential buildings and districts. Moreover, there is a growing emphasis on involving community stakeholders in preservation initiatives. Urban regeneration, also, has gone through the phase of large-scale demolition and reconstruction, focusing now not only on the improvement of the urban environment and economic growth, but also on the improvement of community environments, promotion of place attachment, and cultivation of community spirit through small-scale, resident-engaged "community planning.

Incorporating the notion of the "sense of gain," the preservation and renewal of houses in historic residential districts should: 1) prioritize the comprehensive advancement of both material and spiritual aspects of human well-being; 2) guarantee community participation rights and equity; 3) drive innovation in mechanisms and policies.

2. Review of the housing renewal process in Shanghai's historic districts since the 1990s

In chronological order, the paper examines how Shanghai enhanced people's housing conditions over different periods since the real estate boom in the 1990s.

Shanghai's central area is characterized by a significant number of historical houses, primarily comprising lane residences (Lilong houses) from the early 20th century concession period, blending Chinese traditional and Western architectural styles. Another prevalent type is the Workers' New Village, constructed for the working class in the 1950s following the establishment of the People's Republic of China. The construction of Workers' New Village continued until the 1990s when the Chinese real estate market flourished. These housing types form the fundamental urban fabric of central Shanghai.

These historical houses serve as tangible reflections of Shanghai's political, economic, social, and cultural evolution over time, embodying collective memories and everyday life experiences of its residents. Consequently, they hold significant historic preservation value. However, due to initial economic and technical limitations during construction, coupled with historical factors, these houses often exhibit issues such as aging structures, outdated floor plans, cramped living spaces, and a lack of modern amenities like independent and private kitchens and bathrooms. These factors render them incompatible with contemporary living standards and fail to meet residents' needs.

Presently, most residents inhabiting these historical houses are elderly individuals who have resided there for decades or low- and middle-income groups unable to afford new commercial housing. Many are former laid-off workers who experienced serious employment challenges during China's economic reforms in the 1990s. Additionally, some residents are domestic migrants seeking livelihoods in Shanghai and young recent graduates. These residents generally express a desire to renovate the old houses.

In the 1990s, China ceased large-scale construction and distribution of state-owned houses, pivoting towards vigorous development of the real estate market and renovating historical houses. Renovation efforts varied across time:

1) 1990s: reconstruction

In the 1990s, many historic houses in bad maintenance in Shanghai underwent reconstruction, involving the relocation of residents to new suburban homes and the demolition of old houses to make way for new high-rise residences aimed at the middle class.

In 1991, as part of market economic reforms, Shanghai implemented a housing reform plan, discontinuing the longstanding practice of providing subsidized welfare housing at very low rents and transitioning to the commodity housing market. Residents were required to purchase commodity properties if they needed new houses.

At that time, Shanghai faced a critical housing shortage, with the per capita living space remaining extremely low despite decades of worker housing construction. The housing area constructed in Shanghai from 1949 to 1990 was 2.8 times the total housing area of Shanghai in 1949. However, by 1990, the per capita living area in Shanghai was still only 6.6 square meters per person, with over 470,000 households residing in less than 4 square meters of space. To address this issue, the Shanghai Municipal Government launched the "365 plan" in 1992, aiming to increase the per capita living area to 10 square meters by the end of the 20th century

through the demolition of 3.65 million square meters of old housing with very poor living conditions.

Reconstruction of old areas, known as "Jiu Qu Gai Zao" in Chinese, involves the complete demolition of very poor old houses, predominantly Lilong residences of poor quality. Residents are compensated monetarily or provided with new suburban homes based on family size or the original housing area. Many former city center residents have been relocated to the suburbs, making this the primary method for improving housing conditions in Shanghai's historic center. Following the demolition of old houses, high-rise residential or office buildings were constructed on most sites to balance demolition compensation funds and stimulate Shanghai's economy. This attracted substantial foreign and domestic investment in real estate development, leading to rapid growth in the real estate sector. By 2002, real estate investment accounted for 30% of total social investment, establishing it as a key pillar industry for economic development.

This reconstruction method facilitated rapid economic development in Shanghai and also led to the creation of a significant number of new housing units within a short timeframe. By 2000, the per capita living area in Shanghai had exceeded 14 square meters, addressing a problem that had persisted for over 40 years. Many residents who previously lived in small, old Lilong houses relocated to newly constructed modern high-rise residential buildings, substantially improving their living conditions.

However, the drawbacks of this approach are evident. Before the reconstruction, these lower-income groups resided in the historical city center, benefiting from convenient transportation and comprehensive public services, including medical care, education, and entertainment. Moreover, numerous small local businesses provided affordable goods and services. Importantly, residents had fostered deep bonds and close social networks over time, offering mutual material and emotional support. As residents relocate to new suburban settlements, they lose access to the low-cost lifestyle and conveniences of the city centre, as well as the sense of belonging fostered by tight-knit social networks.

2) 2000s: Indoor repair and renovation

In the 2000s, indoor repair and renovation emerged as a prominent strategy for revitalizing old houses in Shanghai, known as “Zong He Xiu Shan” in Chinese. While preserving the primary structure of these buildings, modest kitchens, bathrooms, and other facilities were added. This approach gained traction since most of the low-maintenance historical Lilong houses were demolished in the 1990s and new historical preservation policies were implemented. This strategy particularly targeted old housing with better maintenance quality and a relatively recent construction time. As part of the renovation initiative, funds were allocated by the government to upgrade roofs, water supply, and power facilities. Additionally, small, detachable private kitchens and bathrooms were created within each household, replacing the previous communal arrangements where three to five families shared public facilities.

The advantage of this approach lies in allowing long-term residents to remain in their homes in the city centre, preserving established social networks and meanwhile offering the opportunity for improving living conditions. However, it is most effective for historical houses that have been well-maintained, but for those that have not been adequately maintained, this method may impose additional burdens on historical buildings without alleviating residential density.

3) 2010s: Restoration of old houses to their original appearance

From the 2010s on, there has been a trend towards restoring old houses to their original appearance, focusing on preserving historic features while addressing the aging structures and outdated interior floor plans by rebuilding, known as "Cheng Tao Gai Zao" or "Yuan Yang Chong Jian" in Chinese. Architects tailor indoor plans for individual households, providing private kitchens and bathrooms. Residents are given the choice to stay or relocate, with various compensation options provided.

Some historical buildings possess significant cultural value warranting preservation, despite their poor maintenance and lack of modern amenities for residents. Given the impracticality of adding a very small kitchen and bathroom inside these buildings, Shanghai implemented a new approach in 2016. The new method involves restoring the buildings to their original appearance, and keeping the historic features of the houses unchanged while reconstructing the internal structure and spatial layout. This process entails reducing the area of original public spaces like corridors and re-purposing them to accommodate private kitchens and bathrooms for each household. Additionally, to alleviate overcrowding and increase the available indoor space, Shanghai offers residents various options: They can choose to remain in their current homes, or to relocate to alternative residential areas, benefiting from monetary or housing compensation.

Compared to the indoor repair and renovation method of the 2000s, this approach offers several optimizations. It not only preserves the townscape, appearance, and features of historical buildings, but also repairs and restores aging structures, optimizes indoor spatial plans, greatly improves living conditions for residents, and preserves social relations in the neighborhood. This comprehensive approach considers architectural protection, improvement of living conditions, maintenance of social relationships, and residents' preferences regarding staying or leaving. Generally, residents express satisfaction with the outcomes of this housing improvement approach.

However, this approach also has drawbacks: it prioritizes the improvement of residents' living conditions, which entails renovating the indoor spaces and structures of historical houses. As a result, only the external appearance of the buildings is frequently preserved. Additionally, to accommodate the need for increasing indoor living space, restoration of historical buildings may inadvertently lead to changes in their width and height, altering the original size of these structures.

This approach also encounters certain challenges. For instance, when designers reallocate the expanded indoor spaces among households, they must ensure each household receives an equitable and comparable area for kitchens and bathrooms to prevent conflicts and dissatisfaction within the neighborhood. Additionally, after the meticulous restoration and renovation of historic houses, funded by the government, some residents opt to profit by renting their rooms to visitors at high prices rather than continuing to reside in the historic districts. This practice contradicts the original aim of preserving social relations within these areas.

3. Efforts and trends in housing improvement in Shanghai's historic districts from the perspective of "sense of gain"

The paper discusses Shanghai's efforts and trends in improving housing conditions in historical districts to give residents a better sense of "gain":

1) In terms of the content of the housing renewal

The urban reconstruction of the 1990s primarily aimed to swiftly enhance the overall housing situation in Shanghai's historic centre, expand the total housing area and alleviate the city's longstanding housing shortage. The emerging real estate industry was also heralded as the cornerstone of economic growth. However, the focus on providing new, larger, and modern housing largely disregarded the spiritual needs of residents experiencing extreme "housing poverty," including place attachment, interaction with neighbours, social relations, transportation convenience, access to public amenities, and affordable goods and services.

While some young residents express satisfaction or strong anticipation regarding relocating to new high-rise housing in the suburbs, many long-time residents are hesitant to leave their homes and neighbourhoods where they have spent a significant portion of their lives. Influenced by the traditional Chinese value of "settling down on their land instead of relocating," some elderly residents strongly dislike living in sparsely populated suburbs. Some citizens attribute the death of their elderly family members shortly after relocation to the move, while others prefer to sell their new houses in the suburban resettlement area and purchase second-hand homes near their original residences.

The indoor renovation strategy of the 2000s took a "conservative" approach, primarily focusing on integrating modern amenities like compact private kitchens and bathrooms into existing structures with minimal alterations to the building framework. This approach aimed to preserve the social dynamics of the neighborhood and residents' attachment to their original homes, safeguarding both the functional and emotional ties within their social networks. However, many residents perceive indoor renovation as a temporary and interim solution to housing issues, as overcrowded living conditions, outdated floor plans, and inadequate maintenance persist. Consequently, there is continued anticipation for more thorough housing improvement initiatives.

In the 2010s, restoration efforts take a more thorough approach, preserving the style, characteristics, and appearance of historical houses while repairing and reconstructing building structures and re-planning outdated or unsuitable indoor living space layouts. Additionally, original living patterns are maintained. Living in row-patterned low-rise dwellings, row-patterned multi-storey collective dwellings, or point-shaped high-rise dwellings, peoples' daily life can be significantly different. This approach prioritizes the preservation of social relations within neighborhoods and respects residents' preferences regarding staying or relocating. Residents express the highest satisfaction with restoration, as it addresses both material and spiritual needs.

2) In terms of community participation

The 1990s reconstruction process involved only two consultations: one regarding the community's willingness to proceed with the reconstruction project, and another concerning residents' agreement to sign contracts after the government formulated the compensation plan. Community decisions required unanimous agreement, forcing residents to either collectively accept relocation or remain in aging, crowded homes without improvement opportunities. Some residents felt compelled to agree with others' decisions due to pressure from neighbours and the

government, despite personal reluctance to relocate. Additionally, residents had almost no say in their relocation destinations.

In indoor renovation projects from the 2000s, the frequency and degree of residents' participation increases. Residents are initially asked to vote on whether to proceed with the renovation. Subsequently, representatives of residents gather opinions and demands in public meetings before designers formulate renovation plans. Following the completion of the preliminary plan, residents are consulted for feedback and suggestions. Once the plan is finalized, consent and signatures from each household are necessary before implementation. Compared to the reconstruction projects of the 1990s, resident participation in indoor renovation projects has increased both in depth and frequency. However, residents still wield limited direct influence over plan formulation, as indoor renovation plans are primarily developed by architects independently. Furthermore, public meetings often feature only resident representatives invited by local authorities, rather than the entire resident body. Additionally, indoor renovation plans lack sufficient flexibility and adaptability to accommodate the diverse needs of different households.

In the restoration projects from the 2010s, the spatial interests among the residents involved become much more complex, because both the building structure and interior space need to be completely reshaped. So the depth and times of residents' participation have also further increased. They are directly involved in the process of restoration design. As residents' "partners", the architects discuss repeatedly with each household about their needs of design from the beginning of the project and customize different plans and designs for each household. Details involve the size of the kitchen and bathroom they want, the combination of facilities, and even the location of the sockets. In addition, architects must coordinate residents' conflicts about the use of space to avoid injustice, such as the encroachment of public corridor space, or the uneven increase of living areas for different households in the restoration. In short, in the restoration projects from the 2010s, residents can participate in the entire process and even "control" the restoration design of their rooms in the historic houses. Residents put "efforts" in the restoration design, and thus "gain" satisfactory results of their renewed rooms in the historic houses. During the restoration process, complaints about injustice from residents are reduced.

3) In terms of institutional and mechanism support

The development of the community planner system, the introduction of various compensation policies, and the promulgation of relevant technical documents have provided support. In the reconstruction from the 1990s, the government did not appoint planners to contact the communities. Planners had little understanding of the communities and the communities had little understanding of the reconstruction plans. In the later stages of the indoor renovation project of old houses, the local government began to appoint specific planners to maintain long-term contact with the community to listen to the needs of community residents and their opinions on the plan. This approach gradually formed a more mature "community planner" mode, which was promoted by the Shanghai government in 2016. The role of "community planners" is pretty obvious in the restoration project in the 2010s: they are not only an intermediary between the government and the community but also professional and technical personnel who accompany residents to participate in the design process. Sometimes the community planner system also needs to recruit social workers, to coordinate neighborhood conflicts about the use of space, which are accumulated during a long time, so that the housing improvement project can go on smoothly.

4. Discussion

In short, this paper examines housing renewal in Shanghai's historic center and discusses the changes, efforts, and experiences in China's recent urban development oriented toward the people's "sense of gain". The goals of housing renewal are shifting from mere expansion of living space to considering spiritual aspects such as social relationships and place attachment. Active and deep community involvement enhances residents' satisfaction and the fairness of the renewal outcomes. All these contribute to increasing disadvantaged groups' "sense of gain".

The reconstruction of historic residential districts from the 1990s was more concerned with the increase in the total housing stock in Shanghai in a short period, the increase in per capita housing area data, and the elimination of extreme "housing poverty", which resulted in the relocation of many residents from the city center to high-rise residential buildings in the suburbs. Although residents' living area was increased and they had modern kitchens and bathrooms, they were deprived of convenient public services in the city center and emotional support from their old neighborhood. Residents have also few rights to choose whether to stay in or leave their old houses according to their wishes.

In the comprehensive indoor repair from the 2000s, residents' participation increased and every resident could express opinions during the plan publicity stage, although they were unable to further control the process of plan design and the "space production". Not only were private kitchens and bathrooms added to residents' rooms and living conditions improved, but it also took the preservation of residents' social relations into account, and residents can continue to live in the city center. However, residents still do not have many choices. They can only make a collective decision as a whole community: either all of them must accept the repair plan, or all of them must wait for reconstruction and relocation, or all of them must maintain the status quo unchanged.

In the restoration projects from the 2010s, residents, accompanied by community planners, were able to influence the process of the restoration design and "privately customize" the restoration plan for their rooms. It avoids injustice complained by the residents such as the uneven distribution of increased living area. They can choose to continue renting these rooms in the state-owned houses, purchase these rooms at discounted prices, or accept compensation and move elsewhere based on their wishes. This gives residents greater freedom and avoids the situation where the "minority obeys the majority". The current housing renewal project in Shanghai comprehensively considers factors such as historic preservation, improvement of living conditions, maintenance of social relations, and respect for the wishes of residents, so that residents have a greater "sense of gain" both at the material and spiritual levels.

However, the current housing improvement practice in Shanghai is still questionable. For example, there is a "contradiction" between historic preservation and the improvement of living. In the restoration projects from the 2010s, the government paid more attention to improving the living conditions of disadvantaged groups, so the indoor space was completely renewed and rearranged and the building structure was rebuilt, leaving only the appearance and main features of the historical building unchanged. Due to the need to increase available indoor space, the height and width of buildings often increase. This somehow injures the authenticity of historical buildings. As for historic preservation, the complete restoration projects in the 2010s are not as good as the "reversible repair" in the comprehensive repair projects of historic houses in the 2000s.

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Towards an inclusive and developmental housing regime in Chinese megacities? Evidence from the implementation of the Affordable Rental Housing Programme in Shanghai

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Abstract

Affordable Rental Housing (ARH) is the latest social rental housing programme proposed by the Chinese government, which forms part of the social housing system and is primarily designed to alleviate the housing difficulties of the inflowing new citizens and young people in megacities, thus moving towards a developmental housing regime. Focusing on the implementing process of the ARH program in Shanghai, this study observed the location of ARH in the housing system, the project types, provision mode, spatial distribution, and affordability of ARH, then explored the tensions between the government and stakeholders through the conceptual lens of governance structure. This study enriches the conceptual and empirical understanding of ARH in China and enriches the understanding of housing regime transformation in China.

Keywords housing regime; rental housing system; affordable rental housing (ARH); public rental housing (PRH); Shanghai

1. Introduction

It has been long argued that the East Asia region is embarking on the so-called 'productivism welfare regime', however, certain East Asian societies such as Singapore witnessed the emergence of a developmental welfare regime. More recently, some scholars considered an ongoing transformation from a productivist housing regime to a more inclusive and developmental housing regime in China since 2016 when the central government encouraged the simultaneous development of the rental and sales markets. Particularly since 2020, the Affordable Rental Housing (ARH) programme was initiated as one of the three programmes that make up China's current social housing system, the housing regime transformation has become a debatable issue, stimulating debate over whether China is moving towards a more inclusive and developmental housing regime.

Esping-Andersen's "Worlds of Welfare Capitalism" has provided a powerful framework for comparative welfare state analysis(Esping-Andersen, 1990, Esping-Andersen, 1999). Upon this, Holliday introduced a fourth "productivist" welfare regime, which has subsequently become dominant in explanations of social policy and welfare system development in the more recently

industrialized East Asian economies(Holliday, 2000, p.706-723). The productivist welfare regime is characterized by the subordination of social policy to the overarching goal of economic growth. It entails minimal social rights that are contingent upon productive activity, the strengthening of productive elements, and the growth-oriented relationships among the state, market, and family (Holliday, 2000, p.706-723, Kim, 2015). But recently, scholars suggested Singapore as a developmental welfare regime. In the developmental regime, universal social investment underpins welfare provision, and social policy has proven to be an effective instrument for averting economic crises (Kwon, 2005, p.477-497). The developmental welfare regime offers a conceptual formula that goes beyond facilitating economic growth and aims to promote the simultaneous integration of economic and social development through significant social investment(Midgley and Tang, 2001, p.244-252).

The salience of the housing system to the welfare regime has been widely recognized in comparative research(Zhou and Ronald, 2017, p.253-276), and researchers have increasingly considered state approaches to housing as a welfare regime pillar(Kemeny, 2001, p.53-70, Ronald and Kyung, 2013, p.452-474). The housing regime refers to a typology of systems of power, which is determined by varying degrees of corporatism in economic and political decision-making. According to Kemeny'sapplication of Esping Andersen's approach to housing systems, the main characteristics defining housing regimes are related to the rental sector, and the basic distinction lies between dualistic and integrated (or unitary) rental systems(Kemeny, 2006, p.1-18). Societies with a dominant homeownership culture exhibit a 'dual rental market', where the private sector is strictly means-tested and always restricted to the poor. In contrast, countries with a 'unitary social rental market' have both private and public sectors operating under the same institutional arrangements and competing with each other. The dual system tends to marginalize renting, whereas the unitary system presents renting as a competitive alternative to homeownership. Singapore and Germany are widely considered as typical representatives of the unitary rental system. Some Chinese scholars suggested ARH programme will be an effective approach to compete with the private sector, which may help to turn China's rental system from a dualistic to a unitary system and shift from productivist welfare to a developmental welfare regime(Chen et al., 2014, p.534-550).

There has been a considerable amount of research related to China's rental housing system, housing regime, and long-term rental apartments (Lin, 2018, p.96-105, Chen et al., 2022, p.105442, He and Chang, 2020, p.592-616, Huang et al., 2021, p.102967, Li and He, 2023, p.1-25, Li et al., 2023, p.102715). A few researches are focusing on the emerging ARH programme in China(Li and He, 2023, p.1-25). However, as the newest rental housing project proposed by the central government, the implementation process of the ARH programme has received insufficient scholarly attention, particularly the roles of various agencies and several modes of governance in producing ARH.

Focusing on the implementing process of the ARH programme in Shanghai, this study observed the tensions and contradictions between the central and the local government and then explored the transition of provision modes in two stages through the conceptual lens of governance structure, to understand local government's adaptive strategies, which strive to balance top-

down political pressure with local fiscal interests, and the dilemma for different stakeholders.

The paper proceeds in a number of subsequent parts. The following section reviews China's housing system evolution in the past 30 years and the characteristics of ARH such as relevant policies, its concept, and target groups, and then locates ARH in China's current housing system. Section 3 introduces the methodology of qualitative and quantitative analysis of the ARH programme in Shanghai. This is followed by ARH provision modes in Shanghai, including two major provision modes, the spatial distribution of ARH projects and the affordability through in-depth field investigation. Section 5 aims to explain the institutional and governance transition of ARH provision in Shanghai through the conceptual lens of governance structure. The final section concludes the above empirical findings and considers how our findings and analysis of China contribute to theoretical debates on housing regime transformation.

2. Locating ARH in Chinese Housing System

2.1 Housing Regime Evolution in China

Before 1998, China's housing system was undoubtedly a productivist housing regime. Housing, as a basic benefit, was provided by State-owned work units to house their employees and was allocated based on hierarchy. By the 1980s the housing system was able to cover more than 90% of the urban labor force (and dependents) through public housing(Gu, 2001, p.91-111). This was like other socialist economies where low-cost housing functioned as a form of social wage(Huber and Stephens, 2010). Beginning in 1998, China completely abolished welfare housing and began to encourage market ownership housing and its financialization, in response to the 1997 Asian financial crisis. The transformation of urban housing from a welfare good to a commodity good greatly helped drive a consumption boom and economic prosperity in urban China. Local state revenue from the sale of residential housing land has played a crucial role in financing urban infrastructure investment since the 1998 reform(Man, 2011). This seems to be a shift from a productivist welfare regime to a liberal welfare regime. Under these circumstances and institutional arrangements, local governments were reluctant to implement large-scale public housing programmes.

The Economic Comfortable Housing (ECH) programme, which began in 1994 and was cancelled in 2013, was a national housing guarantee scheme designed to promote homeownership among low-middle-income households but has been flexibly implemented by local governments as a housing allocation for key workers[1]. The Cheap Rental Housing (CRH) programme, which started in 1998, had a very limited supply and was strictly limited to the poorest local citizens with serious living difficulties.

Between 2000 and 2010, the Chinese government's efforts in the housing security system

1 Key workers Normally defined as providers of essential local (usually public) services whose pay cannot be adjusted to reflect variations in the local cost of living – particularly in the cost of housing. Essentially public sector workers on national pay scales; most commonly teachers, nurses and police officers but who is included can vary between authorities.

included two other kinds. One is Capped Price Housing (CPH), which is targeted at middle-income households, and the sale price is set at around 70-75% level of comparable nearby market housing. The other one is Shanty Town Renovation Housing (SRH), which is reserved for households relocated due to urban renovation projects.

Public Rental Housing (PRH), which was started in 2010, aimed to accommodate a fifth of the Chinese urban population by 2015, as a significant progress in China's housing system. While CRH covers only the poorest local households, PRH is targeted at both low- and middle-income households who cannot afford decent housing at the market price and is accessible by not only permanent residents but also migrant workers. In 2014, the CRH was merged into PRH.

However, China still had a predominantly ownership housing system until then, with rental markets mainly existing in mega-cities with an inflowing population, and mainly consisting of the private rental sector. Public housing was substantially downgraded to a supportive role in the whole housing system(Chen et al., 2014, p.534-550). However, with the rapidly increasing market housing purchase and investment, the incredibly high housing prices exclude new citizens[2] and migrant workers, which may restrict the industrial development of mega-cities in China, and make home purchases increasingly unaffordable for low- and middle-income households. In 2016, President Xi Jinping asserted a new fundamental principle for housing policy, emphasizing that 'housing is for living, not for speculation'(Xinhua News, 2016[3]). For the first time, the Central Government has proposed the development of a housing rental market and the establishment of a housing system that combines renting and purchasing. To facilitate the simultaneous development of the rental and sales markets, the State Council (SC) and the Ministry of Housing and Urban-Rural Development (MHURD) issued a series of policies, with the intention of cultivating the private rental sector and accelerating the provision of long-term rental apartment (LRA).

The years from 2016 to 2019 witnessed China's central government supporting the construction of rental housing, guiding local governments to increase the supply of rental housing through a variety of approaches, including the construction of rental housing on new construction land, the compulsory allocation of rental housing in new market housing projects, and the conversion of idle and inefficiently utilized industrial plants and commercial office buildings into rental housing. A large amount of LRAs invested by market institutions have emerged. However, LRA was facing a crisis in China due to unsound financial regulation, and a considerable amount of literature has already examined in detail the rapid growth of LRAs in China in those years, and the broken capital chains and bankruptcies of LRA companies.

As a result, starting in 2020, China's central government proposed to carry out the construction of the affordable rental housing (ARH) programme, which aims to provide adequate and

2 The term 'new citizens' mainly refers to individuals who have relocated to cities for permanent residence due to factors such as employment, entrepreneurship, children's schooling, or seeking refuge with children.

3 Xinhua News. (2016). Housing is for living, not for speculation. http://www.gov.cn/zhengce/2016-12/16/content_5149066.htm.

affordable rental housing. For the first time, the national state clarified the top-level design of China's social housing system, put forward the construction of a social housing system with PRH, ARH, and Shared Ownership Housing (SOH) as the mainstay, and clarified the basic system of ARH and the relevant support policies (Fig.1).

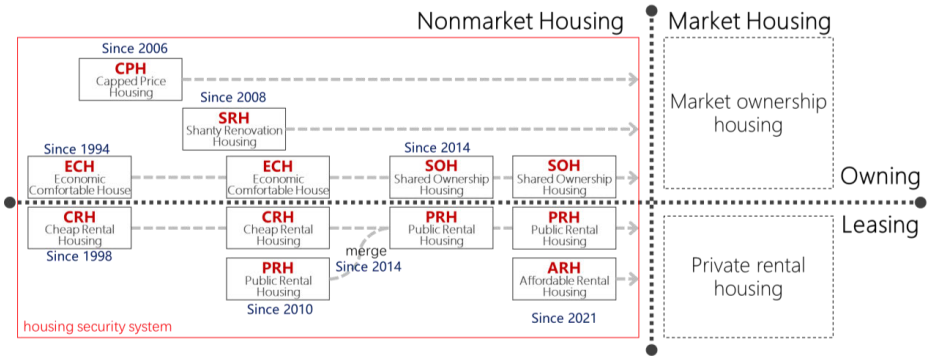

Fig.1 Evolution of Chinese housing system

2.2 The characteristics and roles of ARH in Shanghai

In the Chinese context, the ARH programme aims to provide comfortable, secure, and affordable rental housing with a price set around 90 percent level of comparable nearby market rents, to alleviate acute housing affordability problems faced by new arrivals and young working-class who migrate to megacities.

In the state's top-level design, PRH and ARH are two types of social rental housing, targeting different groups. PRH is provided to key workers, newly-employed workers and migrant workers, and low-income local households with limited per capita living space. ARH is provided to newly employed workers and migrant workers with fewer limitations. In Shanghai, for example, these two types of rental housing are also different in terms of the application process and rental price, but to fulfil the task indicators issued by the central government, PRH is also merged into ARH for quantity counting.

Taking Shanghai as an example, as a mega-city with serious housing difficulties for the inflowing population, Shanghai has been vigorously developing LRAs, talent rental housing(special discounts for highly educated groups), and rental communities since 2017, and designated some of these rental housing projects as ARH programmes later. Currently, the Shanghai Municipal Government has proposed a four-type housing system, including nonmarket rental housing, market rental housing, nonmarket ownership housing, and market ownership housing. Among them, the rental market is mainly divided into ARH (except PRH), PRH, LRA, and the former CRH (which has been merged into PRH) (Figure 2). Only the PRH projects are owned by the local government. The operators of LRA and ARH are similar, with a mix of private companies (real estate companies, hotel companies, rental agencies, etc.) and state-owned enterprises (SOEs), with SOEs generally operating a larger proportion of ARH

according to government directives. The centralized LRA can be added to the ARH by application of the operating company, subject to certain conditions. The provider, regulation, subsidies, rent price level, and target groups of these types of rental housing are differentiated, as can be seen in Table 1.

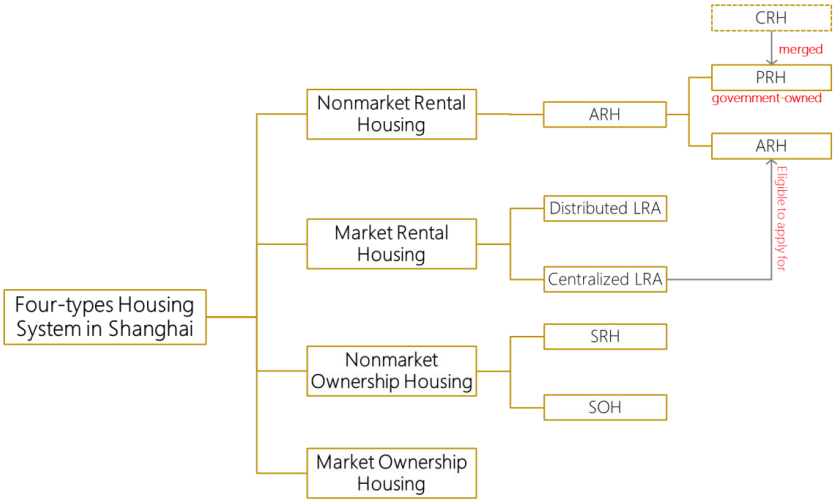

Fig2. Four-types housing system in Shanghai

Tab.1 characteristics of 4 types of public rental housing in Shanghai

	CRH (Cheap Rental Housing)	**PRH (Public rental housing)**	**LRA (Long-term rental apartment)**	**ARH (Affordable rental housing)**
since	1998	2010	2016	2021
Provider	Government	Government	SOEs & private companies	SOEs & private companies
Regulation	enclosed management	enclosed management	less regulation	overall supervision
Subsidies	High (land freely allocated, rental price subsidies, tax incentives)	High (land freely allocated, rental price subsidies, tax incentives)	Low (tax incentives)	Medium (Land supplied at cost, tax incentives, discounts on utilities)
Rental Price	Much lower than comparable nearby market housing	50-80% level of comparable nearby market housing	Market price	90% level or almost equal to comparable nearby market housing
Target Group	•very low-income local households	•Key workers •newly-employed	•Senior management of	•newly-employed workers and migrant

		workers and migrant workers •low-income local households with limited per capita living space	foreign enterprise •newly-employed workers and migrant workers	workers •middle-low-income local households with limited per capita living space
Floor Area Per Household	≤45m²	40-60 m²	Without limitation	≤70 m²

2.3 ARH designed to change China's dualistic rental system

According to official newspaper reports, at the end of 2022, there were approximately 8 million housing units in Shanghai, of which 2.1 million were rental housing, and these were made up of 1.8 million private rental housing, 100,000 LRAs, and 200,000 ARHs and PRHs. So, the rental market accounted for 26 % of the overall housing market, with social rental housing accounting for approximately 14 % of the rental market[4]. The municipal government of Shanghai committed to providing 400,000 units of affordable rental housing by the end of 2025, which consists of nearly 20% of the whole rental housing market. According to Kemeny's theory, the housing system in Shanghai was once a dualistic rental system, but the implementation of ARH driven by the state seems to be a step towards an integrated rental system, by improving rental housing quality and affordability to become a competitive alternative to homeownership.

3. Research design

3.1 Study area

We chose Shanghai's ARH project as the object of study because Shanghai, as China's economic centre, mega-city, and famous global city, has faced a large inflowing population for a long time, and therefore the housing problem is very serious, then the process of ARH implementation, the motivation of the local government, and the social impacts generated by the project will also become particularly noteworthy.

3.2 Methodology

This research employed both qualitative and quantitative methods. Firstly, we reviewed publicly available policies, legislative documents, and official news at both the central and municipal government levels. Then we collected land conveyance data from the official website[5], mapping urban rental lands from 2019 until now in Shanghai, and collecting statistics on new ARH assignments to each district in Shanghai from official planning documents.

4 Liberation Daily, report in Feb. 2023
5 www.landchina.com

Additionally, we conducted in-depth field investigations of 6 ARH, 2 PRH, and 5 LRA Projects (Tab.2, Fig.3) in Shanghai during June and July 2023, including participation observation, and semi-structured interviews with front-line staff of ARH operating companies. We also posted recruitment on the social network Xiaohongshu (Chinese top 3 popular social media applications) for tenants of PRH, ARH, and LRA in Shanghai, and collected 48 questionnaires of tenants from ARH programme, and 37 questionnaires from PRH tenants, as well as 67 questionnaires from LRA tenants.

Tab.2 details information on 13 projects for in-depth field investigation

No.	ARH project	Location	Operator	Types	Rental Units
1	Pujiang V-linker Community	No.20, Lane 131, Kanghua Road, Pujiang Town, Minhang District, Shanghai	V-linker	ARH	3116
2	City Wonder Community-Jiangyue Road	No.55, Nan Jiang Zhou Road, Pu Jin Sub-district, Min Hang District, Shanghai	City Wonder (SOE)	ARH	1080
3	Mofang Luheng Road Community	No.18, Linheng Road, Minhang District, Shanghai	Mofang	ARH	1255
4	Anxin Community Long dream Hongkou	760 Xijiangwan Road, Hongkou District, Shanghai	Anxin	ARH	440
5	Mofang (Ningguo Road Metro Station)	No.7, Lane 29, Longkou Road, Yangpu District, Shanghai	Mofang	ARH	250
6	SIUD-Xin Community	Lane 555, Xiulian Road, Xinzhuang Town, Minhang District , Shanghai	SIUD (SOE)	ARH	2562
7	Chenpin Apartment	No.1234 West Yan'an Road, Changning District, Shanghai	District government	PRH	116
8	Baodi Hongleyuan	Lane 76, Guangyue Road, Hongkou District, Shanghai	Baodi (SOE)	PRH&ARH	747
9	Creative Apartment - Bay Valley Community	Lane 1566 North Guoquan Road, Yangpu District, Shanghai	Creative Apartment (SOE)	LRA	852
10	Poyu hongkou Jiangwan Apartment	1400 Xinshi North Road, Hongkou District, Shanghai	Vanke	LRA	256
11	Yi-Mofang Apartment(Wujing ECNU)	No.5395 Longwu Road, Minhang District, Shanghai	Mofang	LRA	200
12	Pujiang OCT Umihome	Lane 339, Pukang Road, Minhang District, Shanghai	CIFI Group	LRA	1869
13	City Wonder Community - Huashan Road	No.161, Lane 1038, Huashan Road, Changning District, Shanghai	City Wonder (SOE)	LRA	104

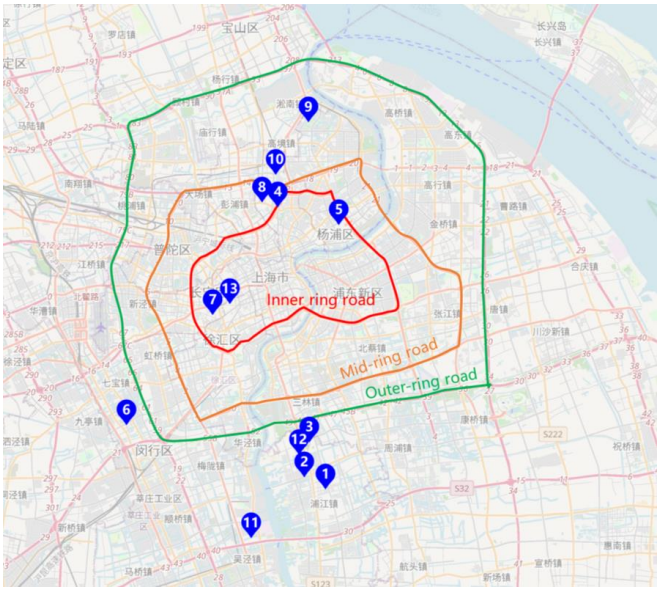

Fig.3 13 projects for in-depth field investigation

It is worth noting that LRA has access to ARH, while PRH and ARH could co-exist within one site or project, so all three types of rental housing were researched, for a better comparative study and a better understanding of the rental housing system in Shanghai.

4. ARH Provision and distribution in Shanghai

4.1 Two types of ARH Provision modes

ARH can be mobilized through two main channels: new construction and stock building conversion. There are five modes of land supply for new construction, including supporting land for industrial parks, collective construction land supply, unused land owned by enterprises and institutions, direct supply of Rental Housing Land('R4' in Shanghai, which means that the land can only be used to build housing for rent), and mandatory allocation of a certain percentage in market ownership housing). Of course, the most efficient way is to build ARH communities directly in R4 land, which often brings in several thousand units of rental housing in a single project, such as the SIUD-Xin Community (Fig.4; No.6 in Fig.3). Stock building conversion refers to the conversion of existing buildings that were not originally intended for residential use into ARH, or LRAs that have been converted from other types of buildings (industrial, commercial, office building) and can be incorporated into ARH through application, such as Mofang Luheng Road Community, which was converted from factory building (Fig.5; No.3 in Fig.3).

Fig. 4 SIUD-Xin Community

Fig.5 Mofang Luheng Road Community

LRAs applying for ARH need to meet several conditions. Firstly, the rent price needs to be no more than 90% level of the same type and quality of housing nearby (but this can be operated flexibly). Secondly, the products should be mainly small households under 70m^2 (at least 70% units of the project). Thirdly, the stability and the total living units are important, if the property rights of the building do not belong to the operating company, then the operating company needs to sign a lease contract with the property owner at least for 5 years, and generally need at least 50 rooms to be operated within the same plot. Fourthly, the rent will be regulated by the government's housing management department after being included in the ARH, and the price increase shall not be more than 5% per year.

By designing policies, the Government encourages former LRA companies to join the ARH and be subject to stricter regulation. One point is tax incentives and utility concessions. After joining the ARH, those former LRAs converted from non-residential buildings, which were originally required to charge utility bills according to industrial and commercial functions, can now be charged according to residential use (in terms of electricity tariffs, for example, the residential tariffs are about 60% of those for industrial use, and 40% of those for commercial use), which may be more attractive to potential tenants. The second point may be more important, after joining ARH, it is equivalent to getting the endorsement from the government, and the company can then issue REITs with this project as the underlying assets. therefore, at present, for LRA projects in Shanghai, unless they don't meet the conditions such as the household area, we have found in our interviews with front-line staff of LRAs, that the majority of the property owners and operating companies are willing to join the ARH, however, it is not easy to join the ARH even if meeting all the conditions, there is still a waiting list.

4.2 Three types of ARH projects in Shanghai

In terms of building form, ARHs can be categorised into community-type, apartment-type, and dormitory-type. The community type often consists of several buildings forming a gated community containing hundreds or even thousands of living units, such as Baodi Hongleyuan (Fig.6). This type of ARH is mainly located outside the Outer Ring Road in Shanghai. Apartment-type is generally composed of a single building, often originally used as factory

buildings, factory dormitories, office buildings, hotels, etc., such as Mofang (Ningguo Road Metro Station) (Fig.7). The dormitory-type is generally 4 and 6 beds in one room, serving blue-collar workers and employees in the service industries (waiter, courier, housekeeper, etc.), such as Anxin Community Long dream Hongkou (Fig.8), with the rent generally paid by the employers. If dormitories are not provided, this type of company may not be able to recruit a suitable labor force in Shanghai.

Fig. 6 Baodi Hongleyuan

Fig. 7 Mofang (Ningguo Road Metro Station)

Fig.8 Anxin Community Long Dream Hongkou (outside and inside)

4.3 ARH Distribution in Shanghai

The Shanghai Municipal Housing Authority has split the overall target of building 400,000 units of ARH down to the district level under the Five-Year Plan, setting individual targets based on the available land and the existing PRH and LRA. Among them, Pudong New District will build 120,000 units, and Minhang and Songjiang districts will build more than 100,000 units, with these three districts taking on more than half of the task. Since this quantity is a task that each district must complete, we can take the target value of 2025 as definite (Fig.9; Tab.3), and according to the news on the Internet, the districts have completed 80% of the target by the beginning of 2024.

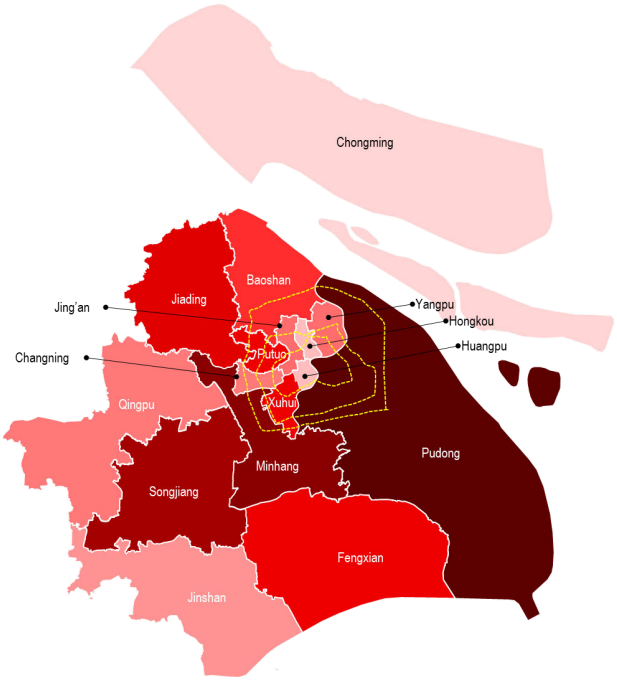

Fig.9 ARH units in 2025 targets split to district level

Tab. 3 ARH units in 2020 and 2025 targets split to district level

District	**Current ARH by the end of 2020 (thousand units)**	**Goals by the end of 2025 (thousand units)**	**New ARH mandates within 5 years (thousand units)**
Pudong	33.4	120.3	86.9
Minhang	16.1	62.9	46.8
Songjiang	23.00	44.4	21.4
Jiading	5.8	23.4	17.6
Putuo	13.0	21.4	8.4
Xuhui	11.8	21.0	9.2
Fengxian	7.2	20.0	12.8
Baoshan	3.7	18.2	14.4
Yangpu	4.9	13.4	8.5
Jing'an	2.4	12.6	10.1
Qingpu	3.9	10.7	6.8
Changning	1.5	10.2	8.7
Jinshan	5.2	9.6	4.4

Hongkou	1.8	6.2	4.3
Huangpu	1.0	5.8	4.8
Chongming	2.2	4.0	1.8
Total	**137**	**403.9**	**266.9**

There are manufacturing companies gathering in Pudong, Minhang, and Songjiang districts, thus gathering a large number of industrial workers and R&D personnel, who are often migrant workers and willing to live near their workplace, and the ARH project provides them with a convenient and comfortable rental environment. At the same time, the majority of these areas are located outside the Outer Ring Road and have lower land costs. In our field research, we found that large ARH communities such as Pujiang V-linker Community and SIUD-Xin Community, for example, are located outside the outer ring road of these districts, and generally have a metro terminal nearby, with at least half of the tenants in the community need to commute to the city centre for work via the metro. Even so, young people are still willing to endure a long commute, as there are not many ARHs in the central city (only more expensive LRAs). That means housing segregation and discriminatory site selection do exist in ARH programme.

When choosing ARHs in the suburbs, but not private rental housing in the city center at the same price, people in the questionnaire reflected that stability and privacy are their primary considerations. The fact that private rental housing may need to be shared with 1-2 roommates, may be suddenly withdrawn, may experience sudden price increase, and may require frequent negotiation with the landlord are not favored by the surveyed group.

4.4 Effect of the ARH Programme on Housing Affordability

The rising housing affordability crisis in urban areas has constituted a major threat to the future sustainability of urbanisation in China (Chen et al., 2010, p.877-901). Housing affordability in Shanghai and other Chinese mega-cities is very poor worldwide. According to the Numbeo website[6] in March 2024, the Price to Income Ratio (PIR) in the city centre of Shanghai remains outstandingly high among the global cities (Fig.10). So have ARH projects improved housing affordability in Shanghai?

6 https://www.numbeo.com/

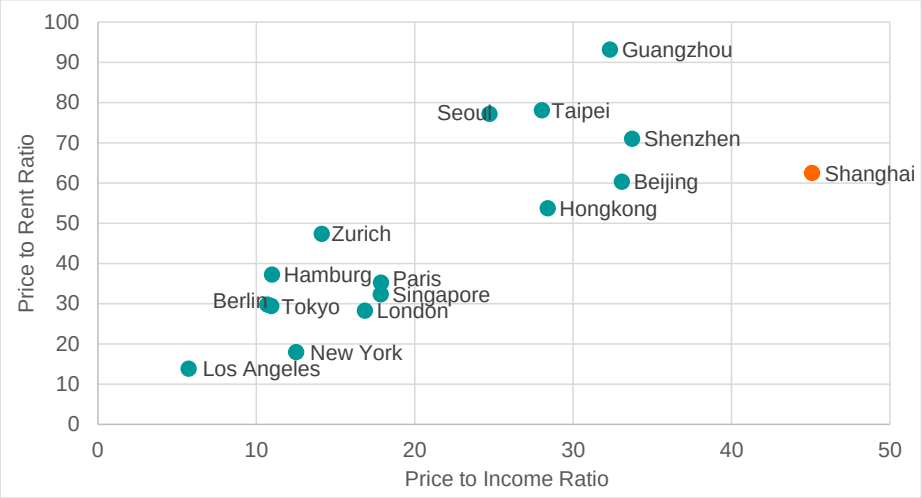

Fig.10 PIR and PRR of 16 global cities in 2024

According to Shanghai's policy on the ARH programme, the rental price of ARH shall be set by the ARH institutes or companies and reported to the housing management department of the local government for record. For ARH suppliers, the rental price should be less than 90% of the rent of market rental housing of the same quality in a similar location.

At the same time, it is stipulated that applicants for ARH are required to meet two conditions: firstly, they are legally employed and working in Shanghai; secondly, they have housing difficulties, which is precisely delimited, in principle, according to the family's per capita housing floor area of less than 15m^2 within the city centre of Shanghai.

However, according to our findings in field research, the rental price per square metre of ARH is not cheaper than that of ordinary private rental housing nearby. The policy provides for a 10% discount on the assessed price, but the assessed price can be declared by the ARH companies themselves. Sometimes, even the rental price will be higher since it comes with some additional service charges and higher-than-civil utilities. However, the total rental price is relatively low as ARHs are generally smaller, around 20 m^2 (usually for 1-2 persons living). This is because it is difficult to divide an ordinary private house or apartment into 20 square metre living units for rent. So as rents are not significantly cheaper, the application threshold in practice is often applied flexibly and does not require proof of housing difficulties.

Even so, the affordability of the ARH programme in Shanghai remains bleak. According to our questionnaire distributed to 48 ARH tenants, 37 PRH tenants, and 67 LRA tenants, only 18% of the tenants pay more than US$620 in monthly rent, which is also consistent with our interviews with housing agents, where a total rental price of RMB 4,000 (about US$620) is a clear watershed in Shanghai (Fig. 11). But even if total rental prices are kept in a reasonable amount due to small floor area, their housing affordability remains a challenge, with 23 ARH tenants' rent to income ratio above 30%, exceeding the international warning line(Fig.12).

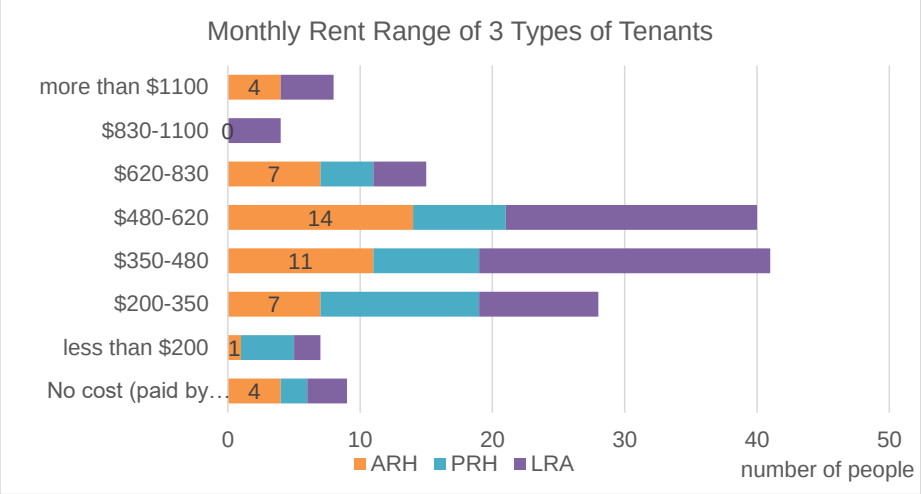

Fig. 11 Monthly Rent Range of 3 Types of Tenants in Questionaries

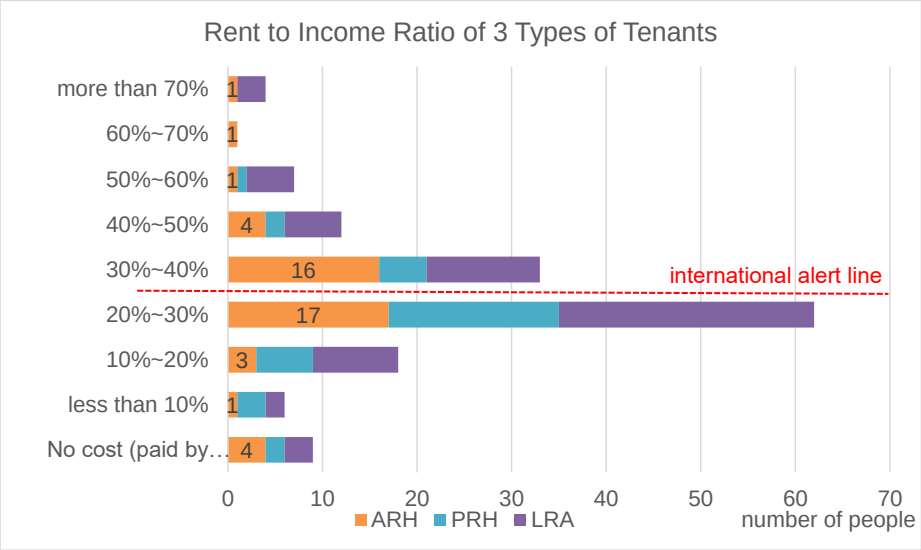

Fig. 12 Rent to Income Ratio of 3 Types of Tenants in Questionaries

A comparative study shows that the PRH is the most affordable (Fig.11; Fig.12). While it is worth noting that although the target groups of ARH and PRH seem to be relatively similar, the difficulty of applying for PRH is much more than ARH due to the more favorable price. PRH requires submitting a series of supporting documents and applications from the official system and queuing up for a limited number of units, and the waiting time is generally over 6 months for Shanghai, and you have to withdraw after 6 years of residence. Based on interviews, PRH can be categorised into two types, provided by the municipal government or district government.

PRH projects provided by municipal government are often available for all applicants, while PRH projects provided by district government are built with revenues from district governments and are more inclined to be rented to those who are conducive to the development of the districts. In the field investigation, we find that PRH projects may have a priority application channel. According to the interviews, we learned that the PRH programme in the district has priority access to key companies and key workers in the district and that the employers apply PRH together, often without a waiting list. In contrast, PRH is more affordable than ARH, but the supply amount of PRH is smaller than that of ARH because it requires higher government subsidies.

5. The Institutional and Governance Transition of ARH Provision

5.1 Two-stage development of ARH in Shanghai

According to the main provision modes, we divide the implementing process of the ARH programme in Shanghai into 2 stages——SOEs-led newly-built large-scale rental communities (from 2017 to 2021), and public-private governance to encourage converting previously underutilised commercial or industrial properties into ARH (from 2022 onwards).

Stage 1: SOEs-led newly-built large-scale rental communities (from 2017 to 2021)

We counted the supply of ARH, PRH, and LRA land supply on official websites from 2019 to the present (Fig. 13), and the most obvious supply peak occurred in 2021 when Shanghai supplied 2.7 square kilometres of R4 land (a type of land exclusively dedicated to the construction of rental housing, as mentioned earlier). The Central Economic Work Conference at the end of 2020 identified the construction of ARH as one of the key tasks of the economic work in 2021, proposing to mobilise 8.7 million units of ARH within five years, and requesting municipalities to prepare a five-year plan for ARH supply. In Shanghai, for example, only 137,000 units were available by the end of 2020, while 400,000 units will need to be completed by 2025. Under this intense political pressure, newly-built community-type ARH or PRH is a solution as each project can provide thousands of living units and the construction duration often takes two to three years, so local governments have seized on 2021 as a critical point to supply a large amount of land for rental housing.

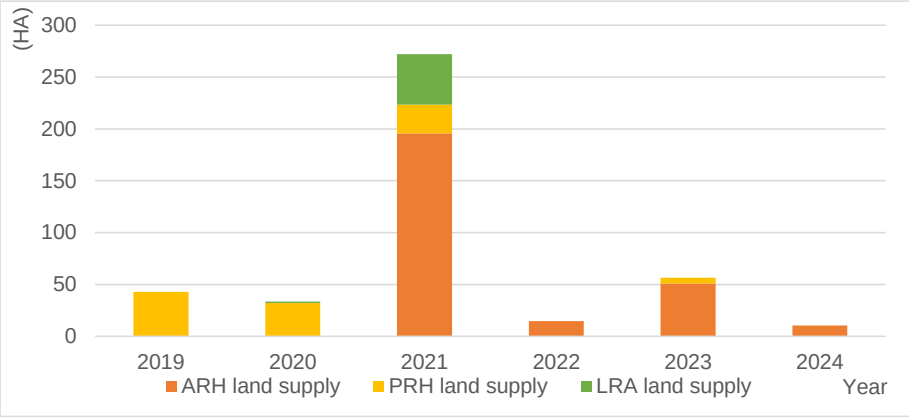

Fig.13 Land supply for rental housing from 2019 in Shanghai

In Shanghai, for example, R4 land is typically priced at one-third the price of market residential land nearby, but in practice, real estate companies are still reluctant to auction land to build ARH communities, and in our interviews with rental institutions, we found that the return on investment cycle for ARH building and operation is generally around 20 years. Against the backdrop of China's rapid economic growth over the last 20 years, few companies could accept this rate of return on investment. As a result, local governments have urged SOEs to act as the mainstay of ARH community building, auctioning off the R4 land. For example, two of the biggest SOEs in Shanghai, Shanghai Land (Group) CO., LTD created a new brand *City Wonder*, as well as Shanghai Chengtou Group Corporation created *Creative Apartment*, to build and operate the ARH community on their rental housing land.

Stage 2: Encourage converting previously underutilised commercial or industrial properties into ARH (from 2022 onwards)

On the one hand, it seems too late to fulfil the 2025 mandate by building new ARH communities after 2022. On the other hand, the supply of R4 land is almost at cost, in which local governments do not receive any land appreciation gain, and therefore have no incentive to continue supplying. At Stage 2, the local governments mainly focus on incorporating the original LRA into ARH, and converting the stock of vacant buildings into ARH projects through renovation and refurbishment. This may involve negotiating with the property owner of the vacant buildings and brokering a deal for them to cooperate with the LRA company to renovate it (Fig.14). The Shanghai Municipal Housing Bureau introduced incentives related to the conversion of non-residential stock into ARH in 2022, including the implementation of residential prices for water, electricity, gas and cable TV, as well as tax incentives such as value-added tax and property tax, low-interest loans and government subsidies, and the latest trend in 2023 is that only ARH can be used as an underlying asset for the issuance of publicly-funded REITs. This trend is also present in other Chinese mega-cities and super-large cities exist, with an intensive batch of local policies from 2022 to 2023.

This transformation poses higher governance requirements for local governments. First, it is not simple to find a stock of houses suitable for transformation, which tests the local government's familiarity with the current situation of real estate in the city and how to incentivise the owners of vacant buildings in the stock to participate in the transformation. Secondly, there are many difficulties in the process of renovating the stock buildings. China currently only has normative standards for new buildings, such as sunlight, sanitation, and fire protection standards, but no standards for the renovation of old buildings, and it is difficult for these buildings to meet the standards, which leads to the inability of many vacant buildings in the central urban areas to be converted into ARHs, which requires breakthroughs and innovations against the national standards from the local governments.

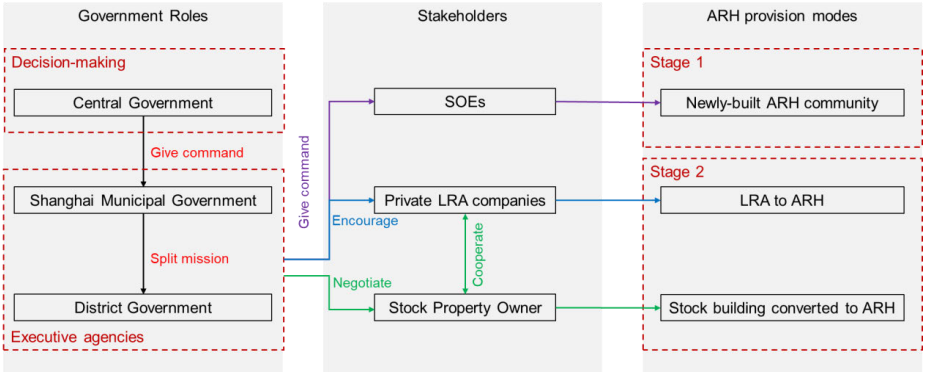

Fig. 14 Two-stage development and governance structure of ARH in Shanghai

5.2 The Institutional and Governance Transition in ARH Programme

The transition of provision modes between the two stages is due to several reasons, including the fiscal burden of local government, lack of available construction land, and the pressure under strong central government mandatory command. The role of the local government shifted from dominant to market resource coordinator, which requires less subsidies but higher demands on governance capacity. From interviews with the operators, we learned that the ARH programme is still a dilemma for local government, SOEs, and institutional investors, due to the lack of land value capture and limited return on investment.

6. Discussion and Conclusion

This study systematically examines the emerging ARH projects in China, taking Shanghai as an example, and systematically comprehends the policy background of the ARH proposal, its positioning in the housing system, the target groups, the provision modes, etc. It also carries out social investigation on the types of products, spatial distribution, and affordability of ARH, conducts a comparative study among ARH, PRH, and LRA, and then carried out interviews with operators, tenants, etc. The conclusion is that ARH is an attempt by the Chinese government to move the rental housing system from a dualistic to a unitary system. However,

ARH is still not enough affordable at present, and there is spatial segmentation for new citizens and young people.

More importantly, local governments and stakeholders are skeptical about the implementation of ARH projects. Local governments are more interested in fulfilling the tasks of upper-level governments, in which they will adopt alternative strategies, such as Shanghai's inclusion of PRH in the ARH statistics and urging SOEs to undertake ARH construction tasks. Due to the low return on investment, SOEs and private enterprises are less willing to participate in the construction of new ARH communities. In terms of converting stock or vacant buildings into ARH, or converting LRA into ARH, local governments have taken some incentives, but institutional innovations are needed before they can be rolled out on a wide scale.

This study enriches the conceptual and empirical understanding of the latest housing policies and the implementation process in China and enriches the understanding of the stage of the housing regime transformation in East Asia societies. It is still doubtful whether China has moved towards a developmental regime. As it stands, PRH is supplied at a lower price to the highly skilled and educated people that the city hopes to attract, employees of large companies, etc., while ARH is more expensive, which is still a productivist welfare regime. Whether ARH and PRH can be truly integrated and expanded in the future may be the path toward a developmental regime in China.

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Dynamics, Mechanisms, and Benefits of Micro-Renewal in Urban Residential Areas: A Case Study of the Xiaoxihu Block in Nanjing

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Abstract
As urban development paradigms shift, micro-renewal focused on enhancing the built environment and fostering a sense of identity has become a transformative pathway in China's urbanization process. Residential spaces, being the most critical elements of urban structure, frequently face complex challenges in their micro-renewal efforts: the constraints on urban construction capacity limit the impetus for innovation; the lack of effective implementation mechanisms impedes the progression of regeneration; and the pursuit of short-term economic gains often traps these spaces, preventing the enhancement of comprehensive benefits. This paper employs the micro-renewal of the Xiaoxihu Block as a case study, examining the sources of renewal impetus, the mechanisms of action, and the enhancement of comprehensive benefits, with the aim of providing a feasible model for sustainable micro-renewal practices in residential settings. The research findings reveal that: (1) the driving force behind micro-renewal is the incremental value derived from the operation of existing spaces; (2) the mechanism of micro-renewal involves the full-cycle participation of multiple stakeholders in public affairs; (3) micro-renewal is a process that holistically elevates environmental, economic, and social benefits, engaging with a diverse array of stakeholders and yielding synergistic effects.

Keywords: micro-renewal, dynamics of micro-renewal, implementation mechanism, benefits of micro-renewal

1. Introduction

In 2015, the United Nations promulgated the Sustainable Development Goals, which underscore that urban renewal is a critical strategy for achieving urban sustainability in the pursuit of improved living conditions, environmental remediation, and economic revitalization. Historically, urban renewal in China's residential spaces has predominantly focused on the secondary development of land(Liu et al., 2020), involving the large-scale demolition and reconstruction of low-quality existing residential areas within cities(Lai et al., 2017). This approach has restructured the original land property rights. Government, market entities, and society constitute the primary stakeholders in this process of resource redistribution(Li et al., 2018). Local governments augment their fiscal revenues and operational capabilities through the land transfer fees and expanded tax revenues generated by urban renewal. Simultaneously, they reinforce the legitimacy of governance by maintaining and enhancing the overall welfare of society(Liu et al., 2020). Market participants are primarily concerned with economic and efficiency gains, leveraging increased development intensity post-renewal—such as the "one-for-many" demolition and construction approach—to capitalize on land value increments through expanded spatial availability. They also seek to minimize transaction costs by reducing the time required for demolition. For homeowners, the substantial monetary compensation from property demolition, the improvement of living conditions, and the resolution of employment issues typically serve as their incentives to engage in urban renewal. Consequently, economic considerations have been the primary drivers and benefits during the era of large-scale demolition and construction in urban renewal(Shen et

al., 2021). However, numerous scholars have pointed out that the over-construction associated with this approach can lead to environmental issues, including the destruction of traditional urban landscapes and natural ecosystems(Hui et al., 2018; Wang et al., 2016). Additionally, social equity concerns have emerged, such as the disregard for residents' renovation preferences(Hin & Xin, 2011), the loss of tenant spaces(Wong et al., 2018), the disruption of community networks(He & Wu, 2007), the disappearance of mixed-use spaces(Zhou et al., 2017), and the loss of reasonable residential densities(Lee et al., 2017).

With the transformation of urban development approaches, the Ministry of Housing and Urban-Rural Development (PRC) issued a notice in 2021 titled "On Preventing Large-Scale Demolition and Construction Issues in the Implementation of Urban Renewal Actions," which explicitly mandates the strict control of "large-scale demolition, substantial addition and subtraction, and extensive relocation" within urban renewal initiatives(Tang et al., 2022). An increasing number of scholars advocate for the proactive adoption of micro-renewal methods to address the challenges of urban residential space stock(Li et al., 2019). Specific practices in various cities reveal that more and more existing residential areas have limited potential for incremental growth, or are even required to undergo de-growth. Consequently, the use of small-scale, incremental micro-renewal strategies, which enhance quality through the renovation and renewal of smaller-scale environments within plots, has become a significant approach to invigorating the continuous renewal of entire regions. This method focuses on the gradual improvement of existing spaces rather than drastic transformations.

Under the guidance of the "organic renewal" concept, micro-renewal attentively addresses residents' daily needs through a gradual and progressive approach. It respects the spatial reutilization of the built environment and emphasizes multi-stakeholder co-governance. This methodology seeks to enhance the quality and management of existing urban spaces, while preserving their fundamental layout and cultural continuity through practical strategies and methods of renewal, repair, and protection(Wang et al., 2023). However, the micro-renewal of residential spaces in Chinese cities currently faces several challenges: (1) Micro-renewal efforts often struggle with a lack of funding sources. Market entities see little profit due to limited urban construction capacity, and residents encounter complexities related to property rights. These issues inherently restrict the motivation to initiate such projects(Jiang et al., 2020). (2) During the renewal process, difficulties arise in coordinating the opinions of various stakeholders and in the flaws inherent to different cooperation models, often impeding the smooth implementation of micro-renewal initiatives(Zhuang et al., 2019). (3) Residential micro-renewal tends to focus predominantly on beautifying and organizing the physical urban environment, falling short in achieving a comprehensive enhancement of benefits(Shen et al., 2021). Moreover, existing research typically approaches urban residential micro-renewal from singular perspectives such as practical pathway design(Hui et al., 2021) and space optimization strategies(Tan & Altrock, 2016). There is a notable lack of systematic research summarizing the drivers, mechanisms, and benefits of renewal, which are insufficient to meet the theoretical research needs of China's urban renewal path transformation.

Therefore, the purpose of this paper is, based on an interpretation of the

essence of micro-renewal, to explore the following questions:

(1) What are the intrinsic drivers that initiate micro-renewal?

(2) What mechanisms ensure the implementation of micro-renewal?

(3) What are the comprehensive benefits that sustain micro-renewal?

This study delves into the dynamics, mechanisms, and benefits of urban micro-renewal, using the preservation and regeneration of Nanjing's Xiaoxihu Block as a case study. The research commences with a succinct literature review, followed by an exposition of the empirical data collection methods and a detailed description of the Xiaoxihu Block. The case study unveils intricate details concerning the driving forces, operational mechanisms, and resultant benefits, thereby elucidating the research findings. Consequently, this paper offers valuable insights and references for the strategic pathways and execution processes of urban renewal within the context of existing urban stock, making a noteworthy contribution to the scholarly discourse on urban renewal.

2. Urban micro renewal of residential areas

2.1 Spatial Logic of Urban Micro-Renewal

Since Molotch introduced the urban growth machine theory, this theoretical paradigm has become the dominant analytical framework for scholars to explain the driving forces behind urban development(Shen et al., 2021). Numerous scholars contend that spatial production is one of the most profitable means to achieve urban growth and serves as a primary catalyst for driving urban renewal projects(Liu et al., 2019). China's urban renewal during the period of incremental expansion also followed a similar logic of spatial production. However, as China's urbanization shifts from incremental development to stock renewal, the logic of spatial production based on real estate development and land finance profiteering is losing its economic foundation. The marginal value of land and various collateral assets as capital for spatial production is declining, and their mission is no longer confined to the regeneration of physical spaces such as old and derelict buildings(Shen et al., 2021). Resource integration and benefit reconstruction are among the key tasks of micro-renewal, with the logic of residential urban renewal shifting from spatial production to community building. Particularly in the context of the renewal of built environments, greater emphasis is placed on the social dimension, focusing on how to maintain the original social structure and property rights, facilitate collaboration and collective action among neighbors, and balance operability and fairness to enhance community vitality and the level of social governance. Consequently, the power of different stakeholders, the network of relationships and operational mechanisms, the role of social capital, and the comprehensive benefits generated by the micro-renewal process have become focal points of urban renewal in the new era.

2.2 Stakeholders in Urban Micro-Renewal

Influenced by the urban growth machine theory, most scholars have identified three key driving factors of urban development: municipal governments, business groups, and communities, as well as the relationships among them(Jiang et al., 2020; Liao & Liu, 2023; Wang et al., 2021; Zhuang et al., 2017). They have also examined how to balance between attracting investment to promote economic development and sharing the benefits. However, unlike the pursuit of economic benefits in urban renewal primarily involving land development, the purpose of micro-renewal is to

make comprehensive investments in and modifications to cities, renew urban functions, and repurpose urban space. It involves complex relationships among multiple stakeholders, which, aside from municipal governments, business groups, and community residents, also include designers, neighborhood committees, the media, and the public(Chou et al., 2023). It places greater emphasis on the granularity of distinct stakeholder groups. For example, residents could be further differentiated by their property rights, willingness to renew, and material conditions, while government departments entail multiple coordinating units such as the comprehensive planning bureau, the urban renewal bureau, and the housing bureau. Social organizations or individuals are no longer simply real estate dealers but involve multiple forces such as real estate, banks, and state-owned asset platforms(Li et al., 2024). Therefore, the management and coordination of stakeholders in urban renewal are particularly important.

2.3 Enhancing Benefits of Urban Micro-Renewal

Urban renewal is an inevitable process in urban development. Prior to 1860, the primary focus of urban renewal was to eliminate slums and improve the material living standards of residents. With the advancement of urbanization and the transformation of urban economic development models, the economic benefits brought about by land development have become the pursuit of both government departments and market entities. However, if the sole objective is to promote economic development, it is bound to harm the interests of vulnerable urban groups and lead to social injustice. Consequently, the goals of urban renewal have diversified to encompass social, environmental, and economic aspects(Chen et al., 2023; Nachmany & Hananel, 2023). On one hand, this involves the built environment as a carrier, with cautious and moderate modifications to the built environment to enhance the quality of living spaces, thereby addressing the supply-demand contradiction of public services, safeguarding the diverse demands of the people, and promoting social equity. On the other hand, it focuses on the management of complex property rights relationships during the process, striving to reach a consensus on renewal intentions and plans. The issues addressed by renewal have become more comprehensive and complex, providing optimized solutions and improving urban functions(Hao & Wang, 2023).

3. Research methodology

The empirical analysis of this study is primarily based on case studies. The research selected the southern part of the old city of Nanjing as the study area because it is a typical urban area that has fully experienced the tumultuous modern renewal process of Nanjing (Table 1), and can be considered a microcosm of the renovation of urban residential areas in China(Bai & Xu, 2023). The selection of the Xiaoxihu Block as a specific case study is for two reasons. Firstly, the Xiaoxihu Block underwent a long 9-year renewal period, becoming the first relatively mature micro-renewal project in Nanjing, allowing us to track changes over different time stages. Secondly, a five-party communication and coordination platform was established during the renovation process of the Xiaoxihu Block. The renovation has garnered broad social attention from the media, scholars, non-governmental organizations and the public, reflecting complex benefit and mechanism issues in the regeneration process. The data mainly come from in-depth interviews, non-participatory observation, and archival research. From March to April 2024, semi-structured interviews and literature research were conducted. Respondents included local

residents, shop owners, designers, and tourists still residing in the Xiaoxihu Block.

Table 1. The Urban Renewal Process in Nanjing

Renewal Phase	Stage One	Stage Two	Stage Three	Stage Four
Time	1978-1990s	Early 1992-2000s	2000-2015	Post-2015
Characteristics of Renewal	Distress-Driven Demolition and Reconstruction	Growth of Agglomeration-Propelled Demolition and Reconstruction	Extensive Demolition and Construction	Incremental Micro-Renovation
Participant Entities	Government-Led	Government-Led	Government-Enterprise Collaboration	Multi-Stakeholder Engagement
Primary Contradictions	Alleviating Housing Shortages	Pursuit of Economic Benefits from Rent Gap	Land Development Symbolized by Culture	People-Centered Approaches Addressing Daily Resident Needs

The renovation of Xiaoxihu Block exemplifies a model of incremental micro-updates, pioneering innovative strategies for the conservation and activation of heritage resources within the district. Located in the southern region of Nanjing's Qinhuai District, occupying an area of 46,900 square meters, Xiaoxihu Block is designated as one of the 22 historical and cultural areas in the "Nanjing Historical and Cultural Name Protection Plan (2010-2020)" (Figure 1), specifically within the Da You Fang Lane Historical and Cultural Area.The Xiaoxihu Block predominantly consists of residential land. However, due to its long exclusion from the old city renovation plans, the once-storied historical and cultural area had fallen into disrepair, with numerous dilapidated and hazardous structures. This led to a chaotic spatial layout, an extremely high population density, and rampant illegal construction, transforming it into a "shantytown"(Dong et al., 2022).By 2016, the division of property rights into 216 plots resulted in extremely small housing units, most of which lacked essential living facilities such as independent kitchens and bathrooms.There are a total of 810 households (2,641 people) in the renewal site, with an average household living area of only 22.14 ㎡, and an average per capita living area of only 11.65 ㎡, which is much lower than the per capita living area standard of 40.1 ㎡ in Nanjing.Additionally, scattered within the renewal area are various property types stemming from historical legacies, including private homes, public housing owned by institutions, government-owned housing, and industrial enterprise properties. When overlaid with the spatial layout, this creates a highly convoluted relationship among property rights.

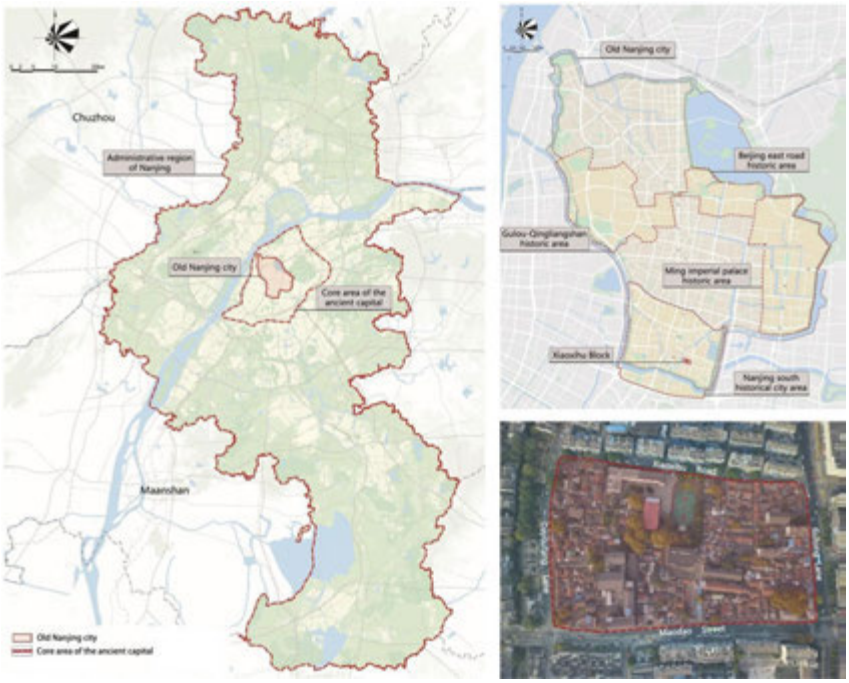

Fig. 1. Location and Boundaries of Xiaoxihu Block

The renewal of the Xiaoxihu Block commenced in 2015. To promote the regeneration of this area, the Nanjing City Planning Bureau and the Qinhuai District Government initiated a voluntary action program involving postgraduate students from three universities based in Nanjing to explore the methods of old city renewal in the southern part of the old city. In 2016, entrusted by the Qinhuai District Government and the implementing entity, the Nanjing Historic City Conservation Construction Group Co., Ltd., a team from Southeast University officially undertook the detailed planning and design of municipal facilities and demonstrative courtyards for Xiaoxihu Block. In 2017, following basic research and a survey of residents' preferences, the formal planning design and expropriation work began. The implementing entity conducted the expropriation, while the designer proposed preliminary planning solutions for the street system, municipal facilities, and public space layout. Residents were informed about the expropriation policies and expressed their relocation preferences. The expropriation work concluded in 2018, and the implementing entity began to advance the property rights transfer of expropriated land, planning the overall business format and layout. The designers completed the detailed constructive planning and planning results, formulated micro-renewal rules, and the government departments studied the micro-renewal work mechanism and policy innovation to ensure the smooth implementation of the micro-renewal process. The official micro-renewal construction started in 2019. The designer carried out the scheme design and rule formulation for key areas, the implementing entity conducted mapping and structural inspection of existing buildings, and initiated construction in key areas according to the planning scheme.

Residents participated in discussions on the scheme design during this process (Figure 2).

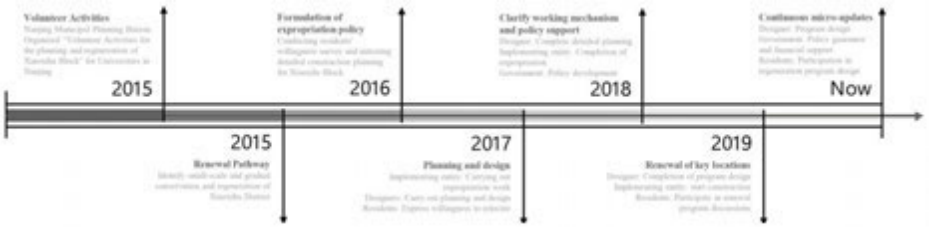

Fig. 2. The Renewal Process of Xiaoxihu Block

4. Dynamics, Mechanisms, and Benefits of Micro-Renewal

4.1 The Dynamics of Micro-Renewal: Determining the Initiation of Micro-Renewal

Urban renewal during the land development phase can achieve land value appreciation through capacity enhancement and functional replacement, thereby stimulating the market's motivation for renewal(Cao et al., 2023). In contrast, micro-renewal, constrained by strict spatial increment control, faces limited returns and can only realize marginal value appreciation through the reuse of existing spaces. The renewal of the Xiaoxihu Block, in addition to utilizing government financial subsidies, primarily relies on the operation of existing spaces for value enhancement, which is mainly reflected in the multifunctional utilization of existing buildings.

The architectural space reutilization in the Xiaoxihu Block's renewal is based on assessing the condition of use, functional classification, and spatial layout to reemploy building space resources for marginal profits. This is chiefly accomplished through functional replacement and enhancement. Functional replacement involves transforming underutilized buildings that no longer meet residents' needs into non-profit life support service facilities. The implementing entities achieve spatial value appreciation through the collection of space rent differentials and service fees. The former Chengnan Power Supply Company building, located at the intersection of Madao Street and Xiaoxihu Lane within the Xiaoxihu Block and rendered obsolete due to functional inadequacy, was vacated. Subsequently, designers repurposed it into a fire water tank, substation, and control center to fulfill the district's power and fire service needs(Dong & Han, 2022).

Functional enhancement, on the other hand, is achieved by reorganizing the functions of residential units and optimizing circulation layouts to improve the living environment. The renovated buildings can introduce commercial and other profit-generating facilities, capitalizing on space rent differentials for the accumulation of spatial assets(Liiu et al., 2022). The dilapidated housing located at the southeast corner of the Xiaoxihu Block, originally the significant Taoist temple Sanguantang, was redeveloped through an orderly site condition assessment. With the foundational goal of protecting and displaying historical sites, the renovation included the repair of traditional houses and the reorganization of street-facing properties to enhance the site's environmental quality. The introduction of hotels and restaurants among other business ventures has been designed to achieve financial balance (Figure 3).

Fig. 3. Comparison of Sanguantang before and after renovation

In summary, the value enhancement benefits of the redevelopment of existing space through the "investment-renovation-operation" model are primarily derived from three aspects: spatial rent differentials, basic property management, and revenue from value-added service management. A long-term, sustainable model of micro-profitable space operation fulfills the market entities' demand for economic viability.

4.2 The Implementation Mechanism of Micro-Renewal: Ensuring the Smooth Implementation of Micro-Renewal

Micro-renewal in urban residential areas not only requires attention to the enhancement of physical space quality but also necessitates the reconciliation of complex social interest conflicts. The decision-making process manifests itself in the multi-stakeholder participation throughout the full cycle of public affairs. Decisions are significantly influenced by the characteristics and relationships of the various participating entities, as well as the structure and mechanisms of the participation process.

4.2.1 The Holistic Workflow Mechanism for Micro-Renewal

Micro-renewal represents a distinctive approach to urban renewal, with its workflow divided into two principal phases: the urban renewal coordination stage and the micro-renewal implementation stage. During the urban renewal coordination stage, cities in China have established an operational system that follows a "city renewal action plan - regional renewal scheme - specific project implementation" framework(Tang et al., 2024). The urban renewal coordination stage in Nanjing comprises three steps:

(1) Formulation of the renewal plan: The participating entities include municipal and district-level functional departments and sub-district offices. Municipal departments are responsible for drafting urban renewal guidelines, while district governments compile urban renewal action plans based on the current built environment. These plans provide the conceptual foundation for the implementation of renewal schemes. In 2015, the former Nanjing Municipal Planning Bureau and other departments proposed a shift from "top-down expropriation" to "bottom-up renewal," clarifying the overall principle of old city renovation to be "seeing objects, people, and life," which guided the "small-scale, progressive, courtyard-by-courtyard" micro-renewal transformation of the Xiaoxihu Block(Han & Shen, 2022).

(2) Compilation of the renewal scheme: After assessment by government departments, the designated implementing entities, under the premise of

safeguarding public interests, must conduct thematic research for the area and formulate a renewal scheme. The renewal work of the Xiaoxihu Block is carried out by the state-owned enterprise Libao Group, which has developed a detailed renewal scheme.

(3) Implementation of renewal projects: This process requires the determination of renewal objectives, funding models, and other requirements based on the scope and type of renewal.

The specific implementation phase of micro-renewal primarily comprises three procedures:

(1) Micro-renewal project planning: In the Xiaoxihu Block, due to complex property rights, applications for renewal, based on different types of property rights, are initiated by property owners or tenants. Concurrently, the Planning and Natural Resources Bureau approves the renewal applications according to the rule requirements and provides the applicants with planning indicators, business functions, and other technical conditions for renewal(Han & Shen, 2022).

(2) Micro-renewal design and construction: This typically involves stages of preliminary research, scheme design, decision-making, and implementation, aiming to develop a renewal plan based on the investigation of the current residential environment and the exploration of resident needs. In the Xiaoxihu Block, in accordance with the "small-scale, progressive" renewal concept, the fragmented 810 property units were reorganized into a two-tiered system of "planning control units" and "micro-renewal units" based on the road network pattern, legal property boundaries, and shared architectural relationships investigated onsite(Han & Shen, 2022)(Figure 4).

Fig. 4. Two-tiered system of Xiaoxihu Block

(3) Micro-renewal management and maintenance: This process mainly involves

the maintenance of physical space environments, such as public service facilities, with the aim of promoting sustainable governance of living spaces. As the renewal of the Xiaoxihu Block encompasses various models, its management and operation modes are also diverse: resident-led modes, which self-serve and self-manage through the establishment of public service teams and hosting themed events, stimulating residents' active engagement in community transformation; and government and market dual leadership modes, formed by multi-level government financial incentive funds and property management companies, creating a multi-governance pattern.

4.2.2 Multi-Stakeholder Collaboration

（1）Stakeholder Engagement

Micro-renewal, in essence, is a form of social governance where multiple stakeholders collaborate in decision-making. Its sustainability is achieved through a shared understanding of the most rational division of labor under each stakeholder's comparative advantages(Zhuang et al., 2019). In the renewal process of the Xiaoxihu Block, to better balance the interests and wishes of all parties, a five-party communication and coordination platform has been established after years of exploration and refinement. This platform includes government departments, residents, designers, community committees, and implementation entities (Figure 5).

Government departments play the role of guiding forces and key administrators in the micro-renewal of residential areas. In the renewal process of the Xiaoxihu Block, these departments can be categorized into two types based on their dominant roles: municipal and district-level functional departments, and sub-district offices. The initiator of the renewal is the Nanjing Municipal Government. However, as urban renewal deepens, the original horizontal management structure, characterized by inefficient collaboration between departments, has proven inadequate to address the diverse challenges. On the foundation of achieving phased success in the Xiaoxihu renewal, the governance model for urban renewal has been further refined. Nanjing established its first district-level Urban Renewal Office, assembling a streamlined yet professional team by drawing on the expertise of various departments. Operating under the principles of "centralized unity, collaborative coordination, and practical efficiency," the main responsibilities of this office include overseeing and coordinating urban renewal efforts across the district, thereby facilitating targeted progress in urban renewal. The establishment of the Qinhuai District Urban Renewal Office has provided effective decision-making support and policy provision for the renewal of the Xiaoxihu Block.

Residents are the direct beneficiaries of urban micro-renewal in residential areas. Due to the complex property rights relationships within the Xiaoxihu Block, residents can be further categorized into private property owners, public housing tenants, and actual occupants, among others. The neighborhood is characterized by high population density, low income levels, and an aging population, leading to diverse opinions on staying or leaving, as well as varying needs for preservation and regeneration. Given the significant individual differences in residents' needs and their limited decision-making capabilities, most of them participate indirectly in the micro-renewal process through surveys or consultations.

Community committees play a significant role in the urban renewal process of the Xiaoxihu Block. On one hand, they provide flexibility and the possibility for residents to assert equal discourse rights. On the other hand, they ensure the effectiveness of micro-renewal planning and governance while also shortening decision-making times, thereby facilitating the implementation of projects.

Designers act as coordinators in the micro-renewal process, with the Xiaoxihu Block renewal primarily involving designers and community planners. The government-appointed responsibility planners play a leading role, providing professional guidance and technical services in planning and construction within their scope of responsibility, along with coordinating non-technical tasks. From a neutral perspective, they proactively identify and solve problems based on their professional expertise.

Implementing entities in residential micro-renewal, such as developers, investors, and property management companies, operate on market principles. They are responsible for financial support, construction supervision, and the routine management and maintenance post-update. These entities significantly impact the quality of the urban built environment and the improvement of infrastructure. In the Xiaoxihu Block renewal, the Libao Group is in charge of implementation.

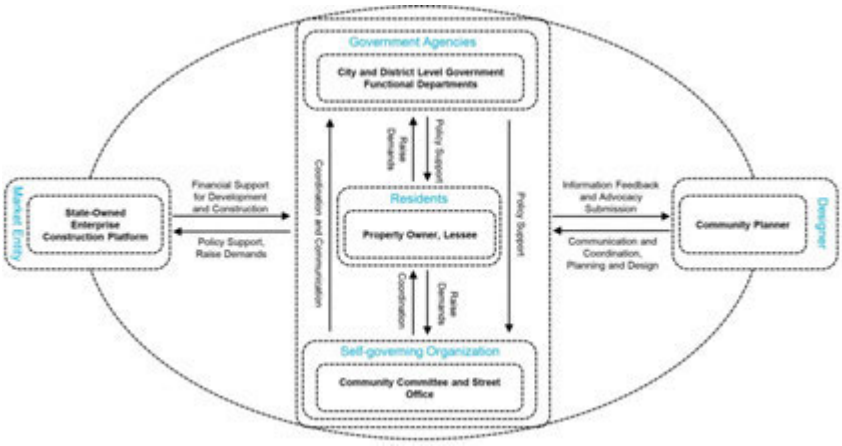

Fig. 5. Multilateral Governance Structure of the Five-Party Consultation Platform

（2）Participation Processes and Models

The complexity of the network involving diverse stakeholders determines that micro-renewal is a systematic project. Based on the diverse characteristics of residential buildings and land property rights in the Xiaoxihu Block, the implementation models for renewal can be categorized into three types: government-led, public-private partnership, and resident-initiated. The government-led model refers to the dominant role played by government departments throughout the entire micro-renewal process, directly intervening in specific processes and steps through coordination, construction, and operational management(Tan et al., 2020). In the Xiaoxihu Block renewal, this model primarily focuses on the renovation of old public

housing and public infrastructure. This process offers advantages such as process control and stable outcomes but also presents structural barriers to public participation and collaborative decision-making. The public-private partnership model involves the implementation entities taking a leading role in funding, planning, action, and operational management during the micro-renewal process(Huang & Jiao, 2018). For example, the "Shared Courtyard" in the Xiaoxihu Block is a public-private partnership initiative for residents unwilling to relocate but lacking the capacity for renovation. The implementation entity funds the transformation of private courtyards, and the homeowner agrees to open the courtyard to neighbors and tourists, taking on the responsibility of trimming the surrounding greenery. The resident-initiated model involves community self-governance organizations or residents as the renewal subjects, with responsibility planners and other social forces conducting planning and design, while government departments formulate policies and provide financial support. This model is primarily used for the renewal of privately-owned housing. The "Xu Residence" at 39 Madao Street is the first demonstration case of autonomous renewal in the Xiaoxihu Block, with a four-step technical renewal path: 1) the property owner submits a renewal application; 2) the government provides planning conditions and financial subsidies; 3) the renewal plan is compiled; 4) the renewal, construction, and renovation are carried out.

4.3 Comprehensive Benefits of Micro-Renewal: The Process Determining Sustainability

Micro-renewal represents a departure from the traditional model of urban renewal focused on the capitalization of space through incremental development. Instead, it moves towards a phase centered on the enhancement of comprehensive benefits with a human-centric approach. The positive impacts of micro-renewal are primarily manifested in three dimensions: environmental, social, and economic benefits.

4.3.1 Environmental Benefits of Micro-Renewal

（1） Enhancing the Quality of Residential Space Environment

The improvement of residential space environment quality is a direct manifestation of the goals in micro-renewal projects, particularly in residential areas, where it is closely associated with the local residents and stakeholders. In the case of the Xiaoxihu Block renewal, the following three aspects were prioritized:

1)Optimizing structural safety: The three-story east-west oriented brick-concrete public housing, located at the corner of Duicaoxiang, a T-shaped main alley in the middle of the Xiaoxihu Block, has aged over 30 years, with deteriorating structural integrity and poor living conditions. The renovation aimed to provide living spaces for the local residents' on-site resettlement and elderly care. The regeneration of the resettlement houses employed a combination of masonry structure renovation and steel structure addition on the top floor(Figure 6)(Bao et al., 2023). Through inspection, maintenance, and reinforcement of the building structures, a more stable and secure living environment was provided for the residents.

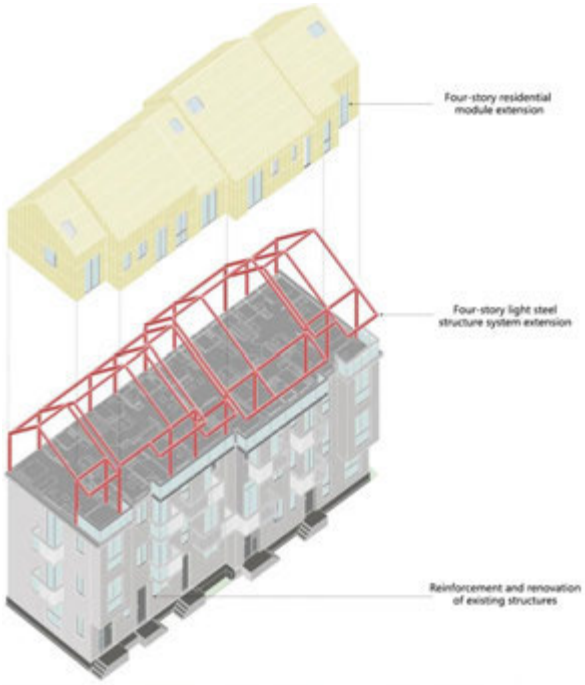

Fig. 6. Architectural structure optimization

2) Improving architectural functionality: The existing residential buildings in the Xiaoxihu Block addressed the aforementioned issues through two measures: On one hand, specific horizontal and vertical modifications, such as external wall additions, interior consolidations, and mezzanine installations, were implemented to increase the per capita living area and address the lack of kitchen and bathroom facilities. For example, in the renovation of the relocated resettlement houses, the inefficiently used space under the pitched roof and above the stairwell was redeveloped, transforming 18 previously "two-bedroom dark living rooms" into 23 fully lit units of various types, achieving an integrated enhancement of the building's functions and performance. On the other hand, the interior spaces were reconfigured with flexible methods such as movable partitions to improve circulation(Bao et al., 2023).

3) Enhancing building performance: The optimization of existing building exteriors and the application of green renovation technologies were employed to increase natural light and improve thermal insulation and heat preservation capabilities. In the reconstruction of the relocated resettlement houses within the Xiaoxihu Block, the added fourth floor posed potential light and sightline obstructions for other residents. The final adjustments included sealing and raising the windows of all balconies, twisting the walls to change the direction of the windows, and other methods to avoid interference and ensure ventilation and natural light(Bao et al., 2023) (Figure 7).

Fig. 7. Pre- and post-renovation relocation housing

In summary, the Xiaoxihu Block renewal project exemplifies a comprehensive approach to improving the quality of residential space environment, focusing on structural safety, architectural functionality, and building performance to create a more livable and sustainable urban community.

（2） Optimizing Outdoor Space Environment

The optimization of outdoor space environment primarily involves the improvement of infrastructure, the streamlining of road and traffic systems, and the enhancement of public space quality.

1)Improving infrastructure: For an extended period, the Xiaoxihu Block has grappled with outdated infrastructure and low environmental quality, necessitating urgent improvement and enhancement. To address this, the design team developed the "Micro-Utility Tunnel" technology within the narrow historical alleys. Unlike traditional direct burial of utility lines, this approach employs underground micro-utility tunnels for the installation of municipal utility lines, resolving the conflict between the small scale of historical alleys and the installation of utility lines, and addressing the management challenges of post-maintenance and update expansion .

2) Streamlining road and traffic systems: The Xiaoxihu Block project renovated the Xiaoxihu Alley and Duicaoxiang on the east side of the neighborhood to serve as lanes for motor vehicles and micro-fire engines, setting the narrowest width at 3 meters and the smallest turning radius at 3 meters for the cross-shaped internal streets. This configuration formed two main guiding axes in the north-south and east-west directions, reducing fire safety risks in historical areas while also providing possibilities for the installation of municipal infrastructure and the special passage needs of motor vehicles.

3) Enhancing public space quality: Along the north-south and east-west main guiding axes within the Xiaoxihu Block, designers have refurbished the paving, introduced public seating and sculptures, and created a pleasant atmosphere for leisure, thereby upgrading the neighborhood's external image for public display.

In summary, the optimization of outdoor space environment in the Xiaoxihu Block focuses on the enhancement of infrastructure, the improvement of traffic flow, and the elevation of public space quality, aiming to create a more livable, safe, and aesthetically pleasing urban environment.

4.3.2 Economic Benefits of Micro-Renewal

（1）Direct Economic Benefits

The direct economic gains in the renewal of the Xiaoxihu Block stem from the secondary development of existing space. This encompasses several key aspects:

1) Enhancing space operation efficiency and reducing costs: Due to the government's innovative property rights policy, the implementation entities in the Xiaoxihu Block can obtain the right to operate existing buildings and land without altering the original ownership relationships and land use rights. This reduces and avoids costs and risks associated with interest negotiations during property rights changes, thereby improving the efficiency of space utilization.

2) Diversifying industrial formats and increasing operational revenue: The functional transformation and efficient use of existing space resources in the Xiaoxihu Block aim to meet the needs of residents. The renovation or reconstruction of street courtyards after voluntary relocation by residents has added one community activity center, one comprehensive control center, two non-heritage cultural and creative studios, two learning spaces, two distinctive homestays, and nearly ten small shops to the neighborhood. The introduction of small-scale commercial and daily life convenience services has broken the homogeneity of format clustering. By targeting and addressing residents' differentiated needs, it has achieved high rental rates and operational vitality, diversifying business formats while increasing space operational revenue.

In essence, the direct economic benefits of the Xiaoxihu Block renewal are realized through the efficient use and functional transformation of existing space, leading to increased operational efficiency, cost reduction, and revenue growth.

（2）Indirect Economic Benefits

The indirect economic benefits of the Xiaoxihu Block renewal are the intangible gains resulting from the enhancement of the living environment. These benefits encompass the appreciation of residential space rents and property values, as well as the increase in cultural gains.

1) Appreciation of residential space rents: The improvement in living space environments and the enhancement of infrastructure due to the efficient use of existing space in Xiaoxihu can generate positive externalities and spatial spillover effects. This can lead to an increase in spatial rent differentials and potential ground rent levels.

2) Increase in cultural gains: The micro-renewal of the Xiaoxihu Block, while preserving the physical carriers such as the style and texture of the area, has given rise to new cultural scenes. The introduction of cultural and creative product shops, teahouses, and other cultural-displaying businesses within the neighborhood has realized the interactive integration of culture and economy.

In summary, the indirect economic benefits of the Xiaoxihu Block renewal are manifested in the appreciation of residential space rents and property values, as well as the enrichment of cultural scenes, contributing to the overall economic and cultural vitality of the area.

4.3.3 Social Benefits of Micro-Renewal

The human-centric urban micro-renewal for residential areas tends to promote the co-development of spatial renewal and social governance. This process increases resident participation, enhancing their satisfaction and sense of belonging.

(1) Multi-stakeholder participation: Unlike the "top-down" urban renewal mode that involves large-scale demolitions and constructions, the renewal of the Xiaoxihu Block emphasizes multi-stakeholder participation. Residents, especially during the stages of land expropriation and scheme design, transition into voluntary participants, collaborating and taking joint actions with the government and community planners.

(2) Innovative and diverse approaches: The renewal process integrates residents' wishes and explores various innovative paths, such as the lively "Co-living Courtyard" and "Shared Courtyard" models.

(3) Improvement of social population structure: The micro-renewal of living spaces can improve the social population structure. The enhancement of the physical spatial environment in Xiaoxihu after the micro-renewal has diversified the supply of rental housing and tenant groups, significantly influencing social population changes. The culture-led improvements have attracted creative industries and young people to the area, triggering "social mixing" and balancing the population structure against the backdrop of "double aging" (an aging population and aging infrastructure).

Cultivation of Grassroots Autonomous Mechanisms: Micro-renewal can nurture grassroots autonomous mechanisms and promote sustainable community governance. The five-party collaboration platform established during the renewal process of the Xiaoxihu Block serves as the main platform for residents to participate in community construction and contribute ideas. A community planner workstation was also established after the renewal, facilitating residents' collective participation in community affairs.

5. Discussion and conclusion

This study focuses on the conservation and regeneration of the Xiaoxihu Block in Nanjing. By reviewing literature and collecting empirical data, it delves into the renewal process and detailed dynamics of the Xiaoxihu Block, summarizing the intrinsic motivations, mechanisms, and comprehensive benefits of urban residential micro-renewal. The findings indicate: The driving force behind urban residential micro-renewal stems from the value appreciation of existing spaces, primarily through spatial operations. This can be achieved by the combined use of architectural space and the efficient enhancement of land value. The mechanism of micro-renewal involves the participation of multiple stakeholders in the entire cycle of public affairs. Decision-making is significantly influenced by the characteristics and relationships of different stakeholders and the structure and mechanisms of the participation process. And the about benefit, micro-renewal is a process that collectively enhances environmental, economic, and social benefits. The effects of these benefits are diverse and synergistic, targeting multiple entities. The study aims to provide a viable and effective model for sustainable practices in urban residential micro-renewal.

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Evaluation of Fuel Poverty in Urban Regeneration Areas: A Case Study of Ankara, Türkiye

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Abstract

This paper discusses fuel poverty in urban regeneration areas, as regeneration activites aim to improve socio-economic and structural conditions. Low Income High Cost method is adopted to assess fuel poverty, and a logistic regression is conducted to determine the factors affecting fuel poverty. The results indicate that fuel poverty level among households living in urban regeneration areas is 11.7%. Structural and design components such as aspect, size, heating duration and heating system, alongside global socio-economic factors like household size, employed households, and young children in the household appear to be influential on fuel poverty level. Structural and design factors can be addressed in future regeneration activities, while broader socio-economic factors require complex and large-scale interventions to deal with fuel poverty.

Keywords: Urban regeneration, fuel poverty, energy justice, energy efficiency.

1. Introduction

Urban regeneration, aimed at enhancing social, environmental, and economic conditions through the improvement of urban fabric, has been a longstanding focus of Türkiye's housing and development agenda. Regeneration interventions specifically concentrate on squatter settlements, which are characterised by challenges in infrastructure provision, low environmental quality, and substandard building conditions. Energy efficiency and accordingly fuel poverty, stand as prominent environmental and economic issues to which urban regeneration is expected to provide responsive solutions while enhancing energy justice. The buildings that replace squatter units needs to be higher quality with improved energy efficiency, thereby mitigating fuel poverty among residents of these settlements who exhibit heightened vulnerability to fuel poverty in terms of demographic and socio-economic characteristics, besides the structural conditions.

To understand how urban regeneration addresses fuel poverty, it is necessary to first determine the level of fuel poverty in these areas. Then, discussing factors influencing fuel poverty can help highlight problem areas in the housing units obtained through urban transformation, providing insights for future regeneration activities in terms of better design strategies and policies. This paper aims to identify fuel poverty level and explore the variables contributing to it, using Ankara's Mamak district as an example. In the following part, the concepts of fuel poverty and urban regeneration will be framed within the context of the literature. Study area will be introduced next, followed by the data and the method. After presenting the analysis results, the study concludes with a discussion and conclusion section.

2. Fuel Poverty

In the literature, it is relevant to describe fuel poverty as a subset of the broader concept of energy poverty. While both terms address issues related to the inadequacy and the inefficiency of energy resources for meeting basic human needs, there are certain distinctions between them. Fuel poverty is integrally linked to financial aspects of energy access which primarily focuses on affordability and is specifically concerned with the economic constraints that prevent households from heating their home to an adequate level or powering household devices (Moniruzzaman and Day, 2020). The condition is particularly identified by the proportion of income that is spent on energy, leading to excessive costs or not being able to allocate income for energy needs. Although early definitions of fuel poverty consider only heating, more recent and comprehensive definitions cover all residential energy needs including heating, cooking, lighting, and the operation of devices (Boardman, 2010; Hills, 2011; Moore, 2012). Energy poverty, however, is a more comprehensive framework which encompasses a wider range of issues. It includes not only affordability but also the physical access to modern energy services (Bouzarovski, 2014). This broader term covers the quality and reliability besides health and safety issues.

Spatial variations in energy poverty can be considered as the outcome of structural geographic injustices ingrained in different phases of energy systems as well as in the economic, cultural and infrastructural components of society (Bouzarovski and Simcock, 2017). Similarly, fuel poverty constitutes a multidimensional challenge, regarding household income, fuel prices, and the energy efficiency levels of buildings (Sovacool, 2015). In this context, squatter settlements exhibit an elevated risk of fuel poverty due to a significant proportion of vulnerable groups in terms of low-income, child and elderly populations, as well as low structural quality. Ho et al. (2012) mentions energy efficiency one of the problems in urban regeneration, while Ng et al. (2001) state that it is aimed to prevent the decline of the built environment and to upgrade the appearance and structural conditions.

Vulnerable groups in terms of low income, elderly, children, refugees etc. are more at risk of being fuel poor. However, the problem is also evident in the developed countries. Fuel poverty levels appear to ben 13% in England, 25% in Scotland, 12% in the Wales and 18% in North Ireland (Hinson and Bolton, 2021). In Belgium, fuel poverty is reported to be 14% in 2013, while in more recent studies, the value increases to 27.6% in Belgium (Lyons, 2021). The issue is related to socio-economic conditions as well as old housing stock with poor insulation. The only national-level study for Türkiye is conducted by Dogan et al. (2021) using 2018 data concluded that the fuel poverty levels are %17, %18 and %7 with regard to 10%, 2-median and LIHC criteria. The study of Senyel Kurkcuoglu (2023) asserted 23.6% fuel poverty for the city of Ankara using LIHC criterion.

It is expected for squatter settlements to have higher fuel poverty due to low income and structural issues. Urban regeneration suggests the potential alleviation of fuel poverty, primarily through improvements in building quality. The actual impact of urban regeneration on fuel poverty, however, remains an understudied issue in the existing literature. Therefore, this research investigates the impact of urban regeneration on fuel poverty, aiming to provide insights into whether urban regeneration activities enhance energy efficiency and accordingly decrease the levels of fuel poverty. In the following section, urban regeneration and its development in Türkiye is discussed.

3. Urban Regeneration in Türkiye

Housing development has been characterised by political and socio-economic realms of Türkiye. Candas et al. (2016) states that population growth, informal settlements and hazard-prone buildings and infrastructure are the most prominent issues in Turkish cities. Beginning in the second half of

the 40s, a substantial influx of rural migrants to urban areas was spurred by a combination of factors. On the one hand, there was an urban pull driven by job prospects, especially in the industrial sector. On the other hand, there was a rural push fueled by diminishing employment opportunities in agriculture due to mechanisation of production. Housing supply fell short of accommodating the needs of incoming residents, and the government struggled to implement timely solutions for rapid and affordable housing production. Consequently, informal settlements in terms of squatter areas, began to proliferate, offering a short-term solution to the housing shortage at the expense of exacerbating structural, environmental, and socio-economic issues. Throughout years, laws and regulations intended to prevent further illegal housing developments and upgrade the existing ones ended up with legalizing those areas particularly due to political concerns. Urban regeneration or rehabilitation efforts remained at plot or single structure scale, often entailing the replacement of one or two-story squatter housing units with multi-apartment story buildings until mid-2000s.

Urban regeneration can be considered as a government-lead initiative (Guzey, 2009; Oktem Unsal, 2015) with the objective of creating enhanced living spaces that are more sustainable and viable in socio-economic senses. The process aimed to replace the outdated and risky buildings and infrastructure with the new ones while upgrading the structural, environmental and social qualities. Although practiced for years, regeneration activities gained momentum with regulations that expedited the process and expanded the scale and the coverage of the projects put into effect in late 2000s. Municipality Law (No:5393, 2005) and the Law on Transformation of Areas under Disaster Risk which has been abbreviated in daily use as Urban Transformation Law (6306, 2012) particularly addressed to urban regeneration. The Urban Transformation Directorate was established within the Ministry of Environment, Urbanisation and Climate change, in accordance with the Urban Transformation Law. With all these developments, comprehensive and widespread urban transformation projects began in cities. This period is also characterised by the neo-liberal discourse focusing on the increasing urban land-rents and real estate development, while the process includes private sector actors as well as state institutions such as the Mass Housing Development Administration (Eren & Tökmeci, 2012). Gozozkut and Somuncu (2019) mention that although the legal bases is created, the sustainability of these areas following the completion of regeneration remains open to debate.

One of the areas that sustainable urban regeneration deals with is energy efficiency and resource use (Korkmaz, C., 2016; Gonullu Sutcuoglu and Kalayci Onac, 2022). Although the goals of urban regeneration are straightforward, the outcomes – especially those concerning energy efficiency – remain unclear and not being discussed in detail. There are some studies in the literature considering sustainability-oriented aspects which evaluate regeneration projects from environmental point of view besides the economic and social assessments, mostly through qualitative methods (Eren & Tökmeci, 2012; Uzun & Celik Simsek, 2015; Korkmaz & Balaban, 2020). Tuç (2018) mentions that the regeneration focuses on beautification and image-building through better environmental services and large green spaces in his study of North Ankara Urban Entrance regeneration project. Demirtaş (2019) and Korkmaz and Balaban (2000) discusses the same project while indicating the benefits of the provision of large green spaces and landscaping but lacking the adoption of renewable energy. Akkose (2022) states that urban regeneration practices in Türkiye lack sustainability approach while her study on Bursa Doganbey urban regeneration project concludes that environmental impacts have not been considered at all. However, none of these studies address to energy issues other than the criticism of not adopting the use of renewables.

4. Study Area

Ankara is the capital city, located at the centre of Türkiye. It has a temperate continental climate with colder winters and house heating expenses can be overwhelming in household budget in winter. The research focuses on the urban regeneration areas in Mamak district of Ankara (Figure 1) due to the high prevalence of squatter settlements in the district, which has been subject to widespread urban regeneration projects. Starting from the 1940s, an uncontrolled growth has been experienced in cities such as Ankara, İstanbul and İzmir, yet, due to the lack of adequate affordable housing provision to respond the rapid urbanisation, squatter areas formed (Uzun, 2006). Arik (2021) refers to a study conducted by the Ministry of Construction and Settlement in 1964 analyzing the thirteen largest cities of Türkiye in terms of the presence of squatter settlements, which noted that these areas used to constitute 64.4% of the total housing stock in Ankara, making the city with the highest rate in the entire country. Mamak locates at the eastern part of Ankara, which received many immigrants from the eastern part of the country for years (Gözözkut and Somuncu, 2019). Housing areas for middle- and higher-income groups are located in the western corridor, whereas squatter settlements emerged in the eastern, southern and northern fringes of the city (Duyar-Kienast, 2005). For a long time, Mamak was an area known for its squatter neighborhoods, thus urban regeneration projects are considered to change the image of Mamak for the better (Gözözkut, 2016).

Figure 1. Mamak District of Ankara

Four urban regeneration areas are selected, which cover urban regeneration areas: Gulseren Neighborhood, Altiagac Neighborhood, Derbent Neighborhood and Uregil Neighborhood (Figure 2). In Gulseren Neighborhood, 1222 squatter units have already been demolished. The first stage with 688 housing units and the third stage with 1219 housing units in high-rise apartments have already been constructed. The construction of the second stage with 1312 housing units are about to be completed while the activities in other stages are ongoing. In this study, only the first and the third stage areas, which have already been finalised are included. Urban regeneration in Uregil Neighborhood is the first stage of the North Ankara Urban Entrance Project was completed in 2015 with the transformation of 2160 housing units. In Altiagac Neighborhood, 1350 squatter units were replaced by 3881 residences in 25 point-blocks and more than 100 high-rise apartments. Urban regeneration activities are completed in the neighborhood, but not all flats have been occupied yet. Derbent Neighborhood also locates within the North Ankara Urban Entrance Project; however, the construction is still going on in the area so that only the completed residences are included in the

study, which are Zirve Residences, Ihlamur Residenzes and Palmiye Residences. The contractors for Uregil and Altiagac are private companies, whereas the residences in Derbent were undertaken by Portas A.S., a subsidiary of the Ankara Metropolitan Municipality.

Figure 2. Study areas

5. Data

Data is collected from 4 urban regeneration neighborhoods given in the precious section. All calculations are done at monthly level, since the data covers winter season only. The study includes a household survey with 400 participants. In the household survey, precise questions were asked to the respondents covering information about their household size, age distribution of the household, monthly income, monthly natural gas and electricity payments. These variables are utilised in fuel poverty calculations. Some additional variables in terms of the socio-economic characteristics of the household such as total employed individuals in the household, home ownership, receiving social help, household head's education level, as well as the energy-related and structural characteristics of their houses such as insulation, aspect and size of the house, and total heating months are included in the questions to understand the factors affecting fuel poverty. Descriptive statistics for the variables are presented in Table 1.

Table 1. Descriptive Statistics for the Household Survey

	N	Minimum	Maximum	Mean	Std. Dev.
Ownership (1 owner, 0 renter)	400	1	0	1.34	.473
Rent (TL/month)	400	0	5000	847.20	1413.36
Mortgage (TL/month)	400	0	2550	688.22	891.32
Household size (# person)	400	1	6	2.95	.99
Employed household (# household)	400	0	3	.96	.79
Income (TL/month)	400	3000	50000	17122.50	9209.11
Heating system (1:central, 2: individual)	400	0	1	1.10	.30

Insulation (1:yes, 2:no)	400	1	2	1.02	.14
Heating duration (# months)	400	3	7	5.69	.84
Social Help (1:yes, 2: no)	400	1	2	1.97	.17
Natural gas expenses (TL/month)	400	350	13000	1306.87	1799.44
Electricity expenses (TL/month)	400	100	4000	439.65	592.20
Aspect (1: North, 0: all others)	400	.00	1.00	.2975	.45773
Children under 5 (1:yes, 0: no)	400	.00	1.00	.2129	.40984
Size (1:Less than 80m^2, 2: 80-100m^2, 3: 100-120m^2, 4:120-150 m2, 5: 150m^2 and more)	400	1	5	2.94	1.56
Household head education (1:primary, 2:secondary, 3:high, 4:university, 5: graduate)	400	1	5	3.36	1.18

6. Method

This study covers a mixed method framework. First, fuel poverty level in the urban regeneration areas is calculated, then, a logistic regression is run to reveal the variables contributing to fuel poverty.

6.1. Fuel Poverty Assessment with LIHC Criterion

Fuel poverty does not have an agreed upon definition since some studies consider only the heating costs while particularly the most recent ones include energy costs of household appliances. The size and the scale of the issue varies with the definition (Moore, 2012), thus, assessment methods of fuel poverty have evolved over time with changing definitions and different perspectives. UK is at the forefront of research into fuel poverty, leading both in the study of its implications and in the development of methods to assess it. In the early 1990s, evaluation criteria started to be developed and included it in the policy documents in UK.

Isherwood and Hancock mentioned that the household with fuel expenses more than 2 median of the national average are in poverty (Osbaldeston and Liddel et al., 1984), while the term fuel poverty was not mentioned explicitly (Heindl and Schüssler, 2015). Brenda Boardman (1990) defined fuel poverty first, stating that household allocating more than 10% of their income to fuel expenses are considered as fuel poor, and the criterion was included in the official documents. Hills (2012) developed another criterion in fuel poverty assessment considering not only fuel expenditures but also household income with regard to national averages. The criterion, named as Low Income High Cost (LIHC) was published in the Fuel Poverty Methodology Handbook (FPMH) in April 2020 (BEIS, 2020). The most recent criterion, Low Income Low Energy Efficiency (LILEE) considers energy efficiency besides fuel expenses of the households, and was published in FPMH in 2022.

This study adopts LIHC criterion, and fuel poverty level is calculated accordingly. The assessment has two parts: income and fuel cost, while equivalent values of both with regard to household size are considered since different households have different spending requirements (BEIS, 2020). The equivalisation factors are taken from FPMH (Table 2)

Table 2. Equalisation factors for the fuel cost and income (BEIS, 2020)

Household	**Equalisation Factor**
	Fuel Cost
1 individual	0.82
2 individuals	1
3 individuals	1.07
4 individuals	1.21
5+ individuals	1.32
	After Housing Cost Income
First adult	0.58
Other individuals aged 14 and over	0.42
Individuals under 14	0.20

Income is the amount after mortgage and rent payments, and fuel costs include natural gas and electricity payments. Household net income and fuel cost are compared to corresponding threshold values, and the ones with lower income than the income threshold and higher fuel expenses than the fuel threshold are accepted as fuel poor.

6.2. Logistic Regression

After identifying fuel poor households, a logistic regression analysis is conducted to reveal factors influencing fuel poverty. Logistic regression is a statistical method used to model the probability of a binary dependent variable with one or more independent variables. The model estimates the coefficients, which represent the change in log-odds of the dependent variable with a unit change in the independent variable. In this study, output is a binary categorical variable (1: fuel poor, 0: not fuel poor). SPSS software is utilised for the binary logistic regression analysis.

7. Results

The results of the fuel poverty analysis with LIHC and the interview are presented in the following parts. First, the calculation of income and fuel cost thresholds for LIHC analysis is given, followed by the analysis of fuel poverty levels. Then, the findings of the content analysis are discussed.

7.1. Fuel Poverty

The fuel poverty level of the urban regeneration areas is calculated according to LIHC criterion. First, net incomes are calculated through subtracting the rent and mortgage payments from the monthly income. The fuel costs are the sum of average monthly natural gas and electricity bills. After the calculation of equivalised income and fuel cost, the values are compared to income and fuel cost thresholds. In the FPMH, the threshold values are the national median levels for both values. In terms of income, national median can be a reasonable threshold, however since the climate variations are high in Türkiye, median fuel cost of the whole country can be misleading. Moreover, natural gas unit prices and electricity distribution costs vary in different cities. Dubois (2020) discusses this issue as some local specificities might be existent while national level research may miss them, so that energy poverty analysis at regional level is suggested. Therefore, a benchmark value is calculated for Ankara, considering the average electricity and natural gas

consumption for a household with 4 people. Then, the value is equalised for a household with 2 people since the equalisation factors in Table 1 consider 2 people as the base value.

Income threshold is assumed to be the national median income level. Annual equivalised median household income is 83808 Turkish Liras (TL) for 2023 (Turkish Statistical Institute, 2024), which corresponds to 6984TL monthly, which sets the Low Income (LI) benchmark. Household with monthly income less than 6984TL is considered as LI.

A fuel cost threshold which is accountable for Ankara is calculated through average natural gas and electricity bills with the following method. Average monthly electricity consumption is 230kWh for a 4-person household (Chamber of Electricity Engineers, 2021), while the unit electricity price for residentials is 1.73 in the first quarter of 2023 (Rep. of Türkiye Energy Market Regulatory Authority, 2023)The monthly average electricity cost turns out to be 449.6TL including taxes 4-person household. Daily average natural gas consumption is 4.83m^3, which is equal to 145m^3 monthly, while the natural gas unit price is 5.06TL in 2022-2023 winter season in Ankara (BaskentGaz, 2024). Average natural gas cost turns out to be 859.7TL including taxes. Total average monthly fuel cost is, then, 1315.3TL. When the value is converted to a 2-person household, the benchmark value for high cost (HC) becomes 1229.3TL. Households spending more than 1229.3TL for energy bills are accepted HC. The households below LI threshold and above HC threshold constitute 11.7% of the entire sample according to LIHC criterion.

7.2. Logistic Regression

When he factors affecting fuel poverty are investigated, the binary logistic regression shows that the odds of being fuel power is decreased by being an owner, having children under age 5, and the number of households being employed, whereas increased by the household size, having individual heating system instead of central heating, and number of months required heating, having north-faced apartment, and very large houses (more than 150m^2) (Table 3). Other variables such as household head's education level, insulation and social help do not have statistically significant effects. In fact, 97.8% of the houses have insulation, which minimizes its distinguishing effect.

Table 3. Results of the binary logistic regression

							95% CI.for EXP(B)	
	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Ownership	-1.527	.547	7.785	1	.005	.217	.074	.635
Household size	.893	.211	17.858	1	<.001	2.442	1.614	3.696
Employed household	-1.969	.357	30.432	1	<.001	.140	.069	.281
Heating duration	1.066	.321	11.057	1	<.001	2.904	1.549	5.444
North Aspect	1.081	.444	5.942	1	.015	2.949	1.236	7.036
Very Large Size	1.277	.470	7.380	1	.007	3.584	1.427	9.004
Children under 5	-1.975	.618	10.210	1	.001	.139	.041	.466
Heating system	2.905	.696	17.426	1	<.001	18.260	4.669	71.416
Constant	-11.27	2.423	21.654	1	<.001	.000		

The logistic regression model was statistically significant $X^2(8, N=400)=79.624$, p= <.001, and the model explained 35% (Nagelkerke R^2) of the variance in fuel poverty and correctly classified 90% of observations.

8. Discussion

When the components of LIHC are investigated, it can be concluded that almost half of the households are low-income groups. It is reasonable that the area just went through a structural transformation that the residents' economic circumstances have not changed much. Households classified as HC, representing 21.2% of the entire sample, indicate that the fuel costs of nearly one in five households exceed average spending on energy in Ankara. Fuel poverty, which presents 11.7% of the households, is observed in lower levels than LI and HC groups, which can be concluded that either the ones with higher incomes are able to spend more for energy so that they turn out to be HC but not LI, or the household with LI could not spend more than average values for energy so that they are LI but not HC. The second group can be further investigated in terms of hidden fuel poverty. When the result is compared to the literature, it is evident that the fuel poverty levels in urban regeneration areas tend to be lower in general. When considering the studies conducted in Türkiye, this research indicates a fuel poverty level that falls between the rates reported by Dogan et al. (2021) at 7% for the national level and Senyel Kurkcuoglu (2023) at 23.6% exclusively for the city of Ankara.

Home ownership, household size, employed households, heating months, north-facing apartments, very large houses, young children and house heating system turns out be influential on fuel poverty. Home owners tend to be less prone to fuel poverty when compared to renters. When the number of employed individuals increase it becomes less likely to be fuel poor. Having at least a child under 5 years old also decreases the chances of being fuel poor, of which impact is the slightest among all variables. When at least one young child is present in the household, the family is 0.139 times less likely to be fuel poor. Increasing size of household affects fuel poverty in a positive way, so that large households are more likely be fuel poor. When the number of months increase for heating, fuel poverty risk increases as well. Indeed, some apartments may need to heat their homes for longer durations due to the lighting conditions as a result of housing design, having a vacant flat upstairs or downstairs, having individuals with critical health issues, etc. North-faced apartments receive less sunlight during winter, leading to higher energy consumption. As a result, their chace of being fuel poor increases 2.94 times compared to apartments facing other directions. Additionally, heating very large spaces is costly. Therefore, houses exceeding $150m^2$ increase the probability of experiencing fuel poverty by 3.58 times more than smaller houses. The most influential variable appears to be the house heating system while households with individual house heating are 18.2 times more likely to be fuel poor than the ones with central heating. It is plausible because central heating systems typically heat all spaces and rooms equally. In contrast, individual heating systems allow occupants to turn off heating in certain rooms, which can result in increased energy usage in other apartments and cooler overall building spaces.

9. Conclusion

Urban regeneration activities in Türkiye, particularly the ones targeting transformation of squatter settlements, are anticipated to improve living conditions by enhancing structural quality, efficiency, and environmental standards. Although the various aspects of urban regeneration have been discussed in the literature, environmental outcomes, particularly those related to energy, have been overlooked in the literature. The discussions in the existing literature revolve around the positive impacts of the providing large green spaces, while criticisms focus on the lack of adoption of

renewables in any urban regeneration projects. Fuel poverty, however, has not been addressed in the studies.

Fuel poverty is a multi-dimensional issue that arises from both the socio-economic situation of the household and the structural conditions of the housing units. The problem has a spatial dimension, leading to its prevalence in specific areas. Squatter settlements are those which has an increased risk of fuel poverty due to having low-income residents and low structural qualities. Urban regeneration is expected to eliminate fuel poverty in such areas by improving building quality and infrastructure. Therefore, this study focused on assessment of fuel poverty in urban regeneration areas, using Ankara's Mamak district. Due to its history of high rates of squatter settlements, Mamak has been subject to numerous urban regeneration projects. A household survey conducted in four different urban regeneration project areas in Mamak revealed that nearly one in every ten households experiences fuel poverty. The observed rate is lower than figures reported in the literature, but it cannot be argued that fuel poverty is fully eliminated after urban regeneration.

The analysis of the factors influencing fuel poverty provides valuable insights for future policies in urban regeneration. Structural and design strategies can be implemented to address the issues such as very large houses, north-facing apartments, longer heating months and individual heating systems, which are associated with increased probabilities of experiencing fuel poverty. The remaining variables are primarily associated with the broader socio-economic context, necessitating comprehensive policies and strategies beyond the scope of urban regeneration. For instance, state-level policies could be developed to provide mortgages with long-term low-interest rates, thereby facilitating home ownership and potentially reduce fuel poverty. Finally, further analysis can be conducted to determine the presence of hidden fuel poverty, where households struggle to allocate sufficient funds for energy expenses, leading to inadequate heating and limited use of other appliances.

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On housing affordability. Questioning the European policy perspective in action

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Abstract

Since the early 2000s, owning or renting a dwelling has increasingly become in Europe a toil for many. National policies have been reducing the investment on council housing and at the same time households' incomes and spending power are decreasing, putting low- or unstable-income people at risk of homelessness. As the "availability of" and "access to" decent housing has been dropping in many European large and medium-size cities, EU policies are trying to address policies for "affordable" housing solutions. While this term has been widely used in an economic perspective, affordability should tackle on a wider range of issues embracing financial aspects, solutions for social support, funding measures and spatial models, as tools to improve the conditions for "just" cities to thrive.

Keywords

Affordability; Social Housing; EU Policy; Urban Planning; Urban Regeneration

Full text

1 Beyond economic affordability: hypothesis and research leads

In this paper, a work outline around the concept of "affordability" in the production of housing in contemporary European cities and in connection to EU urban policies will be provided. The theme of "affordable living" is continuously more urgent: with a growing range of people in crisis, the starting point in the discussion will precisely be the current challenges and trends that design on accessible living is asked to develop with thoughtful and durable solutions. Living in Europe is increasingly hard (Bianchetti, 2016): in the past 20 years, waves of economic crisis and a severe post-global geopolitical instability have impacted on public- and private spending power, further deteriorated by neoliberal policies, inflation and fluctuations of raw materials and energy costs. This scaled down the availability to pay and living conditions of not only people in need but also those traditionally included in the "middle class". The negative demographic trends (combining falling birth rates and the aging population) and the crisis of the traditional welfare state have increased the demand for 'social and very social' housing (Saraceno, 2015; Tosi, 2017; Bricocoli et. al., 2021).

Approaches from individual governments on housing are diverse, but the topic is one of the priorities for the EU coordination policies. This is clear also from the growing number of observatories and platforms promoted by the European Union (EU) exactly on the housing approach, especially after the approval of the EU Urban Agenda and the 2020 European Green Deal. Here, "affordable" has become a recurring attribute for housing solutions throughout EU policies, tools and funding measures. As described in the following text, the term "affordability" opens towards a popular field in housing literature (Pittini, 2012; Heylen, 2023; Peverini, 2023; Bricocoli&Peverini, 2024), even if it is often considered in an uncritical and "comforting" way. Reinforced by with other repeated adjectives – such as "adequate", "accessible", "sustainable" – "affordable" is often used with the effect to reduce the discussion on housing policies (and on their impacts on households' costs) to a mere economic and sectoral equation. As known, affordability is generally defined as the ratio between the costs for the accommodation (rent or ownership) and the family income; alternatively, it is measured in relation to the housing cost overburden rate expressed as the share of households spending more than 40 percent of their disposable income for accommodation costs (OECD, 2023). However, beyond the economic and statistical definition, how affordability is defined and translated into concrete tools and actions should be carefully questioned. From this perspective, observatories and platforms become interesting sources to investigate for understanding the innovation fields and the perspective of the affordable housing that should inspire measures in national and local European policies.

Specifically, the paper offers critical investigations on the concept behind the word "affordability" as it is used in EU tools: policies, funding measures, and projects. In the EU-related platforms (i.e., UIA-Urban Innovative Actions initiative, New European Bauhaus, Horizon, etc.), there is a variety of planned or built case studies with a focus on housing policies: the emphasis is hence put on how the term affordability is translated into multi-layered planning and design solutions (i.e., health-care models in housing blocks, self-maintenance and self-

building, flexibility in design and allocation models), and into innovative and integrated housing and welfare policies.

Right up against the European elections, it is necessary to understand how the EU policies build up in local projects and if these can suggest more complex ways to articulate "affordability". This analysis could be useful to address the next housing policies, towards a 'just city' (Feinstein, 2010), in which housing can become again one of the pillars of welfare state (meaning an articulated set of public policies).

This research proposal will unfold at the Department of Engineering and Architecture in Trieste within two research projects, in which the topic of affordable housing is examined in urban contexts of large and medium cities. One project is focusing precisely on the topic of affordability: the research of national interest UAH – Unconventional Affordable Housing[1] will provide (re)definitions of affordability through investigation on policies, projects and practices in European case studies, as well as in local case studies at a closed level in the cities of the involved research units: Milano, Bari and Trieste. The other project, INEST - Interconnected Nord-Est Innovation Ecosystem, focuses in the Italian North-East area, between Veneto-, Friuli Venezia Giulia and Trentino Alto Adige regions, to knit active networks between universities, public research institutions and companies, with the future challenges of global economy and climate change in mind. Different scenarios will be tested in samples from the three involved Regions; amongst other topics related to the evolution of the environment, housing solutions for increasingly fragile targets will be especially explored in Venice as Trieste acting as pilot cases.

2 Setting and method

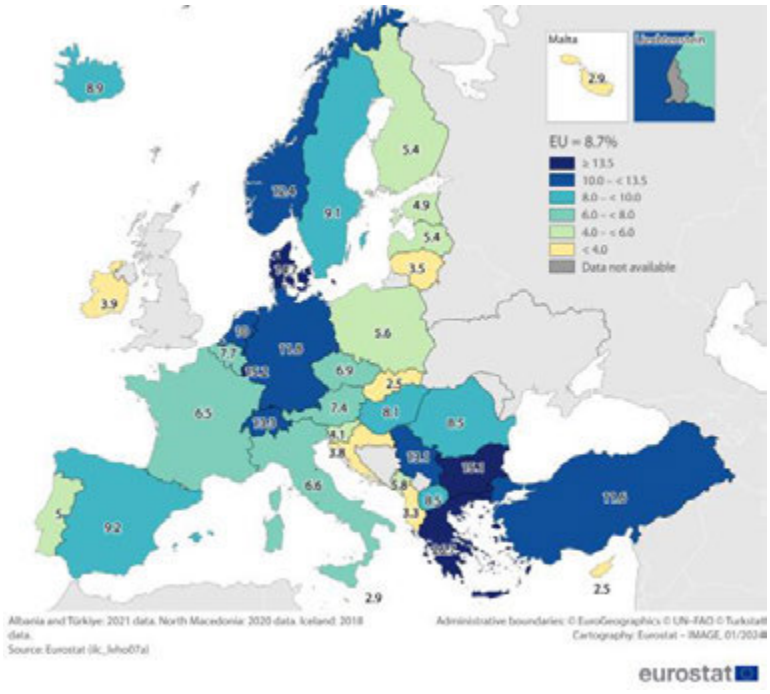
2.1 "Explosive conditions": new crises and housing demand

Since the early 2000s, owning or renting a house or a dwelling has increasingly become a toil for many European families and individuals. In 2022, 8.7 percent of the EU population spent 40 percent or more of their household disposable income on housing (Eurostat, 2022). In general, 'despite the variety of national housing policies, across the continent there is no longer a balance between wages and costs of living' (Cardini, 2023). Given this situation, three concomitant factors can be highlighted, which have further undermined the right to housing in many European contexts: the economic crisis due to the Covid-19 emergency, the touristification following the lifting of restrictions introduced to counter the pandemic, and, at the geopolitical level, the Russia-Ukraine conflict and the recent tensions in the Middle East and the Mediterranean region.

At a global level, the pandemic has drastically reduced households' earnings and spending capacity, widening social and economic disparities and exposing individuals with low or

[1] The project is funded with PNRR funds (2023-2025) and involves the Department of Engineering and Architecture (DIA) of University of Studies of Trieste, the Polytechnic of Milano and the Polytechnic of Bari.

unstable incomes (such as young adults, parents, singles, migrants) to a serious risk of housing instability (OECD, 2021b). Before the 2020 crisis, over a third of low-income tenants in countries of the Organization for Economic Co-operation and Development (OECD) spent over 40 percent of their income solely on rent, net of housing benefits (defined as "housing cost overburden rate"[2]). Housing affordability has been severely impacted by the restrictions and the related interruption of economic activities that have caused a significant increase in unemployment in many European countries. Eurostat data highlight that 16 percent of the European population lives in households that in 2021 reported a decreased income compared to the previous year, with an average decrease of 4.2 percent[3].



1 - Housing cost overburden rate, 2022 (percent) (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:ILC_LVHO07A_values.png)

In Italy, 7.2 percent of households were severely overburdened by housing costs in 2020. This figure rises to 28.6 percent for households with incomes below 60 percent of the median income (Eurostat, 2021). There has been a significant increase in housing stress due to difficulties in paying rent or mortgage payments (reported to have increased by 95.9% and 88.8%, respectively) (Caritas, 2020). It is worth noting that this hardship has been temporarily mitigated by housing support measures implemented during the pandemic. However, soon these

[2] See Eurostat, Glossary: "Housing cost overburden rate", https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Housing_cost_overburden_rate, and paragraph 2.2 below.
[3] Data 2020 from dataset "F1N Change in household income", Eurostat, EU-SILC 2021.

measures were gradually phased out, leaving tenants facing a situation of great uncertainty (OECD, 2021c).

Touristification, which was somewhat halted during the pandemic but reignited soon after the restrictions lifted, has a significant impact on the real estate market, especially on affordable housing, within a broader context of deregulation, with policies unable to counteract the phenomenon (Gainsforth, 2023). In 2022, the total number of overnight stays in European Union in short-term rental accommodations booked through Airbnb, Booking, Expedia Group, or TripAdvisor increased by approximately 7 percent, further growing by an additional 13.8 percent in 2023.[4].

The tourism industry's resurgence has sparked a fierce competition between two distinct housing demands, leading to a significant shift of available housing from the traditional rental market to the short-term rental market, which promises significantly higher returns (FEANTSA, 2020). This shift has exacerbated existing eviction trends already ignited by many mid-2010s regeneration processes (Boschetti, 2023). Numerous studies have demonstrated that Airbnb has driven up rental prices (by as much as 7%) and reduced the availability of existing long-term rentals. It has also influenced housing purchase prices (increasing by up to 17%), further diminishing the availability of "affordable" homes (FEANTSA, 2020). As a result, when specifically referring to the rental sector, the “availability of” and “access to” decent housing is dropping in many European large and medium-size cities, where the effects of gentrification processes (also related to tourism) and higher market prices often combine with the impacts of internal and external migrations and poor maintenance of council housing stock (OECD, 2021c).

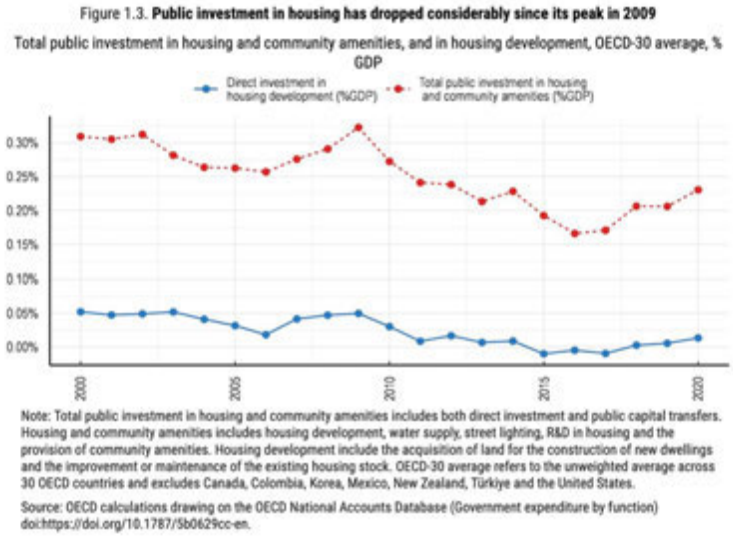
At the same time, the war conflicts at the doors of Europe and the Mediterranean, with their sanctions and trade fluctuations, have severely impacted the public expenditure, with a negative effect on the construction sector due to increased costs of building materials and energy supplies. According to Eurostat data, in March 2023, construction material prices in the European Union increased by 45.8 percent compared to March 2022[5]. This has in many contexts (eg. Italy) reduced the capacity for investments on housing, and especially on public/social housing estates. The war in Ukraine has triggered a generalized increase in prices, particularly affecting low-income families whose consumption basket is more sensitive to energy and food prices, further reducing disposable income for housing costs.

Therefore, it is crucial to examine housing conditions across Europe. EU-SILC data highlights that a significant percentage of European citizens live in precarious housing conditions or experience housing hardship. In 2020, it was estimated that 17.4 percent of population lived in overcrowded dwellings and 1.7 percent in dwellings lacking basic sanitation facilities. Italy stands out negatively with an overcrowding rate of 26.1 percent, almost double the European Union average, while 27.9 percent live in dwellings that do not meet minimum standards (leaky

[4] Data Eurostat 2023 from dataset “tour_ce_omn12, Short-stay accommodation offered via collaborative economy platforms by months, residence of the guest and NUTS1 and NUTS2 regions - experimental statistics”.
[5] Own elaboration based on Eurostat 2023, dataset: Construction producer prices or costs, new residential buildings - quarterly data.

roofs, damp walls, lack of a bathtub or shower, lack of an indoor toilet for exclusive use of the family, and lighting problems)[6].

The causes of this housing distress are diverse and complex: on one hand, the scarcity of affordable housing, the aging housing stock with a corresponding decline in public investment, and on the other, the diversification of housing demand, particularly among the elderly, people with disabilities, and other vulnerable groups (Tosi, 2017). The reduction in public investment in public housing stock has made maintenance and interventions on existing housing rarer, on the one hand, and has reduced the construction of new housing, on the other hand (OECD, 2021c). Among all the countries for which data are available, the amount of public funding for social rental housing as a percentage of GDP was higher in 2010 than in 2020 (OECD, 2019[7]).



2 – Total public investment in housing and community amenities, and in housing development, OECS-30 average, percent GDP (OECD, 2021c)

Housing in Europe is facing a significant challenge: a mismatch between the existing housing stock and the evolving needs and preferences of a diverse range of users. While the housing stock remains largely unchanged, the population is becoming increasingly diverse in terms of age, household composition, and lifestyle. This phenomenon, linked to factors such as population aging, the rise of single-person households, increased immigration, and changes in work patterns, exposes these categories to precarious housing conditions, with negative consequences on health, well-being, and quality of life. According to Eurostat data in 2021, 31.3 percent of households in the European Union consisted of a single person, the proportion of individuals aged over 65 years has increased from 16 percent in 2002 to 21 percent in 2022, and the percentage of individuals aged over 80 years has nearly doubled between 2002 and

[6] Data Eurostat 2023 from dataset “Living conditions and welfare”, EU-SILC 2023.
[7] Data OECD Affordable Housing Database from “PH1.1 Policy instruments and level of governance”.

2022. In 2022, 8 percent of people living in European Union were foreigners[8], with 3 percent being citizens of another European Union country and 5 percent from a non- European Union country. Overall, the foreign population increased by 12.2 percent between 2010 and 2020[9]. The multitude of user profiles asks for greater complexity in property management. In the absence of housing solutions, access to other citizenship rights and the welfare system is also reduced: a spiral that reinforces the personal condition of vulnerability.

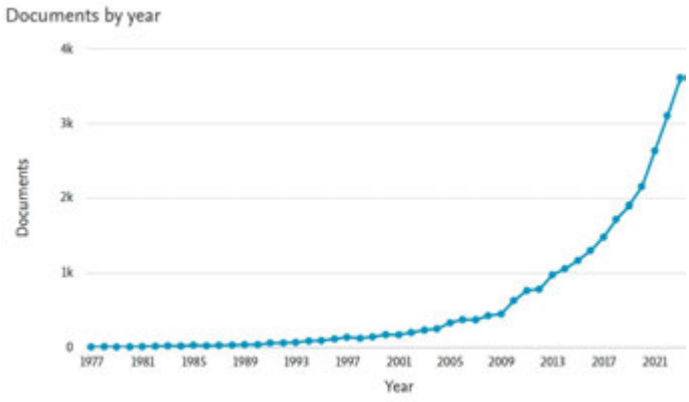
2.2 What We Talk About When We Talk About Affordability

Given this overall picture, no wonder that, especially after the approval of the EU Urban Agenda (2016) and the European Green Deal (2020), "affordable" has nearly become a "buzzword" for housing solutions throughout EU policies, tools and funding measures.

3 - Priority themes in the EU Urban Agenda (https://futurium.ec.europa.eu/en/urban-agenda)

The term "affordability" has gained increasing prominence in housing debates since the mid-1990s, appearing frequently in both EU documents and academic literature (Pittini, 2012; Granath Hansson, 2017; Heylen, 2023). A quick search on Scopus using keywords related to the field of interest and the European context reveals a surge in the use of the term coinciding with the consolidation of neoliberal policies in urban management across Europe in the late 1990s, followed by a series of financial and housing bubbles and economic crises (starting in 2007).

[8] Data Eurostat 2023 from dataset: "Demography, population stock and balance".
[9] Data Eurostat 2023 from dataset: "Migration (migr)".



4 - Number of papers on the theme “affordable housing” in the period 1977-2024.
The figure emphasizes a significant drop in the production related to the issue in the last three years (since 2021).

Studying documents and initiatives within Institutions of the European Union dealing with housing (directives, platforms, observatories) is helpful in grasping whether the idea of "affordability" in European policies can be broadened or refined. Strategic documents, often concise and clear, tend to offer a somewhat simplistic view, often focusing solely on the economic aspect of the issue.

In discussions surrounding "housing affordability" within European policy contexts, the focus tends to focus on the methods used for measurement (OECD, 2021a). There are various approaches to evaluating housing affordability, each with its own strengths and weaknesses. The price-to-income ratio (P/I ratio) offers a broad perspective on how housing prices relate to incomes across different markets and over time. However, this ratio has limitations, primarily because it relies on average price- and wage data, which can oversimplify the picture (aggregated data). The expenditure-to-income ratio (E/I ratio) considers the actual housing expenses of households, providing a more detailed and nuanced assessment of affordability. By examining household-level data, this measure offers insights into the diverse financial challenges faced by different groups and individuals. It encompasses two distinct methods of affordability measurement: the ratio method and the residual income method, both aiming to gauge the relationship between housing costs and household income (Heylen, 2023).

Both the (P/I) ratio and the (E/I) ratio, when constrained by a purely economic interpretation of affordability, show significant shortcomings. These metrics fail to capture essential aspects of housing affordability that extend beyond mere financial calculations. They overlook factors such as the distribution of housing costs and accessibility, mortgage expenses, access to affordable housing, and housing quality. Moreover, the arbitrary selection of affordability thresholds neglects the diversity of housing costs, incomes, and living standards across various regions and contexts. It is widely understood that housing is deemed "affordable" if it does not

exceed 30-40 percent of household income (Pittini, 2012; UN-Habitat, 2019; Eurostat, 2023). However, acknowledging the lack of a comprehensive and critical approach to how this threshold varies depending on territorial contexts is important: 'despite consensus across Europe on housing affordability being increasingly stretched, the idea of what is affordable is subject to national interpretations.' (Pittini, 2012).

Indeed, the concept of economic affordability widely varies in different Countries according to their different welfare policies, taxation frameworks, and overall costs of life. Furthermore, the explosion of social housing demands makes housing affordability a cross-cutting and multi-faceted issue. Questioning how the European policies provide for housing affordability has been practically interpreted in local projects and policies can therefore provide a valuable perspective to: i) understand if and to what extent economic, social and spatial issues can be more effectively integrated; ii) reframe and enrich this term and its operational meanings. As highlighted by Eurostat[10], two concepts can be used to broaden and refine the definition of affordable housing: the housing cost overburden rate and the overcrowding rate. These indicators, which measure the percentage of the population living in housing with excessive costs or overcrowding, respectively, provide valuable insights into the multifaceted nature of housing affordability and its impact on people's lives (OECD, 2021a).

To measure affordability, the use of "objective" indicators (house costs, rent, salaries, associated costs), easily measurable, can be further specified through the use of "subjective" indicators, which, through direct questioning of residents, contribute to questionnaire evaluation factors such as the availability of quality housing in one's city or neighborhood, the perception of security, as well as the perception of housing insecurity, which for example increases as incomes decrease but also with increasing job instability (OECD, 2021b; Heylen, 2023).

Despite the comprehensive framework, the limitations of these definitions and indicator systems do not exhaust the topic. Therefore, delving more closely into projects addressed by "affordable housing" policies seems like a useful step to then address the issue within ongoing research.

2.3 Methodology. Observatories and platforms, policies and projects.

This research delves into the complex landscape of European housing policies, where two fundamental documents set the overarching goals: the UN's 2030 Agenda for Sustainable Development and the Green New Deal, aiming for Europe's climate neutrality by 2050. Within this framework, additional documents like the Geneva UN Charter on Sustainable Housing, the Amsterdam Pact, and the related Housing Partnership Action Plan (2018) provide specific guidelines. Notably, the Renovation Wave Strategy (2020), aligning with the Green New Deal, prioritizes energy-efficient buildings and the reuse of existing housing stock, specifically through the Affordable Housing Initiative (AHI).

[10] For the following terms see the Eurostat Glossary: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Eurostat.

Many of these housing policies prioritize climate concerns, emphasizing energy-efficient buildings and reduced environmental impact. However, it's important to note that affordable housing remains a critical area of study within these frameworks. Therefore, channels of financing and platforms promoting knowledge networks between local administrations and providing financial support for project realization were subsequently investigated: Horizon Europe, main EU funding channel with specific calls for both housing and "affordable" housing; Urban Innovative Actions (UIA), funding and monitoring entity; the New European Bauhaus (NEB), operational channel of the Green New Deal with a strong focus on the spatial and social "creativity" of the project proposals; URBACT, exchange and support network for local administrations, with housing and inclusion as one of the main focuses.

Finally, observers dealing with spatial policies and residential construction were selected, monitoring trends in the construction sector and bringing together stakeholders (builders, promoters, developers, housing agencies, but also...) from both spatial policy perspectives. These "containers" highlight virtuous and "exemplary" cases that can be scaled up to higher-level policies (design and spatial examples) or implemented locally (in the case of policies). Thus, attention was paid to Housing Europe; SHAPE-EU European Affordable Housing Consortium; Eurocities; Housing Solutions Platform; the Housing 2030 Initiative. From here, some case studies proposing innovative elements regarding the concept of affordability, effectively integrating spaces and policies, were selected and will be briefly described in the next paragraph.

The study work, in addition to consulting the documents available from the platforms, will be refined with further operations in the coming months. In-depth interviews with key stakeholders involved in the ongoing processes, including designers, administrators, third-sector entities, construction companies, will allow deeper exploration of various issues, including:

- a comprehensive review and analysis of the local regulatory framework that shapes the implementation of the case studies;
- financing mechanisms and long-term financial sustainability;
- spatial and technological solutions;
- impact on the community and lessons learnt;
- replication potential in other contexts.

The selected case studies will be refined and broadened through thematic lenses. With the other research units, we can develop thematic atlases that transcend geographic boundaries and themes within the affordability container.

The platforms consider a diversity of examples at a global level, even in peripheral and rural areas; however, this research focuses on European cases within medium or large cities. Look beyond Italy is useful, to seek "innovative" solutions and tools to bring into our national framework. This can be strategic, even in a later phase of work, to detect elements of innovation that may already be conventional or regulated in policies elsewhere. Urban areas appear to be the most stimulating dimension for research, as places where social inequalities become more

acute and entrenched. Precisely in cities, where individuals often lack established networks of mutual aid, familial or friendly, and are more vulnerable, access to an "affordable" home is essential to maintain an adequate standard of living and thus contribute more generally to social cohesion (Bricocoli in Peverini, 2023).

3 "Concrete" translations of affordability: relevant topics between spaces and policies

From the observatories and platforms that have been already mentioned in 2.2 section, we can identify a few housing projects and interventions, that more than others are physical translation of the affordability notion. Working on the analysis of design examples allows to verify how the concept behind their peculiar housing offer- which is the "being affordable"- is developed in relation to the supporting housing politics and issues at urban / territorial scale (green & blue networks, energy) and at close-up scale, overcoming a mere financial- and economic approach and offering "overall" solutions. The projects analysed in par.3 are identified as "exemplar" and meaningful case studies in the sources or developed within European financing frameworks. Amongst the selected cases, there are models for the integration between housing and welfare support (health and social assistance); for technological and construction solutions that make it possible to imagine reuse operations in the future or that make use of recycled materials (with consequent reduction of costs); for the relationship with the existing and often abandoned heritage of the urban contexts of intervention.

Working on the topic of affordability, these cases are interesting not only because they aim at reducing the direct costs of the dwellings, limiting them to the threshold of the 30% of the individual income, but because they implement models of "integrated" affordability. They hence integrate financing- and functional mix models in order to: combine the spaces of the single apartment with spaces for social- and healthcare services (Calcio, Belgium); grant the right to housing and support the access to jobs (Vivalla, Sweden); support housing spaces with services to create local communities (La Borda, Spain); contrast the risk of homelessness with multi-scale solutions (Homes for Good, UK). Beyond their innovative content and their overall quality, another criteria for the selection of these cases was that they refer to diversified frameworks of welfare models and somehow represent the different models of European welfare states; therefore they represent the different ways in which the "right to housing" is interpreted and – at what degree- supported from the public policies (Esping-Andersen, 1990; Piketty, 2014). In this perspective, we want to stress the relationship between the right to housing and the right to the individual and collective well-being (Secchi, 2013; Bianchetti, 2016), granted by the welfare policies[11], regarding which "housing" is the passkey.

[11] In this regard, the reference is to the classification of European models of welfare state offered by Salamon and Anheiher (1999, in Corbisiero, 2008) based on which degree States and Third Sectors are involved in the welfare provisions.

3.1 Containing housing costs with Community Land Trusts and innovating the health-care welfare with new co-living models

5 - Topic framework in UIA (https://www.uia-initiative.eu/en/topics)

As known, UIA Urban Innovation Actions is an EU channel of action to 'identify and test solutions for sustainable urban development' (UIA, 2020), that financed with the ERDF channel for the period 2014-2020 of projects with a high degree of innovation and in cities of at least 50.000 inhabitants, up to 80 percent of their overall investment. UIA was an especially interesting experience as the selected projects were supported as case studies and monitored both in the planning and the construction phase, both when in use; this approach allowed to create a multifaced knowledge bank, intervention toolboxes and guidelines to inspire policies at local level and support local administrations in the decision-making process[12].

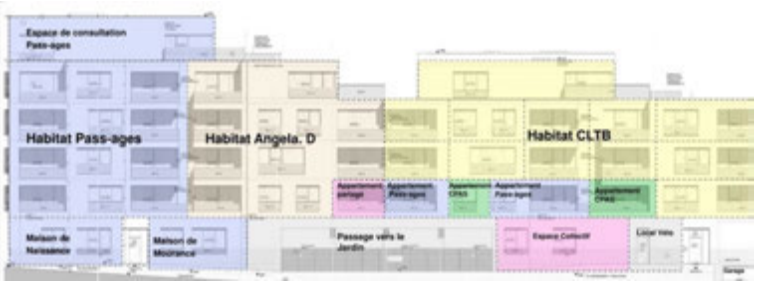
Amongst the realized projects, Calico in Bruxelles is a recently completed intervention (2021) offering innovative ideas for health care models in housing blocks. The project proposes a new governance model for community-led (co-)housing to contrast the severe lack of affordable housing in the metropolitan region of the Belgian capital. Indeed, rental- and buying costs on the free market has nearly doubled in recent years in Bruxelles; on top of that, families with an income of 1500 € or lower spend in average 60 percent of their income for housing and housing-related costs. As suggested by its acronym "CAre and LIving in COmmunity", Calico introduces innovations at the scale of the building (mixing housing units and shared spaces) and of the proximity spaces, offering housing solutions especially addressing the needs of low-income people as women at risk of homelessness (also elderly women), elderly people, families with migrant background.

[12] All information about Calico project in 3.1 comes from UIA website: https://www.uia-initiative.eu/en/uia-cities/brussels-capital-region.

The building houses 34 units and has a rather "traditional" housing scheme that mixes single- or family apartments with collective spaces and shared spaces at the ground floor. Calico's innovation rather lies in the financing- and management model. The financing (5 Meuro) was managed with the collaboration between a Community Land Trust (CLT) and the local government. The land acquisition cost and the financing of the community spaces in the building was managed by the Community Land Trust Brussels (CLTB), while the apartments are partly bought by cooperatives (20 units), partly acquired by CLTB that rents them out to people 50+ (4 units) or as Housing First options (2 units); a few others are put on sale with "social" prize (8 units).

The intervention of the CLT allows to contain the apartments' cost, separating the costs of the land from the costs of the units[13], and to hinder speculation, putting a cap on the sales' prize.

The innovative management can be identified in the presence of three property managers: as seen, CLTB, and other two cooperatives, Angela D. and Pass-Ages, that respectively fight gender exclusion in a feminist perspective and support intergenerational co-living models. In the building an innovative life-to-death health care model (overcoming the hyper-specialization of the Belgian health care system), is integrated. This was developed with the residents and aims at support continuously the residents, along different life-phases.

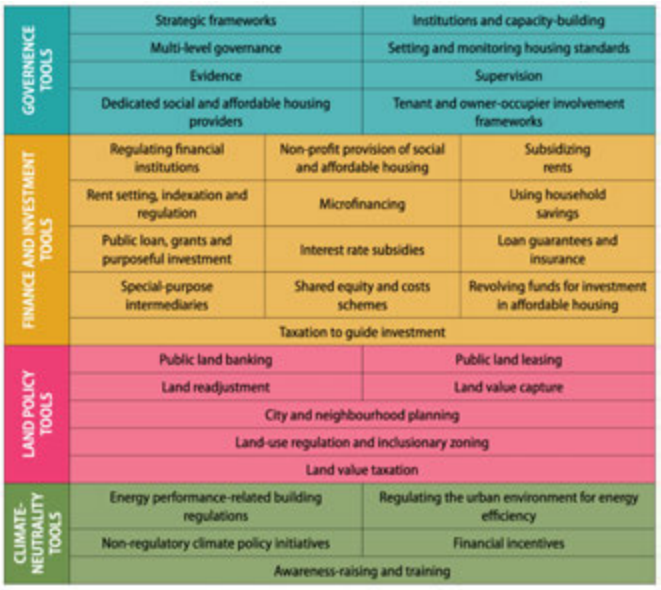


6 - Calico, building facade and managment diagram.
(https://www.cltb.be/calico/?lang=en)

3.2 From abandoned industrial sites to innovative cohousing models with the action of close-knit housing cooperatives

Housing 2030 is an initiative of Housing Europe, Unece and UNHabitat to collect pilot cases offering a set of 'effective policies for affordable housing in the UNECE region' (UNECE and Housing Europe, 2021), addressing housing policies at national level. The 2021 handbook, published during the pandemic, provides an articulated set of policy tools organized in thematic sections such as: governance, finance, land and climate-neutral housing.

[13] In Bruxells, CLTB manages to deduce the costs of the land from the selling costs as the building land is granted in "surface right". More information, here: https://www.cltb.be/how-does-it-work/?lang=en



7- Thematic toolkit and policy tools for affordability.
(UNECE, 2021, p. 20: https://unece.org/sites/default/files/2021-10/Housing2030%20study_E_web.pdf)

Amongst the case studies presented as examples of effective governance policy (multi-level governace and strategic frameworks), there is the Barcelona case, analyzed at both policy- and design level. As known, Spain has developed in the second half of 20th Century a welfare model that excludes the housing provision from the set of "essential services"; moreover, Spanish policies have traditionally supported access to private ownership, while tools for rent- and land leasing regulation, such as the 1964 LAU Urban Leases Act, and its following updates up untill 2013, had hardly an impact on the matter (Falagàn, 2019). In the national framework two issues could be noted: weak support policies combined with a harsh housing crisis in relation to the "property bubble", burst around the time of the 2008 financial crisis, leading in those years to a yearly +30 percent increase of the housing costs, that increased the housing tension in the Barcelona metropolitan area (Falagàn, 2019).

Therefore, since 2014 the Catalan government tried to cool down the situation with an innovative housing plan. The 2016-2025 PDHB New Barcelona Right to Housing Plan tries to deal with severe housing crises by: regulating the housing mix in new interventions (min. 30% of housing units should be affordable housing); encouraging the public operator in using a wide stock of vacant and dilapidated housing units; curbing the tourist pressure; facing the housing emergencies by connecting housing to social support.

8 - La Borda, Lacol Architecture Cooperative.
(https://miesarch.com/work/4554)

La Borda cohousing cooperative project (2014-2018)[14], was developed close to the issuing of the housing plan and is a positive case study for the PDHB implementation, both at level of financial- and social management, both at architectural level. The project was developed after a strong bottom-up process involving several associations in the Sants and La Bordeta neighbourhoods, that were actively trying to push the administration in reusing the former industrial sites of Can Battlò. The area had been disused and with prediction (not implemented until then) by the general plan of 1976 to regenerate it with mixed housing-services. La Borda was funded as housing cooperative within the project of Can Battlò to provide an alternative model of housing management and implementation based on ecologic and inclusive principles, according to which the housing is managed collectively and not by the single users/buyers. In 2015 the cooperative received the land from the municipality in a 75-years right of use (with the payment of a limited fee from the users); the building site was an empty lot in between the brownfield area and the city. Moreover, La Borda managed to finance the whole operation by involving Banca Etica, applying innovative models of microcredit and contribution by the inhabitants. From an architectural standpoint, the design was developed through an intensive participatory process between the cooperative members, involving a wide range of targets. The result is an articulated block in which the presence of collectively used spaces is relevant and the shared spaces work as filter between private- and collective, semi-public spaces. The structural solution with bearing structure in structural wood and aluminium- and steel light elements is combined with technologies for strongly reducing the energetic impact and the use

[14] All information regarding La Borda project in 3.2 comes from La Borda cooperative website: http://www.laborda.coop/en/, unless noted.

of water in the building, carrying out the ecologic values of the cooperative. The architectural value of the building, designed by Lacol cooperative of architecture, has been recognized at international level.

The interviews going deeper in the case study will be an opportunity to analyze the aspects related to the financial and concrete management of the spaces, after the first years of use.

3.3 Combining self-recovery and community support to regenerate social housing neighbourhoods

SHAPE-EU is a Housing Europe- and Eurocities initiative to support developers and local administrations in creating socially inclusive neigbourhoods, developing the social targets of the New European Bauhaus and the Renovation Wave. The project selected 100 Lighthouse Districts that "cast light" on the direction for the policies of intervention on the city to take to create of new neighborhoods (or work on the existing) that are socially sustainable, 'affordable and low impact on the environment' (SHAPE-EU, 2023). Among the SHAPE-EU cases, the work on the Swedish Vivalla neighbourhood in Örebro[15] seems especially interesting for our research work. Built in the "Golden age" of Sweden's welfare state as part of the Miljonprogrammet national housing program, Vivalla neighourhood has over time become a critical area, where isolation and social segregation were tangible. With 85 percent of the population with migratory backrounds, few services and poor connections to the rest of the city, Vivalla could be defined as an area "in crisis", with a high level of social tension.

The redevelopment project (2012-2024), managed by the non-profit housing company and landlord ÖrebroBostäder, with design by leading companies as White Arkitekter and Skanska building company, contributed to improve the physical spaces of the area, 'creating a safer and more positive residential environment'[16]. The collaboration between these actors addressed the intervention at architectural level, maintaining the existing low-rise townhouses, and improving the energy efficiency of buildings (by installing green roofs, photovoltaic- and solar panels, natural cooling systems, new doors and windows, and by working on new facades systems). At urban scale, the focus was the redesign and reorganisation of open spaces, to improve access to proximity spaces and strengthen the sense of safety, belonging and community; the improvement of the local network with the urban network of sustainable mobility; the implementation of community services (Trainstation center) for the involvement of younger residents.

[15] All information about Vivalla project in 3.3 comes from SHAPE EU website: https://shape-affordablehousing.eu/vivalla/, unless noted.
[16] Skanska, Vivalla Örebro: https://group.skanska.com/projects/57906/Vivalla%2C-Orebro.

9 - Vivalla Örebrö. Credits: https://whitearkitekter.com/project/vivalla-orebro/

The physical dimension of the intervention has in fact been associated with a strong social dimension. The recovery work of the existing was an opportunity to address the problem of unemployment suffered by many of the residents, through the Residents Builder program, an innovative initiative promoted by the housing company ÖrebroBostäder. This led to the involvement of approximately 80 jobless residents in a self-recovery process, where the building company worked together with the residents, providing specific training that might later allow access to the job market.

The project is significant for three reasons, two positive and one "debated". Firstly, it is an example of regeneration of social housing area, with a high quality architectural and technological project, which can suggest solutions elsewhere in many European contexts. Moreover, such physical- and spatial intervention was an opportunity to address the problem of social segregation through the concrete measure of training and employment of jobless inhabitants. However (and here it goes the aspect to be analyzed more in depth with ad-hoc interviews), it is not clear if the intervention will become a factor for exclusion or eviction rather than inclusion, with an overall investment of 100,000 € / unit and a significant increase in the rent price, from 90€/m2/year to 125€/m2/year; or if the increase of the direct housing costs will be offset by lower energy costs thanks to the retrofit and performance upgrade, and by the income stabilization of residents and a relative increase in their disposable income (Gustavsson&Elander, 2016), for a real economic “affordability”.

3.4 Housing agencies between public and private to recover the vacant assets and contrast the risk of homelessness.

The lack of warranty of the landlords regarding the renters often results in a mismatch between a high demand for housing and a large stock of vacant privately owned housing not on the market: this is one of the problems that the policies of affordable housing try to address

(Housing Europe, 2024). Another hot issue is the need of increase the stock of housing at affordable price to slow-down the current rise of homelessness (Housing Europe, 2024).

The 2021 Lisbon Declaration on the European Platform on Combating Homelessness and the establishment of the relevant EPOCH network made it evident that increasing the share of housing units managed as Housing First options and the structuring of Housing First policies in the broader frameworks of national housing policies is essential (Housing First Europe, 2024). In this perspective, Housing Solutions Platform is an initiative of Housing Europe, which together with the two European agencies that deal with homelessness and severe housing distress through Housing First policies (Feantsa and Fondation Abbè Pierre), focuses on policies and projects that address new housing paradigms to contrast homelessness.

Among the projects highlighted by the documents available on the platform, of particular interest for the ongoing research is the Scottish case of Homes for Good[17], in Glasgow. Homes for Good is an agency in the private sector, that operates as a property manager and acts as an intermediary between owners and low-income people or "on benefit", who receive state subsidies, and at risk of serious marginalization. The allocation of the housing spaces is managed according to the Housing First model, in which the allocation of the house is granted at the beginning of the support process and lasts for a limited time but sufficient to improve the situation of the recipients. The initiative is interesting as it focuses on the existing housing stock: Homes for Good buys vacant or abandoned houses (apartments but also single-family homes), renovates them with a high design quality and rents them for people with low – very low income or at risk of losing their homes.

HFG operates as a real estate manager acting both as an intermediary and guarantor for the owners, often reluctant to rent to people with low income and social problems; additionally, HFG deals with the renovation of the real estate, often directly involving beneficiaries, thus improving the sense of belonging and responsibility. This involves a mix of activities, such as property acquisition, social activities, property management and construction work, which the group has separated into separate companies within, each engaged in different sectors of intervention and with its own professionals.

[17] All information regarding Homes for Good in 3.4 comes from HFG website: https://homesforgood.org.uk/.

10 - Homes for Good. Photo credits: https://homesforgood.org.uk/

Since 2013, when HFG was born, about 300 dwellings have been bought and/or renovated, plus a further 200 private dwellings (which remain the owners) under their management. Moreover, the agency aims at upscaling its model at national level by multiplying its headquarters and by fostering interactions with public or private lenders; at the same time, HFG offers training for investors, social operators or administrators to activate similar paths in other contexts, always with the HF model as an operational background.

4 Discussion and conclusions: economic-, spatial- and social affordability

The platforms, observatories and projects observed highlight several relevant issues around housing affordability. As far as policy issues are concerned, the selected case studies are convincing as they overlap policies at different levels: the local- and the national framework interact seamlessly by using a varied set of tools (land- or property acquisition, management models, financing frameworks, connection with a wide range of departments in the local authority); at the same time, the projects show a strong collaboration between different actors, structuring bottom-up intervention policies (La Borda) or implementing much wider policies at local level (Calico). From a spatial point of view, in each example there is a strong attention to space, which becomes structural to achieve different goals, both directly related to the project (achieving community goals, as in La Borda, or offering supporting welfare, as in HFG and Calico), or linked to more general objectives: environmental sustainability and retrofit (Vivalla); reduction of land use and reuse of the existing stock (Vivalla, HFG, La Borda). The projects of Calico, Vivalla and La Borda, while working in different ways at the "neighbourhood" level, place strong emphasis on the inclusion of the project within a framework of wider urban dynamics, which consider accessibility and sustainable mobility, as well as the system of neighbourhood services, working in synergy with the intervention sites.

If "affordability", as seen in 2.2, is often associated with the relationship between housing costs and the disposable income of the inhabitants, the policies, platforms, and projects analysed, widens an “all-round” gaze on social-, management- and spatial issues. This approach, going back 70 years, inspired the construction of welfarist housing blocks in the “golden age”. However, the project for the ‘public city’ (Di Biagi &Marchigiani, 2009) arose from the Modernist heritage and surely it offered integrated housing proposals, but these were “flattened” on a single-family model and hung on the rampant post-war certainties, with a booming demography and rich state budget. Today, instead, policies and projects for the affordable housing in Europe have surely to commit to an integrated approach; however, it must face strongly variable conditions: increasingly different fragilities, of "ways of living", of funding channels, and at the same time with a declining demography and a welfare in severe crisis, in which the public withdraws, while increasingly hard issues should be addressed. Housing emergencies, ways of living, community building, social support and health for increasingly diverse targets characterize the near future. Therefore, finding evaluation, measurement and design tools is needed to turn from a mere economic “affordability” to an integrated affordability, with innovations in financing models, environmental networks, spatial solutions, support for the territorialization of the social-healthcare welfare.

From the analysed source and projects results that the current housing issue is an opportunity to redefine affordable housing by envisioning three scenarios of integration:

- Affordability as “health through life”: housing spaces are integrated with a health target, in which “health” firstly implies choosing healthy building materials and designing healthy, accessible, thermally comfortable individual and collective spaces; secondly, supports sustainable networks in the city; lastly, integrates housing spaces with policies to support inhabitants at different stages of life and to address different health needs.
- Affordability as living community: innovative forms of cohabitation impact on the composition of the space inside the buildings, on the articulation between built spaces and open spaces, on the involvement of operators to activate socio-health and training support paths.
- Affordability as inclusion: inclusion is carried out at different levels. At the urban level, this implies integrating policies to stem evictions from the central areas and multi-faceted models to support housing. At the level of the building or of the single housing unit, modular and energy-efficient solutions must be embedded with a high spatial quality and “design for assembly” strategies in mind. At the level of policies, socio-sanitary support paths related to homelessness and education to support job access must be activated, as well enabling models against homelessness risk.

In our pilot cases, in Friuli Venezia Giulia, Veneto and Trentino Alto Adige, these directions are valuable for coping with the worsening social conditions (demographic decline, reduction of available incomes, migratory flows, loneliness), combined with the contraction of public welfare, the increase of abandoned assets to be redeveloped, the territorial fragility linked to the impact of climate change and the increasingly outdated building stock, unprepared for new challenges.

The hints presented in this paper show some trajectories for regional and local policies and on three main nodes. Firstly, investing in the monitoring and observation of good practices, while collecting and "normalizing" data to guide policies, regulatory frameworks and plans, is strategic. Moreover, building on the experience of "pioneering" and virtuous cases can help scaling up new housing policies at the national level. Finally, it is necessary to work at the same time on policies and spaces, to allow on the one hand to implement policies (innovating them), on the other to propose adequate and fitting spatial solutions in projects, bringing the right to housing back at the heart of public intervention.

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Social capital among public housing residents: A comparative study between mixed-income communities and independent public housing complexes

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Abstract
This study aims to examine whether there is a difference in social capital among public housing residents in mixed-income communities compared to those in independent public housing complexes. This study utilizes data from the 2021 Seoul Public Housing Residents Panel Study and employs logistic regression analyses. The empirical analysis shows that public housing residents living in mixed-income communities (i.e., social-mix housing complexes and buy-to-rent public housing) exhibit greater social capital compared to those living in independent public housing complexes. This finding suggests that living in mixed-income communities has an effect on enhancing social capital among public housing residents and thus helps alleviate problems associated with public housing.

Keywords: public housing, social capital, social exclusion

Introduction

Social capital is a crucial element for achieving positive outcomes in economic, social, and political realms, promoting sustainable communities (Fukuyama, 2000). However, public housing residents often experience lower levels of social capital, accompanied by social exclusion and discrimination. This phenomenon could be linked to the inherent structural issues in public housing. In many countries, public housing residents face social isolation and stigma, a situation mirrored in Seoul, Korea. Due to limited residential land, public housing in Korea is typically comprised of high-rise buildings within large complexes, making them distinct from conventional housing. Also, antisocial activities have been observed in public housing sites along with concentrated poverty. These problems together can negatively affect social capital among public housing residents.

In response to these challenges, Korea has developed various public housing programs. Initially, public housing primarily involved the construction of large complexes.

However, over time, the approach evolved to include social-mix housing complexes that integrate private and public housing units. Additionally, the government has started *buy-to-rent public housing*, purchasing existing low-rise detached houses for public housing from the private housing sector and thus moving away from the development of new, large-scale complexes. These later iterations of public housing may have a different impact on the social capital of residents, potentially alleviating some of the associated problems.

Despite the significant influence of public housing on residents' quality of life, there is a scarcity of research exploring how living in different types of, in particular, public housing in mixed-income communities is associated with the level of social capital. Addressing this gap, this study asks a research question, "*Is there a difference in social capital among public housing residents in mixed-income communities compared to independent public housing complexes?*"

To investigate the effect of public housing in mixed-income communities on social capital, this study utilizes data from the 2021 Seoul Public Housing Residents Panel Study, conducted by the Seoul Housing and Communities Corporation (SH). The logistic regression analyses show that public housing residents living in mixed-income communities exhibit greater social capital compared to those living in independent public housing complexes. This finding suggests that social mix indeed has an effect enhancing social capital among public housing residents and thus helps relive problems associated with public housing.

Literature Review

Public housing and social capital

As subsidized affordable housing, public housing is a major supply-side housing program for low-income households in many countries. For example, there are approximately

1.2 million public housing units in the United States, which makes up roughly 15-17% of the total federally subsidized affordable housing stock in the U.S. Approximately 17% of households in the UK live in social housing. In Korea, the number of public housing has been increasing and currently over 1.5 million units along its efforts for broader social welfare initiatives to ensure more affordable housing availability.

Since the Korean government introduced its first systematic public housing in 1989, the public housing program has been diversified over time and includes various types of public housing. The types of public housing are differentiated mostly by income level. The longer-term public housing (either permanent or maximum 50 years of residence) targets the lowest-income class, which pays only 30% of market rate rent while national public rental housing is for those who can afford 60-70% of market-rate rent living for a maximum 30 years.

The most critical issue about public housing across the countries has been concentrated poverty. Wilson (1980) points out that neighborhoods with high poverty rates struggle from a lack of role models and economic resources and thus lead residents not to being able to escape from poverty and learn socially acceptable behaviors. Like this case, large-scale public housing also concentrates poverty and caused various social problems. Pruitt-Igoe, the infamous public housing development in the US, is the representative case exemplifying problems associated with concentrated poverty. As a large-scale public housing development, the public housing site stood out in the neighborhood and thus residents experienced social stigma and isolation and the neighborhood struggled from crime and disinvestment.

Social capital refers to social relationships that facilitates collaboration and cooperation and thus allows to achieve socially, economically, and politically desirables

outcomes. Although differently defined by researchers, major components of social capital include trust, network, norms of reciprocity. Then, what is the state of social capital among public housing residents?

According to the ecological model, individuals' behaviors are influenced by individual and environmental characteristics (Handy & Xing, 2011). As social capital is also trust, network, and norms of reciprocity that individuals form with others, social capital can be also shaped by individual characteristics as well environmental characteristics. At the individual level, studies find that income, gender, age, education, and family types are related to social capital. For example, Bean (2005) finds that trust is lower among the youngest and the oldest age groups while middle-aged group exhibits higher trust in Australia. Tranter and Skrbiš (2009) find that education is positively relation to interpersonal trust. While public housing can positively affect social capital by providing housing stability, more studies are finding that living in public housing is associated with a low level of social capital. For example, Donoghue and Tranter (2012) find that social capital measured in trust is generally lower for public housing residents. Mullins and Western (2002) find that tenure is a key factor affecting non-housing outcomes and living in public housing results in lower perceived quality of life, health status, perceived health, employment status, and educational attainment, greater fear and experience of crime, and poverty rate.

Putnam (2000) also argues that a built environment is important in forming social capital. In the US, conventional suburban developments have been criticized as people spend more time in car and thus not provide opportunities to meet neighbors for casual talks. In supporting this criticism, a large number of studies find that social capital is greater in walkable neighborhoods (e.g., Leyden, 2003; Lund, 2002; Owen et al., 2007; Wood et al., 2008). By contrast, Jun and Hur (2015) finds that while perceived walkability enhances social

capital, physical walkability lowers social capital because of the spatial intersection between where physical walkability is greater (i.e., the inner-city neighborhoods in the US) and where socio-economic distress (e.g., higher poverty and crime rates) is greater. This study suggests that distressed socio-economic environment that is associated with concentrated poverty is likely to lower social capital. Given that the most critical issue about public housing is originated from concentrated poverty, social capital is likely to be lower in large-scale public housing.

Social capital and mixed-income communities

Developing mixed-income communities has been the alternative to the problems associated with concentrated poverty. For example, the HOPE VI in the US is to rebuild severely distressed public housing with market-rate rental housing, thereby developing mixed-income communities. Also, the UK requires including affordable housing for low-income class in building market-rate housing. Korea more recently adopted mixed-income development, so-called *social-mix policy*, in building large apartment complexes.

There are a few studies examining the effect of social mix policies. For example, Jun and Jeong's (2018) study is one of the few that examines the effect of mixed types on residential satisfaction. They find that the level of social mix, which varies from including only public housing in housing complexes (the lowest level) to including both public housing and market-rate housing in the same housing complex, either non-randomly (the medium level) or randomly (the highest level), exhibits a U-shaped relationship with residential satisfaction. In other words, residential satisfaction is higher in housing complexes with no social mix and with the greatest social mix, compared to those with a medium-level social mix. They posit that residential satisfaction is higher in complexes without social mix

because people generally prefer homogeneity and thus are more satisfied living in communities at similar income levels. Sohn and Ahn (2022) examine whether social conflicts exist in socially mixed housing complexes and find that the types of mixtures significantly influence these conflicts. Jun and Han (2020) compare the effect of discrimination on stress among public housing residents living in social-mix housing complexes with those in independent public housing complexes. They find that discrimination has a lesser effect on stress in social-mix housing complexes than in independent public housing complexes and posit that the structural differences of the social-mix housing complexes explain the variations in social networks and social control that reduce stress from discrimination among public housing residents. Although these studies provide insights into the effects of mixed-income communities on housing, they do not directly examine social capital among public housing residents in mixed-income communities.

Mixed-income communities differ from large-scale public housing complexes both in socio-economic and physical environments. Buy-to-rent public housing units located in low-rise residential areas alongside other private housing units, as well as public housing in social-mix housing complexes, are relatively hard to distinguish from ordinary housing in their neighborhoods. Additionally, public housing residents, particularly those in social-mix housing complexes, often live with higher-income families. In Korea, given that housing prices in low-rise residential areas are typically lower than those in large-scale housing complexes, not all buy-to-rent public housing residents live with higher-income families. Nevertheless, there is still a possibility that those living in buy-to-rent public housing may live with higher-income families, as buy-to-rent public housing units are allocated to the lowest-income class.

Based on the logic that we discussed above, we propose the following hypothesis:

Social capital is greater among public housing residents living in mixed-income communities than in independent public housing complexes.

Methods

Study area and data

The study area is the City of Seoul, the capital city, of Korea where population size is about 10 million as of 2022. To analyze the effect of mixed-income communities on social capital among public housing residents, this study utilizes data from the 2021 Seoul Public Housing Residents Panel Study, conducted by the Seoul Housing and Communities Corporation (SH). The SH is the entity that builds and manages public housing units for the City of Seoul. As of 2024, SH manages 221,681 public housing units (SH, 2024). The dataset encompasses data on elements of social capital, details on the physical aspects of the housing and neighborhood, and demographic characteristics. This comprehensive dataset is well-suited to evaluate the hypotheses presented in this study.

Methods and variables

To test the proposed hypotheses, we ran ordered logistic regression analyses as the dependent variables were measured as an ordinal variable on a 4-point Likert scale. The dependent variables are the three elements of social capital: trust, network, and norms of reciprocity. For the trust variable, we used the survey question, “Do you think you can trust the neighbors where you live?,” which has responses 1) very unlikely(=1) 2) unlikely (=2) 3) likely (=3) 4) very likely (=4). For the network variable, we used the survey question, “Do you network with your neighbors,” which has responses 1) I don't know who my neighbors are at all (=1) 2) I know who my neighbors are, but I don’t greet them (=2) 3) I greet my neighbors or have light conversations with them (=3) 4) I am familiar with my neighbors'

family matters or visit them frequently (=4). For the norms of reciprocity variable, we used the survey question, "Would you be willing to assist your neighbors when they need help?," which has responses 1) very unlikely(=1) 2) unlikely (=2) 3) likely (=3) 4) very likely (=4).

The primary independent variable is the types of public housing, which include buy-to-rent public housing that are socially mixed in ordinary neighborhoods, public housing within social-mix housing complexes, and independent public housing complexes. The proportion of each type of public housing is shown in Table 1. About 50% of total public housing in the sample is located in independent public housing complexes that refer to a non-mixed-income community. Approximately 30% of the public housing units in the sample are situated within social-mix housing complexes. These units can be categorized into two types: a randomly mixed type, where mixing occurs within a single building, and a non-randomly mixed type, where the mixing is organized by distinct buildings. Approximately 20% of the public housing units in the sample are buy-to-rent public housing, which were purchased from the private sector and are now leased as public housing.

<Table 1> Public housing type in the sample

Income mix	Type	N	%
Mixed-income community	Social-mix housing complex	387	30.0
	Randomly mixed	216	16.9
	Non-randomly mixed	167	13.1
	Buy-to-rent public housing	258	20.2
Non-mixed-income community	Independent public housing complex	638	49.9
Total		1279	100.0

Control variables comprise housing satisfaction with indoor facilities, housing satisfaction with outdoor facilities, neighborhood satisfaction, and demographic

characteristics, including sex(male=1), age (in years), education attainment (no education=1 to graduate school=6), marital status (married=1), employment (employed=1), years of residence (in years), household size, and household income (10,000 Korean Won).[1] Given that one's health status can affect social interactions, we also included the subjective health rating variable, which ranges from very unhealthy to very healthy (5-point Likert scale).

Descriptive statistics

Table 2 shows the descriptive statistics. The means of the trust, network, and norms of reciprocity variables are around 2.8, which suggests that the public housing residents are likely to trust their neighbors, greet their neighbors or have light conversations with them, and be willing to assist them when they need help.

For the control variables, all the means of the satisfaction with indoor housing facilities, satisfaction with outdoor housing facilities, and neighborhood satisfaction variables are around 3, which suggests that the survey respondents assess 'fairly good' for their residential environments. The mean age of the survey respondents is 63 years old.
Male and employed people account 50% of the respondents. The mean year of residence is

[1] The study conducted exploratory factor analysis (EFA) to consolidate the variables associated with satisfaction with indoor housing facilities, satisfaction with outdoor housing facilities, and neighborhood satisfaction, which were composed of multiple measurement items in the survey. Satisfaction with indoor housing facilities included four items: leakage and waterproofing status, painting and flooring status, heating and cooling system, and barrier-free design. Satisfaction with outdoor facilities included four items assessing satisfaction with amenities, green spaces, parking facilities, and security status. Neighborhood satisfaction comprised seven items measuring satisfaction with accessibility to public transportation, convenience, public facilities, cultural facilities, medical facilities, park, social welfare facilities, school and childcare facilities. The EFA employed principal component analysis and varimax rotation, with factor extraction based on Eigen values exceeding 1.0. The analysis revealed that housing satisfaction with indoor facilities and housing satisfaction with outdoor facilities were grouped into 'Factor 1' and 'Factor 2', each consisting of four survey items. Also, neighborhood satisfaction was categorized as 'Factor 3' with seven measurement items. Each factor was created as a single variable by averaging the satisfaction levels of the measurement items.

13.6 years old and the average household size is 2.45. The mean of the subjective health rate is around 3, which indicates that the survey respondents are characterized by having average health status.

<Table 2> Descriptive statistics

	Var.	Mean	Std.	Min	Max
Dependent var.	Trust	2.80	.44	1.00	4.00
	Network	2.82	.58	1.00	4.00
	Norms of reciprocity	2.85	.49	1.00	4.00
Independent var.	Social-mix housing complex	0.30	-	0	1.00
	Buy-to-rent public housing	0.20	-	0	1.00
	Independent public housing complex	0.50	-	0	1.00
Control var.	Satisfaction with indoor housing facilities	3.14	.64	1.00	4.00
	Satisfaction with outdoor housing facilities	3.18	.66	1.00	4.00
	Neighborhood satisfaction	3.00	.51	1.00	4.00
	Male	.58	.49	.00	1.00
	Age	62.51	12.98	31.00	96.00
	Educational attainment	3.68	1.15	1.00	6.00
	Married	.48	.50	.00	1.00
	Employed	.53	.50	.00	1.00
	Year of residence	13.63	7.44	1.00	33.00
	Household size	2.45	1.28	1.00	7.00
	Family income	2658.59	2052.05	.00	12000.00
	Subjective health rate	3.04	.96	1.00	5.00

Results

Table 3 shows the ordered logistic regression analyses that examine the effect of living in mixed-income communities on each of the trust, network, and norms of reciprocity variables by including the buy-to-rent public housing and social-mix housing complex

variables. First, the trust model shows that the buy-to-rent public housing variable is statistically significant and positively associated with trust while the social-mix housing complex variable is not statistically significant. The network model shows that the social-mix housing complex variable is statistically significant and positively associated with the network while the buy-to-rent public housing variable is not statistically significant. Finally, both of the social-mix housing complex and buy-to-rent public housing variables are not statistically significant on norms of reciprocity. Although the effects of social-mix housing complex and buy-to-rent public housing variables, which indicate different types of mixed-income communities, are not consistent across the three models of trust, network, and norms of reciprocity, the results from the ordered logistic regression analyses, in general, suggest that social capital is greater for those living in mixed-income communities than for those living in independent public housing complexes.

Regarding the control variables, we found that satisfaction with outdoor facilities and neighborhood facilities are positively related to trust and norms of reciprocity. Male is less likely to network with their neighbors and have norms of reciprocity compared to female as expected. We also found that age, employment, marriage, year of residence, and subjective health rate are positively related to social capital.

<Table 3> Ordered logistic estimates: Pooled-sample models

		Trust	Network	Norms of reciprocity
		B (S.E.)	B (S.E.)	B (S.E.)
Dependent variable	Cut 1	1.233 (1.904)	.290 (.940)	-1.118 (.972)
	Cut 2	5.811*** (.990)	1.945** (.937)	2.212** (.936)
	Cut 3	11.763*** (1.064)	6.849*** (.966)	7.058*** (.969)
Independent var.(ref.=Independent public housing	Social-mix housing complex	-.027 (.195)	.642*** (.188)	.096 (.190)
	Buy-to-rent public housing	.941*** (.241)	-.010 (.224)	.376 (.229)
Control var.	Satisfaction with indoor housing facilities	.153 (.136)	-.015 (.131)	.058 (.133)
	Satisfaction with outdoor housing facilities	.497*** (.165)	.104 (.156)	.266* (.159)
	Neighborhood satisfaction	.344** (.161)	.249 (.155)	.632*** (.157)
	Male	-.152 (.179)	-1.248*** (.181)	-.602*** (.174)
	Age	.038*** (.008)	.026*** (.008)	-.009 (.007)
	Education	-.028 (.080)	-.038 (.078)	-.048 (.075)
	Married	.285 (.225)	.518** (.215)	.576*** (.216)
	Employed	.388** (.184)	-.113 (.181)	.258 (.180)
	Year of residence	.004 (.011)	.048*** (.011)	.017 (.011)
	Household size	.124 (.089)	.021 (.084)	.100 (.086)
	Family income	7.243E-5 (5.265E-5)	-4.720E-6 (4.792E-5)	-5.503E-6 (5.010E-5)
	Subjective health rate	.286*** (.090)	.260*** (.087)	.334*** (.087)
Summary Statistics	Degrees of freedom	14	14	14
	LL, full(unrestricted)	1443.059	1826.267	1676.371
	Ll, constants-only(restricted)	1540.471	1958.526	1791.846
	X2 value	97.412	132.259	115.475
Pseudo-R2s	Cox&Snell	.073	.098	.086
	Nagelkerke	.105	.125	.115
	McFadden	.063	.068	.064

*p<.1; **p<.05; ***p<.01

For the robustness of the models, we also differentiated the effect of randomly and non-randomly-mixed housing complexes as shown in Appendix 1. The randomly- and non-randomly-mixed housing complex variables are positively related to only network. These relationships are consistent with the result that the social-mix housing complex variable is positively related to network as in Table 3.

We also ran additional models to examine the relationship between public housing units in mixed-income communities and social capital by excluding those living in independent public housing complexes from the sample and including the non-randomly-mixed housing complex among social-mix housing complexes as the reference variable as shown in Table 4. We found that the buy-to-rent public housing variable is positively related to trust while it is negatively related to network. That is, the public housing residents living in buy-to-rent public housing are more likely to trust their neighbors but less likely to network with their neighbors compared to those living in social-mix housing complexes, especially, non-randomly mixed housing complexes. Given that the pooled sample models in Table 3 indicate that the social-mix housing complex variable, not the rent-to-buy variable, is also positively related to trust, the larger network may be due to various networking opportunities in large-scale housing complexes compared to low-rise residential areas. The randomly-mixed housing complex variable was not statistically significant in all of the trust, network, and norms of reciprocity, thereby suggesting that the level of social capital is likely to be similar between public housing residents living in randomly- and non-randomly-mixed housing complexes among social-mix housing complexes.

<Table 4> Ordered-logit estimates: Mixed-income community models

		Trust	Network	Norms of reciprocity
		B (S.E.)	B (S.E.)	B (S.E.)
Dependent variable	Cut 1	.788 (1.539)	-1.993 (1.420)	-1.818 (1.443)
	Cut 2	4.562*** (1.472)	-.489 (1.414)	1.597 (1.395)
	Cut 3	10.367*** (1.558)	4.666*** (1.436)	6.480*** (1.431)
Independent var. (ref.=Non-randomly-mixed housing complex)	Randomly-mixed housing complex	.318 (.270)	-.421 (.280)	.232 (.266)
	Buy-to-rent public housing	.987*** (.344)	-.864** (.342)	.416 (.331)
Control var.	Satisfaction with indoor housing facilities	-.048 (.192)	.016 (.188)	-.244 (.188)
	Satisfaction with outdoor housing facilities	.425* (.219)	-.095 (.212)	.379* (.212)
	Neighborhood satisfaction	.414* (.223)	.191 (.221)	.835*** (.218)
	Male	-.210 (.252)	-1.164*** (.252)	-.653*** (.243)
	Age	.026** (.011)	.005 (.011)	-.014 (.011)
	Education	.015 (.118)	-.018 (.116)	.013 (.111)
	Married	.289 (.313)	.727** (.304)	.532* (.299)
	Employed	.677** (.263)	.009 (.262)	.533** (.257)
	Year of residence	.008 (.034)	.071** (.035)	-.010 (.033)
	Household size	.009 (.116)	-.173 (.112)	-.060 (.112)
	Family income	5.286E-5 (6.891E-5)	3.513E-5 (6.552E-5)	5.558E-5 (6.538E-5)
	Subjective health rate	.288** (.132)	.355*** (.131)	.281** (.128)
Summary Statistics	Degrees of freedom	14	14	14
	LL, full(unrestricted)	737.815	895.286	832.440
	Ll, constants-only(restricted)	777.909	953.172	917.505
	X2 value	40.094	57.886	85.065
Pseudo-R2s	Cox&Snell	.061	.086	.124
	Nagelkerke	.086	.112	.163
	McFadden	.052	.061	.093

*p<.1; **p<.05; ***p<.01

Conclusion

Public housing is essential for meeting the housing needs of low-income families. Yet, when public housing is concentrated in large complexes, it can centralize poverty, leading to social isolation and stigma for the residents, and potentially causing adverse effects on nearby areas. These structural issues can reduce social capital among public housing residents. As an alternative to the problems associated with concentrated poverty in large-scale public housing complexes, subsidized housing units have been provided in mixed-income communities, such as social-mix housing complexes and buy-to-rent public housing in Korea.

At the beginning of this study, we asked a research question, "*Is there a difference in social capital among public housing residents in mixed-income communities compared to independent public housing complexes?*" Based on this research question, we compared to social capital among public housing residents living in mixed-income communities with those living in independent public housing complexes by utilizing the SH data and logistic regression analyses.

The empirical analysis reveals that residents of public housing in mixed-income communities exhibit higher social capital than those in independent public housing complexes. We found that trust is greater among those living in buy-to-rent public housing located in low-rise residential areas, which are naturally mixed-income communities compared to those living in independent public housing complexes. Additionally, networks are more extensive among residents of social-mix housing complexes, which are designed to create mixed-income communities by housing both public and private units within the same complex.

Based on the findings in this study, we suggest some policy implications for public housing policy. First, public housing should be designed to facilitate integration between its residents and the general population, enabling those living in public housing to have more social interactions. Considering that social capital underpins socioeconomically desirable outcomes, public housing should be developed in mixed-income communities. This can be achieved by encouraging more buy-to-rent public housing and developing social-mix housing complexes that positively influence social capital among residents. Second, A more structured approach should be implemented to integrate public housing with private housing. Although the empirical analysis shows that social capital is generally greater for those living in mixed-income communities, it is not consistent across the three elements of social capital. Trust is greater only for those living in buy-to-rent public housing while network is greater only for those living in social-mix housing complexes compared to those living in independent public housing complexes. Norms of reciprocity did not exhibit a difference across different types of public housing. Given that all three elements of social capital are important for socially sustainable community development, it is important that public housing is designed to evenly increase each element of social capital.

This study contributes to the literature by comparing social capital among public housing residents living in mixed-income communities with those in independent public housing complexes, thereby exploring the impact of mixed-income communities on social capital. Nevertheless, this study still has limitations, including missing some factors that might affect social capital among public housing residents. For example, neighborhood characteristics such as income diversity can influence social capital. Future studies will need to consider more specific information about not only the characteristics of individual public housing units but also the characteristics of the neighborhoods where these units are located.

Appendix 1. Ordered-logit estimates: Pooled sample models diving into randomly and non-randomly-mixed housing complexes

		Trust	Network	Norms of reciprocity
		B (S.E.)	B (S.E.)	B (S.E.)
Dependent variable	Cut 1	1.258 (.1097)	.287 (.939)	-1.116 (.973)
	Cut 2	5.838*** (.992)	1.942** (.936)	2.214** (.937)
	Cut 3	11.796*** (.1068)	6.850*** (.965)	7.063*** (.970)
Independent var. (ref.=Independent public housing complex)	Randomly-mixed housing complexes	.118 (.237)	.456** (.221)	.186 (.228)
	Non-randomly-mixed housing complexes	-.172 (.236)	.787*** (.237)	.000 (.233)
	Buy-to-rent public housing	.944*** (.241)	-.019 (.224)	.376 (.229)
Control var.	Satisfaction with indoor housing facilities	.135 (.137)	.007 (.132)	.044 (.135)
	Satisfaction with outdoor housing facilities	.502*** (.165)	.102 (.157)	.270* (.159)
	Neighborhood satisfaction	.357** (.162)	.228 (.155)	.639*** (.157)
	Male	-.136 (.179)	-1.262*** (.181)	-.594*** (.175)
	Age	.039*** (.008)	.025*** (.008)	-.009 (.007)
	Education	-.030 (.080)	-.033 (.078)	-.050 (.075)
	Married	.264 (.226)	.539** (.215)	.563*** (.217)
	Employed	.399** (.184)	-.121 (.181)	.264 (.180)
	Year of residence	.004 (.011)	.047*** (.011)	.017 (.011)
	Household size	.130 (.089)	.016 (.084)	.104 (.086)
	Family income	6.857E-5 (5.285E-5)	2.968E-7 (4.809E-5)	-7.839E-6 (5.023E-5)
	Subjective health rate	.285*** (.090)	.262*** (.087)	.334*** (.087)
Summary Statistics	Degrees of freedom	15	15	15
	LL, full(unrestricted)	1441.893	1825.855	1675.8541
	Ll, constants-only(restricted)	1540.471	1958.526	1791.846
	X2 value	98.578	132.671	115.992
Pseudo-R2s	Cox&Snell	.074	.099	.087
	Nagelkerke	.106	.126	.115
	McFadden	.064	.068	.065

*p<.1; **p<.05; ***p<.01

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How Shanghai's Urban Heritage Conservation Plan Loses Effect? Paradoxical Governance Goals and Disparities in the Regeneration of Residential Historic Neighborhoods

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Abstract

Shanghai is a pioneer for urban heritage conservation in China. However, a sharp turn has emerged since 2018, where existing regeneration pathways for historic residential neighbourhoods are replaced by governmental buyouts, total demolition, and exclusive luxury housing redevelopments, facilitated by conservation masterplan revisions achieved through invitational expert participation. This paper examines the multiple self-contradictory goals that the local government plans or claims to achieve behind this sharp redevelopmental turn, and argues that these paradoxical goals – together with widespread debates and contestations across various realms that transform into coalitions of distinct stances – have necessitated the creation of a complex governmentality mediated through mainstream narratives about urban renewal. As a case study, we mapped sweeping land buyout, urban fabric change, and conservation masterplan breaches/revisions in Shanghai's Historic City Centre (*Laochengxiang*), and carried out discourse analysis based on text and video materials (n=393) to reveal dynamics of contestation, coalition formation, and governmentality production. While the Shanghai case echoes existing models such as state-initiated social engineering and state entrepreneurialism, emerging traits of "new municipalism" (manifested by self-mobilisation of non-government stakeholders) are also observed. With this perspective, we analysed risks and disparities in Shanghai's urban renewal movement, and discussed ways forward focusing on community agency.

Keywords: urban regeneration, historic district, contestation, governmentality, state entrepreneurialism, new municipalism.

1 Urban Heritage Conservation in Shanghai: Context and a Redevelopmental Turn

With a variety of heritage designations including 44 historic districts, 250 historic cityscape blocks and 397 historic cityscape streets, Shanghai is considered a pioneer for urban heritage conservation in China. In this section, we review the evolution of urban heritage conservation pathways in Shanghai as they relate to urban renewal agendas (Fig. 1 - Fig. 3), examine the sudden redevelopmental turn that resulted in the demolition of much of the city's historic fabric since 2018, analyse the multiple self-contradicting governance goals behind this sweeping city-led urban renewal movement, and raise our hypothesis that a governmentality is established to demonstrate achievement of these goals and resolve concerns and dissents regarding mass displacement, gentrification, and the loss of cultural heritage.

1.1 "Strictest Protection Measures": The Evolution of Urban Heritage Conservation Mechanisms in Shanghai

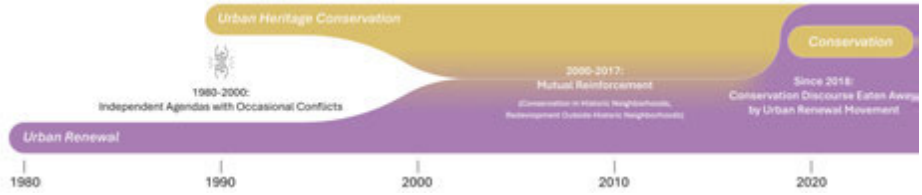

Fig. 1. Evolution of the relationship between urban heritage conservation and urban renewal in Shanghai.

1980s-2000: "Shanty Area Renewal" and Early Efforts of Heritage Conservation.

As China entered its marketisation and economic reform era, Shanghai's urban renewal project took stage in the 1980s. Early governmental focus was placed on evacuating "shanty areas" (棚户区) where per-capita housing area was less than 2 m^2, and portable toilet buckets, coal stoves, intertwined electric cables, and makeshift kitchens in corridors were prevalent (Shanghai Observer, 2018). Higher-rise and higher-value developments would be allowed block-by-block in these areas, as land was bought-up by the government and resold to developers, while existing residents were compensated by cash or apartments (either commodity housing or government-built resettlement communities, both largely in the suburbs) (Wu and Li, 2024; Chen et al., 2018; Chen, 2018).

Faced with drastic changes that started to happen in historic urban space, an awareness for cultural heritage conservation started to emerge. In 1986, Shanghai was designated among the second batch of China's National Historic and Cultural Cities. During the 1990s, early building-scale conservation efforts showed promising results: *Shanghai Municipal Regulations on the Protection and Management of Excellent Modern Buildings* was enacted in 1991, and by 1999, 398 such buildings had been designated (Zheng, 2017). Efforts for historic district conservation also took shape, as 234 neighbourhoods and 440 historic building clusters were identified. Nevertheless, due to a lack of enforcement mechanisms, some historic districts still witnessed wholesale demolition (Shao, 2016).

2000-2017: The Rise of Urban Heritage Conservation in an Expanding City.

New developments were concentrated in the outskirts, as Shanghai rapidly expanded into its suburbs and satellite towns in the early 21st century. In the city centre, salvaging cultural heritage became a consensus after the past decade of "great demolition and construction" (大拆大建).

Shortly after the promulgation of *Shanghai Municipal Regulations on the Protection of Historic and Cultural Areas and Excellent Historic Buildings* (《上海市历史文化风貌区和优秀历史建筑保护条例》, hereinafter *Shanghai Regulations*) in 2002, the city raised an agenda to establish "the strictest heritage protection measures"; as a move to operationalise urban-scale heritage conservation, conservation masterplans were formulated for 12 historic districts in the city centre, which were designed to replace detailed masterplans (控制性详细规划) for these areas and serve as sole binding documents regulating land use, development and redevelopment as they relate to built heritage (Shao, 2016, p. 3).

The last update of municipally protected heritage assets was made in 2017, with a range of designations that cover 12 historic districts in the inner-city, and 32 in the suburbs and Pudong New District; 397 historic cityscape streets, 79 historic cityscape rivers, and 250 historic cityscape blocks; 1,058 listings of excellent historic buildings (covering 3,075 individual structures), and 7.3 million m^2 of local alleyway housing (里弄, or *li*-long, as Shanghai's traditional local housing type blending Chinese courtyard and Western attached townhouse typologies).

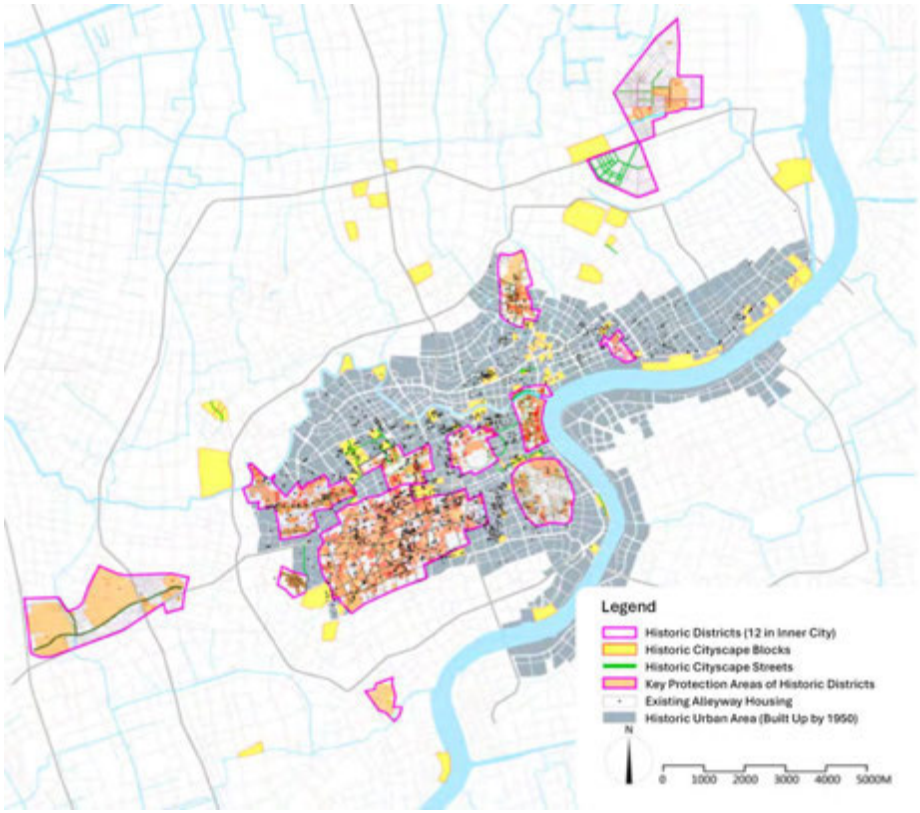

Fig. 2. Designated historic assets in Shanghai by 2017.
Source: Zhou, 2016. Translated by authors.

1.2 Three Typical Regeneration Pathways for Residential Historic Districts

Over the above two periods, flagship regeneration projects were carried out in several residential historic districts or neighbourhoods with higher heritage value and architectural quality, demonstrating three major pathways that represent local practice (Fig. 3) and showcase different stances in balancing heritage (in form and material terms), social, and economic values.

1) **Commercialisation-Oriented Restoration led by developers**, where local government and developers collaborate to turn a historic district into middle-class retail use while relocating existing residents and largely retaining the physical fabric.

2) **Fine-Grained Conservation based on government investment**, as historic districts with high architectural quality receive continuous governmental investments that help to acquire individually designated buildings and revitalise them into public cultural spaces, and subsidy the maintenance of historic alleyway blocks that serve as public or private housing.

3) **Mixed-Use Conversion initiated by local residents and partner stakeholders.** The most famous case for this pathway is *Tianzifang*, where local residents formed an autonomous association and rented unused industrial spaces and their alleyway housing units to artists and retail businesses under the support of local community council (街道), achieving the co-living of local residents, new migrants, and tourists.

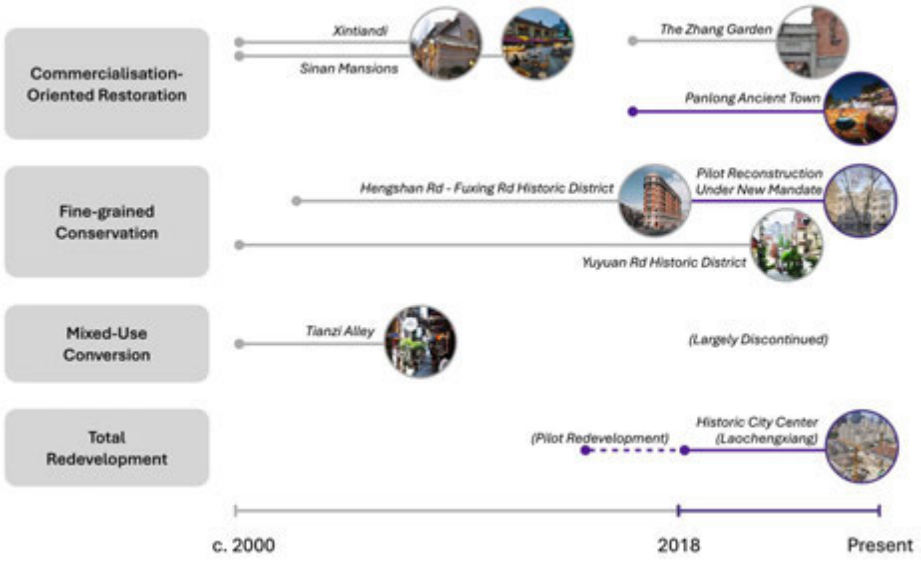

Fig. 3. Regeneration of residential historic districts in Shanghai: models and key cases.
Source: Thumbnails from the Internet; illustration by authors.

1.3 A Sudden Redevelopmental Turn

After the "shanty area renewal" movement, urban renewal programs have been continued in Shanghai under the name of "old district renewal" (旧区改造) (Wan, 2022). However, much prudence was given to neighbourhoods with heritage designation or potentially worth preserving. In 2017, local government policies stressed that living condition improvement should be placed *under* the condition that old buildings in inner-city (such as various forms of alleyway housing) must be protected in principle and demolished only under exceptions (The Paper, 2017).

However, since 2018, many residential historic districts and neighbourhoods in the city centre have been targeted for urban renewal accompanying local administration changes. In 2020, the

city started a "three-year old district renewal battle" (三年旧改攻坚战), requiring old districts to be renewed "as fast and early as possible" (Shanghai Press Release, 2021). As an urban renewal agenda was written into the Central Government's *Outline of the 14th Five-Year Plan* in 2021 (Central Government of China, 2021), Shanghai raised an *Urban Renewal Action Plan* (SMBPNR, 2023) with a key goal to eliminate all "low-quality housing" (locally called "second-class dilapidated housing and below, or 二级以下旧里) in inner-city by 2025, which collocates substantially with the 7.3 million m^2 of alleyway housing that should be preserved, making them a targeted site of intervention (Huangpu District Housing Management Bureau, 2023; Zhang, 2021). By 2022, urban renewal for all major blocks of "low-quality housing" had come into effect (Shanghai Observer, 2022).

Fig. 4. Demolition and redevelopment in the current urban renewal movement. (a) An ongoing redevelopment project (Jade Fragrance Garden, Phase II) in *Laochengxiang*, 2022; (b) Qiaojia Road, *Laochengxiang*, 2024.
Source: (a) National Business Daily, 2022; (b) photo by authors.

Such rapid pace gives rise to a "total redevelopment" model applied to many historic neighbourhoods and districts – particularly *Laochengxiang* (老城厢), Shanghai's historic city centre – as an exact copy of the "great demolition and construction" movement in the 1990s (see Zhang, 2021). Governmental buyouts are prevalent, as land was cleared and resold for often luxury redevelopment, only sparing very few most important landmarks (see Knyazeva, 2022; Zhang and Wu, 2021). All local residents are relocated in the process upon cash compensation, with conservation masterplans or detailed masterplans revised (through the invitational participation of experts) to allow for unprecedented high-density redevelopments of 100 or even 150 metres (see Fig. 9(a)). Urban historic fabric is replaced by exclusive gated communities of upper-class attached townhouses and high-rise apartments, which completely alter socio-spatial patterns made up of historic buildings, streets, alleys, retail storefronts and public spaces, killing community vitality manifested in mixed uses and a mixed residential profile – the exact key characters that make alleyway housing blocks amiable spaces and self-supporting "cities within cities" (Zhao et al., 2023). While a short-term "triple-win" result is seemingly achieved for local government, developers, and residents, many areas with distinct

historic urban and social fabric – which constitute an important cultural infrastructure for global cities (UNESCO, 2013) – are permanently lost.

While there are still a few projects that adopt the "commercialisation-oriented restoration" pathway (e.g., Panlong Ancient Town), or even seek to reconstruct below-standard alleyway housing for existing residents out of governmental cost in an attempt to prove the continuity of "fine-grained conservation" (e.g., the Cloud Water Villas (云水别墅) in Hengshan Rd-Fuxing Rd Historic District, see Shanghai Observer, 2024), demolition and out-of-context redevelopment undoubtedly play a predominant role in the current urban renewal movement.

This government-led urban renewal movement shows a very strong character of state-led gentrification (He, 2019), and reflects the state entrepreneurialism model (Wu et al., 2022) where the state acts through the market, but also has broader political agendas beyond growth-machine logics. In fact, it may even be regarded as a case of "state-initiated social engineering" (Scott, 1999, 4), given the close collaboration between the government, developers, and government-owned land expropriation companies, as well as local community councils, neighbourhood associations (居委会), and conservation masterplan revision mechanisms being mobilised for the agenda.

On the other hand, counternarratives for conservation haven't been able to have any comparable agency, and as we will continue to show, a governmentality has been formed to attribute the dilapidation of historic districts to heritage itself, and create a binary opposition between heritage conservation and living condition improvement. In sum, the current urban renewal movement signals the abandonment of Shanghai's urban heritage conservation measures formed upon three decades of exploration, and leads to extensive disappearance of historic urban landscape as the city's heritage conservation masterplan fails to function.

1.4 Paradoxical Governance Goals, Contestations, and the Creation of a Governmentality

At the backdrop of this sharp and enormous redevelopmental turn, we ask the following questions:

- What are the goals that the local government plans or claims to achieve behind this sweeping urban renewal movement? How are top-down narratives and the combination of different types of regeneration/redevelopment projects utilised to support these goals?
- How are urban renewal campaigns received, debated and contested on-the-ground? What are the contradictory voices projected in different realms of discourse (specifically, the public, the academia, and social organisations / participatory political parties (民主党派) which serve an advisory role in China's urban governance), and how have them influenced the trajectory of this movement?

Our hypothesis is that there are multiple self-contradictory governance goals – whether explicit or implicit – in the urban renewal movement, including land finance, living condition improvement, and cultural heritage revitalisation, which are all written under the low-quality housing elimination mandate by 2025. Meanwhile, widespread debates and contestations have emerged across different realms of discourse, forming into coalitions of distinct stances. These conditions necessitate the production of a relatively complex governmentality mediated through mainstream narratives that renders urban renewal as a progressive movement, opposes heritage conservation against living condition improvement, reduces the scope of "cultural heritage",

frames heritage conservation as a result of urban renewal, and capitalises the cultural and historic connections of historic neighbourhoods to appeal to potential luxury housing buyers; it even manifests itself through flagship programs on intangible and cultural history, and sympathies displayed to local residents on their "bittersweet" experience. These techniques serve not only to resolve concerns and dissents, but also to demonstrate achievement of the government's own paradoxical goals. In the following sections, we seek to ground-truth this observation through policy, discourse and spatial analyses, featuring a case study of Shanghai's historic city centre (*Laochengxiang*).

To begin with, we argue that Shanghai's current urban renewal movement reveals the following self-contradictory governance goals:

- **Low-Quality Housing Elimination** as the overarching political agenda. Completion of buyout/expropriation programs in inner-city districts was celebrated as a major achievement of the local government in 2022, and was viewed as successful completion of a key agenda that involved three decades of effort (Shanghai Huangpu, 2022b).
- **Living Standard Improvement** as the justifying rationale. Extremely congested living environment, safety risks posed by exposed electricity cables, lack of basic living and sanitary infrastructure, and particularly, the persisting existence of portable toilet buckets ("马桶") have been repeatedly used as rhetorics to stress the living standard improvement dimension of urban renewal, which in turn serves to rally public support (especially support of local residents) and suppress pro-conservation voices (see for example, Xinhua News, 2019).
- **Cultural Heritage Revitalisation** as a side goal that is strongly claimed but barely achieved. While carrying out large-scale redevelopments that wipe away historic urban fabric, new concepts such as "urban fabric conservation" and "cityscape conservation" were constructed in local policies, to allow for practices that breach existing conservation masterplans (Zhang, 2021).
- **Land Finance** as an unspoken, but arguably the most important motive. State land ownership allows local government to use revenue collected between buyout and relocation costs and development right sale income to serve its needs or goals (see Wu, 2021). In Shanghai's case, many historic districts and neighbourhoods with dilapidated "low-quality housing" are located in the very core of the city, and are repeatedly sold for record-breaking prices: for example, several blocks in the Historic City Centre (*Laochengxiang*) were sold at ¥17.6 billion ($2.7 billion) in 2021; in 2023, 10 land tracts along the historic East Jinling Road (see Fig. 13) were sold for an astounding ¥22.1 billion ($3.15 billion) (National Business Daily, 2022; 2023).

As governmental buyout programs often manage to garner majority support by local homeowners, all these imperatives – except cultural heritage revitalisation – seem to work well with the urban renewal project on-the-ground. However, as we will show through the case of *Laochengxiang*, heritage conservation – both as a stated goal of the local government and a highly contested debate across different realms of the local society – is something that ultimately has to be responded to, and ostensibly resolved, through the creation of a govermentality embedded in mainstream narratives.

2 Contradictions, Debates, and Governmentality in Practice: The Case of Historic City Centre (*Laochengxiang*)

The city government-led wholesale redevelopment campaign was not implemented without controversy and pushback. Much of such conflict has focused on the Historic City Centre (*Laochengxiang*/老城厢) of Shanghai, a designated historic district of around 2 square kilometres that stemmed from Shanghai's indigenous walled city, and is commonly understood as the city's "origin point" (note 1). In this section, we use *Laochengxiang* as a case study to understand how existing heritage conservation masterplan is breached in Shanghai's urban renewal movement, and how contradictions and debates emerged across various realms into coalitions of distinct stances, and finally got resolved through the creation of a complex governmentality mediated through multiple mechanisms of public communication and political participation.

2.1 The Pilot Redevelopment Project: Jade Fragrance Garden (露香园)

Fig. 5. The location of *Laochengxiang*, based on a 1918 map.
Source: Library of Congress. Annotation by authors based on Zhou, 1999.

With more than 700 years of history, *Laochengxiang* is the origin of Shanghai's local culture. Labelled as "The Chinese City" in colonial-era maps, its historic urban fabric comprises streets filled from waterways, vernacular dwellings, temples/churches, administrative complexes, gardens, academies and public spaces (marketplaces, alleyways, and guild halls) surrounded by a city wall-turned circular road, offering a unique counternarrative juxtaposed with the colonial modernity embodied in the urban landscape of former British, American, and French settlements around it (Chen, 2004; Wang et al., 2017; Zhang and Wu, 2021; Qian, 2021) (Fig. 5). Buildings in *The Chinese City* historically possessed more informality than those in Western settlements, given their wooden construction and an often lack of sanitary systems such as tap water and toilet (Roskam, 2019, p. 107). Spontaneous and unregulated densification persisted for most of the 20th century, making *Laochengxiang* the densest area in Shanghai while exacerbating safety, congestion, and sanitary issues (Zhang, 2020; Zhang and Wu, 2021) (Fig. 6).

Fig. 6. Views of *Laochengxiang*. (a) The Yu Garden, a local landmark; (b) street view before current urban renewal.
Source: (a) - Tripadvisor; (b) - photo by authors, 2016.

By 2005 – when the conservation masterplan of *Laochengxiang* was made – some high-rise developments had already emerged within its boundaries (Fig. 7). Since then, a standoff between urban renewal and heritage conservation was achieved, leaving urban fabric in *Laochengxiang* largely untouched, except for occasional repairs and demolition of some illegal additions.

This fragile continuity was first disrupted in 2013, when a pilot luxury residential redevelopment project named "Jade Fragrance Garden" (*luxiangyuan*/露香园) (note 2) located in *Laochengxiang*'s northwestern corner went on market for pre-sale. Totalling 300,000 m^2 of floor area, the project incorporated attached townhouses, high-rise apartments up to 100m, club houses, and "two hotels of different formats" (Fig. 8(a)). According to historic sale data from local real property platforms Fang.com and Sohu Focus, high-rise apartments in Jade Fragrance Garden were initially touted at ¥80,000 ($13,000)/$m^2$ (as compared to an average ¥56,800 ($9,200)/$m^2$ within the city centre around the same time), with exceptionally large unit sizes of 200-570 m^2. In 2020, its attached townhouses were launched as a rare find in city centre at a price of ¥210,000 ($31,000)/$m^2$, while price for its high-rise apartments had risen to ¥140,000 ($20,700)/$m^2$ (Fang.com, 2013; 2024; Sohu Focus, 2024; SRETA, 2023).

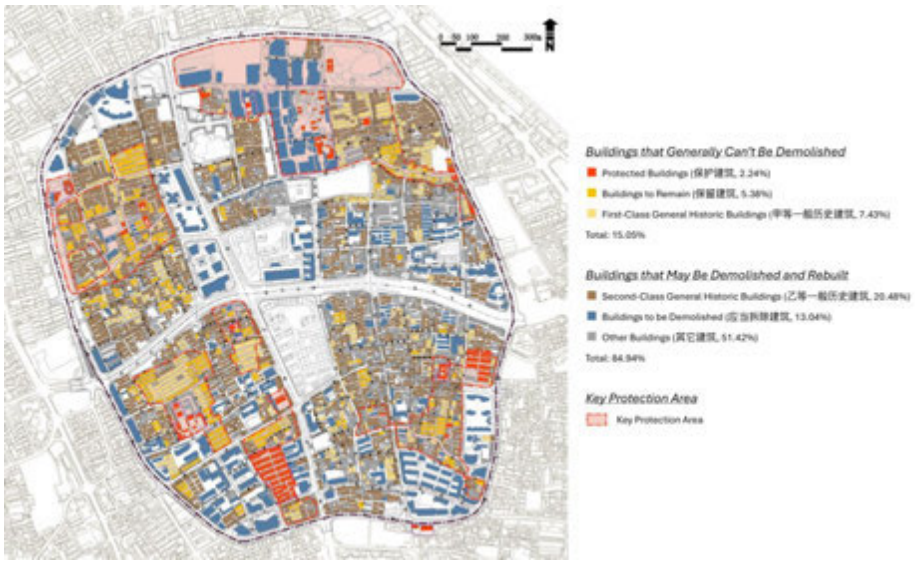

Fig. 7. *Laochengxiang*'s Conservation Masterplan, 2005.
Source: Wu and Wang, 2007, pp. 142-143; annotation by authors, based on Zhou, 2016.

Fig. 8. Urban fabric change brought by the Jade Fragrance Garden Project.
Source: (a) - BIDG; (b) (c) - illustration by authors.

Developed by a joint venture of two major municipal enterprises – Shanghai Municipal Investment Group and Shanghai Construction Group, this redevelopment totally eradicated historic fabric on its site, breaching important designations in *Laochengxiang*'s conservation masterplan (Fig. 8(b) & 8(c)). First of all, not all historic buildings that should be retained were retained, and among those that were spared, at least one (the Zhao Residence) was first demolished and then reconstructed as a "historic and cultural centre"; secondly, one of the only two remaining sections of *Laochengxiang*'s historic city wall was demolished in the redevelopment process; thirdly, while the townhouse-type redevelopment offers a somewhat context-aware scale (albeit presenting a hyper-gentrified image), it contradicts with the masterplan's regulation that new construction shall be strictly discouraged in the key protection area; and finally, intense high-rise developments broke *Laochengxiang*'s landscape continuity

and very sense of place (see Sohu Focus, 2024; Xinmin Evening News, 2012; Shanghai Evening Post, 2012; Shanghai Press Release, 2020).

Besides formal and material changes, it is the displacement and elimination of mixed uses and mixed residential profile manifested in this exclusive luxury redevelopment, as well as the privatisation of these urban blocks (public alleys between luxury townhouses have been guarded as of the authors' site visit in spring 2024) that ultimately killed the site's authenticity and vitality. Furthermore, very little of the site's cultural history is commemorated or spatialised in the project (except for its name, which refers to a garden that existed here until the mid-19th century), while it effectively capitalises on presenting a "Shanghai style blending the East and the West" and "inheriting and carrying forward the cultural context of *Laochengxiang*" (BIDG, 2024; CREDAward, 2021).

2.2 Sweeping Buyout Programs and Breached Conservation Masterplan

The Jade Fragrance Garden project set an example for what would follow on a sweeping scale for the whole Laochengxiang: exclusive luxury townhouses paired with high-rise apartments. Based on notices posted on Huangpu District Government's official website, we mapped land tracts that have been subject to governmental buyout and expropriation since 2015 (Fig. 9(b)), which constitute around 50% of the whole area of *Laochengxiang*. Along with another around 35% of the area that already witnessed large-scale redevelopment or had out-of-context buildings by 2015, *Laochengxiang* is placed under a massive process of social-spatial restructuring.

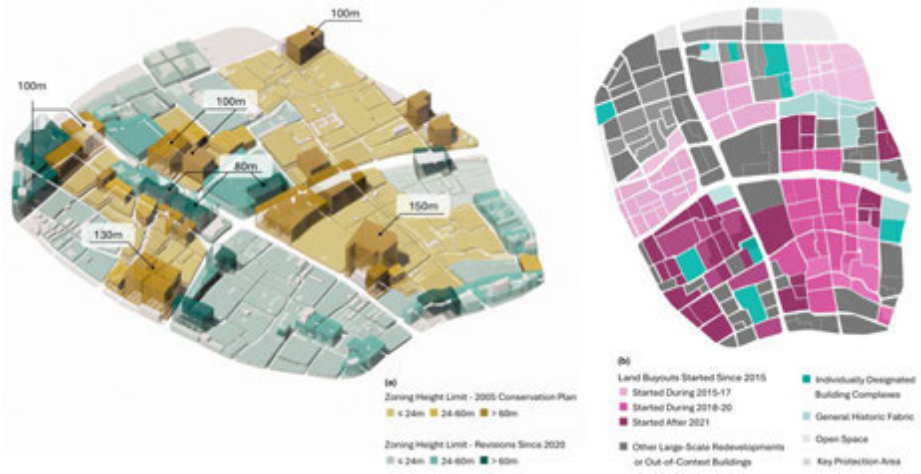

Fig. 9. Conservation masterplan revision and land buyouts in *Laochengxiang*.
Data Source: Huangpu District Government Portal; The 2005 Conservation Masterplan; Google Earth.
Illustration by authors.

On tracts where governmental buyout has been completed while redevelopment has not yet started, all residents have been relocated, and all ground-floor openings of existing buildings have generally been sealed with cement (see Fig. 13). While official narrative for this new round urban renewal is to "keep the buildings, and relocate the people" (*liufang buliuren*, or 留房不

留人, see Knyazeva, 2022), prevalent wholesale demolitions (see Fig. 4(b)) suggest that the very physical fabric is very well likely to be lost as well.

To understand how these sweeping changes were legalised against - and meanwhile predicated upon - the city's early 2000s conservation policy-making, we need to take a closer look into the details of *Laochengxiang*'s 2005 heritage conservation masterplan (Fig. 7) and its subsequent rezoning process (Fig. 9-10). In the 2005 masterplan, buildings in *Laochengxiang* were coded into six categories, from higher to lower heritage value:

1) "protected buildings" (保护建筑, 2.24% of the building stock), which are buildings subject to individual heritage designation and protection under other laws, such as Cultural Relic Protection Units under the *Cultural Relics Protection Law* (《文物保护法》) and "Excellent Historic Buildings" under the *Shanghai Regulations*;
2) "buildings to remain" (保留建筑, 5.38% of the building stock), which can be altered, but not relocated or demolished in principle;
3) "first-class general historic buildings" (甲等一般历史建筑, 7.43% of the building stock), which generally shouldn't be demolished, unless they are reconstructed in original forms;
4) "second-class general historic buildings" (乙等一般历史建筑, 20.48% of the building stock), which can be replaced by new buildings that fit into the historic context and fabric;
5) "buildings to be demolished" (应当拆除建筑, 13.04% of the building stock), which are out-of-context buildings built after 1949; and
6) other buildings (51.42% of the building stock).

This classification is accompanied with the designation of "key protection areas" (核心保护范围), where new construction and expansion is "strictly controlled" and floor area ratio (FAR) is not allowed to increase from the 2005 baseline.

Paralleling government buyouts, this conservation masterplan has witnessed multiple local revisions since 2020, many of which are backed by specific redevelopment schemes. Height limit for some blocks were loosened to 100 or even 150 metres (Fig. 9(a)), and major changes or breaches happened regarding previously instated rules (Fig. 10):

- Blocks of "second-class general historic buildings" (which constitute the expansive historic urban fabric in *Laochengxiang*) are almost always demolished, and replaced by townhouses or out-of-context towers depending on whether they are located in the key protection area or not.
- Most "buildings to remain" and "first-class general historic buildings" would also be demolished. Some of these designations are deleted in newer iterations of the plan, and some are lost during redevelopment implementation.
- Afterall, what seems to be spared are only "protected buildings", or those individually protected by other laws (see Knyazeva, 2022; Zhang, 2021).
- Key protection areas have been reduced to merely a context control area, compromising strict restrictions on new construction.

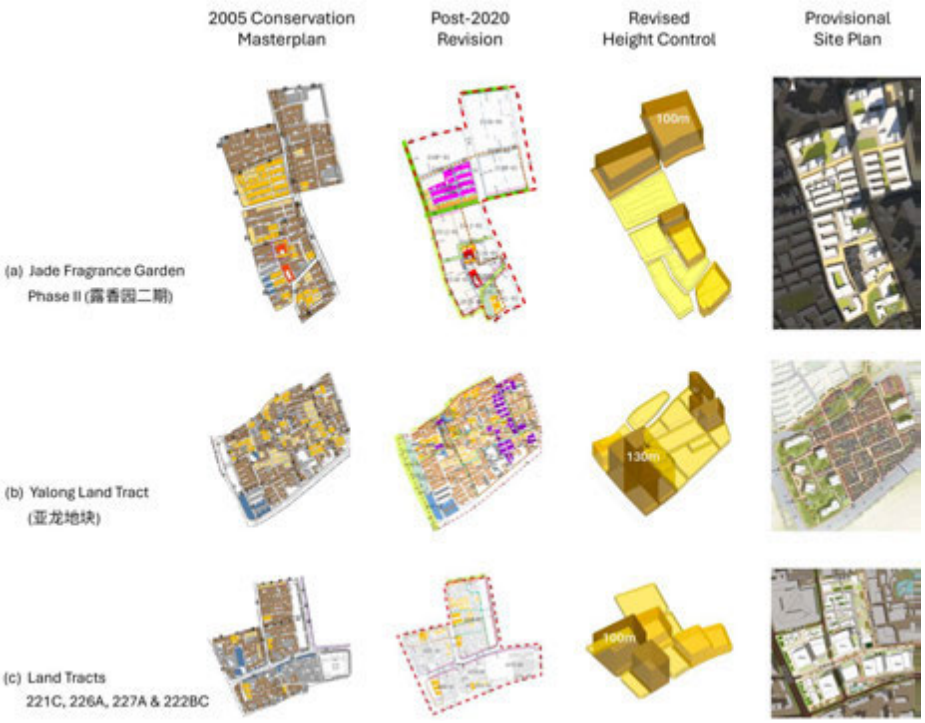

Fig. 10. Cases of conservation masterplan revision.
Data Source: Huangpu District Government. Illustration by authors.

While Shanghai doesn't yet have a public hearing process for rezoning, many of these changes wouldn't have been possible without the *special expert argumentation procedure* (专家特别论证制度) which involves the invited participation of experts within a pool. While pervasive zoning changes against heritage conservation principles demonstrate the shortcomings of invited participation, they are also in many ways predicated by flaws in the 2005 conservation masterplan, which include:

- An architectural significance-oriented approach that systematically downplayed the value of vernacular and indigenous historic urban fabrics of higher informality. Only around 15% of all buildings were designated as "undemolishable" (protected, buildings to remain, or first-class general), and the "key protection area" only covered around 27% of *Laochengxiang* (Zhou, 2016).
- Inconsistent building classifications and conservation guidelines among masterplans of the city's first batch of historic districts (twelve in the city centre), and a common lack of enforcement mechanisms. In *Laochengxiang*'s case, this has reduced the effectiveness of conservation masterplan to nearly zero.
- A relatively laissez-faire attitude to high-density redevelopments outside the key protection area. A significant number of blocks had already been zoned to 50-100m in the 2005 masterplan, especially those along the horizontal and vertical arteries that cut across *Laochengxiang*, and those in its periphery.

2.3 Widespread Contestations and Formation of Coalitions

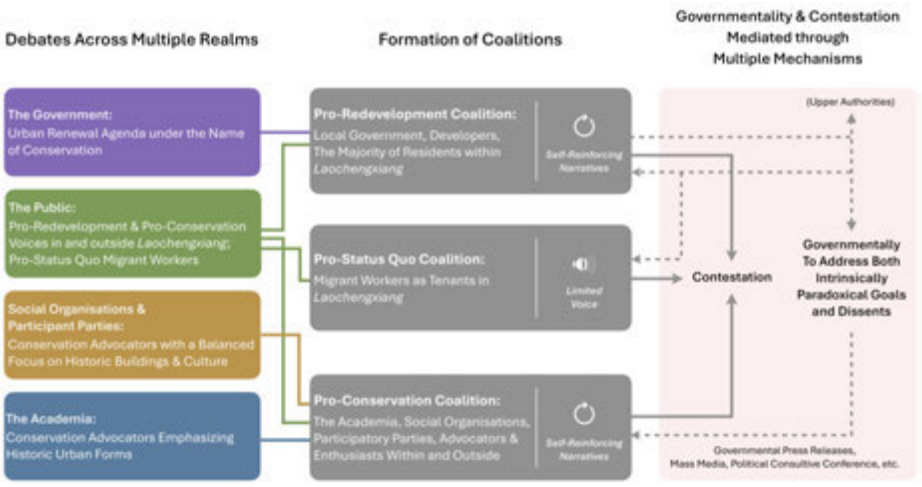

Fig. 11. The formation of coalitions and interactions between them in the widespread debate regarding *Laochengxiang*'s future.

The radical urban renewal movement has spurred polarised public responses and produced a ripple effect that gives rise to widespread contestations and debates. In the following two sections, we examine how debates across different independent realms overlap on, interconnect with and permeate into each other, forming three coalitions of distinct stances (pro-redevelopment, pro-status quo and pro-conservation), which leads to the contestation of ideas and the emergence of a top-down governmentality that are mediated through multiple mechanisms of public communication and political participation (Fig. 11). We argue that such governmentality serves dual purposes, as it addresses both the intrinsically paradoxical goals of the local government itself, and resolves dissents raised by other coalitions.

Our analysis employs a discourse analysis method and is based on evidence presented by publicly available materials including online posts (news articles, blog posts, social media posts, etc.), governmental planning and policy documents, press releases and correspondences, documentaries (*Farewell, My Humble Adobe* ("老城厢·上海的家") and *Reshaping Laochengxiang* ("重塑老城厢") by the *Doculife* channel of city-owned Shanghai Media Group), uploaded videos, academic papers, and particularly their comment sections whenever available. We gathered these materials through online search (see note 3 for detailed parameters), ending up with 289 online articles, 26 governmental documents, 34 journal papers, and 44 videos (including the 2 aforementioned documentaries), creating a total sample size of 393.

We first corralled these materials into four realms: the government, the public, social organisations and participatory political parties, as well as the academia. We then conducted a word-cloud analysis (through NVivo) for text-based materials to reveal the predominant stances and narratives in each realm, with results shown in Fig. 12.

Fig. 12. Word-cloud analysis of narratives by realm of debate.

Overall speaking, the governmental narrative highlights the buildings (it seeks to redevelop) and the residents (it seeks to relocate), while extensively uses the word "protection/conservation" (保 护) to explain its rationale. However, the "protection/conservation" keyword is accompanied by a long list of high-frequency terms associated with the sweeping movement of total redevelopment, such as "buyout/expropriation", "land tract", "community council", "contract signing", "construction", "push forward", "implement", and "initiate". Contrasting this narrative, the key perception of the public is "demolishment/relocation" (the Chinese word "拆迁" means both these two concepts), which suggests ongoing substantial changes to their built environment and loss of their memory and culture (as evidenced by keywords such as "in the past", "currently"/"nowadays", "to retain", "already", and a number of very specific locales, such as West Gate, South Gate, and Yu Garden). On the other hand, both social organisations/participatory political parties and the academia show a strong pro-conservation stance, with the former placing a more balanced focus between built heritage and cultural traditions, while the latter making a vociferous outcry for the protection of buildings and the integrated conservation of historic urban landscape (as evidenced particularly by multiple street-scaled keywords in this realm, including "street" itself (街道), "alleys" (街巷), and "alleyways" (里弄/*li-long*) as a specific local urban space).

Based on this overall understanding, we then examined collected materials piece by piece, to understand the nuances associated with the debates and paradoxes within each realm:

- **Governmental Narratives.** The actual behaviour of the local government is undoubtedly pro-total redevelopment. However, a number of its on-the-ground programs – such as exhibitions, lectures, workshops, oral history programs, and volunteering events where elementary school pupils introduce *Laochengxiang*'s vanished city gates on bus line 11 that goes along its boundary (Shanghai Huangpu, 2023b) – also incorporate a strong inclination to commemorate local heritage and cultural history. Nevertheless, these programs largely focus on the intangible cultural history of the area, without countering the physical wiping-away of historic fabric that characterises much of the debate around *Laochengxiang*.

- **Narratives in the Public Realm.** Public narratives around the redevelopment of *Laochengxiang* is particularly contested, as some online articles with explicit stances may garner more than 100 comments, igniting heated disputes among commentors. The broader *public* in examined materials may be characterised into the following four groups:
  a) Pro-redevelopment local homeowners. Homeowners in *Laochengixang* generally display a strong support for "old district renewal" (Zhou, 2018; Tang, 2019; Shanghai Huangpu, 2023a), which creates a wide divergence between them and pro-conservation experts. Some resident would ask: "why wouldn't those who fight for preserving *Laochengxiang* live here? We've had enough" (Jiang, 2019, comment section).
  b) Enthusiasts and conservation advocators in and outside *Laochengxiang.* Many bloggers, vloggers, photographers, and those lived or frequented *Laochengxiang* have come back to visit local shops again or record its daily life before it "loses connection and memories" (see NetEase Witness, 2019; SH Citywalk, 2021). A netizen questions the renewal movement, stating that the neighbourhood was demolished simply because it was "deemed valueless by the rich" (Yisanxian, 2021, comment section). Enthusiasts who live in *Laochengxiang* have also made much effort in studying, recording, and commemorating its history and physical remains, with a local journalist going through the lengths of publishing books at his own costs (Wang, 2020; Mi, 2020; Yi, 2023; Yan, 2024).
  c) The unheard pro-status quo voice of migrant tenants. By 2019, more than 40% (85,000) of *Laochengxiang*'s 200,000 residents are migrant workers (Zhang, 2020), who reside in small and subdivided units, and make an urban living upon the low rent associated with informality. They seem to possess a pro-status quo stance, as either the restoration required by heritage conservation or the displacement brought by urban renewal brings significant uncertainty to their livelihood (see Chen, 2023). Due to limited agency in urban politics and on social networks, their voices are heard not directly, but through attention given by the public news media.
  d) Advertorials by developers. Not unlike how the Jade Fragrance Garden project was advertised, advertorials for ongoing new developments are seen in the news media, singing praise to *Laochengxiang*'s cultural glamour as Shanghai's origin point, and claiming to have inherited such glamour through the creation of luxury properties. For instance, a project boasts "low-density Shanghai-style villas" that "uncover obliterated redolence from past days" and transform *Laochengxiang* from "Shanghai's origin" into "Shanghai's heart" (Shanghai Observer, 2023).

- **Social Groups and Participatory Political Parties.** China operates upon a multi-party collaboration system (多党合作制度), where the governing Communist Party is accompanied by eight other participatory parties serving advisory roles, through the Policital Consultative Conferences (政协) at multiple levels. In recent years, at least four participatory parties – Revolutionary Committee of the Chinese KMT (民革) (Zhan, 2022),

China Democratic League (民盟) (2018), Association for Promoting Democracy (民进) (Shanghai Observer, 2019), and Jiusan Society (九三学社) (2017) – have actively advocated for more serious and intergrated conservation of *Laochengxiang*'s cultural heritage and better recognition of its values via the political consultative conference platform. Generally, these recommendations showcase a strong focus on the human aspect of cultural heritage, addressing issues such as large-scale displacement, the hollowing local community, loss of intangible heritage and livelihood, and underutilisation of not-yet-demolished buildings. Meanwhile, various social groups and NGOs also contributed to create a more concerted effort (see Guo, 2019; Zhu and Wang, 2022).

- **Voices from the academia.** Local scholars in the fields of urban planning and heritage conservation have been long-time advocators of *Laochengxiang*'s integrated conservation as well. In a 2017 symposium on *Laochengxiang*'s *Past, Present and Future,* local scholars stated that "we can't see *Laochengxiang* disappear piece by piece in front of our eyes" (Website on Architectural Conservation, 2017). Particularly, many scholars have developed critical counter-narratives regarding the official rationales for redevelopment: Zhang (2021) used the word "constructive destruction" to describe the result of living condition improvement being established *against* heritage conservation efforts, and stated that "simplified movements may eradicate toilet buckets, but not poverty." Similarly, architectural historian Li Yingchun questioned "why can't we just have several good public toilets?" (see Jiang, 2019).

The analysis above reveals the intricacies that have emerged in the debates, narratives and stances *within* each realm, but what makes the *Laochengxiang* case even more complex and interesting is that like-minded groups have interconnected across realms in dynamic ways and formed coalitions based on their stances. In many cases, inter-realm collaboration serves to reinforce a coalition's narratives, casting a stronger social impact. Specifically, the following three coalitions are observed in the power struggle to define *Laochengxiang*'s future:

- **The pro-redevelopment coalition**, which consists of the local government, invited experts, city-owned or private developers, and the majority of local homeowners. The pro-redevelopment stance of local homeowners has made it possible for the government to paint urban renewal as a beneficial process responding to local residents' needs and outcries, as governmental press releases often portray senior local residents who have been yearning for living condition improvement throughout their whole life, and describe the applause and cheers when their dreams finally come true (Shanghai Huangpu, 2022a; 2023a; Tang, 2019; Doculife, 2023). Interestingly, the "masses of positive cases" during Covid pandemic is also used as a rationale for relocation, not unlike the role of toilet buckets (Tang, 2022b; Zhou, 2022).

- **The pro-status quo coalition.** As mentioned earlier, the pro-status quo coalition is mainly composed of migrant workers as tenants, who actually don't showcase a strong sense of alliance due to their marginalised voice and lack of partners in other realms of discourse.

- **The pro-conservation coalition**, represented by local academia, social organizations and participatory political parties, and conservation advocators and enthusiasts within and outside *Laochengxiang.* In fact, several leading scholars advocating for integrated conservation are themselves high-ranked members of participatory political parties, and have played a major role in the formation of policy suggestions and proposals raised by these parties. On-the-ground in *Laochengxiang*, local scholar Li Yingchun has collaborated

with architects and photographers in the survey of alleyway housing blocks under renewal, interviewing local residents and conveying research outcomes via multiple channels including exhibition, academic publication, and book for the public (see Mi, 2021; Sinan Books, 2018; Jiang, 2019).

2.4 Governmentality as a Coping Mechanism

What we have seen in this coalition politics is that first, conflicting voices have clashed and contested intensively with each other in the mass media space. While many of these outlets are ultimately owned by or connected with state-owned news enterprises, they have still managed to present complex debates in many nuanced ways. A plethora of online posts and self-produced reports have undoubtedly further nourished these debates.

More importantly, we observed a governmentality created by the pro-redevelopment coalition (largely the local government, but also like-minded developers) operationalised through mainstream narratives that seemingly resolve dissents and concerns from the pro-status quo and pro-conservation coalitions. Akin to Stenson and Watt's (1999) view that the "social" is reformulated instead of displaced in neoliberal governance, we argue that the heritage conservation imperative is not only suppressed in a binary manner against living condition improvement, but also reformulated and achieved in ostensible and reduced ways. Moreover, in *Laochengxiang*'s case, narratives of governmentality may also be used upwards to demonstrate to higher authorities that self-contradictory policy agendas (as we discussed in Section 1.4) have all been successfully implemented. These governmentality-embedded narratives are manifested along the following directions:

- **Rendering urban renewal as a progressive movement, particularly by stressing its living condition improvement dimension.** As we've discussed earlier, unsanitary and undignified state of living environment represented by tiny per-capita space, toilet buckets, and high rate of Covid infection have repeatedly been used to rally local resident and public support for urban renewal. More importantly, this also facilitates and justifies a binary opposition between urban renewal and heritage conservation. For instance, the Qiaojia Road neighborhood in *Laochengxiang* which possesses historic street patterns (filled from rivers and streams), local courtyard houses (Zhu and Wang, 2022) and histories of many important figures (see Shen, 2023) was deemed as the area of "worst architectural quality" (Tang, 2022a), where residents would have to "look up to the Oriental Pearl TV Tower with a toilet bucket in hand" (Tang et al., 2022). Along this line, dilapidation and degradation of the area is attributed to heritage itself, pro-conservation voices are easily viewed as objection to the provision of dignified living environment, and mass relocation in the name of living condition improvement paves way for intensive redevelopment that follows.

- **Claiming that the area's cultural heritage – which has been largely reduced to buildings with individual heritage designation – has been comprehensively preserved along with and as a result of urban renewal**, through the following ways:
  a) Reducing the scope of local cultural heritage. In an official reply to a political consultative conference proposal, Huangpu District Government frames local heritage conservation guidelines as to "conserve individual legally protected buildings outside key protection area, while regulating the amount and height of new construction within key protection area" (Huangpu District Government, 2021). This interpretation largely disregarded important designations in the conservation masterplan, paving ways for demolition and luxury redevelopments.

b) Framing heritage conservation as a result of urban renewal. Two frequently mentioned success stories in governmental press releases are the *Shuyin Building* (书隐楼) and the Confucious Temple, which are acquired by the government and conserved or restored during urban renewal (Tang, 2023; Shanghai Municipal Government, 2022). However, conservation of these landmarks doesn't necessarily have to happen through urban renewal, and there seems to be no mention of how selected conservation and restoration was achieved at the cost of eliminating expansive areas of historic fabric.
c) Capitalising on *Laochengxiang*'s cultural richness and historic connections, and equating conservation with luxury townhouse redevelopment. Many redevelopment projects have made extensive effort in framing *Laochengxiang*'s cultural, historic, and spiritual qualities as major selling points, while claiming to have "inherited" culture and history through their luxury townhouses that in fact wiped away *Laochengxiang*'s historic urban landscape.
d) Flagship programs and projects on intangible and cultural history. As we've discussed in Governmental Narratives (Section 2.3), besides the above interpretations that twisted the concept of heritage conservation, there are indeed official programs to commemorate and communicate local cultural history. However, they largely focus on intangible histories and memories, and have limited influence on the diminishment of physical and community fabric that is currently happening.

- **Sympathising with the place attachment of local residents, while painting displacement and relocation as a bittersweet experience for a brighter tomorrow.** "There will be housing that fits me somewhere anyways," says a young migrant tenant who works as a barista in an interview (The Paper, 2022); "I wouldn't be willing to live in the old place after experiencing my new apartment," says a senior citizen in *Farewell, My Humble Adobe*. While this may be the case for them, urban renewal may also be eating away affordable housing options in city centre for migrant workers in large, and there are actually many aged people who still choose to live by themselves in rental units nearby *Laochengxiang* due to the place attachment they can't give up (Li, 2023). These situations reflect the flip side of urban renewal, which Qin (2013) would call "domicide".

2.5 An Ignored Place of Contestation: Historic Neighbourhoods Outside Historic Districts

While *Laochengxiang* has grabbed the attention of a great amount of people who live in or care about Shanghai, there are other arguably no less significant historic neighbourhoods in-between historic districts that have been evacuated and sealed or are being razed. As Shao (2016) argues, since Shanghai's heritage conservation plans are designed to replace detailed masterplans of specific neighbourhoods, there lacks an urban-scaled spatial strategy for heritage conservation, and conservation efforts within fragmented historic districts have actually accelerated demolition outside and in between them. While many of these neighbourhoods are placed under newer types of heritage designations (such as historic cityscape blocks and historic cityscape streets), these statuses – like designations in *Laochengxiang*'s conservation masterplan – had very little impact on their redevelopment. Similarly, the site of a UNESCO Asia-Pacific Awards for Cultural Heritage Conservation-winning project – West Guizhou Lilong (UNESCO, 2022) – has also been sealed and evacuated as of spring 2024 (Fig. 13(5)). These notable cases are recorded in Fig. 13.

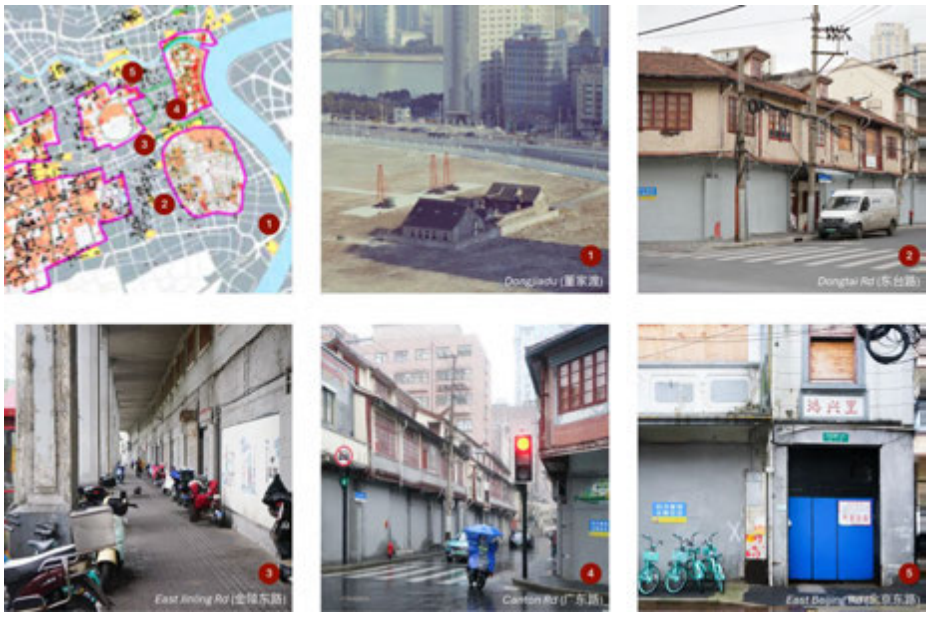

Fig. 13. Historic neighbourhoods under buyout/expropriation or redevelopment outside designated historic districts.
Source: 1 – Knyazeva, 2022; others – photos by authors.

3 Risks and Disparities in Redevelopment-Oriented Urban Regeneration Practice

So far, we have demonstrated how a ferocious urban renewal movement happened in Shanghai's historic districts and neighbourhoods in recent years in breach of local heritage conservation masterplans, and how a governmentality is formed in mainstream discourse to ostensibly resolve dissents and prove the achievement of self-contradictory governance goals. While the governmentality embedded in mainstream narratives may produce a seemingly self-consistent rationale for the government, there are in fact multiple risks and disparities in this fierce redevelopment-oriented urban regeneration practice.

- The loss of vernacular historic urban landscape and urban spatial justice. The so-called "low quality housing" (or "second-class dilapidated housing and below") blocks – which generally collocate with Shanghai's 7.3 million m^2 of alleyway housing fabric – are crucial carriers of Shanghai's indigenous historic urban landscape, and manifest the grassroots side of Shanghai's urbanity which has been profoundly shaped by its long history as a hub for migrants and immigrants. The selected and biased conservation practice based on so-called "architectural significance" (Avrami, 2020) is therefore destroying both valuable historic urban fabric and the grassroots and indigenous lifestyle manifested in local communities (which made alleyway housing blocks unique *cities within cities*). The hyper-gentrification brought by a homogeneous upper-class population associated with luxury townhouses and high-rise apartments that come after demolition and displacement will inevitably exacerbate residential segregation and class stratification, further harming the social justice of urban space (Zhang, 2021).

- Inequities in governmental investment and the failure of neighbourhood self-governance. The systematic undervaluation of vernacular heritage with greater informality has caused great imbalances in governmental investment. Under the same mandate to "eliminate low-quality housing", residents in historic districts of higher architectural quality and socioeconomic status (for example, those who live in the *Cloud Water Villas* which is located in the former French Settlement and a middle-class neighbourhood today) would be able to enjoy fine-grained conservation schemes supported by substantial governmental cost, while many migrants and grassroots local residents in general alleyway housing blocks would have to be displaced or relocated. Meanwhile, neighbourhood associations – which should serve as a self-governing entity representing and reconciliating multiple forms of grassroots interests – have regrettably become a tool to persuade local residents to relocate under the municipal government's land finance imperatives.

- Unsustainable path dependency on land finance. The "total redevelopment" pathway undoubtedly produces the quickest and largest financial revenue for the local government. While land tracts of demolished historic districts in the city centre are sold at record-breaking prices, there is no guarantee that this model will work as well in outer-city neighbourhoods beyond these flagship projects, especially considering China's property market that is weakening and turning more volatile. On the other hand, our preliminary calculation suggests that it would cost the local government ¥0.87-1.22 trillion ($120-168 billion, note 4) to buy out all "low-quality housing" in Shanghai, which may imply a significant financial risk and burden.

4 Discussion: The Rise of New Municipalism and a Pending Refocus on Community

4.1 New Municipalism in Shanghai: A New Possibility?

In the Shanghai case, the intensive contestations across realms targeted at the government-led sweeping redevelopment movement did not significantly change the trajectory of this agenda – instead, they only facilitated the production of a governmentality. However, we observed the emergence of some traits of "new municipalism" in this process, manifested by:

1) The occurrence of multiple contestations and contradictions outside the governmental decision-making process, which reflects the inability of invited participation in reaching consensus;
2) Existing political participation tools (e.g., the political consultative conference platform) that have been used in an unprecedentedly efficient manner, and voices outside the government that have casted stronger and more frequent impact than usual;
3) On the heated debate regarding *Laochengixang*'s future, the spontaneous coalition of non-governmental stakeholders have emerged and made a presence in the forms of news reports, social media, social organisations, and academic events. In this case, the local academia serves as a key node linking participatory political parties, professionals, and local residents in a joined force to survey *Laochengxiang* and advocate for its conservation.

While the pro-conservation and pro-status quo coalitions didn't achieve any substantive self-governance in *Laochengxiang*'s urban space, we still found many similarities between the trends described above and the new municipalism movement currently taking stage in Europe (Thompson, 2021). We believe that creating a larger agency for spontaneously formed

coalitions by the broader public would be an effective way to balance the crises among state-market-society relationship in Shanghai's urban renewal movement; however, a focus should be placed on mechanisms to operationalise such agency (e.g., pro-bono lawsuits on heritage conservation), and fair attention paid to disadvantaged and marginalised groups (e.g., migrant worker tenants). The emerging concept of new municipalism has provided us with a valuable perspective to observe subtly changing power dynamics in China's urban governance.

4.2 Why Shanghai Matters?

We reckon that Chinese cities are embedded with multiple exceptionalities in terms of governance models and mechanisms, creating a dependency on specific urban theories (e.g., the state entrepreneurialism model – see Wu et al., 2022). However, the Shanghai case seems to demonstrate multiple connections to urban issue across the East and the West, as well as the Global North and the Global South. As we've discussed, the close collaboration between the government, developers, and government-owned land expropriation companies and apparent land finance rationales behind urban renewal display significant Chinese characteristics (see Wu, 2021); on the contrary, extensive debates, political (or potentially political) expressions, and formation of coalitions by stakeholders outside the government show traits of new municipalism. Along another axis, *Laochengxiang*'s informality represented by its disorderly built environment and high density is very similar to the typical environment of Global South cities, while its heritage valorisation system that largely builds upon architectural and material lexicons apparently follows Global North pathways (which may in part explain why the city's heritage conservation plan failed on this specific neighbourhood). These connections make conflicts in the regeneration of historic residential neighbourhoods in Shanghai relevant to broader urban contexts, and are thus worth further investigation.

4.3 Ways Forward – Updating Spatial Strategies and Refocusing on the Community

Laochengxiang's heritage conservation plan displays a discrete focus on architectural and spatial conservation. Ironically, it didn't end up protecting either the historic urban fabric, or local culture and lifestyle. Existing studies have raised many solutions in the spatial dimension, including: respecting the legal validity of conservation masterplan, and avoiding "constructive destruction" (Zhang, 2021); recognising the values of alleyway housing and vernacular heritage, and propelling integrated conservation instead of renewal upon demolition (Zhao et al., 2023; Zhang, 2021); developing enforcement mechanisms of conservation masterplan, and protecting the alleyway fabric through progressive and small-scaled regeneration (Zhang and Wu, 2021; Cai and Huang, 2022); facilitating gradual de-densification by allowing voluntary, household-by-household relocation (see Xinhua News, 2019); balancing governmental cost in urban regeneration through transferrable development rights (TDR) (Jiusan Society, 2017), etc. These solutions all correspond to our analysis on how the heritage conservation masterplan was breached. Although some studies expressed explicit attention to the human dimension of heritage (see Zhou, 2023), less recommendations have been made on community agency – which includes not only local residents, but also the broader public. On the agenda of "integrated conservation", we'd like to conclude with the following supplemental suggestions.

- A consensus is urgently needed to structurally revert the systematic undervaluation of indigenous urban heritage. The labelling of indigenous historic urban fabric with more informality as "dilapidated districts" caused the abandonment of urban heritage conservation measures formed in Shanghai upon decades of exploration, which reveals the

poignant need to rethink the values of urban conservation, by weighing the significance of Shanghai's root and origin point against architectural significance-based criteria.

- In practice, current demolition work must be halted, with the production of new conservation planning measures targeting deficiencies in *Laochengxiang*'s 2005 conservation masterplan. Key focuses shall be placed on more strict design review for renewal projects, and the creation of more refined streetscape design guidelines (like those adopted in Hengshan Rd-Fuxing Rd Historic District as an icon of fine-grained conservation, see Wang and Xue, 2021) to address the pairing of exclusive townhouses and high-rise apartments that greatly undermine street experience.

- The *Laochengxiang* case demonstrates that cultural heritage is inseparable not only with the local community, but also with the broader public as it serves as an important symbol of urban cultural identity. Regarding the human dimensions in heritage conservation practice, we believe that:
  1) More transparency should be given to the making and revision of local conservation masterplans by implementing public hearing procedures or similar measures, as they help address shortcomings of invited participation and the evasion of debates afforded by narratives of governmentality, and help achieve a healthier state-market-society relationship.
  2) The extremely explicit pro-gentrification and anti-grassroots stance of top-down urban renewal should be rectified before all local grassroots lifestyle and retail scenes are wiped away. Mandatory affordable housing requirements shall be incorporated into redevelopment plans, to better preserve the character of alleyway neighbourhoods and give basic care to the migrant tenants' rights to the city.
  3) An asset-based community development model shall be adopted, with more focus on investing on the community itself, vis a vis on the renovation, renewal, or demolition of built heritage. During the "Reshaping *Laochengxiang*" governance experiment carried out around 2016, local communities implemented micro fire stations, public kitchens and bathrooms under the support of district government, which enhanced the area's liveability, and spurred community vitality (Doculife, 2019). We call for a comeback to such community-based, acupuncture-mannered regeneration approach, where heritage conservation goals are achieved via investments on community livelihood, small businesses (e.g., craftsmanship and local eateries), and infrastructure that actually enhance day-to-day liveability.

Notes

1 The concept of *Laochengxiang* refers to both the historic walled city *(cheng)* and a strip of blocks outside the city wall along the nearby Huangpu River *(xiang)*. We use the word here to indicate only the historic district that covers the historic walled city (now an urban area surrounded by a circular road).
2 The official translation for the project is Aroma Garden. However, we use the literal translation "Jade Fragrance Garden" to reveal connection between the redevelopment project's name and the actual garden that existed in history on site.
3 Online search parameters for discourse analysis: Chinese keywords "Shanghai" + "Laochengxiang" + "Conservation" or "Old District Renewal" or "relocation" ("上海" + "老城厢" + "保护" or "旧改" or "拆迁"/"动迁") at Google and Baidu, and Chinese keywords "Shanghai" + "Laochengxiang" at academic publication platform CNKI, as well as more targeted perusal of local government portals for disclosed information. First 200 results are collected for each pair of keywords and website, when total results exceed this number. Repetitive materials, those solely referring to neighbourhoods outside the historic district, and those of little relevance to the current urban renewal movement are excluded from analysis.
4 This preliminary calculation is based on the estimation that overall cash compensation for each m^2 of alleyway housing (including bonuses and subsidies) would be around two times the housing price nearby. Upper-limit and lower-limit values are calculated by multiplying Shanghai's alleyway housing stock (7.3 million m^2) with 2 times the average housing price in 7 inner-city districts (around ¥84,000/m^2), and 2 times citywide average (around ¥60,000/m^2), respectively.

5 Conversion between CNY and USD is made based on estimated exchange rates in different years.

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Research on Informal Residential Space Under Viaducts in Shanghai: From the perspective of Socio-spatial Transformation[i]

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Abstract

Since 2019, China has prioritised high-quality development and a 'people-centric' approach in urbanisation, emphasising 'people-oriented' planning. This shift has highlighted overlooked spaces and needs, such as the informal use of space under viaducts in inner cities due to their accessibility and unused areas. Formal spatial transformations are cautious, addressing safety, sanitation, and publicity issues.

This article examines informal living spaces under Shanghai's viaducts, focusing on activities and social networks. It aims to summarise the activity characteristics and spatial patterns of informal use, identify lacking functional needs in urban spaces, and provide suggestions for urban transformation based on socio-spatial insights. The study employs participatory observation, semi-structured interviews, and archival studies to gather information. Typological morphology analysis is used to understand spatial patterns, while actor-network theory analysis reveals the transformation of social networks.

Key Words: Informal Residential Spaces ; Spatial Equity ; Urban Facilities; Space under viaduct

1. Introduction

1.1 Urbanization and Social Integration of Migrant Workers

There is a close relationship between urbanization and migrant workers in megacities. Firstly, the process of urbanization has had a significant impact on the migration and settlement of migrant workers (Chen & Liu, 2016). With the advancement of urbanization, rural labor has become an important part of the urban labor market. Migrant workers have made great contributions to the economic development and social construction of cities. Secondly, megacities are more attractive to migrant workers (Mohabir et al., 2017). Megacities usually

have more employment opportunities, richer resources, and better infrastructure, and these factors attract a large number of migrant workers to settle in cities (Mohabir et al., 2017).

In addition, urbanization has also brought social connections and interactions between migrant workers and urban residents. Such contacts and interactions have not only promoted the diversity and cultural exchanges of urban society, but also brought conflicts between different social groups. and fusion (Liu et al., 2012).

1.2 Migrant workers in Shanghai Have Difficulty in Settling Down and Social Isolation is Obvious

The dynamic monitoring survey on the process of citizenization of migrant workers in Shanghai shows that during the "13th Five-Year Plan" period, the income and living standards of migrant workers in Shanghai continued to improve, but overall, the willingness of migrant workers to stay and settle in Shanghai has declined. The main obstacle is expensive housing and It is difficult to settle down. (Wang L.,2021)

At present, the housing conditions of migrant workers in Shanghai are still far below the average level of residential housing in Shanghai. The simple and changeable housing environment will cause social isolation between migrant workers and surrounding communities and aggravate social conflicts, which is not conducive to the stability and inclusiveness of the community. shape.

1.3 Questions of Research

In summary, the link between urbanization and migrant workers in megacities is both economically interdependent and socially interdependent. While promoting urbanization and the development of megacities, attention should be paid to the protection of the rights and interests of migrant workers and the improvement of social welfare.

Therefore, this paper aims to analyze the living space and social network of migrant workers under the viaduct of Line 3 through social research methods such as space research and questionnaire interviews. Migrant workers' life line, analyzing the characteristics of social interaction between their living space and other spaces.

2. Analysis on Spatial Characteristics of Simple Migrant Workers' Housing Under the Viaduct of Shanghai Metro Line 3

2.1 Area of Research

The research area is situated under Shanghai Metro Elevated Line 3, a location that has been informally occupied for over six months, as illustrated in figure 1. The study is structured into two distinct levels of analysis.

The first level, Scope 1, delineates a spatial range extending 5 meters outward from the residential area of migrant workers, forming a boundary line. Within this scope, the study focuses primarily on the spatial activities and interactions of migrant workers. Detailed interviews and observations are conducted to understand the daily practices, spatial usage patterns, and immediate social interactions within this confined space. This level of analysis aims to capture the micro-level socio-spatial dynamics that define the everyday experiences of the migrant community.

The second level, Scope 2, encompasses a broader living circle with a radius corresponding to a 5-minute walk from the residential area. This scope is designed to analyze the characteristics of land use types and the spatial utilisation patterns by migrant workers within this extended range. By examining different spaces within this living circle, the study aims to summarise the spatial characteristics and life trajectories of migrant workers. It explores how they navigate and utilise various urban spaces, shedding light on the interplay between their living environment and broader urban contexts. Additionally, this scope analyses the social interactions between the migrant workers' living space and other urban spaces, providing insights into their integration and interaction within the urban fabric. This dual-level approach allows for a comprehensive understanding of both the immediate and extended socio-spatial dynamics affecting the migrant population.

Figure1: The Research Scope *Source: Author's own drawing*

2.2 Analysis of the Spatial Characteristics of Residential Points

The types of buildings adjacent to the study area predominantly consist of simple temporary structures and old-style lanes that are slated for demolition. Additionally, there are some small-scale commercial buildings, and the variety of space users is relatively limited.

Based on interviews and a thorough spatial investigation of the migrant workers' settlements, several key spatial characteristics have been summarised:

First, the physical and spatial environment of the migrant workers' residences is notably poor. The dormitories are situated directly beneath Shanghai Metro Line 3, which significantly disrupts the daily lives and rest of the migrant workers due to noise and vibrations from the trains above. This positioning highlights a critical issue of inadequate living conditions exacerbated by urban infrastructural development.

Second, on the south side of the residences and directly opposite the street intersection, there are two large-scale waste recycling and processing sites. These sites contribute to a degraded environmental quality, characterised by noise, pollution, and unsanitary conditions, further impacting the well-being of the migrant residents.

Third, the spatial location of these migrant worker settlements is isolated from the surrounding community. Interviews with waste recycling personnel reveal that this isolation stems from the surrounding old lanes undergoing redevelopment projects. The decision to locate the migrant workers' residences and temporary waste recycling operations under the viaduct was driven by considerations of spatial efficiency and the operational needs of construction projects. However, this arrangement neglects the living experience and social integration of the migrant workers, underscoring a significant disconnect between urban planning objectives and the socio-spatial needs of vulnerable populations.

This isolation not only physically segregates the migrant workers from the broader community but also limits their access to essential services and social networks, contributing to their social marginalisation. The study highlights the need for more inclusive urban planning that prioritises the well-being and integration of all residents, particularly those in precarious living conditions.

Figure2: The living environment of migrant workers *Source: Photographed by the author*

2.3 Analysis on the Law of Migrant Workers' Space Utilization

After conducting extensive research, it was observed that migrant workers regularly navigate the surrounding urban space, engaging in activities primarily related to dining, leisure, entertainment, and work, as illustrated in figure 3. By superimposing the activity patterns and spaces frequented by migrant workers with the existing land use, it was discovered that their actual utilisation of space is concentrated in construction sites and small-scale businesses located at the ground level of nearby residential areas. Notably, the large commercial complex situated within a five-minute walk to the east of their residential area showed no evidence of activity by migrant workers, as neither observations nor interviews indicated any usage of this space. This suggests a pronounced preference among migrant workers for patronising smaller, local businesses rather than larger commercial establishments.

In summary, the management of these settlements reflects a perception of them as transient spaces, with spatial allocators or managers not recognising migrant workers as a long-term, integrated component of urban society. Consequently, the physical and spatial environment of these migrant worker settlements fails to foster their integration into the broader urban social network. Instead, the current spatial configuration exacerbates the isolation of migrant workers from other urban communities.

This isolation is further reinforced by the lack of infrastructural and social amenities that facilitate interaction and integration. The spatial segregation underscores the broader socio-spatial dynamics in urban sociology, where marginalised groups are often confined to peripheral and inadequately serviced areas. The findings indicate that without intentional urban planning efforts to create inclusive spaces that encourage social cohesion, migrant workers will remain segregated, perpetuating a cycle of exclusion from the socio-economic benefits of urban life. This scenario calls for a reevaluation of urban policies to incorporate inclusive practices that address the unique needs of migrant workers, ensuring their seamless integration into the urban fabric.

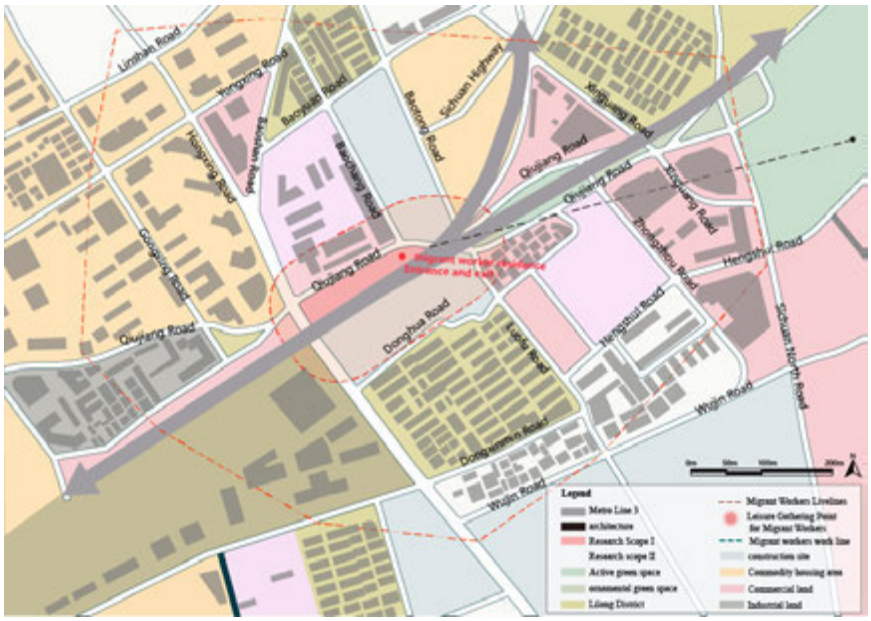

Figure3: Analysis of land use around migrant workers' settlements *Source: Author's own drawing*

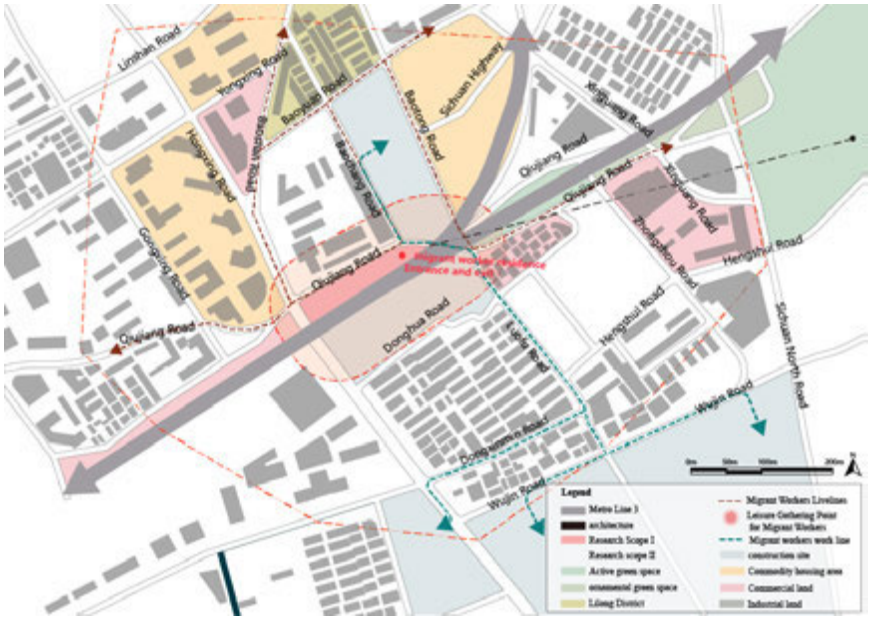

Figure4: Analysis of land use around migrant workers' settlements *Source: Author's own drawing*

3.Characteristics of the Social Network of Migrant Workers' Settlements

3.1 The Inner Social Structure of Migrant Workers

The internal social structure of the migrant workers has developed into a tightly-knit circle with the contractor at its core. According to interviews, the majority of the migrant workers residing in this area originate from Anhui Province and have been uniformly recruited by the construction team. The contractor and the workers share a common background, being acquaintances from the same village, which has fostered a stable and cooperative relationship. This cohesive social network, characterised by strong internal bonds, significantly contributes to their weak connections with surrounding communities and the broader urban social networks (Lu Wenrong, 2019).

The investigation also revealed the presence of occasional temporary migrant workers who reside in green parks outside the designated temporary residences. These individuals are unable to secure long-term positions because they are excluded by the entrenched social network of acquaintances within the migrant worker community. Consequently, their integration into the urban social fabric is even more tenuous, further highlighting the barriers to social cohesion and integration faced by these temporary migrants.

This phenomenon underscores a critical issue in urban sociology: the role of strong internal networks in perpetuating social exclusion. While these networks provide essential support and stability within the migrant community, they simultaneously act as barriers to broader social integration. The closed nature of these networks limits the opportunities for new migrants to connect with established urban residents and access the resources available in the wider urban environment.

Figure5: Temporary migrant workers outside the migrant workers' residences *Source: Photographed by the author*

3.2 Group Interaction Between Migrant Workers And Surrounding Communities Under the Viaduct

Firstly, a service-oriented group of migrant workers congregates around the periphery of their residential areas. As depicted in figure 6, retail vendors position themselves at the entrances and exits of these areas, selling daily necessities to the migrant workers. While the prices of these goods are relatively low, the variety is haphazard and there is a notable lack of quality assurance. This phenomenon highlights a significant issue: the inadequacy and inconvenience of formal business service facilities for migrant workers.

In addition to retail vendors, waste recyclers also play a prominent role in this informal economy. These recyclers collect second-hand home appliances from nearby communities slated for demolition. They refurbish and repair these items before renting or selling them, often directly targeting the migrant worker population. During the day, these recyclers choose to remain outside the residential areas of migrant workers. This choice of location is strategic for several reasons. Firstly, it places them in close proximity to waste recycling stations, facilitating their operations. Secondly, migrant workers constitute a critical consumer base for such refurbished goods, making this arrangement mutually beneficial for both the recyclers and the workers.

This phenomenon can be understood within the framework of urban sociology, where informal economies often emerge in response to gaps in formal service provision. The clustering of retail vendors and waste recyclers around migrant worker residences illustrates the adaptive strategies employed by both service providers and consumers in marginalised urban spaces. These

informal activities not only cater to the immediate needs of migrant workers but also reveal the underlying socio-economic dynamics that shape their everyday lives.

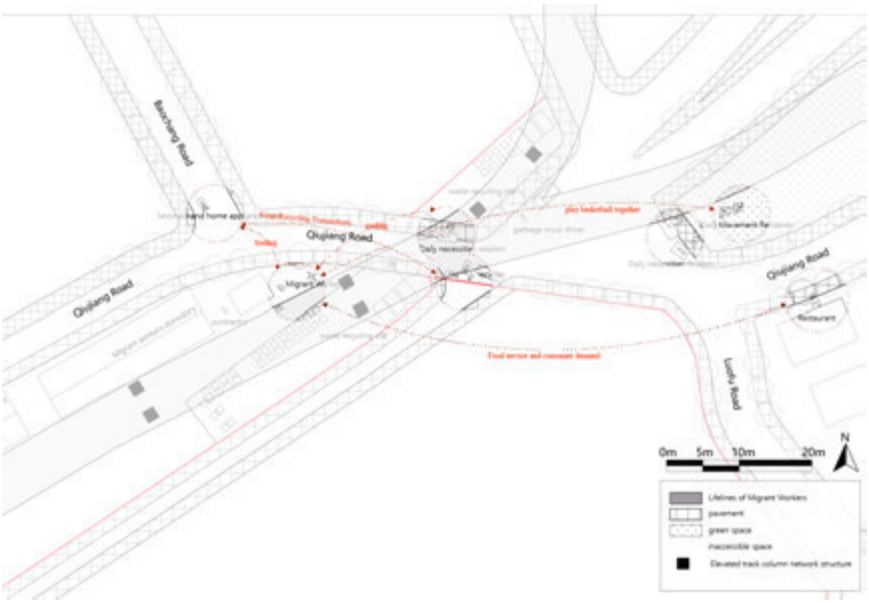

Figure6: Analysis of the social space network of migrant workers' settlements Source: Author's own drawing

Secondly, the interaction between migrant workers and the surrounding community residents is relatively limited. Despite the physical proximity of these groups, meaningful social integration remains sparse.

Besides the retail vendors and waste recyclers mentioned earlier, there are also fast food restaurant owners who set up in the vicinity to cater specifically to the dietary needs of the migrant workers. These eateries are a significant feature of the informal economy, providing affordable meals that fit the budgets and schedules of the workers. Additionally, residents from nearby communities frequently visit the area, particularly to utilise the local parks for recreational activities.

Interviews conducted with both migrant workers and local residents reveal a minimal level of social interaction between the two groups. While some interaction does occur, such as migrant workers playing basketball with local residents, these engagements tend to be superficial and do not extend into deeper social relationships or networks. The interaction remains largely limited to these casual encounters, with little evidence of further social integration or the development of meaningful connections.

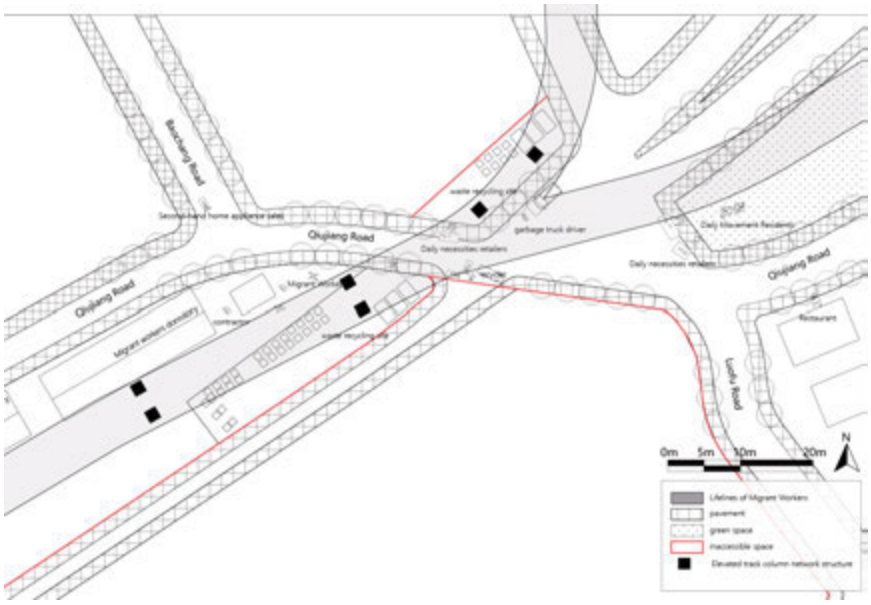

Figure7: Analysis of crowd activities around migrant workers' residences *Source: Author's own drawing*

The spatial distribution of retail vendors and waste recyclers around migrant worker settlements reflects broader socio-spatial dynamics. These service providers strategically position themselves in areas with high demand and minimal competition from formal businesses. This spatial arrangement highlights the intersection of economic necessity and urban planning.

In conclusion, the service-oriented activities around migrant worker residences in Shanghai reveal significant insights into the socio-economic and spatial dynamics of urban marginalisation. The clustering of retail vendors and waste recyclers around these areas highlights the inadequacies of formal service provision and the adaptive strategies employed by both service providers and migrant workers. Addressing these issues requires a comprehensive approach that includes improving formal service facilities, integrating informal economies into formal systems, and fostering social cohesion through inclusive urban policies. By doing so, cities can create more equitable and supportive environments for all residents, including migrant workers.

Meanwhile, Public spaces, such as parks, play a crucial role in facilitating social interaction. The fact that some level of interaction occurs during recreational activities, like basketball games, suggests that these spaces hold potential for fostering greater social integration. Enhancing the inclusivity and accessibility of public spaces could encourage more frequent and meaningful interactions between migrant workers and local residents. Urban planning initiatives that promote mixed-use spaces and community-building activities could be

particularly effective in this regard.

4. Conclusion and Discussion

4.1 Summary of the Living Space and Social Integration Characteristics of Migrant Workers in Big Cities:

4.1.1 Limited Spatial Activities:

The research indicates that migrant workers have a restricted range of spatial activities. This limitation stems from the significant proportion of their daily schedule dedicated to work and rest, leaving minimal time and space for leisure and entertainment. Surrounding public service and recreational facilities are predominantly fast food outlets and high-end malls, lacking diverse options catering to varying preferences.

4.1.2 Network Relationships and Social Structure:

Migrant workers tend to establish relatively stable network relationships within their immediate social environment. However, the structure of these networks is often straightforward. Notably, proximity to green spaces like parks and engagement in activities such as basketball contribute positively to their social integration. Effective public space design can enhance these networks, facilitating greater social inclusion.

4.2 Strategies for Enhancing Migrant Workers' Living Environment and Social Communication in Urban Areas:

4.2.1 Improving Housing Selection and Living Conditions:

Due to the limited possibility of improving the living quality of migrant workers in the short term, it is possible to consider the possibility of supplementing community functions through external spaces around some residential sites when planning the residential layout of migrant workers.

As far as possible, ensure that the site is located in a residential area or a living area, and some micro-green space adjacent to it can be considered to provide public activity space for migrant workers. By optimizing the space points, more optional spaces and activities are provided for the lives of migrant workers, thereby promoting the integration of migrant workers into the local social network.

4.2.2 Establishing a Five-Minute Living Circle Evaluation System:

The simple houses that farmers live under viaducts usually lack public service facilities and social support networks. In the construction of the five-minute living circle, migrant workers should be considered in the allocation of public service facilities as urban permanent residents.

4.2.3 Utilizing Micro Spaces for Community Enhancement:

Due to limited urban construction resources, it is not easy to provide suitable housing options for all migrant workers at this stage, such as collective dormitories, public rental housing or affordable low-rent housing. However, based on the current space environment, multi-functional embedded reconstruction is carried out to realize the basic public service functions of the residential area, and to improve the community functions of the simple housing. For example, when providing basic

Measures such as drug supply, placement of community furniture, and creation of a simple living room in the community.

4.2.4 Regular social assistance and public services:

Provide free or low-cost medical services, including regular health checks. Provide educational opportunities, including compulsory education, vocational training and skills upgrading courses, to improve the educational level and employment opportunities of farmers. Organize social workers and volunteer teams to provide farmers with social services such as consultation, legal assistance and psychological support.

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Rental Affordability, Housing First and Beyond. A Focus on the City of Trieste (Italy)

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Abstract
In Europe, access to affordable rental housing is increasingly recognised as a priority issue, particularly for individuals facing multifaceted distress or temporary and precarious employment. By addressing multiple dimensions of poverty, the Housing First (HF) approach challenges traditional emergency responses, framing access to housing as a comprehensive and diversified set of preventive actions against homelessness. Since 2015, HF has gained recognition in Italy, although its implementation remains limited. This paper explores the spatial conditions, target populations, stakeholders, and both material and immaterial resources that could facilitate the integration of HF into structural policies for affordable social (and 'very social') rental housing. The case study focuses on Trieste, a medium-sized Italian city where the risk of homelessness is significant due to demographic aging, migration flows, and an insufficient supply of public housing.

Keywords: Rental Housing Affordability; Social and Very Social Housing; Housing First; Trieste.

1. Introduction

For several decades now, the call of the UN *2030 Agenda for Sustainable Development* to provide access for all to adequate, safe, and affordable housing and basic services has become a pivotal issue in the international policy debate. In this perspective, actions toward affordable housing are understood as "a ladder out of poverty of families", carrying crosscutting benefits on many other fields of welfare policies (Habitat for Humanity, 2021, p. 5). During and after the COVID-19 pandemic and lockdowns, discussion has intensified, highlighting how the lack of a decent home can provoke uneven impacts on urban populations, worsening the life conditions of those who already suffered from multiple factors of poverty and deprivation (Ayala et al., 2022). Even though the direct correlations among these factors, the geographical spread of the disease, contextual housing conditions, and the overall availability of welfare facilities were complex to measure (Burlina and Rodríguez-Pose, 2023), across Europe people experiencing homelessness were among the most affected by COVID-19. "At the same time, vulnerable groups were even more exposed to the risk of becoming homeless, either due to the looming threat of eviction as their income decreased dramatically, or due to the dangerous situation the pandemic placed them in" (Rahman, 2020). Today, the impacts of concurrent economic, social, and political crises (e.g., inflation, surging energy and food prices, job insecurity) make access to a decent home a difficult goal for a growing number of people to achieve.

This situation emphasises not only the importance of housing as a fundamental social determinant of health and well-being but also what the *Universal Declaration of Human*

Rights stated in 1948, namely that housing is a right, and that preventing the risk of homelessness – in its various expressions – is one of the pivotal missions of welfare policies (The Shift, 2024). Furthermore, the faculty to afford housing constitutes a precondition for the access to a wider range of civil rights (e.g., to political representation, employment, healthcare, education), and related public support. The housing crisis is an impediment to secure equal opportunities especially to fragile groups of people; therefore, it is a strategic field of action for filling in economic and social gaps toward full citizenship for all (Mazzucato and Farha, 2023; Rajagopal, 2023). However, if available welfarist forms of housing policies are still primarily addressed to families and individuals who can afford at least a low rent, the 'very social' demand expressed by households in severe poverty or extreme housing hardship is generally taken over by public economic and social assistance measures, often resulting in emergency responses to homelessness. A 'treatment first' approach prevails, with access to a decent dwelling coming only after a long and uncertain path toward social and economic reintegration, from the dormitory to a stable home. The Housing First (HF) approach deeply questions this paradigm.

Starting with a general reflection on the demand and supply of rental affordability in the European context, this paper investigates the possibility of moving beyond a fragmented and sectoral application of HF, by analysing the operational perspectives and resources needed for its upscaling to a structural urban policy. The paper specifically refers to the activities carried out by the University of Trieste as a partner of the ongoing research projects *UAH! Unconventional and Affordable Housing* (2023-25) and *INEST – Interconnected Nord-Est Innovation Ecosystem – Spoke 4* (2022-25), both co-financed by Italy's EU-funded National Plan for Recovery and Resilience (PNRR). The focus is on the Italian situation, and a specific case study. The assumption is that a growing, plural 'grey area' in the demand for rental housing still receives inadequate responses, calling for a revised conceptualisation of housing affordability. In this regard, the deconstruction of some housing policy paradoxes and the analysis of HF perspectives provide valuable insights for addressing the housing crisis and its many forms. The purpose is to help conceive access to a home not only as a starting point toward independent living but also as a complex set of preventive actions against the risk of homelessness. Fieldwork in the city of Trieste (IT), in collaboration with local stakeholders, offers an opportunity to explore these issues. The aim is to provide inputs for transforming still informal practices into more stable affordable rental housing projects and policies.

2. Rental Affordability: A European Housing Question

Although the available figures provide only a partial and patchy overview, across Europe, housing demand from people at risk of poverty or social exclusion, as well as the number of homeless individuals, is on the rise. The mismatch between this demand and the limited supply of affordable rental housing constitutes a specific dimension of the contemporary housing question, laying at the very heart of the distressed social and economic conditions affecting many EU citizens.

2.1 An Increasing Gap Between Social Demand and the Offer of Rental Housing

In 2022, 95.3 million people (22% of the EU population) were at risk of poverty or social exclusion, namely they lived in households in at least one of the following conditions:

being below the threshold set at 60% of the national median equivalised disposable income after social help given by central, state or local institutions; suffering from severe material and social deprivation, and being unable to meet the costs of basic necessities (e.g., pay for unexpected expenses, afford rental payments, or keep home adequately warmed); having working age members whose work-time was equal to or less than 20% of their total potential during the previous year (EUROSTAT, 2023a). Overall, the critical economic situation of households was largely influenced by the proportion of disposable income spent on housing costs. In 2021, this share reached an average of 19% in the EU, while for people at risk of poverty it stood at 38%, heavily impacting incomes that were already below the national median (EUROSTAT, 2023b). The greatest increase in expenses was borne by tenants. However, for many people, securing a home has become an increasingly difficult condition to achieve. With a 70% increase from 2009 to 2019, the number of homeless individuals sleeping rough or in emergency/temporary accommodation each night in Europe is now estimated at 700,000, with significant differences across countries (Fondation Abbé Pierre – FEANTSA, 2022; Housing Europe, 2023).

A view of changes in the housing offer helps understand the root causes of this situation. Considering that in the EU a third of citizens live in rented flats, and that this is the primary solution vulnerable households turn to, rental housing affordability is a major concern. From 2010 until 2022, average rents increased by 19%, considerably outpacing income growth. This provoked, on the one hand, a particularly precarious situation for tenants in the private rental market (46% felt at risk of needing to leave their accommodation) and, on the other hand, an upsurge in the number of households applying for social housing (namely, housing provided at below-market prices by public, private, non-profit actors, the third sector, and cooperatives) (Housing Europe, 2023). However, in the EU, the share of social housing in the rental sector is currently estimated at only 8% of the total housing stock, with significant cross-national differences (OECD, 2020, 2023).

The underlying factors driving the rental housing affordability crisis are strongly related to the structural economic shifts that have happened during the last decades. “Housing is increasingly treated as a financial instrument and a tool to accumulate capital and make profits. As a result of escalating rents, people find themselves living in poor, overcrowded accommodation and often risk eviction” (Farha, 2021). “The social housing available has also declined in some countries since 2010, partly due to a fall in public investment in housing and the sale of social housing to tenants in some countries” (European Economic and Social Committee, 2024). This pairs with diminished public financial support and inadequate legal safeguards for low- and middle-income tenants facing excessive housing costs also due to sharp rise of energy bills in old and poorly insulated homes.

2.2 The Contextual and Multiple Dimensions of Housing Poverty

The establishment of quantitative indicators and thresholds is at the core of the definition of housing affordability, as well as of international and national efforts to address it. However, understanding housing affordability merely as a calculation based on a minimum standard (typically 30-40% of housing costs – e.g., price, rent, utilities, etc. – as a percentage of household disposable income) reveals significant theoretical and operational limitations when applied to individuals facing multifaceted distress,

those temporarily unemployed, or with too precarious a job to afford renting on the private market. Strong is, therefore, the need to question a simplified definition of this concept, and its use both in investigating housing needs and supply and in building consistent actions and policies (Haffner and Hulse, 2021; Peverini, 2023; Bricocoli and Peverini, 2024). In this regard, the issues of poverty and risk of poverty must be carefully analysed. The precariousness of households' economic and social conditions is not easy to measure, due to its ever-changing nature and the overlapping factors involved (Habitat for Humanity, 2024).

The perspective of having difficulties in making ends meet is common not only among households spending at least 40% of their income on housing, whether rented or owned (Eurofound, 2023). The link between poverty and housing expenditure transcends abstract metrics, while the commodification of the housing sector makes contextual trends in the real estate market, along with their territorial imbalances, highly influential (Arbaci et al., 2021). An increasing disproportion between the overall cost of living (e.g., for utilities, transport, etc.) and stable income plays a major role in worsening the conditions of critical households, with more severe impacts on those living in dynamic metropolitan and urban areas where costs are higher (Engelen et al., 2016; Moscarelli and Peverini, 2023). Moreover, for many people, housing needs are becoming highly changeable throughout their lives (e.g., for temporary and mobile workers, students, etc.), while the limited availability of affordable rental housing limits the choice of where to settle (even temporarily) and reduces the attractiveness of cities and territories, with significant consequences on their demographic, social, and economic assets.

Other important factors relate to the uncertainty of households' income and composition. In fact, "housing vulnerability" is becoming an increasingly widespread risk (Bouillon et al., 2015). In addition to extreme poverty, housing deprivation, and the rise in migrant flows often leading to homelessness, this also refers to the social and economic frailties affecting individuals who were previously part of the 'low-medium class' and have since slipped into situations of housing distress (Hick, Pomati and Stephens, 2024). The reasons for this are multiple: from the social and demographic transformations that have occurred in recent decades, leading to profound changes in the composition of the 'family' (e.g., an increase in one-person households and single-parent families), to the growing number of people whose incomes suddenly collapse (e.g., due to job loss, divorce, retirement, a decline in income purchasing power, and emergencies related to medical or other expenses). Housing and employment insecurities represent a dual and strongly interconnected form of precarity. Since 2008, the number and types of so called 'working poor' have been increasing across Europe, largely due to the lack of adequate government measures protecting against flexible, occasional, and often low-wage employment (Ficocelli, 2020). If "layoffs have become a normal feature of precarious work", fluctuating and uncertain earnings jeopardise the ability to pay a rent, making "evictions […] become a normal feature of precarious housing" (Desmond and Gershenson, 2016, p. 3).

These frailties affect an increasingly diversified 'grey area' of the population that has not yet fallen into extremely critical conditions, but whose intermittent and uncertain disposable income threatens access to the private rental market (which is too expensive), and eligibility for public housing rental offer (too limited). As the grey area expands and becomes more diversified, the boundaries between different levels of

housing poverty (from hardship to deprivation and homelessness) grow more fluid and indistinct.

3. Exploring a Grey Area in Italian Affordable Rental Housing

Given the significant differences among EU countries (in terms of demand, supply, and housing policy systems), an overview of the specific dynamics and characteristics of the Italian context is necessary. The aim is to question whether, and to what extent, a growing grey area of social demand is addressed by public-driven rental housing policies.

3.1 Who Rents in a Country of Homeowners?

In spite of the lack of a national observatory on housing conditions, the overall picture is fairly clear. As a result of the policies developed since the post-war period (Filandri, Olagnero and Semi, 2020), Italy is indeed a country of homeowners: out of a total of 26 million households, 70.8% live in their own homes, 20.5% (5.2 million) live in rented accommodation, and 8.7% in a house under usufruct or free of charge. Overall, the percentage of tenants and individuals living rent-free is significantly lower than the EU average (24.9% compared to 30%).

Renting is more common among less affluent households (e.g., older and younger single individuals, young couples, single parents with children, and people who are unemployed or have migrant backgrounds), with more than 45% of poor families living in rented flats under recurrent overcrowding conditions (Freguja, 2022). Out of the total number of Italian households, 15.9% consider their income insufficient to meet basic needs, and 5.1% as severely insufficient (the latter generally being self-employed or unemployed individuals, aged 35-54, often with children) (Nomisma, 2021). For 1.7 million families rent affects income by more than 30% (e.g., young single persons with less than 35 years, single parents with children, migrants) (Nomisma-Federcasa, 2016). These numbers are likely to rise in the near future: today, in Italy, not only has the share of individuals living in absolute poverty reached 10% (5.6 million) of the overall population, but many people are at risk of poverty while claiming to be employed (11,5% of the total 23.3 million workers) (Caritas Italiana, 2023). As a consequence, since 2008, evictions have increased approximately 8% per year, with 90% of the cases due to arrears in rent payments (Nomisma-Federcasa, 2016; Freguja, 2022). According to the Italian Ministero dell'Interno (https://ucs.interno.gov.it), after the partial moratorium during the pandemic, between 2021 and 2022 there was a sharp upsurge both in the number of eviction requests submitted (more than 99.000, +199%) and in those actually carried out (more than 30.000, +218.6%). The number of individuals suffering from severe housing exclusion is equally worrying: according to the permanent census of population and housing produced by ISTAT in 2021 (https://www.istat.it), 96,197 people were registered as homeless and without a fixed address. These figures highlight not only a plural and growing housing emergency but also a dramatically inadequate response from public policies.

3.2 A Forgotten Field

This is not the place for a review of the long history and extensive technical and political debate on the housing question in Italy, its strong ties with the evolution of urban

planning instruments, and the repeated and unsuccessful attempts to reform land tenure and limit private land income (see, among others, Indovina, ed., 1972; Ferracuti and Marcelloni, 1982; Padovani, 2017; Cucca and Gaeta, 2018; Storto, 2018). However, some key milestones will be recalled to highlight how, since the 1990s, national rental housing policies (and their two main action pillars) have seen a significant retreat of public intervention, with a shift from viewing housing as a social service to considering it as an investment asset.

The first pillar is *edilizia residenziale pubblica* ('subsidised' or 'council housing'), intended for low-income workers. From the INA-Casa Plan (1949-63) (Di Biagi, ed., 2010), through the *piani di zona* (local plans) for popular and affordable housing (Law no. 167/1962) and the decennial housing programme (Law no. 457/1978), to 1998 and the end of the funding mechanism based on the levy on workers' payroll (GESCAL), supporting the building sector and responding to housing demand were understood as intertwined goals. The majority of available council housing was built during this period, even though the rent of flats was already conceived as a temporary solution, leading to rent-to-own schemes and eventual full ownership. At the end of this phase, housing policies underwent further changes. In 1993, Law no. 560 allowed Council housing Institutes (IACP) to sell up to 50% of their properties in order to cover the maintenance costs of the remaining assets, as well as the budget deficit caused by low revenues from tenants' rents. In 1997, IACP were converted into public economic agencies. As a result, the production of subsidised housing collapsed from an annual average of 18,000-20,000 units in the 1980s to 9,000-4,000 units per year in the 2000s, and more than 210,000 flats were sold from 1993 to 2014 (approximately 22% of the estate managed before) (Storto, 2018; Bricocoli et al., 2021).

The second pillar of Italian housing policies is *edilizia convenzionata* ('agreed housing'). While aiming to induce the private market to offer tenants stable and affordable rental conditions, it has always played a residual role. In 1978, Law no. 392 established the so called *equo canone* ('fair rent'), a maximum rent calculated as a percentage of the value of the dwelling (based on its typology, size, urban location, and maintenance conditions) that private providers were required to apply for a minimum of four years. However, the effects were the opposite to the intended goal: many flats became vacant, were illegally rented, or sold. In 1998, Law no. 431 abolished the previous one and revised the overall framework for housing leases: municipalities and local housing stakeholders were given the responsibility for setting maximum rents, discounts on local taxes for rental providers were introduced but agreed rental contracts were reduced to a minimum of three years. Recent responses to the housing crisis are even more controversial. The so called 'housing plan' and the definition of 'social housing' established in 2008 by Law no. 133 clearly fit into the financialisaton process of the housing sector. While explicitly targeting a wide range of social groups within the grey area, the public actor limits its role: on the one hand, to providing various benefits to private investors; on the other hand, to constructing a financial system that also absorbs funds previously allocated to IACPs. In fact, in social housing interventions, the proportion of agreed rental housing (understood as a temporary condition leading to sale), rent-to-own dwellings, and those for sale largely depends on the financial return of private investments, while tenant selection is based on the amount and stability of their income.

Today, as a result, the supply of affordable rental housing in Italy is still primarily provided by council housing agencies. They manage around 700,000 dwellings, and if we add approximately 250,000 units owned by other public actors, the total represents only 4% of the national rental stock; 14% of these units are vacant due to lack of maintenance. The number of pending applications on council housing waiting lists is around 650,000 (Bricocoli et al., 2021). However, many requests do not even meet the eligibility criteria to be included on these lists (e.g., due to insufficient years of residency).

3.3 Working at the Crossroads: Affordable, Unconventional, and Informal Housing

In Italy, the right to housing is at risk, and existing policies do not provide satisfactory solutions. The available council housing stock is largely insufficient to meet the diverse needs and conditions of households, and the age of the buildings and flats often makes them unsuitable for new lifestyles and household sizes. In other words, not only is the demand for affordable housing increasingly elusive and grey, but so too are current housing policies, due to their inertia in adapting to deep social and economic changes, as well as to the dramatic shrinking and ageing of the Italian population which threatens the sustainability of the overall welfare state system (Ascoli and Bronzini, eds., 2018).

The assumption of this paper is that new perspectives for social rental housing, as well as its spatial and management solutions, need to be explored by working at the crossroads of social and very social housing demand and supply. The hypothesis is that public-driven social rental policies can strengthen their role and expand their fields of action by building new alliances with private assets and actors, the third sector, and other welfare measures. From this standpoint, several key concepts guide the 'action-research' developed in Trieste and described hereafter:

- Affordability. This term is understood not only in its broader and contextual dimensions (e.g., referring to rent and overall housing costs in specific urban areas), but also in relation to the variability of households' income (e.g., in the case of the working poor), as well as other social and economic vulnerability factors. The aim here is to go beyond a purely economic conceptualisation of affordability, to include other important aspects (e.g., the reconstruction of social and spatial relationships) that can support individuals with uncertain employment and family circumstances in maintaining their autonomy and rebuilding their life prospects.
- Unconventional. This term refers to a highly diversified housing demand, often expressed by households that were previously not considered a target group for social and very social housing policies. This variety calls for the development of responses that are more tailored and flexible in several respects, such as: the size and spatial arrangement of dwellings, which cannot be easily standardised according to fixed household types and living practices; the range of welfare facilities and services that, in addition to housing, must be provided to support specific vulnerability conditions (e.g., those related to age, loneliness, health); and the adaptation of rents and lengths of stay based on the beneficiaries' individual needs.
- Informal. The final key concept refers to the areas of experience the research focuses on. In Italy, the lack of an effective affordable rental housing policy has led to the search for solutions through a set of often fragmented and

experimental housing practices, which have not yet been institutionalised but could provide valuable insights for developing more diversified and structured public-driven policies.

4. Narratives, Approaches, and a Context

Starting from this interpretative framework, three methodological nodes guide the research carried out by the University of Trieste. The first involves a critical deconstruction of some paradoxes at the root of Italian housing policies, and their inertia in adapting to changes in target groups and solutions. The second node refers to an in-depth analysis of the Housing First (HF) approach. Although HF has gained formal recognition in Italy in recent years and demonstrated its effectiveness, it still tends to remain within the realm of informal practices. Finally, the third node addresses the relevance of the Trieste case study and the methodology used to investigate it.

4.1 Paradoxes

4.1.1 Sectorisation – Complexity

A first paradox of Italian social rental housing policies lies in the strict sectoral organisation of the entry modes and types of responses that underpin the overall housing system, understood as “the full range of inter-relationships between all the actors […], housing units and institutions involved in the production, consumption and regulation of housing” (Bourne, 1981, p. 26).

When considering subsidised, agreed and social housing, eligibility is determined on the basis of households’ disposable income and their ability to meet established rent thresholds. These conditions are assessed during target selection and at the time of entry. Once households enter a specific housing channel, they remain there for a duration set by contract. In subsidised housing, this duration often becomes indefinite, while the lack of periodic checks on tenants’ conditions contrasts with the increasingly rapid changes in household composition and income. The impact on the limited availability of this type of housing is evident: what was intended as a temporary and supportive measure often becomes a long-term (even permanent) allocation for the few families able to access the rankings.

In fact, in response to the growing demand for very social housing from people suffering from severe poverty, solutions must be sought outside the ‘ordinary’ channels of social rent. Housing for the poor falls under various forms of specialised care, distinct from those provided for the general population (Donzelot, 2005). The passive role assigned to the recipients often leads into more structural conditions of marginality, leaving them ‘trapped’ in a vicious cycle of assistance and, in some cases, ‘victim blaming’. In this context, ensuring that poor people have access to decent housing is still considered an indirect task of public policy. Public action is generally limited to the provision of social aid and economic support for household incomes (and, indirectly, for free market rents), while housing emergency solutions for the homeless (e.g., temporary shelters, dormitories, other reception facilities, and precarious cohabitations) are often delivered with the support of the third sector, with limited attention to the quality of housing arrangements and their capacity to foster independent living. From this perspective, poverty is seen as an obstacle to achieving

decent housing conditions, but the potential role that housing can play as a protective and proactive factor takes a back seat (Tosi, 2017). Today, the growing number of working poor and households that are even temporarily at risk of vulnerability clearly highlights the weakness and ineffectiveness of these approaches.

Adding to this, the demand for social and very social housing is generally addressed without considering the potential interactions with the critical economic situation also affecting an increasing number of small property owners, who find it difficult to maintain a second home and pay property taxes. Due to the often-modest quality of this private housing stock, its unattractiveness to the private and tourist rental markets, and the need for extensive renovation, the number of vacant or underused flats is growing. Indeed, putting them back into circulation at social rent could offer new opportunities for affordable housing policies. However, at present, only a few Italian initiatives attempt to reconcile the needs of renters and owners by creating local public rental agencies that, in exchange for agreed social rents, offer landlords tax reductions and guarantees in cases of arrears (Daglio et al., 2021).

4.1.2 Housing – Services

A second paradox, closely related to the previous one, concerns the economic and social resilience of welfare state policies as a whole. Responding to an impoverished social demand by lowering council housing rents on the one hand, and increasing financial subsidies to people in emergency situations on the other, is hardly sustainable. This is even more true when these two solutions are conceived and managed by different municipal sectors and agencies, which often struggle to coordinate their measures (on housing, access to jobs, social services and healthcare), and lack an integrated monitoring system to help calibrate material support to households' actual needs and their real capacity to afford housing costs – whether on the public or private rental market. To break this vicious circle, rental housing should be conceived and managed as a service in itself; namely, as a pivotal material support for ensuring full citizenship and social cohesion, and as a pillar of the "foundational economy" understood as "the economic space where those goods and services that are essential to individual and collective well-being, and constitute the infrastructure of everyday life, are produced and distributed" (Dagnes and Salento, eds., 2002, p. 13; translated by the authors). Adopting this perspective implies substantial work across several operational fields.

A first field concerns the expansion and diversification of affordable rental housing supply, in order to properly address various degrees of households' economic need and autonomy, avoid the concentration of the most problematic situations, and promote social mix. In this regard, one solution is to incentivise the creation of subsidised and social housing by including them within established planning standards (such as provisions for education, healthcare, culture, green spaces, and sports areas) and local town planning regulations. This concretely means granting building permits for housing in publicly or privately owned areas that were previously designated for other welfare-related facilities. When doing so, however, the spatial and social effects of this choice should be carefully considered, directing interventions toward sustainable solutions (e.g., from further land consumption to the regeneration of existing unused public assets) and ensuring the quality and affordability of the provided housing supply (Bricocoli, 2017; Bricocoli and Sabatinelli, 2019).

A second operational field concerns the necessity, when addressing severe social vulnerability, of integrating other services within or adjacent to housing accommodations (e.g., services supporting elderly people aging at home). In Italy, examples can be found in single- or multi-target social and supportive co-housing projects, often originating from specific funding programs (e.g., those delivered by banking foundations) with the active involvement of the third sector, and leading to innovative spatial and management solutions. Even though these experiences are multiplying, they generally remain exceptional and isolated practices, primarily targeting higher-income social groups. Cohabitation is also a common solution for assisted vulnerable groups and the homeless. However, in these cases, it often fails to overcome the limitations of institutionalised and depersonalised solutions, and to achieve spatial quality standards beyond the minimum threshold of decency (Costa, 2022; Costa and Minora, eds., 2023). In fact, when addressing distressed situations, the relationship between housing and services should become even closer, more continuous, and better tailored to the needs of individual recipients and households.

In fact, in the most critical social situations, not only securing a flat at an affordable rent but also keeping it often proves to be a highly problematic objective. Poor housing conditions, lack of work, and limited access to fundamental services and amenities are key components of the precarious living conditions of many individuals and households; therefore, they should be addressed together, at least initially, with almost daily support. The reference here is not to an on-demand management of problems and conflicts that may sporadically arise from the cohabitation of different individuals, but to a truly person-centred approach to constructing and delivering the quality and temporal intensity of both material and immaterial services (including job opportunities). Clearly, such an approach cannot limit itself to rethinking housing as mere spatial support, but must expand its operational scope to involve a broader reframing of 'territorialised' and community welfare systems, alongside the integration of innovative forms of estate and social management for dwellings and their tenants.

4.1.3 Funding – Reforms

Finally, a third paradox concerns the mismatch between the evident need to innovate housing policies and the political inability to allocate sufficient resources and effort to this purpose. In Italy, this is one of the most worrying aspects, as confirmed by the measures and funding provided by the PNRR.

Within the Plan, the building sector undoubtedly plays a central role, with resource allocation estimated at between 40 and 50% of the total €235 billion provided (including REACT-EU investments and those from the complementary fund). However, the issues of social and very social housing occupy a secondary position. They are fragmented into several interventions which, although valuable in themselves, fail to contribute to the formulation of a cohesive policy – one that is driven by a clear assessment of the scale and priority of demands and needs. Approximately €25.5 billion are allocated to rental and temporary housing solutions: student housing (about €1 billion), housing for the elderly and disabled (totalling €1 billion), and temporary housing and night shelters for the homeless (€450 million). Additional funds are dedicated to: energy and seismic efficiency of public and private housing (nearly €14 billion); urban regeneration and social housing plans and projects (€9 billion,

distributed among the Innovative Housing Quality Program PINQUA, projects aimed at reducing situations of marginalisation and social hardship, and Integrated Urban Plans) (Governo italiano – Presidenza del Consiglio dei Ministri, 2021). Housing is one component of these plans and projects; however, their primary focus is on urban renewal, in continuity with the programs implemented over the past 15 years – from the Piano Città (Plan for cities) launched in 2012 to the Piano Periferie (Plan for urban peripheries) established in 2016. Moreover, all the previously identified paradoxes remain: a rigid subdivision of intervention types (and the funds allocated to them) by categories of recipients; the separation between social and very social policies; and a prevailing focus on enhancing the material and economic value of public and private housing stock (Caritas Italiana, 2022). The PNRR offers no indication about the necessary reform of rental housing policies, such as one marked by: a significant increase in supply; innovative synergies among the resources and capabilities of public, private, third-sector, and civil stakeholders; integration of dwellings and services; and adequate support for the development of innovative management and spatial solutions.

4.2 Housing First as Prevention of Homelessness

Building effective responses to the demand for affordable rental housing from a 'grey area' of the population requires a deep rethinking of both the rigid rules and procedures currently in place for accessing subsidised, agreed, and social housing, as well as the ways in which social assistance measures are provided. This leads to working within a 'policy gray area', where the lack of adequate rental housing policies stands out as a critical issue but also allows for experimentation. Therefore, looking at innovative (and somewhat still informal) approaches, such as Housing First (HF) – a housing-led response to homelessness (FEANTSA, 2011) – gains interest. Since the 1990s, HF has spread across North America and Canada. Over the past 15 years, it has also been implemented in Europe, where in 2016 the Housing First Europe Hub was founded by the Y-Foundation (Finland) and FEANTSA (the European Federation of National Organizations Working with the Homeless). Implemented at different levels and in more or less structured ways depending on the context, HF has proven effective in providing homeless people with access to supported apartments, generally found in the private housing market (Pleace and Bretherton, 2013).

HF principles are based on a critical reflection on the paradoxes previously highlighted. Housing is understood as a starting point: this overturns the more traditional 'staircase model', which views access to stable accommodation as the final step after a rehabilitative pathway, often beginning with a shelter placement. In other words, according to HF, having a home is truly conceived as a universal human right. Consequently, in order to access a dwelling, it is not necessary to meet specific requirements or behave in a certain way (e.g., abstaining from alcohol or drugs), as is generally asked for by social assistance. The assumption is that individuals should have the power of choice and control over their own lives, be listened to, and be empowered "to choose the right combination of support for themselves" (Pleace, 2016, p. 30). Accompanying services are offered (e.g., healthcare, training, and job placement) but they are not mandatory for maintaining the accommodation, nor do they follow a 'one size fits all' approach. Instead, they are designed to be flexible, adaptable over time and space, and tailored to meet the needs and specificities of life paths. In this sense, HF challenges the often-punitive attitudes of welfare state

assistance. Another key goal is the individual's social integration within a community where they can find stability, reducing the risk of returning to homelessness. In summary, HF goes beyond prioritising housing: its innovative scope lies in the provision of a home plus a broad set of services, aimed at promoting autonomy over time through the creation of highly customised enabling conditions.

In this perspective, the main goal of housing-led approaches is to develop effective solutions not only for taking care of the homeless by minimising the duration of their stays in temporary placements, but also for preventing homelessness itself. As a result, the pool of potential beneficiaries for HF expands significantly, reaching a more diverse segment of the population at risk of becoming homeless (Jones, Albanese and Revelli, 2022). This expansion entails broadening HF's operational fields and networks. "Housing First works best when it functions as part of an integrated, multi-agency homelessness strategy, alongside prevention, and low intensity emergency accommodation services. […] to get the full benefits of Housing First it needs to be part of a systems wide governance approach […] rather than a standalone intervention addressing homelessness for a sub-group of people with high and complex inter-related needs" (ivi, p. 5). The call is for "a structural and operational shift in the governance of homelessness", and for setting "a new goal for the system by looking at HF from a rather different perspective than that of policy design […] When we talk about governance in the context of homelessness, we talk about every stakeholder involved in the field […] – and the ways in which they work and the directions that they are working towards" (Demos Helsinki and Housing First Europe Hub, 2022, pp. 7, 8).

In Italy today, more than 1,000 individuals live in HF accommodations managed by municipalities and the third sector (fio.PSD, 2024), compared to 292 in 2019 (fio.PSD, 2020). The increasing number of HF projects, along with the establishment of the Housing First Italia Network in 2014 by FIO.psd (an association active in studying and raising awareness about severe adult marginality), signals a shift away from an emergency-driven approach to housing hardship. Specifically, HF is not only proposed as an initiative targeting people with complex difficulties, but also as a lever for systemic change in policies. The aim is to solve the problem of homelessness, not merely manage it, by placing short- and long-term housing at the centre, and integrating it into a broader framework of housing and social policies (FIO.psd, 2024).

Since 2015, with the publication of the *Guidelines for Combating Severe Adults Exclusion* by the Italian Ministry of Labor and Social Policies (Ministero del Lavoro e delle Politiche Sociali, 2015), HF has received full recognition. However, projects remain sporadic, often developed on the initiative of the third sector, and involve a limited number of individuals compared to those seeking shelter in the traditional assistance circuits. In this context, the €450 million allocated by the PNRR to temporary housing and night shelters for the homeless (with target of 25,000 individuals) only partially addresses the recommendations to strengthen HF as a service provided by the National Plan of Social Policies and Interventions (2021-2023). While these financial measures indeed represent a step forward, they are not enough. Moreover, the PNRR fails to address several key critical issues: the difficulty in finding available public or private rental housing, exacerbated by the competition from more profitable sectors such as tourist rentals; the imposition of a 24-month time limit on projects, which directly contradicts HF principles; and the lack of any reference to the third sector and its crucial role in consolidating good practices and building new territorial alliances

between public and private stakeholders. What is missing is a radical shift toward a "network approach", based on a robust "link with the territory" and its communities, and "the construction of local partnerships" aimed at scaling up already existing, albeit not yet stabilised, "fruitful collaborations between public administrations, associations of small owners and social and housing cooperatives" (Casalino and Bergamaschi, 2022, p. 51; translated by the authors). These partnerships are essential to "the transformation of HF experiences into tangible opportunities for the restart of life paths through a gradualness of objectives", and the active involvement of recipients (Ibid).

4.3 Action-Research: Trieste as a Case Study

How can we proceed to define an operational framework that, drawing on the principles of HF, can guide housing policies toward new solutions for social and very social rental affordability? This question drives the research activities that are currently being carried out by the University, focusing on the case study of Trieste. This medium-sized city, with a population of about 199,000 inhabitants and located at the north-eastern border of Italy, provides an opportunity to investigate social, demographic, and economic trends and challenges common to many other 'intermediate' urban contexts – those that are neither metropolitan nor dispersed – across Italy and Europe (Lanzani, ed., 2024). Here, social marginality and housing hardship have not yet reached the most severe levels; nevertheless, the growing awareness of the housing crisis has prompted some local actors to experiment with innovative housing-led approaches.

In Trieste, available data – though partial and fragmentary – paint a picture of social and housing vulnerability, driven by multiple factors:

- Demographic decline and an aging population trend above the national average. According to the latest ISTAT census, over the past decade, the population has decreased by 4.45%, coupled with an old-age dependency ratio of 271.3% (compared to Italy's figures of -1.15% and 193.3%, respectively). The rising demand for welfare services coincides with a lack of economic resources, alongside a growing need for solutions that allow people to age in place.
- Migration flows due to the location on the Balkan route. The Italian Consortium for Solidarity (ICS) reports that, between January and September 2023, more than 12,000 arrivals were recorded, of which 70% were single men and 19% were unaccompanied minors. Approximately 13% of these migrants stopped in Trieste (ICS, 2023). The decision to stay largely depends on the outcomes of asylum applications.
- Inadequate social rental housing stock, vacant dwellings, and tourist pressure. The regional Territorial Agency for Housing of Trieste (ATER) manages over 12,300 public dwellings (almost 11% of the city's total; 93% are subsidised housing, and 14% are municipally owned). Around 9% of the city's population resides in these units (approximately 40% of the renters in Trieste). Due to insufficient maintenance, much of this stock (nearly half of which is over 50 years old) suffers from significant energy and spatial inefficiencies (ATER, 2021). Meanwhile, the demand for subsidised housing continues to grow, now reaching nearly 3,000 applications (D'Amelio, 2024). The issue of vacant real estate is significant: in 2020, there were an estimated 12,000 vacant housing units (2,000 managed by ATER and 10,000 privately owned) (Novacco, 2020). The impact of 'touristification' is also strong and combines with the consistent presence of students and researchers (around 29,000). As a result, this is

leading to an increase in short-term and unaffordable rentals, which are affecting the most vulnerable segments of the population.

Given the lack of coordinated knowledge and the absence of structured housing policies, questioning the complex relationships between local rental housing supply and demand, and their potential evolution, is far from simple. To this end, in 2023, the University of Trieste launched an action-research project understood as a field-based, reflective, and interactive practice (Schön, 1984).

The first steps consisted in mapping local actors, and identifying key stakeholders. Three in particular are the main players with whom, since 2024, a formal agreement has been signed, and research activities constantly discussed: Caritas Trieste, the social cooperative Lybra, and the voluntary organisation Comunità di San Martino al Campo. They are today the most active bodies in the promotion of projects based on the HF model. In 2023, they jointly participated (and won) the call delivered by the Social Services of the Municipality, addressed to the co-design of an integrated system for the accommodation of the homeless and of individuals in conditions of severe marginality. Although the call limits its activities to 2024, it also includes HF and co-housing solutions, demonstrating the willingness to test innovative approaches. However, if we sum up the dwellings owned by Caritas and the Municipality (including those that will be renovated with PNRR funds), the units addressed to HF and housing-led projects do not reach today the number of 30.

The lack of houses to be used for HF is a strong obstacle to the development of this policy. To overcome it, local stakeholders are well aware of the importance to share their resources, match different funding opportunities, and overall rethink the very social housing supply chain (from ownership, maintenance, support, and social and economic accompaniment). With the help of their experiences and points of view, further research was developed in the field. As a result, a first collection of local still ‘informal’ and tentative housing practices promoted by the Municipality, the third sector, and ATER was identified and in-depth analysed to highlight their achievements and failures, as well as enabling and impeding conditions for scaling up to more structured and ordinary policies. This is a fundamental step to avoid retracing the paths of past punctual experiments that, often referring to specific multi-problematic targets, remained stuck in policy sectorisation and failed to consolidate. In order to escape these traps, working in between affordable and unconventional, social and very social rental housing clearly appeared to be a good way. Consistently to this, two complementary moves were put in place: expanding and diversifying the parterre of local actors to dialogue with (from the public and the third sector, to labour organisations, property and housing associations, social and economic foundations, cultural and economic communities’ representatives); and understanding the conditions and beneficiaries to refer to, as well as the set of tangible and intangible resources to mobilise and by whom.

In April 2024, one first discussion table on affordable housing in Trieste was organised, bringing together a wide range of actors to address several crucial issues (Fig. 1): Which real estate assets (both public and private) can be made available to enhance the supply of rental housing at social and very social rents? What obstacles exist, and what conditions and tools can be implemented to overcome them? What management processes and procedures – both for real estate and social services – can ensure the economic viability of innovative and unconventional projects and policies? The call for

a permanent space for discussion on affordable housing was clearly expressed by all the stakeholders the research reached out to. A follow-up meeting of the table was therefore scheduled for June 2024, aimed at further networking skills, experiences, and opportunities for co-designing and co-implementing social and very social housing projects. Meanwhile, University's investigations are continuing through in-depth interviews and debates with specific actors on the key themes that emerged during the previous phases.

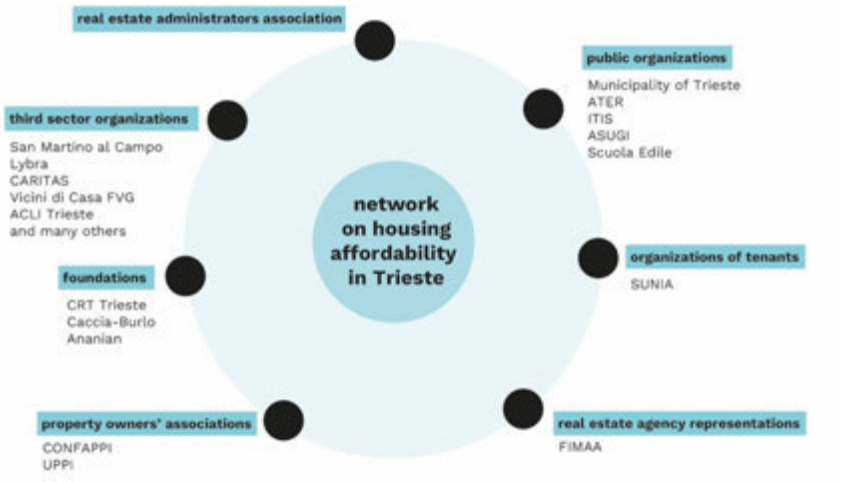

Figure 1 – Trieste. Actors participating in the discussion table on affordable housing, April 2024. Source: V. Novak.

5. Discussing Rental Housing Affordability in Trieste

In Trieste, there is a strong presence of a variety of actors, resources, and experiences in the fields of social and very social rental housing, promoted by the Municipality, ATER, foundations, and the third sector (social enterprises). Despite being fragmented and discontinuous in both time and space, they offer a valuable starting point for developing new responses to a pressing demand. One of the main critical issues, however, is that the actors involved are often overwhelmed by urgent matters and a lack of personnel. This prevents them from dedicating the effort needed to examine their practices, correct them, and eventually redirect their approaches. The discussion table organised by the University was precisely designed to offer an opportunity for self-reflection, critical thinking, and the sharing of issues and ideas. It provided insights into some key levers for conceiving new housing projects and policies, based on stronger collaboration among public, private, and third-sector actors.

5.1 Actors and Actions in Search of Direction

One recurring issue emerging from the discussion is the lack of a framework capable of bringing the various innovative housing practices tested in Trieste into coherence.

Regional Law no.1/2016, *Organic Reform of Housing Policies and Reorganisation of ATER*s, attempted to address this problem. The Law recognises the fundamental importance of housing as a significant factor for inclusion, social cohesion, and quality of life, and promotes a variety of forms of intervention (including those related to rent and ownership, subsidised, agreed and assisted housing). Its goal is to systematise public-driven housing measures and policies through territorial governance and the participation of the actors involved in the housing supply chain. To achieve this, the establishment of integrated tools and processes is foreseen, such as: a regional commission and an observatory on housing policies; local response desks to collect and match data on housing demand and supply; and local permanent forums for discussion involving public, private and social actors, aimed at representing the needs of the different territories, and co-designing innovative projects funded by annual regional funds (Marchigiani, 2015). However, the main weakness of the Regional Law lies in its implementation. Neither the regional observatory nor the local response desks have been established. Moreover, in Trieste, the local housing forum has operated intermittently; over time, it has shifted between the direction of different municipal departments (from Estate Management to Social Services), and more recently, it has been scheduled only sporadically, tied to the equally sporadic allocation of regional funds for innovative projects. In fact, the Municipality has missed the opportunity to create a housing steering committee, while the management of social rental housing still primarily remains in the hands of ATER which, however, faces several difficulties (from the scarcity of ordinary regional funds for the timely maintenance of its housing stock to increasing arrears in rent payments). In parallel, a variable mix of foundations, social-private, and other third-sector organisations collaborate with the Municipality in offering very social housing. This often occurs through specific agreements that also ensure the use of public dwellings for social scopes, but fail to provide a clear direction toward shared visions and long-term goals.

Indeed, a significant weakness of the Trieste housing system is the difficulty in creating and maintaining stable networks among local actors, despite the presence of specific expertise, strong place-based know-how, and practices in innovative welfare services management. This particularly refers to the *Habitat-Microareas. Health and Community Development* programme, which, since 1998, has been operational in a number of urban districts in the province of Trieste. The program is the result of a joint partnership between the Local Health Agency, ATER, and the Municipalities of Trieste and Muggia. This ‘proximity welfare’ initiative has been implemented through a territorialised system of social and health services, addressing the care needs of spaces and people in urban areas with a strong prevalence of subsidised housing, and through the active participation of institutions, residents, and the third sector. One of the spatialised tools of *Habitat-Microareas* consists of setting up a ‘social concierge’ office in each neighbourhood, acting as a reference point for both service demand and supply, a help desk for maintenance requests, and a civic centre for organising activities with residents and fostering community building. From its start, the program has been conceived as an alternative way of constructing adequate responses to specific and complex needs, leveraging all the spatial, social and economic resources available in place (Marchigiani, 2022). In the last years, however, these objectives have gradually changed. The social concierge offices are now mainly used for the provision of basic healthcare support and the re-routing of requests to central institutions. Nonetheless, this approach has become embedded in the mindset of many local

actors, still providing operational inputs for future integrated housing-and-services solutions.

5.2 Fragile Attempts of Cohabitation

In general terms, experiments in the field of solidarity co-housing – due to their more versatile nature compared to the public housing access system – offer valuable insights for accommodating diverse target groups with specific needs. The potential to create partially self-managed communities stands out as an interesting added value when aiming to reconstruct social support networks contributing to the strengthening of individuals' and households' autonomy, especially in the context of pathways out of emergency and highly institutionalised housing.

Different practices developed in Trieste belong to this field, showcasing a variety of spatial solutions, urban settings, target groups, promoters, funding models, and a mix of services (e.g., social housing, solidarity condominiums, assisted housing for the elderly and disabled, co-housing for mothers with children) (Fig. 2).

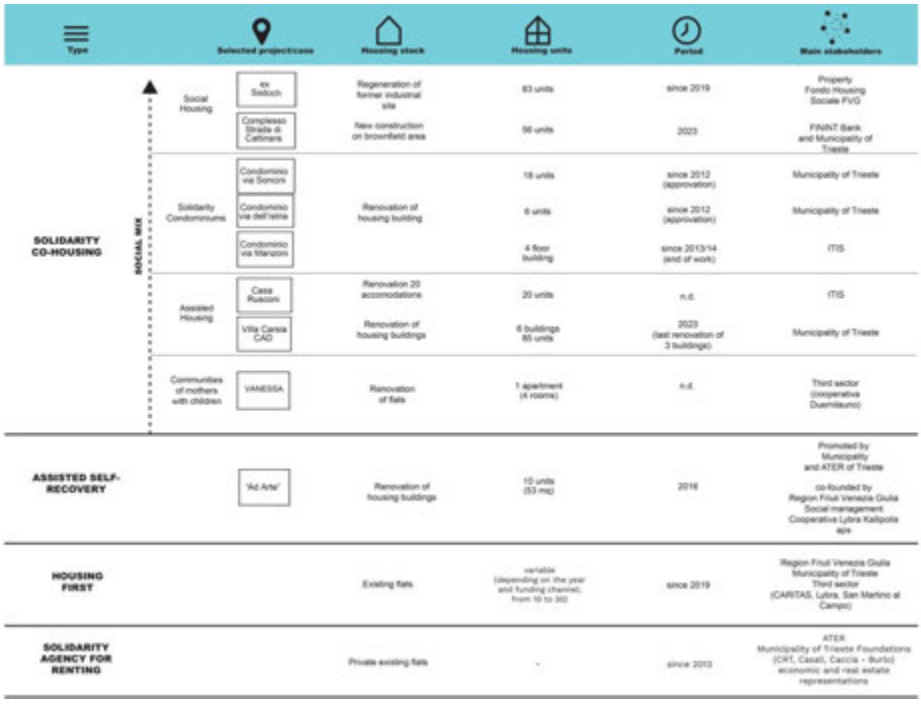

Figure 2 – Trieste. A selection of recent solidarity co-housing projects and initiatives, 2024. Source: V. Novak.

Yet, what the investigation of these practices highlights is a common difficulty in creating a real social mix, due to the limited number of available dwellings relative to demand, as well as inadequate real estate and social management. As a result, these initiatives remain exceptional and episodic.

In particular, the only social housing intervention implemented thus far in Trieste under Law no. 133/2008 has proven ineffective in addressing rental housing demands at affordable prices. Due to the economic constraints imposed by the public-private financial system underlying this type of projects, the balance between owned and rented housing penalises the latter, while rents are too high for the spending capacity of households facing housing hardship.

5.3 Locked Housing Assets

The large number of vacant private dwellings constitutes both a severe problem and a potential resource. As already mentioned, many flats in the city remain empty for extended periods, due to a lack of economic resources for renovation and maintenance. Moreover, even when the quality of the apartments is too low to meet either ordinary or tourist demand, owners generally prefer to turn to the rental market, even if this means running the risk of becoming entangled in long and expensive eviction lawsuits.

In Trieste, the take-off of the Solidarity Agency for Renting was hindered not only by these factors but also by the lack of incentives and conditions capable of competing with the revenue from the free market. After an initial attempt in 2009, the Agency was relaunched in 2014 by the Municipality under ATER's management, with the involvement of several housing stakeholders. The goal was to promote social and agreed rental arrangements of private dwellings by offering guarantees and tax relief to their owners. However, several obstacles emerged: the financial support initially provided by a banking foundation could hardly cover the establishment of an initial and modest guarantee fund to promote rent reductions, cover potential arrears, and repair costs after damages; the management process (including the evaluation of dwellings at the start and end of the rental period) was too demanding to be integrated into ATER's regular operations; and, overall, the poor response from private owners (a direct consequence of these conditions) weakened the political will to allocate local tax abatements for this purpose.

To transform the Solidarity Agency for Renting into an effective tool, a radical rethinking of its fields of action, as well as its financial and operational procedures, is needed. As discussed with the local Association of small property owners (UPPI), a real incentive for shifting from the private to the social rental market should involve substantial relief from housing-related costs (e.g., renovation expenses, and payment of state and local taxes), as well as a significant reduction in the risks associated with arrears and evictions. In this context, a new type of Agency should be created. It could, for example, be managed by third-sector organisations in partnership with the Municipality, with at least partial support from public and/or private funds to compensate for the low rents received. Acting as intermediaries between private interests and public goals, and playing the role of both real estate and social mangers, third-sector organisations would be tasked with 'taking custody' of private dwellings and their overall associated costs for the duration of the lease. However, to ensure the long-term economic viability and the scalability of this service, a feasibility study should be developed to assess the benefits and risks for all parties involved: for small property owners, in comparison to the returns offered by the private market; for third-sector entities, with particular attention to tax conditions and potential reductions; and for the Municipality, in

comparison to the costs associated with the social and economic support traditionally provided by public assistance systems.

To unlock vacant private and public housing, lowering renovation costs is another pivotal issue, as repeatedly emphasised in meetings with local stakeholders. Also in this case, Trieste provides examples from which lessons can be learned. Since several years, ATER has offered households on the waiting list the option to carry out small self-maintenance interventions in exchange for a discount on rent. This solution has proven effective in bringing back into circulation vacant dwellings that do not require major rehabilitation. The self-recovery of entire vacant buildings, however, is more complex. This type of intervention was tested between 2014 and 2016 on a municipally owned building managed by ATER, but without success. The project was supported by third-sector organisations and led to the creation of a inhabitants' cooperative, to which surface rights on the property were to be granted. The initiative encountered a crisis when, lacking real estate and financial guarantees (the surface right is not considered ‘bankable’), the cooperative was unable to secure the mortgage necessary to cover the gap between renovation costs (reduced by their labour) and the funds provided by Regional Law no. 1/2016 (Marchigiani et al., 2019). Nevertheless, this experience offers useful insights. Many of the challenges could perhaps be overcome if surface rights, the future inhabitants’ engagement process, and self-recovery efforts were directly managed by an intermediary organisation providing the necessary guarantees in exchange for collecting (at least partially) social rents from tenants.

6. Open Conclusions: Toward Solidarity Neighbourhoods

The case study of Trieste helps reflect on how new public-driven policies can address the dramatic increase in social and very social demand for affordable rental housing, by involving various stakeholders and resources, and focusing on place-based, local spatial, social, and economic conditions. The goal is to move beyond a sectoral approach, in order to avoid the rigid regulation of access to different housing channels, break down the segregation of target user groups, and address the persistent shortage of available dwellings and services, as well as their integration. From this perspective, several crosscutting issues emerged from the extensive outreach activities conducted during the research, providing inputs for the development of future housing pilot projects in Trieste.

A key general consideration is that, in order to deliver and implement well-informed and effective housing policies, there is a strong need to build structured and integrated knowledge across several aspects: the availability of public and private housing stock and its maintenance status; the social demand, including its various shades of vulnerability; and the broader set of measures provided by economic and social welfare assistance, which are more or less directly aimed at addressing housing poverty and the risk of homelessness. The reference here is to a local housing observatory, understood not just as a means of building a dataset, but as a space and practice for activating a solid network of local actors, and supporting synergistic approaches to rental affordability. Who could be responsible for the practical development of this initiative remains an open question. Perhaps the University, as is happening in other Italian contexts (Consorzio Cooperative Lavoratori di Milano et al., 2024), but this would still require a strong commitment from all housing stakeholders – particularly

public ones – to support and rely on the interactive knowledge that the observatory can produce.

Intensive and sustained funding and effort in the implementation of innovative rental housing projects, as well as their scaling up, is indeed a fundamental requirement and should become a central issue at the national, regional, and local government levels. The current lack of public resources prevents significant action on both existing public and private housing assets, and their adaptation to new demands and lifestyles. It also limits the availability (for both owners and tenants) of stable guarantees to support housing affordability, and hampers the concrete realisation of the right to housing and of HF as a truly preventive approach to the risk of homelessness.

The strategic role that 'intermediate' actors can and should play in renovating housing policies and solutions is another, equally important, aspect to consider. Reflecting on future perspectives for very social rental housing does not mean proposing the creation of a specific (and lower-quality) housing supply for the poor. In fact, today, the term 'poor' encompasses a diverse set of individuals and households, with economic and social conditions that can change rapidly. As such, it resists easy categorisation, both in terms of the duration of rental accommodations and the spatial solutions traditionally proposed by public housing. To effectively address this diversity and foster a genuine social mix within the same dwelling or building, housing and services must be integrated through careful and customised social, economic, and co-habitation management. All these activities require specific expertise and skills, as well as more flexible, person-centred working styles, which are rarely available to municipalities and council housing agencies.

Another consideration is that public assets can be a powerful driver for developing more complex housing projects, also involving other underused or neglected estates, owned not only by small private actors but also by entities controlling larger properties. To move forward in this direction, it is necessary to go beyond an approach focused solely on the valorisation of individual buildings and begin incorporating public spaces and services into urban regeneration processes at the neighbourhood scale. The research team is currently working on these issues with the goal of developing a pilot project in Trieste. The underlying assumption is that taking the neighbourhood as the appropriate scale and field of action can help create a social mix, organise community-building activities, bring together a wider set of material and immaterial resources necessary for implementing differentiated rental housing solutions, and manage various facilities and amenities. At the same time, involving local actors who work on the ground and provide services can help generate a sense of trust within local communities, which may eventually and incrementally attract additional resources and participants (Fig. 3).

The shift from the concept of solidarity co-housing to that of solidarity neighbourhood is the direct result of discussions held during the table on affordable housing organised by the University of Trieste, followed by a series of meetings with Caritas, Lybra, and other stakeholders interested in co-designing a pilot project. These actors include ATER, Fondazione Caccia-Burlo (a charity founded in the early XXth century, currently active in housing for the poor), and ITIS (a public health organisation that has promoted co-housing and community projects, as well as the establishment of a 'social concierge' office next to its operational headquarters). The location of various buildings owned or

managed by these actors in the same neighbourhood (Barriera Vecchia), within a consolidated area of Trieste, was a key factor in shaping the vision of how to create a territorial combination of dwellings and services. In particular, the spatial diversity of these buildings, along with their integration into an urban sector rich in facilities and well connected to the city centre by public transport, provides an opportunity to enhance both social and spatial mix. Additionally, these conditions enable the inclusion of self-recovery processes, and at least partial self-management of social and economic activities open to both the neighbourhood community and the wider city (e.g., a restaurant and/or a B&B in one of the buildings). From this perspective, integrating housing and economic activities not only offers new job opportunities for tenants, but also generates revenue for the stakeholders involved in the cases of arrears. In other words, the solidarity neighbourhood model is seen as an effort to concretely translate the concept of "location affordability" – that is, to integrate the spatial, social, and economic dimensions of this concept in a way that avoids "phenomena of progressive segregation and selection, or filtering-down, of the population based on income" (Bricocoli and Peverini, 2024, p. 60; translated by the authors).

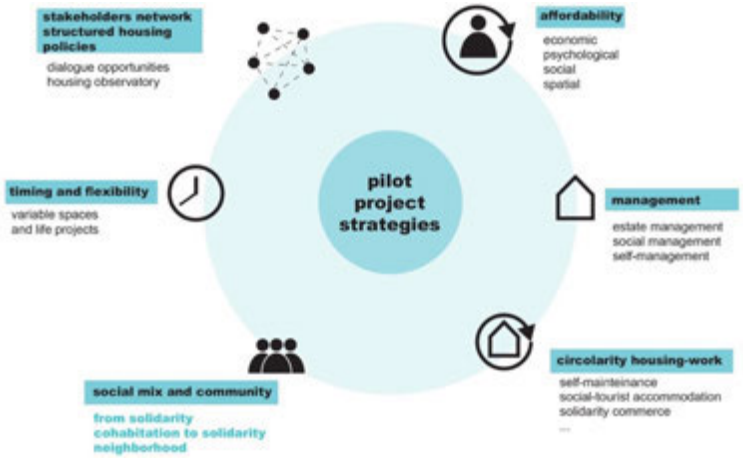

Figure 3 – Trieste. Strategies for a solidarity neighborhood, 2024. Source: V. Novak.

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HOUSING PRICES IN PORTUGAL AND THE COVID-19 PANDEMIC

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Abstract
During the 2010s decade, Portugal witnessed a steep surge in house prices, akin to trends in other European countries. This work aims to: i) analyse the reasons that led to the increase in housing prices in Portugal; ii) discuss the impacts of COVID-19 on the housing market; iii) study the evolution of housing prices during the pandemic; iv) understand how the COVID-19 pandemic has affected the housing market. The analysis adopts a quantitative approach and is based on official data from 2016 to 2023, providing a comprehensive view of the housing market in Portugal before, during, and after the pandemic. Preliminary findings suggest that the pandemic had minimal impacts on the housing market.

Key-words: housing, housing market, real estate, Covid-19, Portugal

1. COVID-19 and public health

Over the past 100 years, developed countries have not been significantly affected by major epidemics, partly due to advances in modern medicine, hygienic-sanitary conditions, antibiotics, and vaccinations. The last generations have not experienced a global disease's devastating and uncontrolled spread (Loomis, 2018).[1] Although developed societies have considered themselves immune to epidemics and pandemics, the COVID-19 global pandemic revealed several weaknesses and new challenges.

Infectious agents have impacted humans from their very inception. It is thought that the interaction between these agents and humans increased significantly during the Agricultural Revolution and the onset of sedentarization when humans started to cohabit in delimited spaces (Loomis, 2018). Throughout history, diseases have influenced battles, caused the decline of civilizations, helped spark revolutions, and, above all, shaped the history of humanity (Oldstone, 2010; Snowden, 2020).

The Industrial Revolution led to an increase in the population density of urban spaces. With this revolution came a new working class living in precarious dwellings, which provided ideal conditions for contagious outbreaks (Laxton and Rodger, 2013; Loomis, 2018). Sanitary improvements to urban spaces started in the middle of the 19th century, primarily due to cholera, measles, and tuberculosis outbreaks in some of the largest European cities. These public health interventions generally enhanced people’s quality of life and transformed the experience of those living in urban areas (Bassett, 1993; Belchem, 2006; Laxton and Rodger, 2013; Loomis, 2018, Snowden, 2020; Antunes, 2021b).

Large cities have always been prone to the spread of infectious diseases, as is the case with COVID-19. In more recent years, the growth of large metropolitan areas, high population densities, overcrowded houses, inadequate transport networks, urban sprawl into forest habitats, globalization, and the expansion of international road, rail, port, and air transport connections have created endless opportunities for the spread of infectious diseases (McNeill, 1998; Loomis, 2018; Snowden, 2020; Oldstone, 2010). As stated by the United Nations, urban areas have become the pandemic's epicentre, with an estimated 90 per cent of all reported COVID-19 cases (UN, 2020).

1.1. The Portuguese housing market before COVID-19

Between 2010 and 2020, the Portuguese real estate market underwent substantial changes and was presented with new challenges (Farha, 2017; Antunes, 2018, 2019a, 2019b; 2020; Mendes, 2018a, 2018b; Santos, 2019; Franco et al., 2019; Gonçalves et al., 2020; Xerez et al., 2020). Briefly, these changes were motivated by internal and external factors:

- Internal factors include political and legislative decisions, such as the liberalization of the rental market, the creation of incentives for foreign investment, compassionate legislation for short-term rental, and the legal-normative facilitation of rehabilitation interventions.

- External factors were those that were hard to control in the globalized market, such as the investments of international real estate funds and hotel groups, the growth of urban

[1] Although epidemics were common in some of Portugal's most significant cities until the end of the 19th century, the country had not suffered from pandemic outbreaks since the Spanish Flu in 1918 (Rodrigues, 1990, 1995).

tourism, the emergence of new forms of housing use, such as short-term rentals (reducing the houses available in the market), and the wide variations in European Central Bank interest rates.

These internal and external pressures are visible in large Portuguese and other European cities. These factors are often associated with phenomena such as “housing financialization,” “touristification,” and “gentrification” (Brenner et al., 2012; Aalbers, 2012, 2016, 2018; Colomb and Novy, 2016; Wetzstein, 2017; Hughes, 2018; Lees and Phillips, 2018; Fuller, 2019).

In summary, the Portuguese real estate market underwent major changes in the decade before the outbreak of the COVID-19 pandemic. Following the conceptualization suggested by Antunes & Seixas (2022), we debate some factors contributing to the current housing market scenario.

- Liberalization of the rental market: since the 1990s, substantial changes have occurred in the Portuguese rental market. First in 1990 with the legal framework "Regime do Arrendamento Urbano" (RAU [Urban Lease Regime]), later replaced in 2006 by the "Novo Regime do Arrendamento Urbano" (NRAU [New Urban Lease Regime]). While in the case of the RAU it is possible to speak of "normalisation" in the rental sector, after several decades of protectionism, the years that followed brought an apparent liberalisation of the market, which reached its peak in 2012, with the wide-ranging legal changes introduced to NRAU (Antunes, 2018, 2020, 2021a; Mendes, 2022). It should be emphasised that the legal changes made in 2012 came as a result of the impositions in the 'Portugal: Memorandum of Understanding on Specific Economic Policy Conditionality', signed in 2011 as part of the Troika's intervention (i.e. the International Monetary Fund, the European Commission and the European Central Bank) (Antunes, 2020). The legal changes made in 2012 clearly liberalised the rental market, seeking to promote its dynamics at the expense of contractual protections for tenants, which was particularly visible when it came to so-called 'old contracts' (contracts signed before the Urban Lease Regime of 1990) (Antunes, 2020). For some authors, this rental market liberalisation led to gentrification (changes to the social fabric) and touristification, aided the conversion of residential dwellings to touristic spaces (hotels, hostels, and short-term rentals (Mendes 2016, 2017, 2018, 2019, 2020; Carvalho et al., 2019, Lestegás, 2019; Lestegás et al., 2019).

- Housing policies promoting homeownership: another critical factor was the historical housing policies that preferred homeownership. According to IHRU (2015), between 1987 and 2011, 73% of the funding provided in the State Budgets for housing was used for "interest rate subsidies on mortgage loans". This political strategy prioritised access to homeownership through mortgage loans, which were only accessible to the middle class, leaving out the lower-income households (Antunes, 2020).

- Fiscal exemptions for foreigners: more recently, it is worth highlighting the fiscal exemptions that arose due to the 2008 financial crisis. In the last 15 years, various legal structures have been created to attract foreign investment, such as the ‘Special Tax Regime for Non-Habitual Residents’ in 2009, the ‘Residence Permit for Investment purposes’ (better known as the “Golden Visa”) in 2012 or, more recently, the fiscal incentives for “digital nomads” (Antunes, 2020). These measures aim to attract foreign capital, promote economic growth, and create opportunities for the host country and

investors. However, these political measures, notably the Golden Visa, have affected the housing market, including price increases and public disapproval, especially in urban areas (Santos & Strohmaier, 2024).

- Growth of urban tourism: the growing attractiveness of urban tourism can be linked to increased investment in short-term rentals (STR) (Arias-Sans and Quaglieri-Dominguez, 2016; Cocola-Gant, 2016; Gurran and Phibbs, 2017; Wachsmuth and Weisler, 2018). STR can be understood as providing rooms or entire houses to guests (tourists) for short periods, often publicized on digital platforms (e.g. Airbnb). This accommodation type has become increasingly popular in urban tourist destinations, such as Lisbon, as it allows property owners to earn additional income. At the same time, holidaymakers enjoy experiences that are closer to local daily life and generally more affordable (De Barros & Novo, 2023). With the increase in tourists visiting Portuguese cities, there is a greater demand for STR. An example of this is the exponential boost in the number of STR spaces in the municipality of Lisbon, which went from an almost non-existent reality in 2010 to more than 20,000 STR spaces in 2020 (Antunes & Ferreira, 2021). Concerning the municipality of Lisbon, Antunes & Ferreira (2021) questions specifically about the STR 'how much is too much', from the perspective that each dwelling used for tourist accommodation has no residential use for a local family, thus potentially removing that dwelling from the housing market. The same authors also found that Lisbon downtown concentrates 14% of all STR in Portugal. Due to this set of factors, STR has come to be associated with contemporary urban phenomena such as 'touristification' (Barata-Salgueiro, et al., 2017; Seixas, 2019a, 2019b; Antunes & Ferreira, 2021), 'gentrification' (Mendes 2016, 2017, 2018, 2019, 2020; Carvalho et al., 2019, Lestegás, 2019; Lestegás et al., 2019) or even the 'financialization of housing' (Santos, 2019; Tulumello & Allegretti, 2021; Drago, 2021).

- The international appeal of the Portuguese real estate market: the growing international attraction of the Portuguese real estate market is also perceptible in the increase in real estate transactions carried out by foreign citizens and global real estate funds. In the case of private individuals, this has been mainly due to increased interest in living in Portugal (or buying a second home in the country), while in the case of international funds, the reason is due to the recognition of a profitable investment that also works as a secure financial asset. Lisbon and Porto entered directly into the international real estate investment circuit as some of the more attractive cities in the European market for real estate and tourism investment (ULI and PwC, 2019).

- Legal-normative facilitation for rehabilitation interventions: It should also be pointed out that since the 2010s decade, building rehabilitation has been favoured over new construction. Various mechanisms have been created for this purpose, such as the 2014 "Regime Excecional para a Reabilitação Urbana" (RERU), which softened the standards imposed by the "Regulamento Geral das Edificações Urbanas" (RGEU), making interventions less costly and demanding. In addition, financial mechanisms were created, such as the "Instrumento Financeiro para a Reabilitação e Revitalização Urbana", known as IFRRU 2020 and co-financed by European funds (Antunes, 2018; Xerez, Rodrigues & Cardoso, 2018; Seixas & Antunes, 2019; Antunes & Seixas 2022). The preference for rehabilitating rather than building has decreased the number of dwellings built in Portugal. For example, in 2022, only 20,156 dwellings were built, a figure that can be compared with the 115,154 dwellings built in 2001 (the lowest was

recorded in 2015, with 7,148 dwellings built).[2] It therefore seems rational to assume that the number of homes built during the 2010s, an average of 16,000 per year, may have contributed to not increasing supply adequately, limiting the number of homes entering the housing market. Also, in this context, it should be noted that in 2022, the residential construction sector accounted for around 3.9% of GDP in Portugal, which is lower than the EU average of 5.9%.[3]

- Euribor rates: another element in understanding the Portuguese housing market is the role of Euribor rates. About this topic we can identify two critical moments: i) during 2008/2009, there was a period of all-time records for Euribor, reaching around 5%, triggering a series of events, including an increase in household effort rates, an upsurge in bad debt, an inflow of dwellings onto the housing market and a decrease in the housing prices due to excess supply face low demand; ii) Euribor interest rates decreased until reaching negative values in 2015 (a trend that has recently been countered by an increase since the beginning of 2022). That is to say that between 2015 and 2021, the Euribor rate was negative, assuming a mortgage was more accessible and not so expensive. This perception of financial solvency contributed to a rise in house prices, as most families were willing to go further with their purchase price. Likewise, this is especially important as Portugal is a country where mortgages are monopolised by variable rates rather than fixed rates, as is commonly the case in the rest of Europe (Costa, et al., 2023).

Among others, these changes contributed to the increase in the housing prices in Portugal. In the Lisbon municipality, the average cost of a square meter was €1,875 at the beginning of 2016; by the beginning of 2020, the average cost reached €3,111. Although this increase is not connected to economic improvements or increases in net income in Portugal, it has affected housing prices in the purchase and rental markets. For real estate investors, this decade represented the "golden years" of Portuguese real estate. However, for individuals looking for a home, the price increase led to less housing accessibility and higher effort rates (Seixas & Antunes, 2019; Antunes & Seixas, 2020; Antunes & Seixas, 2022).

1.2. House prices in Europe

Portugal is one of the EU countries where housing prices persist in rising faster (Eurofound, 2023; Deloitte, 2020, 2021, 2022, 2023). Between 2010 and 2019 in the EU, housing costs increased by 8% for homeowners and 23% for tenants. The highest increases among tenants (over 40 %) were recorded in Portugal, Poland, Greece, Bulgaria, Estonia, and Latvia (Eurofound, 2023). Data on the evolution of house prices in the European Union, provided by Eurostat, confirms not only the trend of housing price rises in Portugal but also the fact that it has led the way over the years, along with countries such as Estonia, Luxembourg, and Hungary.

[2] "Completed dwellings in new construction for family housing", Statists Portugal.
[3] Residential construction - annual data, % of GDP, tipsna50, Eurostat.

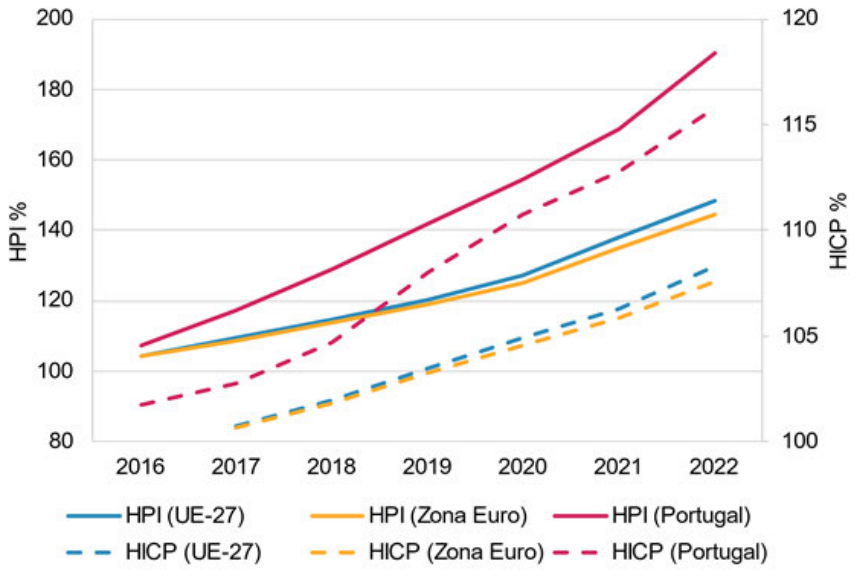

Figure 1 – Evolution of house price index (HPI) and harmonized index of consumer prices (HIPC). Source: Eurostat.

According to Figure 1, it is possible to establish that not even COVID-19 has ended the housing market rise trend, with house prices increasing throughout the European Union. It should be noted, however, that recent Eurostat statistics from 2023 show that influential European housing markets, such as Germany and France, have witnessed a small downward in housing prices for the first time in several years.

2. COVID-19 in Portugal

The following timeline presents an overview of the evolution of COVID-19 in Portugal:

- On March 2, the first cases of COVID-19 were confirmed: two men who had returned from Italy and Spain.
- In the following weeks, the number of cases multiplied, including in public institutions such as schools and universities. On March 11, the World Health Organization declared the COVID-19 outbreak a global pandemic.
- On March 16, an additional 331 daily cases were confirmed, reaching a total of 1,157 cases, and the first death was documented. The Portuguese government decreed a "state of alert" nationwide on the same day. In this period, schools, universities, and various private and public entities decided to close indefinitely.
- On March 18, 2020, the government took a decisive step. It officially declared a 'state of emergency,' effective the following day, to limit the spread of the disease and the loss of lives as much as possible. The 'state of emergency' was renewed twice and ended on May 2, 2020. The "state of emergency" set the Portuguese population under lockdown.

During this period, citizens were prohibited from leaving their homes (with minor exceptions). The police controlled road movements within the country. The borders with Spain were limited to transporting goods, and international airports were closed for civil flights.

- On May 2, the "state of emergency" was lifted, and the country entered a "state of public calamity" (less severe for civil rights than a "state of emergency"). From that moment on, citizens could leave their dwellings without facing legal problems, and some economic activities restarted, but with restrictions. The borders were opened, and the government attempted to promote tourism, an important source of revenue for the country's Gross Domestic Product. Efforts were made to return to a normally functioning society (a so-called "new normal"). Even so, several measures were implemented to ensure social distancing during 2020. In 2021, there were other small moments of public health crisis.

The following timeline traces the spatial spread of COVID-19 during 2020:

- In March and April 2020, most cases were concentrated in northern Portugal, particularly in the Porto Metropolitan Area and more industrialized municipalities.

- In the following weeks, the pandemic grew, reaching the central region of Portugal. For example, on March 29, the Ovar municipality was the target of a cordon sanitaire, which lasted for 15 days.

- In May and June 2020, the focal point of the epidemic moved to the Lisbon Metropolitan Area, which began to register more than 50% of the country's new daily cases.

- At the end of May, official briefings and press releases announced that some more deprived communities (slums) in the Lisbon Metropolitan Area were facing high contagion rates, creating hotspots of contagion.

- In June, COVID-19 cases began to decline, and the government moved the country back to a "state of alert" (the lowest level). However, the Lisbon Metropolitan Area was placed in a "state of contingency" (an intermediate level) due to the higher number of infections in that region. Additionally, 19 parishes in the Lisbon Metropolitan Area remained in a "state of public calamity" until the end of July due to their very high new daily cases. These parishes around Lisbon are generally associated with lower-income households who use overcrowded public transport and must continue working during confinement. At the end of July, the situation in these 19 parishes normalized and the "state of public calamity" ended. The entire country remained in a "state of alert," except for the Lisbon Metropolitan Area, which endured in a "state of contingency".

- At the end of August, the number of new daily cases began to balance out, reaching a level between the Lisbon Metropolitan Area and the northern region of Portugal.

- Since then, COVID-19 cases have remained at lower levels than before, except for a few periods, such as at the beginning of 2021, when the government again limited various economic activities and services due to a new strain of COVID-19.

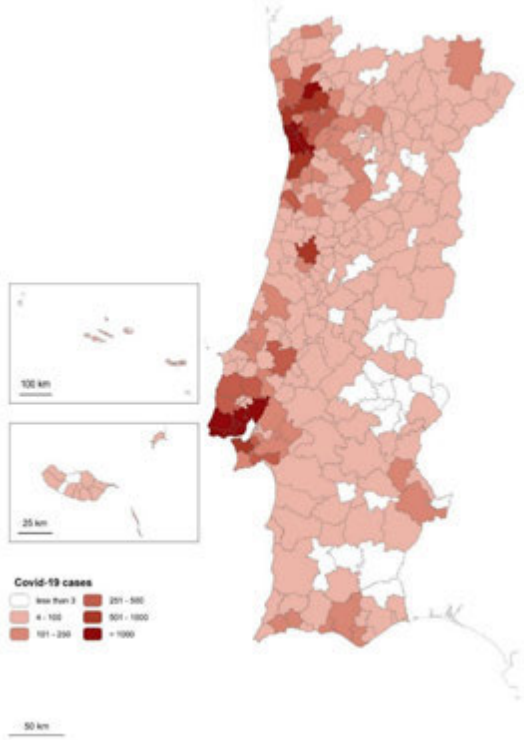

Figure 2 – Covid-19 cases in Portugal until August 31, 2020. Data source: Directorate-General of Health.

As shown in Figure 2, the most affected municipalities in Portugal were located on the coast. Some municipalities in the countryside experienced a few COVID-19 cases, while others were unaffected. This spatial difference allows us to draw a dichotomy between the Portuguese coast, which is mostly rural and contains small or medium cities.

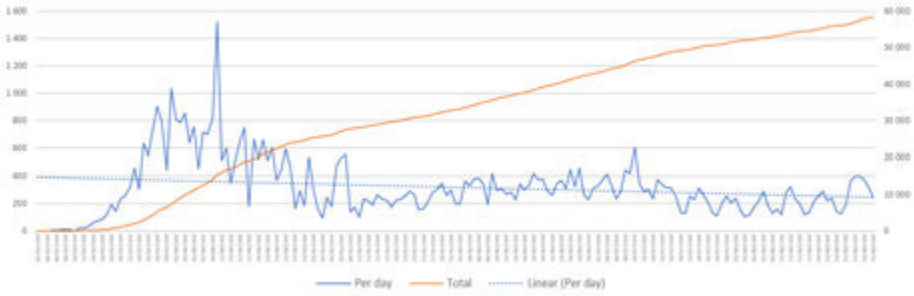

Figure 3 – COVID-19 cases in Portugal, per day and cumulative cases (between March 2 and August 31). Data source: Directorate-General of Health.

According to the Directorate-General of Health, until August 31, 58,012 cases of COVID-19 were identified in Portugal, with 41,961 people recovered and 1,822 deaths. During August, the

number of infected people stabilized, reaching between 200 and 300 new daily cases (Figure 3). To prevent further difficulties with the return to work and the start of the new school year, the government announced that the country would enter a "state of contingency" starting September 15. his declaration aimed to prevent the country from returning to a "state of emergency," the most severe level, which led to the lockdown in March and April. However, new small lockdowns had to be implemented in 2021 for outbreaks of lower intensity.

2.1. COVID-19 and the Portuguese housing market

As discussed earlier, in the second half of the last decade, the housing sector underwent an increase in international investment, the growth of urban tourism (especially the short-term rental), the touristification of Lisbon and Porto, higher pressures in the real estate market, the gentrification of downtown areas, and a surge in residential prices and effort rates for households.

In the first months of COVID-19, several doubts were raised from an academic and political point of view as to whether the COVID-19 outbreak and its economic and social impacts could have consequences on the housing market and possibly break the upward trend in housing prices, launching a period of uncertainty and unpredictability.
COVID-19 also brought new concerns about the difficulties of households paying rent and home mortgages. As stated by the European Commission, the COVID-19 pandemic "*it is a severe public health emergency for citizens, societies and economies. It is putting national health systems under severe strain, disrupting global supply chains, causing volatility in financial markets, triggering consumer demand shocks and having negative effects across various sectors. It is threatening people's jobs, their incomes and companies' business. It has delivered a major economic shock that is already having serious repercussions in the European Union*" (EC, 2020b:1-2).

In response to the COVID-19 pandemic, Portugal adopted several emergency policies to contain the pandemic and provide relief to affected households, enforced in 2020 and 2021. It is also vital to highlight that the European Union decided to apply a broad economic stimulus to European countries in response to the pandemic crisis. The "Portuguese Recovery and Resilience Plan" was an essential support for the national economy, with a substantial part of the funds received being applied to matters related to the housing sector (Portugal, 2021).

3. Housing market: quantitative analysis

The quantitative analysis proposes identifying spatial and temporal patterns using statistical data from Statistics Portugal (Instituto Nacional de Estatística [INE]). We also formulated a theoretical-quantitative model called the 'Housing Access Index' (HAI) for this quantitative analysis. The formulation of the HAI (Figure 4) makes it possible to understand how access to housing has evolved in Portugal by correlating housing prices and household income. The methodological analysis presented in this paper has been developed in previous studies which analysed spatial and temporal housing dynamics in the Lisbon Metropolitan Area (LMA) (Seixas & Antunes, 2019; Antunes & Seixas, 2020; Antunes & Seixas, 2022).

'Housing Access Index'

Mortgages	Rental market
$AHV = A \times B$	$AHV = C \times B$
$HAI = \frac{MP}{HI} \times 100$	$HAI = \frac{AHV}{HI} \times 100$
HAI: Housing Access Index. **AHV:** Average Housing Value. **A:** Median value of dwelling sales (€, by municipality, per m^2).[1] **B:** Average usable floor area of dwellings (m^2, by municipality).[2] **HI:** Household Income (€, municipality).[3] **MP:** Mortgage Payments.[5]	**HAI:** Housing Access Index. **AHV:** Average Housing Value. **C:** Median rental value for dwellings (€, by municipality, per m^2).[4] **B:** Average usable floor area of dwellings (m^2, by municipality).[2] **HI:** Household Income (€, municipality).[3]

Notes

[1] '*Median value per m^2 of dwelling sales*', from Statistics Portugal.
[2] '*Average usable area (m^2) of conventional dwellings of usual residence*', from Statistics Portugal.
[3] '*Median value of gross reported income per tax household*', from Statistics Portugal.
[4] '*Median house rental value per m^2 in new lease agreements of dwellings*', from Statistics Portugal.
[5] Mortgage (monthly payments, simulation):
- Mortgage of 90% of HAI;
- 30-year mortgage;
- Euribor 12 months;
- Spread 1.000%;
- Other compulsory costs (insurance, etc.).

Figure 4 – Housing Access Index.

As portrayed in Figure 4, the HAI calculation is subdivided into two formulas: homeownership and rental market. The HAI for buying a house is calculated in two stages: i) based on data collected from the INE, the average price of housing is calculated by multiplying the "median value of the square metre" and "average usable surface area of family dwellings"; ii) the mortgages are calculated based on bank simulations (considering the conditions mentioned in Figure 5), and the HAI value is obtained after weighting with net family income. In its turn, the HAI for renting is also based on multiplying the "median value of the square metre" (for renting) by "the average surface area of family dwellings", followed by weighting with net family income, from which the HAI is obtained. These calculations are always carried out and repeated for a given territory at a given time.

Figure 5 – NUTS II, Portugal.

For this research, the HAI were calculated for house purchases for NUTS II (Nomenclature of Territorial Units for Statistics II, in Portugal) and the Autonomous Regions of Azores and Madeira between 2016 and 2022 (Figure 5). Regarding renting, the calculation was made for the same statistical units, but between 2017 and 2022. This means that the analysis carried out in this paper is essentially national, but the observation is subdivided on a regional scale. It should be noted that a new statistical division came into effect in January 2024, reorganizing the distribution of Portuguese NUTS II and III, which this work already considers.[4]

3.1. Access to housing: housing purchasing

According to Table 1, between 2016 and 2022, the square metre price rose sharply in all the NUTS II, with the same scenario occurring in the Autonomous Regions. Table 1 also provides an insight into the different rhythms, trends and spatialities of housing appreciation.

[4] These changes mainly concern the NUT II Lisbon Metropolitan Area (LMA), which was annulled and subdivided into NUT II Grande Lisboa and NUT II Península de Setúbal. This work already respects the new statistical organisation. Still, the LMA figures are maintained to better understand the national/regional evolution.

Table 1 – Evolution of the square metre price and HAI, when purchasing a house, in the NUTS II regions, Portugal, between 2016 and 2022. Source: Statists Portugal and own elaboration.

	2016		2017		2018		2019		2020		2021		2022		Variation Rate (%) (2016 - 2022)	
	m²	IAH	m²	IAH	m²	IAH	m²	IAH	m²	IAH	m²	IAH	m²	IAH	m²	IAH
Norte	692	29	731	31	795	31	869	33	977	37	1 065	37	1 169	38	69	31
Centro	575	24	600	25	652	25	679	25	784	29	815	28	861	28	50	17
Oeste e Vale do Tejo	600	24	627	25	665	25	702	25	815	29	865	29	923	29	54	21
AML [previous]	1 125	31	1 210	34	1 283	34	1 355	35	1 535	40	1 668	41	1 885	44	68	42
Grande Lisboa	1 139	32	1 250	35	1 451	39	1 698	44	1 875	48	1 998	49	2 241	51	97	59
Península de Setúbal	784	24	838	25	928	27	1 038	29	1 184	33	1 350	35	1 513	37	93	54
Alentejo	586	23	581	22	639	23	651	23	685	24	717	23	746	23	27	0
Algarve	1 222	48	1 296	49	1 424	52	1 562	56	1 721	61	1 836	61	2 095	66	71	38
R. A. Açores	611	25	645	26	677	26	737	28	807	29	867	30	939	31	54	24
R. A. Madeira	974	36	1033	38	1 143	40	1 197	41	1 258	42	1 310	41	1 481	43	52	19

In 2016, the NUTS II that topped the list for square metre prices for house purchases were Algarve (1,222€/m2), Grande Lisboa (1,139€/m2), Autonomous Region of Madeira (974€/m2) and Península de Setúbal (784€/m2). However, this changed by 2022, with Grande Lisboa (2,241€/m2), Algarve (2,095€/m2), Península de Setúbal (1,513€/m2) and Autonomous Region of Madeira (1,481€/m2) taking the lead.

Regarding the results of the HAI for house purchases, it can be seen in Table 1 that between 2016 and 2022, the highest HAI values were found in the NUTS II Algarve, Autonomous Region of Madeira, Grande Lisboa, and Norte. However, there have been some changes in their position over the years. In this analysis, the Algarve region has the highest HAI (i.e., house prices and net incomes have the most significant gap). Table 1 also shows that Grande Lisboa and Península de Setúbal were the statistical units with the most important variation in the square metre price, with HAI values over 90%.

3.2. Access to housing: rental market

The HAI for renting tends to be higher than the HAI for buying, indicating more difficulty accessing the rental market. In most of the NUTS II, the price of the square metre is on a steady upward trend, apart from the Alentejo and Autonomous Region of the Azores, both of which showed a slight decrease in 2021 compared to 2020, and the Autonomous Region of Madeira, where there was a drop from 2019 to 2020 (Table 2).
In 2022, the NUTS II with higher square metre prices were Grande Lisboa (9.97€/m2), Peninsula de Setúbal(7.50€/m2), Algarve (7.05€/m2) and Autonomous Region of Madeira (6.81€/m2). However, the rate of change shows a different pattern, as the top are Península de Setúbal (60%), Grande Lisboa (53%), Norte and Algarve (41%).

Table 2 – Evolution of the square metre price and HAI, when renting a house, in the NUTS II regions, Portugal, between 2017 and 2022. Source: Statists Portugal and own elaboration.

	2017		2018		2019		2020		2021		2022		Variation Rate (%) (2017 - 2022)	
	m²	IAH	m²	IAH	m²	IAH	m²	IAH	m²	IAH	m²	IAH	m²	IAH
Norte	3.83	53	3.96	52	4.36	55	4.72	59	5.00	60	5.41	62	41	17
Centro	3.25	44	3.35	44	3.56	45	3.76	47	4.07	48	4.28	48	32	9
Oeste e Vale do Tejo	3.31	44	3.42	43	3.65	45	3.89	47	4.20	49	4.48	49	35	13
AML [antiga]	6.06	56	6.50	58	7.54	65	8.42	73	8.68	73	9.29	75	53	32
Grande Lisboa	6.53	61	7.02	62	7.68	68	8.58	74	9.35	79	9.97	79	53	31
Península de Setúbal	4.68	47	4.94	48	5.87	54	6.22	58	6.84	62	7.50	64	60	37
Alentejo	3.45	44	3.52	43	3.56	42	3.83	45	3.82	43	3.95	42	15	-3
Algarve	5.00	56	5.27	64	5.93	70	6.54	79	6.74	78	7.05	77	41	38
R. A. Açores	3.48	47	3.57	46	3.85	48	3.97	49	3.95	47	4.37	49	26	5
R. A.Madeira	5.15	63	5.32	63	6.00	68	5.98	67	6.15	66	6.81	69	32	11

In the case of renting, the HAI shows more significant regional heterogeneity, particularly in the variation rate (2017-2022), where the Algarve is the NUTS II that suffers the most significant increase (38%), while in NUT II Alentejo the HAI decreases by 3 percentage points. Thus, although there are different rates, all the statistical regions, except for Alentejo, show a generalised upward trend in the HAI.

4. Access to housing: exploratory lessons

4.1. Contemporary trends

Over the last decade, access to housing in Portugal has been progressively limited, both for buying and renting. The HAI values observed make it practically impossible for average-income households to purchase or lease a house. The analysis carried out in the previous chapter refers to NUTS II. At the same time, when analysed on a municipal scale, the situation is much more complex, with territories experiencing very high housing prices that are out of line with national average incomes.

As mentioned, the evolution of regional patterns is highly heterogeneous. However, the rise in the square metre price is a generalised reality throughout the country for buying and renting. Regarding purchasing a home, in 2022, some statistical regions showed high HAI values, namely the Algarve (HAU 66), followed by Grande Lisboa (HAI 51), the Autonomous Region of Madeira (HAI 43), Norte (HAI 38) and Península de Setúbal (HAI 37).

Regarding renting, all the NUTS II and Autonomous Regions had an HAI above 40. The situation is dire in the NUTS II Grande Lisboa (HAI 79), Algarve (HAI 77), Autonomous Region of Madeira (HAI 69), Península de Setúbal (HAI 64) and Norte (HAI 62).

It should also be noted that this heterogeneity is caused by the considerably unequal housing price rises in the different territories, which may indicate socio-geographic mutations. This disparity in price rises reflects the regional complexities of the housing market. It suggests an evolving socio-geographic and demographic dynamic, with potential future impacts on the structure and distribution of the population.
The data suggests that renting requires more financial effort from families than buying (Figure 6). This situation highlights significant weaknesses in the housing needs of lower-income social

households, who generally opt for renting. This situation also negatively impacts the population's residential mobility, which is low in Portugal. Consequently, the difficulties in accessing housing are growing both in buying and renting.

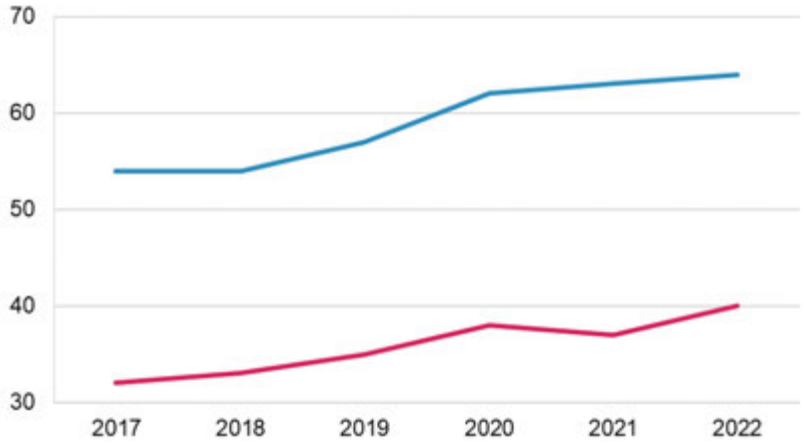

Figure 6 – Evolution of HAI between 2017 and 2022, NUTS II, Portugal. Red line purchasing market and blue line rental market.

In general, it is possible to identify that in Portugal, access to housing has been made difficult continuously since 2015, placing this topic on the academic, political and media agenda. Therefore, it is not surprising that housing is an established right (ie. the right to housing) in various international declarations and protocols, for example, in the Constitution of the Portuguese Republic (Antunes, 2021a). In this context, it should also be noted that vulnerable populations, such as people experiencing homelessness, immigrants, refugees and low-income households, face additional challenges in accessing mortgage loans, meaning they are compelled to turn to the rental market (formal and informal). In addition, these lower-income households, or migrant and historically stigmatised communities, often face discrimination in the rental market, increasing the problem of access to housing (Costa, 2023).

4.2. COVID-19 impacts and new challenges

As can be seen from the analysis above, the COVID-19 pandemic has not had a significant impact on the housing market. Although during 2020, there were several doubts about the real estate market's ability to continue its upward trend due to all the social and economic setbacks posed by the pandemic, the data confirms that the trend of house price growth has not been broken.

Although some stagnation or even small falls can be identified in 2020 and 2021, the Portuguese housing market has continued the trend it has been on since 2015, with the price of homes growing in both the purchase and rental markets.

More recently, Portugal and Europe faced new challenges that could impact the housing market, such as the inflationary crisis, the war in Ukraine, and the rise in interest rates decreed by the European Central Bank. Although the data present in this paper are not temporally comprehensive for rigorous analysis, it can be indicated that in Portugal, none of these new

challenges had an impact on the housing market in 2022 or 2023, according to the new existing statistical data. Nevertheless, quite recently, in 2023, some critical housing markets, such as France and Germany, recorded their first annual drops in several years, possibly because of inflation and high interest rates. The spread of this change to other markets cannot be ruled out in the future.

For all these reasons, Portugal's governments have initiated various housing policies and strategies in the last decade to relieve the problem of access to housing. Of particular note in 2018 was the “Nova Geração de Política de Habitação” (New Generation of Housing Policies), which had no significant impact on the housing market. Later, several extraordinary measures emerged in the context of COVID-19, as discussed in this paper.

More recently, new strategies have been presented. In 2023, the centre-left government introduced the "Mais Habitação" (More Housing) housing strategy, which included various efforts, such as rental support, mortgage support, restrictions on short-term rentals, coercive use of vacant private housing and rent control. After extensive political and public debate, these measures were implemented at the end of 2023. Already in 2024, the Portuguese government changed, and the new centre-right government presented its housing strategy, called "Construir Portugal" (Building Portugal). This housing strategy maintained previous policies that supported rents or mortgages but revoked less consensual ones, such as restrictions on short-term rentals and the coercive use of vacant private homes. The new policies are also more market-related, with various tax exemptions and support for private companies and housing cooperatives.

The debate that took place in 2023 and 2024 around housing policies is quite interesting, as it highlights the ideological differences in the Portuguese political spectrum when it comes to the problem of housing. In fact, in Portugal, the 'centre-left' and the 'centre-right' proposals are quite divergent, even in the most moderate parties. This situation is not unique to recent years, and the political divergence, the permanent abolition of previous policies and the dissolution of previous strategies is a long-standing problem in Portugal, which does not allow for the consolidation of stable and durable housing policies.

5. Final considerations

In the second half of the 2010s, house prices began an upward trend that can be identified in most European countries. It can be verified that since 2015, Portugal has been one of the European Union countries that recorded the most significant annual rises. This situation has led to greater difficulties in accessing housing, in a pattern that is widespread throughout Europe and, as has been recognised. On the European and national scene, there have been no significant trend breaks during COVID-19 (in 2020 and 2021), as might have been expected during the suspension of economic activity and lockdowns.

Looking particularly closely at Portugal, it is possible to understand that the NUTS II most under pressure are Algarve, Grande Lisboa, and Península de Setúbal. It could thus be indicated that there is a differentiated situation in the Algarve and Lisbon Metropolitan Area; these statistical regions are generally under more pressure than the others.

However, as indicated above, it should be emphasised that the observation restricted to NUTS II has some analytical limitations, as, for example, can be noted in NUTS II Norte, which covers very different realities from the "deep countryside" and the urban concentration of Porto

Metropolitan Area. Nevertheless, although Porto Metropolitan Area is not directly analysed in this study, as it is a NUTS III and not a NUT II, its situation on access to housing is not as severe as in the NUTS II Algarve and Lisbon Metropolitan Area (Grande Lisboa and Península de Setúbal). However, as expected, the figures for the Porto Metropolitan Area (as NUTS III) are very different from the NUT II Norte. These and other limitations of this study can only be overcome in a more comprehensive and disaggregated analysis, which, using a multi-scalar approach, can carry out spatial-temporal analyses of NUTS II, NUTS III, municipalities, and parishes following the development of this project.

The trends have impacted the Portuguese housing market in the last decade and highlighted housing as a financial asset. Access to housing has a direct impact on people's quality of life and well-being. During the last decade, the right to housing, the right to the city, and spatial justice were not priorities in public policy discussions. As these trends evolve, they threaten to exacerbate urban inequalities and metropolitan fragmentation. Eventually, this could worsen socio-spatial segregation and create "exclusive zones" for the wealthiest citizens and "excluded zones" for the poorest, producing further social and urban tensions.

Considering the above, Portugal today faces a clear problem of access to housing, which is generalised throughout the country and more significant in large urban areas, particularly under pressure. Regarding access to housing, real estate appreciation has not been accompanied by increases in household income in the same proportion and pace, thus conditioning access to housing year after year in a situation that no longer only affects the lower-income households but the middle class in general.

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Track 12: Futuring

FUTURING - Planning as a game changer: utopias and dystopias vs missions, models, scenarios, pathways, actions and politics of change

Chairs:

- Tijana Dabovic, University of Belgrade
- Dimitri Toubanos, Ecole d'Architecture de Paris-Val-de-Seine
- Abdallah Jreij, Politecnico di Milano

Keywords: *future, time, space, spatio-temporal, baseline, timeline, modelling, scenarios, forecasts, pathways, transitions, alternatives, politics, action, change, collaboration, urgency, uncertainty, level of certainty*

Behold all of you, shamans, prophets, Nostradamus -, Jules Verne - and Kubrick- wannabees, charlatans with YouTube channels - Here come planners to change the game of storytelling the future - the most powerful stories made to change the minds and wrongdoings on all life on Earth!

Come planners - show us how to wake up corrupted politicians, hypnotised consumers, hungry money makers, crazy innovators, angry activists and the ones we left behind! Tell us all and invite us to your well-organised, knowledge-based rewilding regional designs, urban labs, digital twins, energetic communities, nature-based solutions, place-making tools and degrowth platforms!

In the age of increasing collective vulnerabilities and responsibilities, this track explores planners' knowledge, skills and values in imagining and navigating societies towards a desirable future 10, 20, 50 or 100 years from now.

Which scenarios of sustainable development would you see coming to life? Discuss different approaches and purposes of making spatial scenarios -descriptive, normative, predictive or exploratory: do you develop Three Horizons or the Cascade Model Strategy? All those who make their stories by modelling STEEP (social, technological, environmental, economic and political) trends and their spatial impacts are invited to come and unpack their black boxes.

We invite you to reveal your forecasting technique, future-proofing, and backcasting knowledge. Please discuss with us the skills and values behind the well-organised, knowledge-based rewilding regional designs, urban labs, digital twins, high-tech or IA-driven metropolises, energetic communities, circular economy action plans, low-tech and bioclimatic resolutions, resource-saving proposals, nature-based solutions, place-making tools and degrowth platforms! The future at stake needs both game-changing storytelling and actions.

As such, how does your proposal construct a new narrative for a desirable future?

Does it pursue philosophical, ethical and political approaches, such as the Conservation ethic of Gifford Pinchot, the Utilitarianism of Jeremy Bentham and John Stuart Mill, the Preservation ethic of John Muir or John Ruskin, or the Deep Ecology of Arne Naess?

Is it linked to an economic perspective, pursuing Goergescu-Roegen's thesis on "entropy" (1971), conducting to "decrease" approaches, or does it follow Robert Solow's or John Hartwick's « weak sustainability » thesis?

On top of the new narrative, how does your proposal translate to concrete actions? Is it a new form of utopia or a feasible scenario?

If such, what innovations or technical renewal are necessary to make it happen? Finally, what constraints and controversies do your game-changing scenarios face, either political, economic, social or technical?

The track welcomes abstracts addressing, but not limited to, the following sometimes overlapping themes:

- future as a domain of freedom and domain of power;
- utopian/dystopian narratives, missions and their purpose - sustainability, climate action, climate justice;
- technical forecasts and projections, their purpose and methods;
- tools for making collaborative and innovative scenarios and pathways;
- sustainable spatiotemporal transitions - concepts, methods and politics;
- cross-scalar futuring - from global to local futures and back and forth;
- practice of co-construction of practical alternatives

Individualized Perspective on Spatial Restructuring of E-commerce Villages: A Case Study of Village Q in Shaanxi Province, China

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Abstract: The introduction of e-commerce in rural areas is profoundly reshaping the modes of production and lifestyle in these regions, altering the developmental trajectories of villagers, and promoting the restructuring of rural spaces. This study uses Q Village in Shaanxi Province, China,as a case study, employing semi-structured interviews, activity log surveys, and sales data analysis to explore the spatial restructuring of the rural e-commerce landscape from an individual perspective. The findings reveal: (1) E-commerce provides unique developmental pathways for rural individuals, enabling them to transcend traditional kinship and geographic constraints and establish a nationwide economic network, thereby enhancing their economic income; (2) E-commerce expands the sales reach of rural individuals, shifting the traditional geographically-based economic patterns towards regionalization; (3) E-commerce transforms the traditional organization of production spaces in rural areas, moving from a village-centered to a layout centered around fields, residences, and towns; (4) Under the influence of e-commerce, the living time of rural individuals is compressed by production demands, increasing temporal pressures on individuals. These results offer insights for developing and constructing rural spaces influenced by e-commerce.

Keywords: E-commerce Villages; Spatial Restructuring ; Individualization ;Rural Revitalization

1. Introduction

The development of rural e-commerce is a crucial pathway for achieving rural revitalization. According to the "China Rural E-commerce Development Report (2021-2022)" released by the China International Electronic Commerce Center, online retail sales in rural China reached 2.05 trillion yuan in 2021, accounting for 15.66% of the national online retail sales, representing a 129.2% increase compared to 2016. The advancement of online e-commerce has brought significant opportunities to rural development and has profoundly impacted the spatial structure of rural areas.

Related studies indicate that e-commerce platforms based on "de-geographical centralization" algorithms have broken the traditional geographical constraints on spatial flow(Krivý,2018,p.15), enabling rural areas to integrate into a broader regional cooperation system. Simultaneously, e-commerce has altered the internal operational mechanisms of rural areas, with interactions between virtual and real spaces driving the restructuring of rural spatial patterns. From a regional perspective, under the influence of e-commerce technology, rural elements have shifted from a unidirectional flow to a multidirectional flow between urban and rural areas and regions(Zhang, et al.,2014,p.6), giving rise to new industrial division chains and spatial organization models(Chen&Luo,2020,p.69), thus restructuring the economic geographical space of rural areas. From the internal system of rural areas, the introduction of e-commerce has spurred the rise of numerous rural industries, leading to a

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diversification and de-agriculturalization trend in rural employment(Zhang, et al.,2022,p.207). The village space is transitioning from agricultural spaces to commercial spaces, and multifunctional spatial units incorporating production processing, design and development, and innovation are emerging(Zhou,2016,p.69), though residents' living spaces are also being compressed(Zhang, et al.,2019,p.954). Government support, industrial foundation, and elite-driven factors are key to the formation of e-commerce villages, further triggering a series of changes such as the "urbanization" of rural land structures, "commercialization" of spatial functions, "de-agriculturalization" of industrial development, and "non-localization" of social relations(Yang,2021,p.3076).

"Individualization" is a concept proposed by Ulrich Beck(2001)that reflects the trend of social change, referring to the process by which social members exert subjective initiative to detach from traditional institutions and ties. E-commerce provides a new pathway for the individualization process in rural areas, allowing rural individuals to quickly build new identities within the village using the convenience brought by e-commerce platforms, "detaching" from traditional urban-rural relations and rural social relations based mainly on kinship and locality, and "re-embedding" into new types of urban-rural relations and rural social relations centered on e-commerce platforms. Under the logic of algorithms and platforms, labor relations have shifted from traditional employment relationships to "platform-individual" relationships(Wu&Li,2019,p.137), and individuals' daily lifestyles and their perceptions of surrounding spaces are increasingly reliant on the internet(Longhurst,2016,p.135; Nafus&Sherman,2014,p.1793). Additionally, under the influence of the internet, rural individuals are part of larger spatial-scale groups and networks, enabling them to grasp new knowledge and ideas and apply them to rural development（Yang,2021,p.3085）, promoting economic development, the status of female subjects, and the reconstruction of social relations in rural areas(Xin,et al.,2022,p.1306).

Overall, current research on the reconstruction of rural areas by e-commerce often focuses on macro and meso-level changes in economic forms, power relations, and spatial distribution, with fewer studies focusing on the micro-level individualization processes that highlight the spatial reconstruction induced by e-commerce. Most research subjects are concentrated on industrial e-commerce villages, with results on land use, spatial function transformation, and development mechanisms being less applicable to rural areas primarily engaged in agricultural e-commerce. In terms of research data, most case studies are based on semi-structured interviews, lacking more refined research data to discern the impact of e-commerce on spatial changes in rural areas. Based on this, this paper, from the perspective of individualization, takes the e-commerce behavior of individuals in Q Village, Shaanxi Province, China, as the object of analysis to explore how rural individuals actively learn and utilize e-commerce technology in the process of engaging in e-commerce, promoting rural economic development, and reshaping rural production and lifestyles, thereby revealing from a micro perspective the mechanisms and spatial effects of individual behavior driving rural construction.

2 Research content and data collection

2.1 Research content and methods

This article selects Q Village in Shaanxi as the research subject and Mr. Y as the core case study, adopting an individualization theory perspective to explore the development trajectories of rural individuals, the organization of rural individual living time, and the reconfiguration of rural individual production space under the influence of e-commerce. The specific research contents are divided into the

following four parts: First, through a narrative analysis of rural individuals, it examines the motivation, trajectory, and effectiveness of their e-commerce entrepreneurship and discusses the impact of e-commerce on the changes in individual development paths. Second, it investigates the characteristics of regional economic linkages and division of labor collaboration of rural individuals under the influence of e-commerce, focusing on the sales scope of their agricultural products and collaborative network relationships. Third, it analyzes the differential characteristics of rural individual production space organizations under the varied outcomes of e-commerce dissemination. Lastly, it examines the changes in the allocation of residents' daily living time due to the influence of e-commerce.

2.2 Research Data

This study primarily employs methods such as participatory observation, semi-structured interviews, and activity log surveys to conduct semi-structured interviews with six villagers in Q Village regarding the changes in agricultural production and life in the village under the drive of e-commerce. It also collects data on the personal development history of the villagers, daily activity logs during the busy farming period (recording the type of activity every 15 minutes), GPS trajectory data, and daily mobile app usage data(Table 1). This approach aims to explore the impact of e-commerce on rural spaces from both qualitative and quantitative perspectives, focusing on individualization.

Table 1 Basic information of the 6 interviewees.

ID	Identity	Gender	Age	Online Sales Proportion（%）
1	Mr.Y	Male	56	100
2	E-commerce Intermediary	Male	60	100
3	Partial Online Sales Villagers	Female	69	80
4	Partial Online Sales Villagers	Female	75	50
5	Offline Sales Villagers	Female	71	0
6	Offline Sales Villagers	Male	76	0

3 Individualization Perspectives on E-commerce Rural Spatial Reconstruction

3.1 Changes in the Pathways of Rural Individualized Development Under the Influence of E-commerce

Before the introduction of e-commerce in Village Q, sales prices could only sustain the villagers' daily living needs. Around 2013, a group of villagers who had been working outside the village, along with some recent university graduates, brought e-commerce skills back to the rural area. They combined these skills with the local cultivation of kiwifruit, initiating entrepreneurial ventures. Mr. Y, a representative of those from Village Q who returned from working outside to start businesses, utilized the internet knowledge and skills he acquired while working away from home. By integrating e-commerce sales with the village's specialty agricultural products, he became the pioneer of e-commerce entrepreneurship in Village Q and a leader in driving local prosperity. Mr. Y said:

"Traditional agriculture was insufficient to support the economic needs of his family, prompting him to migrate to Dongguan, Guangdong, in 1998 to seek higher income and provide financial stability for his household. However, by around 2012, facing a downturn in the furniture manufacturing sector he was involved in, geographical separation from his spouse, and the upcoming high school education

of his child necessitating parental guidance, he returned to his village in 2013. Leveraging his urban living experiences, the internet skills he acquired, and the kiwifruit cultivated on his family farm, Mr. Y utilized e-commerce platforms like Taobao and WeChat to market his products to former city coworkers and their families, achieving impressive sales figures. "

Traditionally, the physical marketplace yielded around 3-5 yuan per jin (half a kilogram) for kiwifruit, whereas online sales enabled pricing between 6-10 yuan per jin, effectively doubling the unit sale price. With the burgeoning demand online outpacing supply, Mr. Y expanded beyond selling his own produce; he began purchasing kiwifruit from fellow villagers at above-market rates to assist in their sales efforts. This e-commerce venture not only delivered higher profitability for the sale of kiwifruit but also substantially increased the happiness and satisfaction within the community households. Mr. Y expressed :

"since he commenced the online sale of kiwifruit, the demand was so strong that his own harvest was insufficient, prompting him to also sell produce from neighboring villagers. This initiative significantly elevated his family's economic status—from an annual income of 50,000-60,000 yuan over a decade ago to a current annual household income of around 150,000 yuan. The revenue generated enabled him to expand his agricultural operations, purchase urban property for his children, and support their matrimonial needs. "

3.2 Restructuring of Rural Individual Regional Economic Spatial Connections under the Influence of E-commerce

3.2.1 E-commerce has restructured the spatial linkage between individual villagers and the regional economy, expanding the coverage area of product sales.

The utilization of e-commerce has enabled Mr. Y's production to form an extensive flow of online transaction information and offline product transportation. The real-time communication between online sales personnel and customers continues to shape a robust stream of information regarding product quality, price, after-sales service, etc., alongside considerable cash flow. The information flow and product flow together constitute the advantages of the commodity transaction model and have significantly facilitated the establishment of long-distance spatial networks. For ease of analysis, the spatial distribution pattern of product sales is illustrated (Figure 1) based on the 695 sales orders Mr. Y processed from September 2022 to November 2023. Using the natural break method, the ranks are divided into five levels to intuitively reflect the strength of connection between Mr.Y. as an individual and different cities. Looking at the individual network sales space, compared to traditional physical sales, the economic linkage of individual villagers has significantly increased, covering 107 prefecture-level cities nationwide. In contrast to the traditional sales scope of direct sales to a single province, the Internet has expanded the sales reach of agricultural products. Mr. Y stated:

"Before the advent of the internet, kiwifruits were sold directly to merchants. Once the merchants took the fruits, they would transport them directly to fruit markets in Zhejiang and Jiangxi to sell to distributors, who would then sell to retailers, and finally, the fruits would reach the consumers. The sales scope that I could access was just within the village. After the internet came into play, my family's kiwifruits have been sold all over the country."

Figure 1 The number of delivery orders to each destination from Mr.Y.

3.2.2 Expansion of the Division of Labor and Collaboration System from Local to Regional Under the Influence of E-commerce

Individual villagers selling agricultural products online have reshaped their relationships with regional division of labor and collaboration systems. Under the influence of the Internet, a new business model has emerged, strengthening the connections and division of labor between urban and rural areas. The traditional individual sales model of agricultural products mainly involved merchants purchasing directly at the doorstep or selling to local markets and nearby towns, with the individual's sales radius and scope being quite limited. However, with the rise of e-commerce, villagers can now sell their agricultural products to any place within the country. To seize this business opportunity, many villagers have begun to experiment with online sales. The key to online sales lies in expanding sales channels, which requires the division of labor and cooperation between urban and rural areas. In this new model, households, predominantly residing in rural areas, mainly take responsibility for growing, packaging, and shipping agricultural products, while other family members and their friends gradually assume the role of online sales agents, selling through their own social circles, thus forming a regional network division of labor pattern (Figure 2). Mr. Y remarked:

"Initially, my online sales primarily targeted acquaintances in Dongguan, Guangdong, whom I knew through work. Subsequently, as relatives and friends from other regions tasted and appreciated the quality of our fruits, they began promoting them on their respective digital social platforms, leading to the formation of a stable cooperative network for distribution. Presently, my distributors are situated in cities like Shanghai, Suzhou, Harbin, and Baoji, where they facilitate the annual sale of several tens to hundreds of boxes of kiwifruits. Following the expansion of sales channels, my son and daughter-in-law also participate in marketing our fruits through their online social networks, returning home to assist with production during peak agricultural seasons."

Figure 2 Individual Regional Division of Labor and Collaboration Network

3.3 Diversification of Local Production Spatial Organization under the Influence of E-commerce

The increase in economic income further influences changes in production organization. In the cultivation of kiwifruit, e-commerce has not changed the villagers' traditional paths for purchasing agricultural inputs. Due to high-quality requirements for kiwifruit, villagers generally rely on traditional rural kinship and geographical social relationships to purchase pollen and fertilizers. Mr. Y said:

"There are also pollen and fertilizers available online at lower prices, but we dare not buy them because we don't know about the quality. We use a large amount, which relates to the selling price of kiwifruit; we must ensure quality and quantity. Also, there is no guarantee of after-sales service online,

so we generally buy from acquaintances in the village or town. The quality is good, and there is after-sales service. Generally, acquaintances charge us only after the kiwifruit is sold, so we do not need to pay in advance. "

In the sales aspect, the dissemination method in the village mirrors the general technology spread, where Mr. Y's success quickly catalyzed the learning and replication among neighboring villagers. This spread, leveraging social networks, follows kinship, geographical, and professional ties, eventually forming a wave-like spatial diffusion(Wang,2023,p.130). However, due to technical, social capital, and market access barriers in online kiwifruit sales, the sales models have diversified into fully online sales, partially online sales, and traditional offline sales at the household level. Specifically, villagers engaged in fully online sales market their agricultural products exclusively through the internet; those in partially online sales use their own and their distant relatives' or friends' social media platforms to sell some of their produce, with the majority still sold physically; and those in entirely physical sales directly market their goods to local or distant merchants. Compared to the traditional village-centered production space organization, the advent of e-commerce has led to noticeable differences in the organization of production spaces around fields, packaging points, purchase locations for distant merchants, and local merchants' buying spots due to the variation in sales models (Figure 3). Specifics are as follows:

In the realm of urban and rural planning and geography, the translation of the sales models in the context of e-commerce influence on agricultural practices is as follows:

Villagers engaged in fully online sales: Around the key nodes of online sales, a local support spatial system of "fields—residential areas—courier points" has formed. Due to the large volume of online sales, the primary method of dispatch is courier services for door-to-door pickup.

Villagers engaged in partially online sales: A hybrid virtual and physical collaborative space system of "fields—residential areas—village—town" is established. As the volume of online sales is relatively small, the main dispatch method for these villagers involves transporting goods to logistic points at the town or village level, while physical sales predominantly occur through direct pickups by merchants at the village.

Villagers engaged in traditional physical sales in the digital age: Different support spaces have formed, such as "fields—residential areas—village purchase points (for distant merchants)" and "fields—residential areas—town purchase points (for local merchants)." The primary method of dispatch in these models involves direct pickups by merchants at the designated purchasing locations.

Figure 3 Local Spatial Organization of Different Sales Models

3.4 Compression of Living Time under the Influence of E-Commerce

Under the influence of e-commerce, individual villagers in agricultural product e-commerce villages have experienced a significant change in the rhythm of their daily living time. Compared to traditional agricultural product sales models, online sales not only enhance economic income but also impose more time pressures on their lives.

A comparison of daily living time and mobile phone usage between villagers who sell online and those who do not reveals that during the busy farming season, villagers engaged in kiwifruit sales (both online and offline) work an average of 17.19 hours per day, with only 0.63 hours allotted for leisure. In contrast, villagers operating under traditional sales models work a total of 7.65 hours, with 5.13 hours dedicated to leisure (Figure 4). Evidently, the development of e-commerce businesses significantly compresses villagers' personal living time. Under traditional models, they need only complete basic production processes like picking and sorting before selling the fruit to middlemen. However, in the e-commerce era, villagers not only have to complete these traditional processes but also invest considerable time and energy in online order handling, video shooting, and other promotional activities. These additional e-commerce operational tasks substantially occupy the time originally intended for rest and personal life. Furthermore, the time rhythm of e-commerce sales is much tighter. During peak sales seasons, villagers need to constantly monitor online orders and prepare shipments promptly to meet the demands of distant consumers. This real-time sales model forces them to adjust their daily routines, enhance work efficiency, and ensure immediate responsiveness. Additionally, e-commerce platforms' requirements for product presentation increase the workload for villagers. They are required not only to take high-quality product photos but also to edit promotional videos. Tasks traditionally performed by professional teams have now become essential skills for individual villagers, posing significant challenges to their time and energy. Mr. Y said:

"Before the advent of the internet, peaches were sold directly in the fields, with trucks arriving during the day to collect and transport them by night. Evenings were spent chatting at the doorstep or watching television at home before resting. However, with the shift to e-commerce, there is a constant need to process orders and dispatch goods throughout the day and night, as purchase times vary and volumes can be high. This requires continuous loading of goods in the evening to ensure delivery within 48 hours. Thus, the introduction of the internet has extended working hours, with busy nights followed by some time on the mobile phone before sleep. Sometimes, when there's nothing to eat at home, purchases are made online. Mr. Y is primarily responsible for handling orders and shipping during downtime, and also takes videos while working. After busy evenings, he spends his leisure time editing short videos for promotional purposes. "

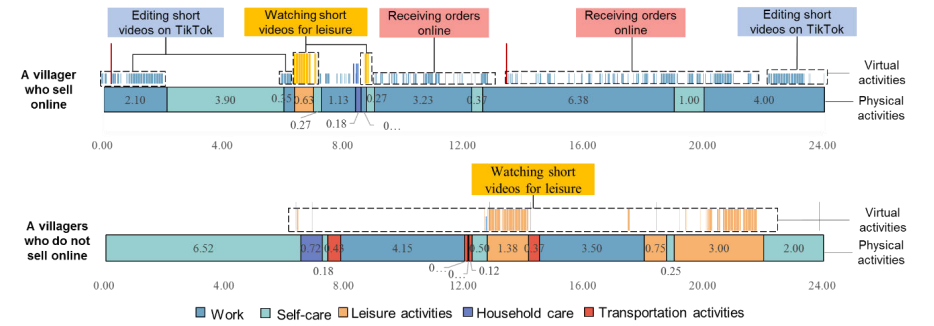

Figure 4 Comparison of daily time utilization between villagers who sell online and those who do not.

4 Conclusions and Research Prospects

4.1 Discussion and Conclusions

4.1.1 E-commerce Empowering Individualized Development Pathways from Urban to Rural Areas

The introduction of e-commerce has provided rural individuals with new economic development pathways, enabling them to transcend traditional geographical limitations and proactively integrate into broader socio-economic networks. This restructures the spatial connections between rural areas and regional economies, thereby accessing more developmental resources and opportunities. This process of identity "re-embedding" through individual agency promotes the transformation of rural social structures and brings new dynamism to rural economic development. It also encourages many villagers who have worked in cities to return to rural areas, using their acquired knowledge to further promote rural development. To fully leverage the potential of rural individuals in the e-commerce sector, it is advisable to encourage the cultivation of distinctive rural e-commerce brands that align with local resource endowments and industrial strengths. Through policy support and the establishment of e-commerce demonstration bases, rural individuals can be guided to focus on local specialty products to meet the personalized needs of urban and rural consumers, continuously enhancing their competitiveness in the e-commerce market.

4.1.2 E-commerce Inducing the Reshaping of Rural Spatial Relationships

The introduction of e-commerce has driven the restructuring of the economic space in rural areas. Through e-commerce platforms, rural individuals, previously limited by geographical constraints, can now overcome traditional spatial distances and establish cross-regional distribution networks that cover both urban and rural areas. This enables them to break away from the insular and singular local economic patterns, expanding connections with external markets and significantly enhancing their economic development space. Additionally, the advent of e-commerce profoundly affects the organization of local production and sales spaces in rural areas(Luo&He,2017,p.36). Research has observed that the demand-driven nature of e-commerce prompts farmers to consciously adjust traditional planting structures and

production methods, such as adopting standardized agricultural practices to meet the demands of the e-commerce market. In terms of sales space organization, towns not only continue to provide traditional services like fertilizer sales but have also added new functions such as selling packaging boxes and offering courier services, thereby strengthening the connection between towns and villages.

4.1.3 E-commerce Empowerment: Contradictions and Balance in Rural Production and Living

The introduction of e-commerce has not only increased the economic income of rural areas but has also significantly compressed the villagers' leisure time. Under the online sales model, villagers are required to invest substantial time in handling orders, packaging, shipping, and other e-commerce operational tasks, which drastically reduces their personal leisure time. This adds more time pressure to the already busy rural life, potentially jeopardizing the physical and mental health of the villagers. This contradiction between economic development and quality of life reflects the dual nature of rural development empowered by e-commerce. On the one hand, e-commerce opens new channels for rural economic development, providing villagers with unprecedented opportunities for wealth accumulation. On the other hand, excessive involvement in e-commerce operations can lead to an imbalance between work and life, compressing leisure time and affecting the experience of well-being. Finding a balance between the economic benefits brought by e-commerce and the quality of life is an issue that needs careful consideration in future rural revitalization practices.

4.2 Research Prospects in Urban and Rural Planning and Geography

E-commerce is emerging as a pivotal force in the socio-economic spatial reconfiguration of rural landscapes. It not only avails rural inhabitants of unprecedented developmental prospects but also crucially redefines the organizational morphology of indigenous production systems. This trajectory of spatial reconfiguration heralds e-commerce as an instrumental catalyst in the resurgence of rural areas. To date, this investigation has concentrated on the influence of e-commerce on rural restructuring from a micro-perspective. Prospective studies in urban and rural planning and geography might extend the scope to embrace a broader array of subjects and enhance the sample magnitude to encompass a more diverse spectrum of agrarian household profiles. This approach would more comprehensively encapsulate the intricacies of rural spatial reconfiguration facilitated by the advent of e-commerce.

Conflict of interest

The authors declare no competing interest.

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Study on the Evolution Characteristies and Collaborative Governance Strategies of "Production-Living-Ecological" Space at county level in Loess Hills and Gully Areas--Taking Huangling County as an Example

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Abstract
With China's rapid economic development and continued urbanisation, the contradiction between urban expansion and land resource use has become increasingly prominent. The study site is located in the gully area of the Loess Plateau, where soil erosion is a prominent problem. The acceleration of urbanisation further complicates the spatial contradiction between production, life and ecology. In the context of ecological civilisation construction, it is crucial to study the spatial evolution of production-life-ecology in the county. The study indicates that the production space in Huangling County is fragmented, the living space is inefficient and the ecological space is fragile. Consequently, a comprehensive management strategy to protect the production space, optimise the living space and regulate the ecological space is proposed.

Keywords
Production-Living-Ecological space; Spatio-temporal evolution; Collaborative governance; PLUS model

Full text

0 Introduction

The rapid development of China's urbanisation is often more concerned with the economic benefits that can be gained, often neglecting the improvement of the comprehensive benefits of land resources(Liu and Sun 2020). The Loess Plateau, as a typical soil and water loss region, not only faces long-term ecological pressure for urban development, but also the complex topographic environment severely restricts the rapid advancement of urbanisation. In 2019, the Ministry of Natural Resources explicitly proposed that territorial spatial planning should be aimed at building intensive and highly efficient production space, livable and moderate living space, and unspoiled and beautiful ecological space. With the gradual entry into the transition of urban development in China, the optimisation of the “production-living-ecological” space coordination in the loess plateau region at the development stage has gradually received hot attention from planning academics(Wang, Sun et al. 2020, Liu, Huang et al. 2023).

The collaborative governance of county “production-living-ecological” space is directly oriented towards solutions, and is an important aspect of the coordination and optimization of national spatial resources. Currently, studies on the collaborative governance of county “production-living-ecological” space often start from the two core aspects of classification system and optimal spatial layout, and have formed a diverse research system(Zou, Wang et al. 2018, Cui, Zhu et al. 2020, Gao, Yang et al. 2022). From the perspective of research content, although the current research generally attaches importance to the scientific proof of the coordination of the “production-living-ecological” space, most of the research focuses on the use of the established results to analyse the current situation, while the “production-living-ecological” space often takes a certain amount of time to unfold, so it is important to carry out collaborative governance on the basis of analysing the evolutionary patterns and future development trends of the “production-living-ecological” space in a long time series.

1 Data sources and research methodology

1.1 Overview of the study area

Huangling County has a total area of 2,292 square kilometre, and the geomorphological types within the regional scope are complex and diverse. The eastern loess plateau surface area is part of Luochuan tableland, which is the main area of agricultural activities in the county, and more than 70 percent of the production space is distributed here; the western mountainous area belongs to loess hills and soil and rocky mountainous areas, and more than 80 percent of the ecological space, which is dominated by forests, is concentrated here; and the river valley and

river channel area, which is mainly the valley of the Discouragement River and its terraces, is the living space It is the main distribution area of living space. In recent years, as the urbanisation process continues, more and more urban construction activities have begun to encroach on cultivated land and grassland in an uncontrolled manner, and under the influence of a series of policies such as "grain for green project" and "cultivated land requisition-compensation balance", structural imbalance has begun to appear in the internal development of the region.

1.2 Data sources

The land use data used in this paper come from the publicly released 30m-resolution land cover dataset by the team of Professors Yang Jie and Huang Xin of Wuhan University, which is based on 5,463 visually decoded samples and has an overall accuracy of more than 80%; for the spatial environment data, the population distribution, GDP, spatial interpolation of mean annual temperature, spatial interpolation of mean annual precipitation, and distribution of soil types are from the Resource and Environment Science and Data Centre (https://www.resdc.cn/); road data and watershed data are from the National Geographic Information Resources Catalogue Service System (http://www.webmap.cn/); and DEM data are from the Geospatial Data Cloud (http://www.gscloud.cn/).

1.3 Research methodology

1.3.1 Classification of “production-living-ecological” space

The classification method based on land use type is more suitable for analysing the spatial and temporal evolution of “production-living-ecological” space, and the study area is divided with reference to the classification system of the dominant function method, combined with the actual situation of territorial spaces in Huangling County (Liu, Liu et al. 2017, Jiao, Yang et al. 2021)(Table 1).

Table 1. Land use classification system of “production-living-ecological” space.

Spatial categorisation	Dominant function	Land use type
Production space	Agricultural production activities	Cultivated land
Living space	Urban and rural living activities	Construction land
Ecological space	Regulation and maintenance of regional ecological security	Woodland,Shrubland, Grassland, Water area

1.3.2 PLUS model

The PLUS model can effectively simulate the complex evolution of multiple land classes. Based on various types of acquired data on land use drivers in Huangling County, the Land Expansion Analysis Strategy (LEAS) and the CA model based on multiple types of stochastic patch seeds (CARS) are used to simulate the land use types of Huangling County in 2025 and 2030, and the combination of land use data of each year can show the “production-living-ecological” space of Huangling County in its entirety history and future changes.

1.3.3 Land use transfer matrix

The land use transfer matrix describes the quantitative structure and spatial distribution characteristics of regional land use type changes. According to the relationship between the changes in land use data of Huangling County from 1995-2030, a number of two-dimensional matrices are obtained, and by analysing the obtained transfer matrices, the transformation

between different land categories is obtained, which can be used to analyse the land categories that have changed in different years, as well as the location and area of change.

1.3.4 Spatial conflict model

The spatial conflict model is often used to quantitatively characterise the state of conflicts between land uses, and according to the quantitative analysis of three dimensions of the spatial complexity index, spatial vulnerability index and spatial stability index of the six periods of land use data in the study period in Huangling County, the spatial conflict intensity index is obtained through comprehensive calculation, which can be used to assess the degree of coordination of the “production-living-ecological” space. The lower the spatial conflict intensity, the higher the degree of coordination.

2 Characteristics of spatial evolution in Huangling County

2.1 Spatial aggregate characteristics of staged evolution

The results of the evolution of the total amount of “production-living-ecological" space in Huangling County show that the production space is decreasing, the living space continues to grow, and the ecological space is relatively stable in the time period of the study. The study is divided into three phases based on the increase and decrease of each type of space (Figure 1).

The first phase was from 1995-2005, during which the changes in the “production-living-ecological" space were relatively stable, with production space and living space continuing to grow and ecological space continuing to decrease. The ecological space decreased by 4.37 square kilometre while the production space increased by 2.33 square kilometre, and both the decrease in ecological space and the increase in production space were the largest in the study period, which shows that the urban development of Huangling County in this period was mainly based on agricultural production, and the additional cultivated land caused a large amount of damage to the ecological space.

The second stage is from 2005-2010, in which the “production-living-ecological" space changes drastically, the production space decreases and the ecological space starts to increase, while the living space increases further. During the study period, the total amount of production space decreased for the first time by 10.03 percent and the total amount of ecological space increased by 1.22 percent, which indicates that along with the rapid advancement of urbanisation, the urban development of Huangling County has adjusted its dominant production mode and paid more attention to the protection of the ecological environment.
The third stage is from 2010-2020, in which the evolution of the “production-living-ecological" space has intensified, and the changes in production space and living space have gradually increased, while the ecological space has maintained its growth. After 2010, the average annual decrease in production space reached 2.43 percent, and the average annual increase in living space reached 45.82 percent, both of which were the largest in the study period. At this time, the total difference between the "production-living-ecological" spaces in Huangling County becomes more and more obvious.

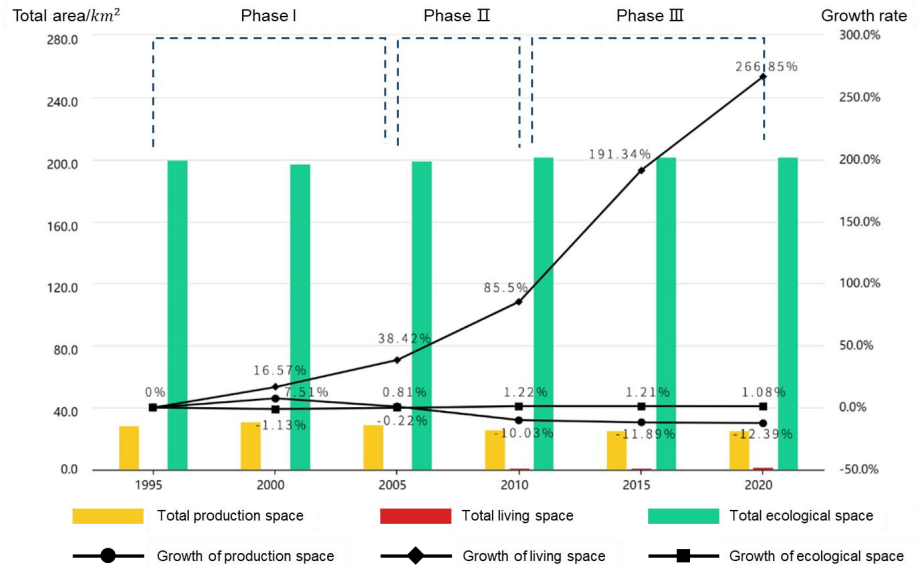


Fig.1. Evolution of spatial aggregates from 1995 to 2020.

2.2 Characteristics of spatial transformations dominated by production space

According to the five-period land use transfer matrix of the “production-living-ecological" space in Huangling County during the study period, the Sankey diagram of spatial transfer was drawn, from which it was found that the production space played an important role in the process of mutual transformation of the “production-living-ecological" space, and that the interchange between production space and ecological space, as well as the conversion of the production space to the living space, were the main spatial interaction modes (Figure 2).

From 1995-2010, the total amount of production space transferred to ecological space remained at a relatively large stage, with a cumulative transfer of 129.18 square kilometre during the study period; unlike this, the transfer of ecological space to production space experienced a process of growth, then decrease and then growth of the total amount of transfer, with a cumulative transfer of 60.28 square kilometre, which suggests that the early stage of urban development focuses on ecological environment maintenance, while the importance of cultivated land is gradually increased as urban problems gradually come to the forefront. From 2000-2015, the transfer of production space to living space in Huangling County increased period by period, reaching the peak in 2015, and then the transfer dropped, which shows that the construction speed of urban development is gradually slowing down, and the production space has been protected to a certain extent.

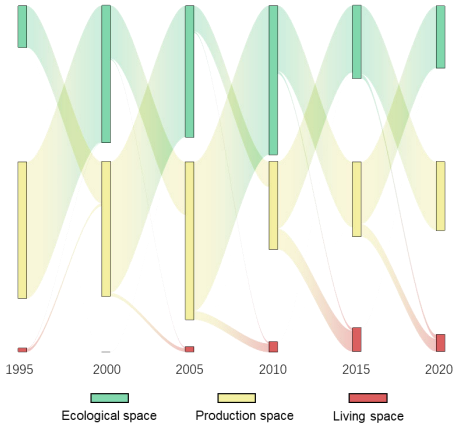
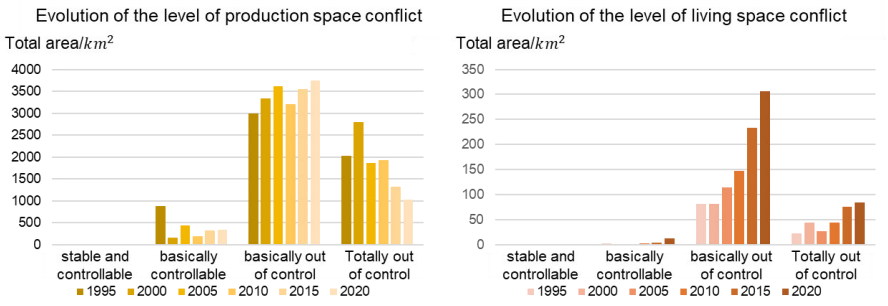


Fig.2. Evolution of the spatial transition from 1995 to 2020.

2.3 Spatial conflict characteristics of asynchronous change

Based on six periods of land use data in Huangling County, the conflict index of the “production-living-ecological" space is calculated, and the change process of the degree of coordination of the “production-living-ecological" space in a long period of time is analysed. It is found that the degree of coordination of the “production-living-ecological" spaces is inconsistent, with the production space and living space in a long-term uncontrolled state, and the ecological space in a long-term controllable state (Figure 3).

During the study period, the production space has the lowest degree of coordination, 60.61 percent of which is in a long-term basically uncontrollable state and does not change, and 32.51 percent of which is in a completely uncontrollable state but has been alleviated year by year since 2000; the degree of coordination of living space is also poor, with the long-term basically uncontrollable and completely uncontrollable spaces occupying 75.02 percent and 23.11 percent respectively and deteriorating year by year during the study period; the degree of coordination of ecological space is relatively good, with 76.37 percent of the space in a long-term basically controllable state and remaining relatively stable, but 23.62 percent of the space in a long-term out-of-control state cannot be ignored.



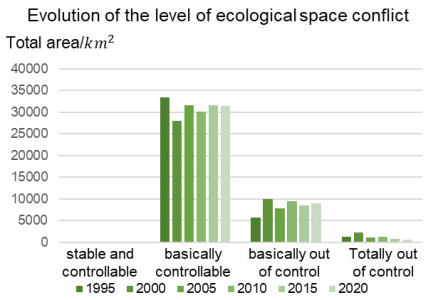


Fig.3. Evolution of "production-living-ecological" spatial conflict from 1995 to 2020.

3 Summary of spatial evolution mechanisms and Issues in Huangling County

3.1 Mechanisms of spatial evolution

3.1.1 Progressive development period (1995-2000)

The period from 1995-2000 was the period of progressive development of the “production-living-ecological" space in Huangling County. Although urban development had already begun in this period, the low level of development and the complex topography of loess gullies limited the agglomeration capacity of the city, and therefore, the integration of production space and living space, which was mainly based on traditional farming, remained the mainstream in this period.

With the rapid growth of population in Huangling County, on the one hand, a large number of labourers carried out residential construction in the areas around the towns, and faced with the disorderly construction, the county government strictly regulated the living space in that period, which made the living space decrease and revert to the production space; on the other hand, the income of the new labour force mainly comes from agricultural production activities, so land reclamation is more frequent in this period, and the production space expands while the ecological space decreases. As the total amount of high-quality cultivated land in the Loess Plateau region itself is limited, the selection of new cultivated land is very difficult, with part of the new cultivated land choosing to encroach on ecological space around towns and cities and subsequently being forced to fallow, and the other part of the cultivated land being concentrated in loess gullies, resulting in the complication of the overall pattern of production and ecological space, and a decline in spatial coherence.

3.1.2 Period of fluctuation (2000-2010)

The period from 2000-2010 was a period of fluctuating development of the “production-living-ecological" space in Huangling County, during which industrial production, mainly coal mining and processing, gradually became the main driving force for urban development, and a large number of surplus agricultural labourers began to move to non-agricultural industries, with urban construction activities becoming more and more active.

Around 2000, the first round of grain for green project was launched in Huangling County, and the land with poor farming conditions was gradually transferred to ecological space, which increased the ecological space and improved the overall coordination between production space

and ecological space, but along with the gradual widening of the gap between urban and rural areas, the excess rural population began to concentrate in the urban areas, the negative impacts of rapidly advancing urban construction activities on the coordination of production and ecological space have gradually become obvious. On the one hand, the loss of population in rural areas has led to the abandonment of cultivated land, and on the other hand, with its favourable geographic environment, the valley area has become the focus of land development, and a large amount of high-quality arable land has been occupied, additional cultivated land is often cultivated on the sidewall of loess gully, loess tableland surface, and loess gully by villagers as a unit. As a result, a large number of fragmented ecological and production spaces appeared, leading to another reduction in spatial coordination. Supplementary cultivated land in this period was far less than the reduction of activities such as urban construction as well as abandonment of land, so the total amount of production space declined.

3.1.3 Green transformation period (2010-2020)

The period from 2010-2020 is the period of greening transformation of the “production-living-ecological" space in Huangling County, during which the problems of environmental pollution and food security in the process of urbanisation have gradually come to the fore, and with the proposal of new urbanisation in 2012, the importance of the production and ecological space has been significantly increased, and the traditional development mode, which is mainly based on industrial production, has begun to change.

In the process of rapid urbanisation, the expansion of living space has increased the encroachment on production space and ecological space. On the one hand, the more complex spatial patterns have led to a continuous decline in the coordination of living space; on the other hand, although the supplementary cultivated land is still unable to make up for the loss of cultivated land, the county government has begun to pay attention to the protection of the quality of new cultivated land, and inefficient cultivated land, such as sloping cultivated land, has gradually been replaced by ecological space under the policy of grain for green project. In contrast, the coherence of ecological space in this period declined to a certain extent, mainly due to the fact that the grain for green project that lasted for more than ten years had seriously changed the local vegetation structure, and the single species of forest land and the loss of a large amount of shrubland and grassland had caused the development of ecological space to be stagnant.

3.2 Summary of space issues based on development projections

Through the analysis of the evolution characteristics and evolution mechanism of the “production-living-ecological" space in Huangling County, it can be found that its development is the result of the long-term accumulation of natural, social and economic factors under the leadership of policy factors, so the prediction and analysis of the development evolution of the “production-living-ecological" space is one of the necessary steps in the collaborative governance of the “production-living-ecological" space.

In order to verify the reliability of the simulation results of the PLUS model, firstly, the land use data of Huangling County in 2017 and 2020 were used to give the relevant driving force data and parameters to obtain the simulation results of land use in 2023, and compared with the status quo situation in 2023, and the Kappa coefficient was greater than 0.7, which indicated that the model had a high degree of credibility. Therefore, further using the current land use data in 2023 to simulate the land use results in 2025 and 2030 under the natural development

scenario, the study found that the problems in the long-term evolution of the “production-living-ecological" space in Huangling County from 1995-2030 are mainly concentrated in the following three aspects.

3.2.1Evolution of production space fragmentation

In the long-term development of production space in Huangling County, since the Loess Plateau region itself has less high-quality arable land, a large amount of supplementary arable land is concentrated in loess gullies, loess gully slopes, and loess plateau borders, etc. It is found that in the future, Huangling County will still maintain an average annual reduction of production space of 1.73%, and the production space in loess gulleys and loess plateau borders will further increase. However, on the one hand, the shortage of agricultural labour cannot be effectively improved in the short term, and the long-term cultivation of new cultivated land cannot be guaranteed; on the other hand, the complex topographic conditions of loess gullies and the soil and water environment of loess plateau borders, which are prone to erosion, will continue to affect the farmers' motivation to cultivate, so that these long-term unavoidable production problems will seriously affect the spatial stability of the development of the space. Combined with the time-space distribution of spatial conflicts and the comparison of satellite maps, the spatial coordination between loess gullies and loess plateau areas has not been effectively alleviated, and the new cultivated land has continued to appear in a complex spatial pattern under the requirement of the annual target of the total amount of cultivated land, and has been intermittently abandoned under the long-term negative impacts of the natural environment and other factors, so that the production space in these areas will continue to evolve in the direction of fragmentation in the future(Figure 4).

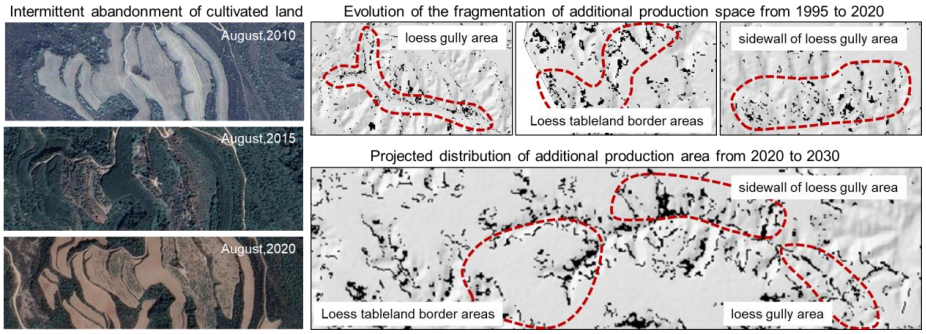


Fig.4. Evolution of production space fragmentation.

3.2.2 Non-stable expansion of living space

In the process of construction of living space in Huangling County, the rapidly developing urban economy and urban construction activities are closely related. Valley area has become the first choice for urban development by virtue of its flat terrain and dense river distribution, because the limited construction space in valley area cannot be reasonably matched with the rapid increase in the construction demand, so the living space along the valley area spreads continuously to form a long and narrow belt-shaped space form, and even part of the living space is connected with the ditch bank of the valley, which not only leads to the disorderly distribution of the living space but also seriously affects the overall stability. In the future urban development, the living space in the valley area will further increase, the expanding narrow space not only makes the urban spatial layout inefficient, at the same time, linear elements such

as rivers, high voltage lines and railway lines seriously damage the integrity of the urban form, coupled with the construction of land to change the catchment environment of the valley, the valley ditch bank suffers from more serious rainwater erosion, thus affecting the safety of the living space itself. Therefore, the living space in these areas is destabilised for future development(Figure 5).

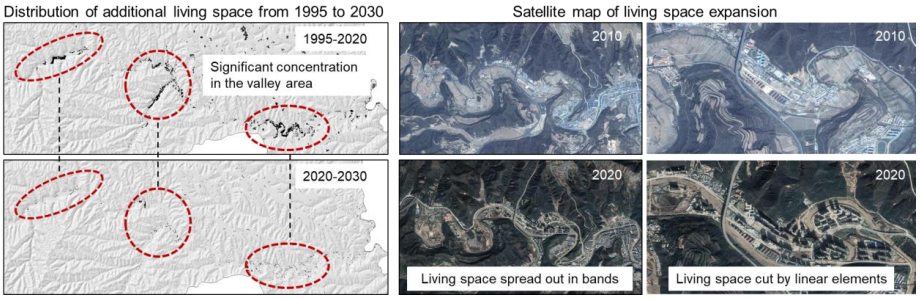


Fig.5. Non-stable expansion of living space.

3.2.3 Binary polarisation of ecological space

Huangling County is located at the southern edge of the Loess Plateau, with the eastern loess area being part of the Luochuan tableland, and the western mountainous area belonging to the loess hills and soil and rocky mountains; since soil erosion is more serious in the eastern area, more than 70 percent of the increase in ecological space in Huangling County in the period 1995-2020 under the impetus of the grain for green project will be concentrated in the eastern side of the county. Local fast-growing tree vegetation, mainly acacia, is more suitable for planting and simple to maintain, so through long-term forestry activities in the eastern part of Huangling County, a relatively single vegetation structure dominated by trees has been formed, which has greatly reduced the species richness in the eastern part of the county, and for a long time, not only are the ecological differences caused by the topography and soil environment faced by the eastern and western parts of the county, but also the dichotomy of species diversity resulting from the grain for green project has also become more and more obvious. These factors have intensified the formation of the ecological border zone, and the development of the ecological space located in the ecological junction zone in the central part of Huangling County has obviously stagnated. In the future, the growth of ecological space will be further concentrated on the eastern side of the county, which will lead to more obvious ecosystem differentiation, and the overall stability of ecological space will continue to decrease(Figure 6).

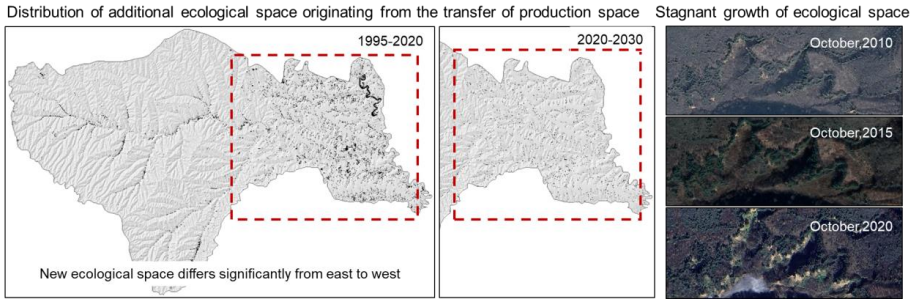


Fig.6. Binary polarisation of ecological space.

4 Spatial collaborative governance strategy for Huangling County

4.1 Connecting production space to improve the quality

In Huangling County's long-term development process centred on urban construction, a large amount of high-quality cultivated land has been replaced by construction land, and the quality of cultivated land has inevitably declined in the production space. Aiming at the scattered distribution of new cultivated land and the intermittent abandonment of cultivated land, which has led to the reality of the evolution of the fragmentation of the production space, the study puts forward the strategy of connecting production space to improve the quality.

Firstly, taking the territorial spatial planning of Huangling County as the basis, integrating and optimising the overall pattern of production space, higher quality cultivated land in the valley area should be prioritised into permanent basic farmland to strengthen the protection of high-quality cultivated land, and when cultivated land has to be occupied for urban expansion, less suitable cultivated land should be selected first, while cultivated land with higher cost of use and higher ecological risk should be designated into the ecological protection red line, and cultivated land will be launched in an orderly manner, so as to continuously harmonising the interrelationships among the “production-living-ecological" space. Secondly, the policy of "cultivated land requisition-compensation balance" needs to be linked to the construction of agricultural infrastructure. On the one hand, new cultivated land must adhere to the principle of "quantity-quality-ecology" balance in the selection of replenishment areas, and compensation measures need to be proposed for the phenomenon of "occupying the best and replenishing the worst". On the other hand, the relatively poor quality cultivated land in loess gullies and loess tableland borders need to invest more public resources in the construction of agricultural infrastructure to improve the conditions for the use of the production space continuously. Finally, it is necessary to optimise the rural settlement system, adjust the distribution relationship between population and arable land, and guide the integration of fragmented cultivated land resources for contiguous development.

4.2 Saving living space and making it suitable for the location

The rapid expansion of living space has long been spreading in the form of a long and narrow belt, which not only causes the inefficiency of living space, but also has a serious negative impact on the production and ecological space in the vicinity. Aiming at the unstable development of living space and thus leading to the decline of spatial coordination, the study proposes the solution strategy of saving living space and making it suitable for the location.

Firstly, the expansion of living space needs to strictly comply with the requirements for the coordination and integrity of the “production-living-ecological” space, and in the dual evaluation stage of territorial spatial planning, the key protection areas of production and ecological space should be identified in advance, so as to take the lead in protecting them and preventing the disorderly encroachment of living space. Secondly, the ever-expanding living space needs to respect the natural geographical conditions of the Loess Plateau region. On the one hand, the urban construction should be adjusted from a long and narrow belt to a continuous group, forming a relatively independent and complete living space, changing the current inefficient development mode, and gradually forming a "finger" urban structure by linking up the surrounding gully areas through the newly built roads. On the other hand, the grouped spaces should be interspersed with continuous ecological and production spaces, so as to reduce the environmental risks in the valley area. Thirdly, in the process of rapid development, there are a lot of inefficient urban spaces in Huangling County that need to be improved, so it is

important to actively promote urban renewal to ensure the efficient use of the stock of living spaces.

4.3 Regulating the ecological space into a stable and healthy system

The evolution of ecological space needs a long time process to appear the effect, for a long time Huangling County grain for green project to relatively single fast-growing vegetation planting forestry activities, although a significant increase in the total amount of ecological space, but at the same time, also greatly changed the overall stability of the ecological environment, for the construction of ecological space ignoring the ecological functions of the local adaptability, thus leading to the development of ecological space binary polarisation of the reality of the problem, the study proposes a solution strategy for the regulating the ecological space into a stable and healthy system.

In terms of technical support, Huangling County is located at the southern edge of the Loess Plateau, and its topography, soil and climate are all special to the area, so the construction of ecological space needs to set up a special research team, and on the basis of the ecological zoning of the territorial spatial planning, it should adjust the proportion of planting structure of trees, shrubs and grasses based on native plant species according to the actual conditions, so as to ensure stable and healthy development of the ecological space. In terms of policy support, the construction of ecological space requires long-term and stable local policies and regulations. The government of Huangling County should carry out long-term planning for the development of ecological space, and allocate funds in instalments according to the construction period and the maintenance period, so as to guarantee the funding requirements for long-term coordinated management. For the ecological space located in the ecological border zone, its own vulnerability is high, so it is necessary to reduce the intervention of external factors through planning, on the one hand, to reduce the concentration of new cultivated land in these areas, and at the same time, put forward more stringent control measures for the production activities; on the other hand, to minimise the intervention of short-term human activities in plantation areas through the closing hillsides to facilitate afforestation.

5 Conclusion

The construction of “production-living-ecological" space with harmonious integration of production, living and ecology is an inevitable requirement for urban development in the context of ecological civilisation, and also a key issue for the transformation of urban development in Huangling County in the new period. The analysis of the “production-living-ecological" space in Huangling County in a long time sequence can not only clarify the implementation of the previous plan, but also has practical significance in identifying the problems of urban development. Although there are some limitations, this paper conducts collaborative governance research based on the spatial and temporal evolution of the “production-living-ecological" space, which provides a guideline for the optimisation of the “production-living-ecological" space in Huangling County in the future, and also provides a scientific reference for the transformation of urban development in the Loess Plateau region.

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Backcasting as a tool for governing transitions beyond techno-solutionism: the Torino2050 and ToMove projects

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Abstract
The paper addresses the complex and multifaceted issue of how planners, public administrations and scholars can approach high-tech transitions, and more generally the governance of transition to desired futures beyond techno-solutionism. The paper first presents the results of the Torino2050 project, which addressed the issue of governing the transition to autonomous driving. It then discusses how a collaborative backcasting approach will be applied in the recently launched ToMove project, which will test an autonomous public transport shuttle and a robot for last-mile delivery in a quasi-superblock testbed area. The project is promoted by the Municipality of Turin and the authors are involved in setting up a participatory scenario planning process. The project is a useful opportunity to actively involve the public administration in the scenario planning process, taking stock of the lessons learnt in the previous Torino2050 project.

Keywords:
scenario-planning, backcasting, autonomous vehicles, public administrations

1. Introduction

The salvific power of urban smartification should not be taken for granted, nor should its sustainability (Cugurullo et al., 2023). Whereas techno-solutionism which dominates the smart city discourse highlights the potential of new technologies (including AI) for urban efficiency and performance, a passive laissez-faire approach from public administrations can lead to undesired, unexpected and ungovernable outcomes. The deployment of Autonomous Vehicles (AVs), being a dominant manifestation of the emergence of AI in the management and development of cities, fully encapsulates these dilemmas.

The advent of AVs is likely to produce significant changes in how we move and live. Yet, when, how and to what extent these changes will take place is unclear, due to several dimensions of uncertainty. Not only is there high uncertainty about when full automation will reach significant market penetration, but also the direction and intensity of the potential impacts of AVs are

related to how public administrations will intervene in their diffusion. Public administrations need to deal with this challenge, in the short and medium term, but they are often reluctant to take up the challenge (Curtis et al., 2019). This is due to various factors, such as the high levels of uncertainty, the long horizon – much longer than the timeframe of administrative and political offices, for instance – and the lack of sufficient "actionable" information to direct investments or planning priorities. Scenario planning methods (Ariza-Álvarez et al., 2022; Tori et al., 2023) can be very helpful to support public authorities in dealing with these issues, but they rarely enter planning routines.

Aiming to stimulate discussion on these issues, this paper refers to two projects. Firstly, it summarises the results of the Torino2050 project, aimed to address the issue of governing the transition to autonomous driving, defining, through a collaborative backcasting, a policy pathway toward urban liveability and sustainability in Turin (Vitale Brovarone & Staricco, 2023). The process involved public and private actors, and shed light on three very important issues. The first is the power of anticipatory visions and the importance of defining concrete propositions to govern the technological transitions, beyond techno-determinism and towards desired urban futures. The second is the opportunity to ride the wave of the seductive power of technological innovation to promote goals of liveability and reduction of vehicle traffic within urban neighbourhoods. The third is the challenge of actively involving public administrations in the scenario planning processes (Vitale Brovarone et al., 2021).

Secondly, it discusses how backcasting is going to be applied in the recently launched ToMove project, that will test an autonomous public transport shuttle and a robot for last-mile delivery in a quasi-superblock testbed area. The project is promoted by the Municipality of Turin, and the authors, as part of the FULL-Future Urban Legacy Lab of Politecnico di Torino, are involved to set up a participatory scenario-planning process. In this case, the public administration is leading the process, and has accepted the researchers' proposal to use backcasting as a tool to envision a desired future and govern the transition to it, seeing AVs as just a small part of a desired future. The project is therefore a useful opportunity to actively involve the public administration in the scenario-planning process, taking stock of the lessons learnt in the Torino2050 project.

2. Scenario planning

In recent years, scenarios have been increasingly used to support decision makers to engage with uncertainty. For example, in the transport sector scenario planning is a well-known method to help solve future mobility challenges of cities (Tori et al., 2023). Nevertheless, as Cordova-Pozo and Rouwette (2023: 1) point out, three main challenges "limit the spread and the usefulness of scenario planning: conceptual confusion, methodological chaos, and scarcity of evidence on its effectiveness". Moreover, visions and scenarios are often acontextual as they do not refer to real case studies. This can be seen in the literature on AVs, where scenario planning frequently does not refer to the real spaces in which these vehicles will be circulating and parking (Staricco et al., 2019).

The process of scenario building foresees the delineation of a number of scenarios (generally three), including the reference scenario (usually referred to as the 'Business as Usual' or 'BAU scenario'), that is used to compare desirable futures. An important part of scenario building process is also the identification of key factors, which "may determine qualitatively different paths for the socio-economic environment" (Stead & Vaddadi, 2019: 127). The timeframes of scenarios can vary: they can be developed for both the medium term (e.g. 5-10 years) and the long term (10 years or more).

According to Stead and Vadaddi (2019), scenarios can be quantitative or qualitative. However, both quantitative and qualitative scenario methods seem to carry a certain number of disadvantages. For example, Weimer-Jehle (2006) argues that the complexity of quantitative methods often makes it difficult to involve stakeholders in a scenario building process. To counter these disadvantages, mixed-methods approaches, such as the cross-impact balance (CIB) development of socio-technical scenarios could be used (Tori et al., 2023).

Stead & Vaddadi (2019) identify three main approaches to scenario construction: (i) the forecasting approach; (ii) the exploratory approach; and (iii) the backcasting approach. The forecasting approach is often quantitative, where substantial change is not expected and current trends continue in the future. The exploratory approach is usually interactive and involves the identification of key independent and dependent variables. The backcasting approach is a widely known normative scenario method, which formulates future visions and goes backwards to define the actions needed to achieve them. It is often used to look at long-term futures, examining the way in which the desirable future can be reached. To do this, expert stakeholder participation is expected throughout the various phases of the analysis. It then delineates a set of criteria and policy pathways to support decision makers.

In the following sections, this paper presents, examines and discusses how a backcasting scenario planning approach is being applied to a real context in the City of Turin.

3. The case study of Turin

The case study focuses on the City of Turin, located in the north-west of Italy. Known as the 'city of the car', the city has deep roots in its economic specialization in the automotive sector. Although its economy is no longer centred on the automotive industry, today the local population is largely car dependent and presents high ownership rates, among the highest in Europe. The public transportation system is underused, as well as the bicycle and car sharing networks and services. Nevertheless, the presence of a technologically advanced public infrastructure for the management of the local mobility has led to the designation of Turin among the first cities in Italy for the national experimentation of the 'Torino Smart Road' project.

In 2018, it was the first Italian city to have launched a pilot project, the 'Torino Smart Road', to experiment with the circulation of AVs on public roads. One of the most significant results of the initiative was the definition of a 35 km urban circuit on which innovative autonomous and sustainable mobility solutions could be tested on a real road network (Figure 1). This real-world experiment has helped to place Turin at the forefront as regards the transition to AVs.

Figure 1. A road in Turin equipped with technologies needed to test autonomous vehicles (Source: Scudellari et al., 2020).

In 2021, the City adopted its Sustainable Urban Mobility Plan, which will regulate actions and interventions with a time horizon of ten years (up to 2030), developing a vision of the mobility and transport system that could improve the quality of life of citizens. Moreover, the City of Turin is one of the 100 European 'Mission Cities' that is committed to reducing emissions by 2030, i.e. it is a hub of experimentation and innovation in the climate sector.

4. The Torino2050 project

This section summarises the results of the Torino2050 project[1], which addressed the issue of governing the transition to autonomous driving in the City of Turin. In particular, the research project focused on the possible impacts of the diffusion of AVs, as well as the policy strategies and instruments (e.g. transport and land use policies) that should be adopted to govern them. In fact, one of the aims of the project was to provide policy guidelines that the public administration could implement in the short, medium and long term, to guide the transition of autonomous driving towards a future scenario based on the sustainability and liveability of the urban environment. To do this, the research adopted a collaborative backcasting approach, involving both public and private stakeholders, in order to define a future vision and the actions needed to achieve it. In particular, the project involved the participation of the various stakeholders (e.g. public administration, private companies, non-profit associations) throughout all of the phases of the project. This strong collaboration allowed the research group to deepen the technical knowledge of autonomous driving systems, as well as the understanding of the potentials and risks of these new means of travel (Scudellari et al., 2020). Finally, the project defined a policy pathway toward urban liveability and sustainability (Vitale Brovarone & Staricco, 2023), where the diffusion of AVs could be managed in an integrated and sustainable way.

[1] The project "Governare l'impatto spaziale e territoriale della diffusione di Veicoli a Guida Autonoma" was carried out by the Interuniversity Department of Regional and Urban Studies and Planning (DIST) of the Politecnico di Torino.

As mentioned above, the study adopted a backcasting approach, formulating future visions and going backwards to define the actions needed to achieve them. The visioning exercise was carried out in three different phases (Staricco et al., 2019): (i) the development of three visions by the research group; (ii) the validation of the three visions through a focus group with expert stakeholders, and (iii) the selection of the most advisable vision through a set of more than 50 interviews with expert stakeholders. The first two steps were based on a think-tank model, whereas the third was grounded on a participatory model.

In the first phase, three long-term visions (2050) for the city of Turin were delineated:

(i) a 'business as usual' scenario (Vision 1), in which the diffusion of AVs would not be explicitly governed, not their positive or negative impacts;

(ii) an optimistic and technology centred scenario (Vision 2, strong deregulation), which assumed that the impacts of AVs on the city would be largely positive;

(iii) a pessimistic scenario (Vision 3, strong regulation), which presumed that the negative impacts of AVs on the city would prevail if not properly managed.

The three visions were defined with reference to fourteen items: i) road hierarchy, based on the articulation into main roads and local roads; ii) limitation to vehicle circulation; iii) parking areas, with a specific focus on roadside parking and areas to pick-up/drop-off the passengers, multilevel parking, and intermodal parking; iv) local public transport, with specific focuses on the main lines, feeder capillary network and reserved lanes; v) shared mobility, differentiated between motorised and non-motorised services (e.g. bike-sharing); vi) pedestrian areas; vii) bicycle facilities; and viii) modal split.

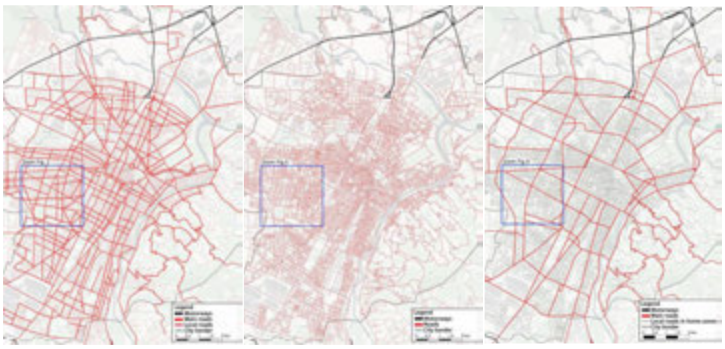

Figure 2. Road hierarchy in the three visions (Source: Staricco et al., 2019: 9, 11 and 13).

In the second phase, a focus group was organised and seven local experts in the transport sector (e.g. from the municipal and metropolitan administration, public transport authority, and third-sector associations) were invited to discuss and validate the three visions and assess their advisability and sustainability.

In the third phase, the seven experts who participated in the focus group and 44 other local stakeholders were interviewed to identify the most advisable of the three validated visions. The stakeholders were chosen in order to cover a wide range of actors interested in the possible future impacts of AVs in the City, such as: automotive companies, research centres, public administration, and environmentalist or professional associations. Finally, Vision 3 (strong regulation) was considered to be the most advisable, Vision 1 (business as usual) ranked second and Vision 2 (strong regulation) was deemed the least advisable.

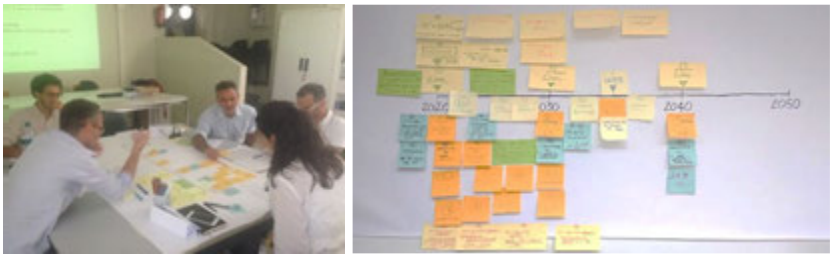

Figure 3. Policy pathway outcome of the Torino2050 collaborative backcasting (Source: Staricco et al., 2020).

The project has shed useful light on three very important issues. The first is the power of anticipatory visions and the importance of defining concrete propositions to govern the technological transitions, beyond techno-determinism and towards desired urban futures. The second is the opportunity to ride the wave of the seductive power of technological innovation to promote goals of liveability and reduction of vehicle traffic within urban neighbourhoods. The third is the challenge of actively involving public administrations in the scenario planning processes (Vitale Brovarone et al., 2021).

5. The ToMove project

Building on the lessons learnt in the Torino2050 project, this section looks at how backcasting is going to be applied in the recently launched ToMove project. The project is led by the City of Turin, and funded with 7 million euros by the National Recovery and Resilience Plan. The overarching aim of the ToMove project is to test an autonomous public transport shuttle and a robot for last-mile delivery in a quasi-superblock testbed area of the City of Turin. To do this, the project foresees a Living Lab, which focuses on the co-design of innovative and sustainable autonomous mobility solutions. As mentioned above, the project is promoted by the Municipality of Turin, and the authors, as part of the F*UL*L (Future *Urban Legacy* Lab) of the Politecnico di Torino, are involved in setting up a participatory scenario-planning process. The public administration has accepted the researchers' proposal to use backcasting as a tool to envision a long-term desired future and govern the transition to it, thus seeing AVs as just one part of a desired future. The project is therefore a useful opportunity to actively involve the public administration in the scenario-planning process. The aim is to actively involve the public administration from the beginning and throughout the various phases of the scenario planning process, thus facing one of the challenges which emerged from the previous Torino 2050 project.

Starting from the test area of the autonomous public shuttle of the ToMove project, envisaged near the Einaudi Campus of the Università di Torino, the scenario planning activity intends to look at a larger urban area, which can experiment with various different integrated forms of mobility. Referring to the approaches of organizing the urban fabric into superblocks (as in the well-known case of Barcelona, which many other cities are taking inspiration from), the area subject to experimentation includes the Vanchiglietta district and its immediate surroundings (Figure 4). The objective is to stimulate a broader reflection on the future of this part of the city, where important urban transformation projects are currently being implemented (e.g. projects involving green and blue infrastructures, redesigning public spaces, addressing climate neutrality, etc.). The study also takes into consideration current and future urban transformations in the test area and its surroundings, such as the former Italgas gasometer area

and the transformations along the riverside areas and the related parks, like the Meisino Park and the Fausto Coppi Motovelodromo.

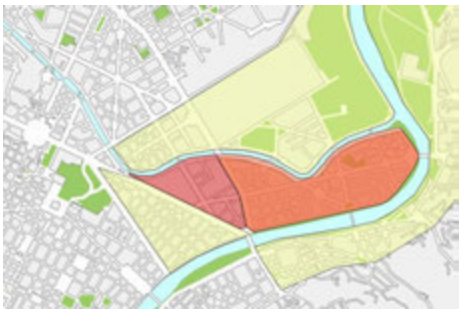

Figure 4. The testing area (in red), the Vanchiglietta area (in orange) and the interface areas (in yellow). Source: own elaboration.

There are various considerations underlying this choice, partly morphological and partly concerning the transformative urban potential. First, the area is contiguous with the autonomous mobility experimentation area around the block within which the Einaudi Campus is located. The extension of the area will provide access to a greater urban area in which to outline strategic transformation scenarios. Second, the spatial conformation of the area along its main road (Corso Belgio), an ogive shape surrounded by the rivers Dora and Po, which is relatively isolated with less than a dozen accesses via bridges lends itself to a reflection on the overall transformation. Third, there are various transformation processes already underway, in particular around the Einaudi Campus of the University of Turin and a former gasometer site. Fourth, the interface area extends north to the city's important monumental cemetery, partly because it is an attractor at an urban scale and partly because the area between the cemetery and the Dora is also relatively isolated. Fifth, the area offers possible solutions to support a redesign of mobility strategies on a larger scale, also through MaaS (Mobility as a Service) solutions. Moreover, this urban area is ideal for supporting a greater valorisation of the area along the rivers, as well as for integrating soft mobility routes.

The scenario planning activity goes beyond the experimental dimension carried out through autonomous driving tests, seeing AVs just as a part of a desired future. In fact, it aims to accompany a reflection on the future of this part of the city from various aspects, such as: innovative mobility (e.g. public transport, sharing mobility, bike lanes), urban regeneration (e.g. urban transformation projects, the redesigning of public spaces) and environmental sustainability (e.g. energy transition, circular economy, urban greening). The ToMove Living Lab also pursues the objectives of energy and environmental sustainability in line with the commitments undertaken within the European programme "100 Climate-Neutral Cities by 2030 - by and for Citizens", in which the City of Turin participates (see Section 3 above). It could be interesting, moreover, to exploit the momentum of Climate-Neutral Cities, where the concept of new mobility with MaaS services would be more visible on both a larger and smaller scale.

In order to co-design a new innovative mobility, the project involves the introduction of the concept of superblock, and the rethinking of public spaces, according to a principle of integration and diversification. In particular, these are the interventions that could be discussed with the various stakeholders and citizens: (i) the rethinking of vehicular traffic by concentrating it on some key sections; (ii) the possibility of using limited transit or pedestrianised areas; (iii) the connection with the areas along the river; (iv) the rethinking/connection with public transport lines; (v) the connection with MaaS systems,

creating exchange hubs; (vi) the taking into consideration of some of the major urban attractors (Einaudi Campus, former Italgas hub, monumental cemetery, etc.) and the customization of travel plans and integrated modes; (vii) indications for the redesigning of public spaces gained through the rethinking of vehicular transit spaces.

The project also looks at the overall normative framework, such as urban planning regulations: the comprehensive plan (Piano Regolatore Generale, PRG) and the various sectoral plans, such as the Sustainable Urban Mobility Plan (SUMP, Piano Urbano della Mobilità Sostenibile) of the Metropolitan City of Turin. Moreover, the test area, due to its particular location, offers the possibility of thinking about possible partnerships with carpooling systems, for innovative mobility services. Finally, the scenario planning will also consider how to integrate the topic of last mile logistics within the area. The scenario planning activity will be carried out within a CityLab[2], adopting the collaborative backcasting method, indicated in the literature as particularly suitable for supporting local authorities in the definition of transition pathways and policy packages towards desired visions for the medium and long term in contexts characterised by multiple elements of uncertainty.

As explained in Section 4 above, the collaborative backcasting method has already been tested by the research group as part of the "Torino2050 – Governing the impacts of the transition towards autonomous driving" project (Scudellari et al., 2019; Vitale Brovarone et al. 2021). The involvement of stakeholders will be based on the experience of the research group and the most recent indications from the scientific literature on scenario planning (Ariza-Álvarez et al., 2022; Tori et al., 2023). The backcasting approach is divided into different temporal and spatial levels (test area / extended area; ten-year scans) and is organised in five work phases:

i) a preliminary phase of identifying stakeholders;

ii) a visioning phase, with a pre-configuration of the different scenarios (there are usually three alternative visions of desirable futures, including the business as usual scenario) and of the transformation drivers;

iii) an interaction phase with experts and stakeholders (focus groups, interviews) to validate the scenarios, evaluate their strengths/weaknesses and select the desired scenario, to which the subsequent backcasting phase refers;

iv) a backcasting phase, for the definition of a policy pathway and the identification of different policy packages, i.e. sets of integrated policies to support the transition towards the desired future. These policy packages will then be evaluated against a series of criteria (e.g. environmental, social and economic). The backcasting operation will be conducted collaboratively, with the direct involvement of the stakeholders, followed by the re-elaboration and systematisation of the results by the research group.

v) a collective public restitution event. The results will be collected in a report that can inform and support the strategic plans and the definition of general (e.g. urban development policies) and sectoral (e.g. SUMP) guidelines of the City of Turin.

As regards the stakeholder involvement, four macro-categories of stakeholders will be involved in the process: (i) public administration; (ii) mobility and ICT services; (iii) research and consultancy; (iv) citizens' associations.

[2] Method already tested in Turin for the project financed by the Compagnia di San Paolo "Mover La Movida", proposed by the Municipality of Turin, and reported in the research report "Vivere, convivere, far vivere la notte a Torino" (Mangione et al., 2023).

6. Conclusions and future directions

As pointed out in the Introduction, today smart cities are dominated by techno-solutionism, pressing for more urban efficiency and enhanced performance. At the same time, the current advent of AVs is bringing a high level of uncertainty to urban areas. Public administrations and decision makers need to face this rising challenge but are often reluctant to do so (Curtis et al., 2019), which may lead to undesired, unexpected and ungovernable outcomes. Nevertheless, scenario planning seems to effectively support public authorities to deal with uncertainty, as well as to plan in such a long-term timeframe.

Both the Torino2050 and the ToMove (even if the latter is currently at an early stage) projects have shed light on a number of relevant issues as regards the application of scenario planning in the City of Turin. First, the governance structure of the urban environment is of fundamental importance to guide the future transition of cities. The urban normative framework, such as planning regulations and sectoral plans (e.g. the urban mobility plan), has a key role in shaping the desired future development of cities. As seen in the Torino2050 project, the "regulation of AV circulation and parking is likely to play an important role in governing the impacts of this innovation on the city" (Staricco et al., 2019: 17). Second, scenario planning seems to be a very useful instrument for decision makers in order to plan uncertainty. Moreover, as González-González et al. point out "in contrast with more commonly used forecasting approaches, backcasting provides a way of imagining a desirable future and identifying a set of core goals on which key decisions can be made" (2019: 153). It also seems that an active involvement of the public administration (as well as expert actors) during the different phases of the scenario planning processes helps the delineation and the evaluation of future scenarios. Finally, the literature on scenario planning seems to be mostly acontextual and a high number of studies seem to focus more on mobility issues rather than general planning issues. The case study of the City of Turin aims to help fill this gap and it is hoped that the ongoing implementation of the collaborative backcasting approach in the scenario planning will provide further fruitful results and considerations that can then be usefully applied in other contexts.

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Projecting The Future:

Scenario Building and Storytelling for Holistic Perception of Future Context.

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Abstract

In this paper, hybrid use of scenario development and storytelling tools is discussed to enhance the design process and how they can be used in the field of urban design to create solutions to the wicked problems of the future.

The workshop in which the proposed scenario building and storytelling processes were experienced was presented and how the methodology used in this study was developed, its findings and outcomes were introduced. As a result, it was determined that by integrating these tools into the design processes, the needed common idea development platform was created and design teams from different disciplines were enabled to holistically define the unpredictable context of the future and accordingly, a positive contribution was obtained in the development of the design idea.

Keywords: Scenario building, storytelling, future context, design education, wicked problems.

1. Introduction

The aim of this paper is to demonstrate how urban space can be considered within a holistic contextual proposal to build a vision of the future and confront possible wicked problems by using the scenario building and storytelling tools.

Based on the prediction that wicked problems such as climate change, whose global effects we have begun to encounter, will turn into continuous phenomena rather than isolated events, there is a need to define a new future context (IPCC, 2018). The concern that the idea projects produced through the analysis and synthesis of existing data for the problems of today and the near future cannot provide solutions to the wicked problems of the distant future is the starting point and basic question of this paper. Therefore, this paper explores the need to develop tools for interdisciplinary discussion of the uncertain and unpredictable new context of the future, especially in the field of education, at professional scales ranging from planning to architecture and other disciplines related to urban space.

Within this scope, the positive effects of the use of scenario building and storytelling tools were first examined through the development of the design idea in the historical process, the qualities that can be transferred to the current design process were determined. A redeveloped and interrelated hybrid process of using these tools collectively was tested in a workshop with mixed groups of undergraduate and graduate students from different disciplines working on urban space, and the findings were shared and discussed. When the results obtained are evaluated, it is determined that by using scenario building and storytelling tools together, it is possible to establish a common working platform that is necessary for interdisciplinary work and thus, it is possible to define the context of the future holistically in a part-whole relationship to support the design education process.

2. Design Problematic in The Presence of Crises

Although the act of design is simply defined as a fundamental problem-solving process (Archer, 1965), underlying this simplicity is the system approach that has developed since the late 19th and early 20th centuries, when scientific approaches developed and discussed the design problematic in relation to other disciplines. The necessity of considering the internal and external contexts starting from the individual who is the subject of the design to the society and community and their environment, as the whole system to which the problem belongs, and the need to analyse the diversified scales in relation to each other has been revealed (Bertalanffy, 1968).

The emergence of this awareness can be explained by a process in which past practices were inadequate, social problems requiring urgent solutions were fed by increasing crises and the need for *the new* and thus the need to refer to scientific methods became a necessity. In parallel with the change in production systems with the industrial revolution and the transition to globalisation, the identification and diagnosis of problems with all their components in a comprehensive context has become the main focus of the problem-solving process. Eventually, this approach brought the concept of *context* to the center of design problematic. The need for a new cross-scale approach has emerged in design education, which was once associated with only arts and crafts and should be evaluated together with different fields of specialization (Giedion, 1959).

The inadequacy of a single point of view in defining the problem and developing proposals for solution in the field of design, reveals the necessity of new approaches in education at the end of the 19th century. Beginning in the early 1920s, the shift from the arts and crafts movement based education system of the early Chicago School in the United States to a model supported by functional utility and knowledge gained from laboratory experience can be cited as an example (Jaffee, 2005, p. 42). Similarly, it is claimed that the strong development of the *Ecole Polythecnique* system in France from the beginning of the 19th century, alongside the classical *Beaux-Art* education, arose from the need to produce urgent solutions to the problems encountered in contemporary practice, in the sense of bringing together life and design. (Giedion, 1959, p. 211). The fact that the attempts to *search for the new* gained strength and increased after the First World War which were stimulated by economic and political crises, reveals the view that design is a tool that is questioned again especially in times of crisis. Giedion (1959, p. 291) defines this period as *infected atmosphere* and attributes the differentiation that emerged in design in two basic conditions. These were the abandonment of historical methods and the adoption of the principle of fitness for purpose in creativity. The salvation of the city from the individual citizen to the society and building to the urban structure

took a new breath in Germany at the beginning of the 20th century with the innovative design model brought by Bauhaus, bringing all disciplines together for the human needs.

The new crisis that started with the Second World War and the design approach that developed afterwards, by introducing new rational methods, proposes a systematic city that is distinguished with precise lines where people can live faster while accelerating production processes (Le Corbusier, 1927). Against this crisis of *standardisation*, it is possible to see models such as the Doorn Manifesto of 1954, which proposes different design approaches to achieve liveable urban areas and to reunite people, cities and nature with all their differences (Mumford, 2002, p.239). It is understood that the efforts of the reformist, innovative approach, which continued with TEAM 10 in the continuation of the Doorn Manifesto, addressing the design problem together, starting from the individual to the urban scale, could not prevent the space from becoming an object of consumption (Urry, 2016, p.104). As an example of this, it is possible to read the meeting of the city with the automobile, starting from the design object, through the way it affects the city, the individual, the society and its interaction with the social, political and economic context (Sheller and Urry, 2000). It is not surprising that a linear design approach was adopted to find solutions to the crisis of demand hunger encouraged by the economic system of the consumer society, while the real crisis of hunger, which has no material equivalent, was ignored. Therefore, it is possible to define the basic method of the design process in this economic boom period as the transformation of the idea into a design product within a basic approach that extends from analysis, synthesis, projection, concept design and production.

Design process carried out with such a limited analytical evaluation may also have lack off creative dimension and visionary perspective (Cross, 2004). However, it should not be ignored that the search for alternative solutions brought to the design process by temporary economic-based problems such as the oil crisis in the 1970s has enabled approaches that we define today as nature-based solutions or passive architecture (Wright, 1978). Similarly, collective architecture or place-making practices, the integration of participatory methods from planning to architecture, or the search for alternative transportation solutions have become tools of a design approach that seeks new ways to overcome the crisis of consumer society.

Based on these arguments, it is possible to say that starting from the 19th century, the design process was shaped by social conditions and crises that radically changed the production of space. it is seen that in the presence of crises that develop within defined contexts, it is accelerated to adapt to the current situation or to produce solutions to mitigate the effects of the crisis. Such a determination shows that crises that can be reduced to defined problems are effective in creating new methods that strengthen the design process until today.

On the other hand, in a situation such as the climate crisis, which poses a threat on a global scale and whose unpredictable effects cannot be reduced to defined problems, the design methods we have implemented until today can be considered inadequate. Distinction between *time ahead* and *upcoming prospects* conveys an important caution. *Time ahead* conveys a chronological sequence and linear flow of phenomenon mostly about a predictable near future, while *upcoming prospects* includes problems of distant future that are the focus of this paper such as certain outcomes conditional to significant societal events, natural hazards or public action plans (Ghimire, 2018). What we expect from design today is not only to produce solutions to current problems or the needs of today or the near future, but also to produce solutions to the unpredictable context that awaits us in the distant future.

3. The Need for A Tool to Predict the New Future Context

In the early 1970s, teams working in the technological field developed ideas on how methods such as operations research and systems analysis could be transferred to find solutions to urban problems. In this period, innovative methods were introduced to address the newly encountered *wicked problems* (Rittel and Webber, 1973) in social, technological and scientific fields within a systems approach (Skaburskis, 2008).

The definition of wicked problems also coincides with the *infected atmosphere* used by Giedion (1959) to describe the crisis where the design process has failed to produce innovative solutions. Today, wicked problems are recognised as the global problems emerging with the climate change, the parameters of which we cannot yet define precisely, but the consequences of which we may face in the short, medium and long term (IPCC, 2018). The consequences of problems such as overpopulation, urbanisation in the process of sudden spatial transformation, change of coastal areas, lack of biodiversity, transformation of agricultural lands, urban heat island effect can be listed as wicked problems (Neil, 2020). The main challenge is to identify wicked problems for which conventional solutions are insufficient in the framework of an unknown future context and in the presence of new complex problems, including issues that were not on the agenda of the last century. The systems thinking approach of looking at the wicked problems through patterns, provides important guidelines for holistically envisioning the contextual relations of the future. Senge (1990) defines systems thinking as the discipline of seeing the whole and emphasises that it is a framework for understanding interrelationships rather than singular elements, an approach to recognising patterns of relational change rather than momentary static fixations. According to Senge, an intuitive intelligence is needed to deal with complexity. While the intuitive side of problem solving is neglected in conventional educational theories, the role given to intuition by the systems thinking approach has the potential to make a significant difference.

The tendency towards the approach of interdisciplinarity in the design process can be considered as a result of the need to discuss the adaptation and interaction of changing space typologies in different time uses and contexts, and to consider different scenarios in the presence of uncertainties. Criticizing the design approach of the past, reveals that thinking across scales and establishing connections in the part-whole relationship cannot be reduced to a single point of view or a specific profession. When complex systems such as urban space are subject to design, it is recognized that interdisciplinary, participatory, holistic approaches that are open to discussion and questioning as much as possible require interdisciplinary, participatory and holistic approaches. The existence of program requirements in the accreditation of architecture schools, which state that the criteria for the evaluation of the social, economic, ecological, technical, artistic and cultural dimensions of design all in harmony, shows today's tendency towards a multidimensional and interdisciplinary approach to design education (UNESCO-UIA, 2023).

Despite of this tendency, in the field of education, the existence of tools that will enable different fields of expertise to work together in order to produce creative solutions by comprehending the complexity of the problems, uncertainties and the complex structure of the city as a whole is questionable. It can be said that the plan and project production processes applied today are limited within the problem and potential orientated design process, which is developed on a very linear and rational cause and result relationship to serve the current production and consumption systems coming from the legacy of the modern period.

Considering these current remarks and the approaches to the design problem defined from the beginning of the 20th century to the present day, it is possible to see that we are facing a different urban phenomenon and the problems it brings. Although the components that constitute the multiple structural layers and form of the city have changed slightly since the modern period of 1950's, it is seen that the scale relationship, socio-economic and political factors that constitute the parametric structure of this complex system have changed on a local and global scale. Especially the increase in the speed and accessibility of information flow compared to previous periods has brought a different dimension in reading and understanding this complex structure. While obtaining and synthesising the information needed from this complex pool of data requires the development of new areas of expertise in relation to the field of planning and design, it also shows that no single voice in the field of planning and design can be authorised to project ideas for the new context of the future. Consequently, this has led to a new wave of complexity-oriented urban science (Lepri et al., 2015). Especially in the field of planning and design education, it is becoming increasingly important how these data can be evaluated.

4. Scenario Building and Storytelling as The Unifying Tool for Interdisciplinary Studies

Based on the problems and potentials defined at section two and three, it is understood that the starting point of the design idea in complex systems such as cities is not the subject-object relationship based on a single problem, but the dilemma of finding a way in a chaotic situation. While dilemma often draws an unpredictable, ambiguous future, the design team consisting of different expertise are expected to produce creative thinking system in order to deal with today's complex set of problems.

Contemporary approaches suggest that planning and design processes should be evaluated in a multi-layered and interdisciplinary or even transdisciplinary structure, in the interaction of complex systems with the natural and artificial environment, and by considering the changing human perception (Gallotti, Sacco, & Domenico, 2021). Among these dimensions, perhaps the most striking emphasis is the difficulty of human perception to perceive this complex structure. Therefore, the need for conceptual tools to abstract this complex structure is particularly important. Today, as the climate crisis being a part of our daily lives, it is understood that the future predictions or plans and projects put forward by conventional methods are insufficient. Although the priority is to find resilient city solutions and to mitigate the impacts of climate change for developing short, medium, and long-term interventions, on the other hand the scenarios of adaptation to the new facts and new contexts for a future proof city needs to be considered. From this point of view, it is thought that the scenario building method (Chermack, 2011; Kahn and Wiener, 1967; Martelli, 2014) can be re-considered and developed in the field of planning and design education and can be evaluated as a tool to create a mutual platform that will bring together students dealing with urban space at different scales.

The philosopher and futurist Gaston Berger, with his discourse *la prospective*, is mentioned to have used the concept of scenario not only as a tool for imagining but also as a tool for understanding the future and making long-term predictions (Martelli, 2014). The concept of scenario building, which has found a wide implementation area today, was defined as a series of hypothetical events that aim to focus our attention on decision-making processes and was developed by Kahn and Wiener (1967). Urry (2016, p.97) states that *scenario workshops* play a role in determining the events and processes that are expected to occur at the chosen time of the defined scenario, and that future alternatives can be evaluated in the light of scientific data based on yesterday and today's information. In this sense, according to Urry, scenario building

enables the creation of a characterisation of the economy or society for a future time in the light of known trends, the main sources of change and possible patterns of economic and social life.

At present, scenario building tools are used in a wide range of perspectives, especially in the field of planning and design, from the development of country and regional development strategies to urban design and architecture (UN-Habitat, 2023; Merrie *et al*., 2018; Abou Jaoude *et al*, 2022). Considering these implementations, it is important to note that scenario building tools are actually considered as learning tools, as they are used to develop alternative proposals about the future context. This emphasises the importance of using this tool in the field of education (Berkhout *et al*., 2002; Brown and Castellazzi, 2014).

Among the actual scenario building tools that can be applied with multiple participants from different disciplines, the quad matrix (2x2 prediction matrix) created in the x and y coordinate plane with concepts representing extreme case oppositions finds a widespread implementation area. Although this tool is considered inadequate because it only allows the discussion of four alternative future scenarios, it is preferred as a practical application tool for short-term workshops for the development of design ideas. In order to establish the basic concepts to be discussed on the matrix, a preliminary study is required to identify future uncertainties and trends. This process can be developed through group discussions and debates and considered as a broad platform where the participation process can be conducted. While defining concepts of extreme cases to be placed on the matrix, the discussion of trends and uncertainties through political, economic, social and technological data constitutes the infrastructure for the development of scenarios with scientific data.

It is important to remember while developing scenario building tools that scenarios are stories about the future and should be presented as a narrative (Martelli, 2014). When Calvino's (1978) Invisible Cities is considered, it is possible to see that the abstraction technique and power of narratives have always been used as a valuable tool to conceptualise, represent and communicate the complexity of urban environments (Mukhija, 2015). In addition to Calvino's storytelling through text, it is also possible to see examples of how this approach can be used in the design process of storytelling through visualisation. In the context of the standardisation brought about by modernism, it can be said that the Archigram team (Cook, 1999), which questioned the urban space in the 1960s and emerged with a new manifesto, used the method of designing and transferring through storytelling, going beyond the strict architectural language and making the idea of design a source of inspiration for different disciplines. The competition, which brought together the experiences on sustainable and liveable urban development and aimed to project Metro Manila's future vision of the city by 2050, is an example of thinking, designing and communicating through storytelling in the current period (Manila Bulletin, 2020). Espinosa's work titled *Broken But Still Beautiful*, which won the grand prize, is noteworthy for narrating the urban context of the future through storytelling in a part-whole relationship.

When the changing perception of design in the historical process, its interaction with crises and interdisciplinary dimension are evaluated, it is seen that the utilization of scenario building and storytelling together can be evaluated as a tool to produce potential solutions to the new wicked problems we face with climate change. It shows that scenario building and storytelling have the potential to be developed as a tool that will enable the evaluation of the environment in a part-whole relationship and the creation of interdisciplinary collaborations, starting from the upper scale context in which all design fields from urban to architecture, and industrial design are involved. This holistic approach does not aim to uniformise and standardise cross-scale

approaches, as has been experienced in the historical process, but to foresee the conditions for a common future context that prioritises diversity and to encourage the development of different creative solutions to wicked problems.

It is argued that crises are the driving force for the development of innovative approaches in the design process. However, it is seen that the innovative pursuits that emerge in the aftermath of crises develop manifestos that form their basic discourse by first conceptualizing and questioning past and present trends. It is noteworthy that these manifestos use storytelling tools to convey how they transform the space for the future and to develop the idea of design. Although scenario development and storytelling tools seem to be communication tools, the idea that they can also be used as design development tools stands out as a potential model to be developed.

5. Construction of the Ideathon

In this framework, the combined use of scenario building and storytelling approach was tested through a workshop focusing on the coastal areas of Istanbul for the year 2100 and aiming to re-think the urban context when the sea level rises through different scenarios. Thus, the theme of the workshop was selected as *Sea Level Rise Due to Climate Change* as it is a contemporary theme with a multi-layered data set in terms of future projections in various fields. Based on this approach, the aim of the workshop is to develop design methodology in the presence of wicked problems and new crises and to test the use of innovative tools in the field of education as a supportive element of the design process.

5.1. Methodology and Work Structure

The workshop was organised in an ideathon format, bringing together different disciplines and creating an atmosphere of an idea marathon. The structure of the workshop has been developed to combine the process of performance-based scenario building with the process of stimulating creativity, generating different future ideas based on analytical data and developing design thinking through storytelling. The use of scenario building and storytelling tools, proposed as the main tools of the Ideathon, were utilised to allow participants to develop holistic and multi-layered approaches through quick thinking and high concentration. The scenario building tool, involving of a basic 2x2 prediction matrix, was used to present extreme opposite conditions and thus develop ideas about four alternative future scenarios to be used in the workshop. The groups to be formed by the students were asked to build their original scenarios by choosing one of these four conceptual frameworks.

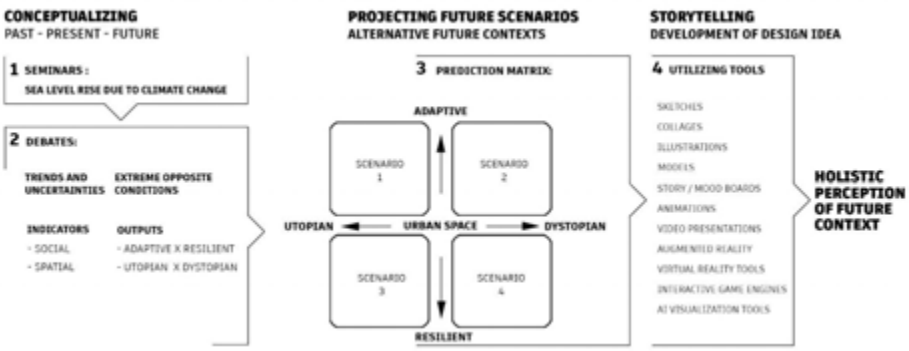

Figure 1. Methodologic approach to integrate scenario building and storytelling tools into the design process.

The methodologic approach that framed the workshop was applied in three phases over three days to bring participants together on a common platform and integrate scenario building and storytelling tools into the design process to create a holistic perception of the future context (Figure 1). These three phases were defined as *conceptualizing* the past, present and future, *projecting future scenarios* as alternative contexts and *storytelling* as development process of the design idea. The fourth day, which includes the jury evaluations and the closing panel, can be considered as the final phase that reveals the outcomes of the work.

The establishment of common conceptual structure for the discussion of the future context is important for the evaluation of the workshop outcomes. Therefore, there is a need to identify and conceptualize the variables that drive collective thinking in a short-term workshop with participants from different disciplines. The professional diversity of invited lecturers for seminars, jury members for evaluations and mentors to guide idea projects is as important as the diversity of participants in ensuring interdisciplinarity. In this way, different scenario proposals based on technical and scientific data can be developed, different storytelling tools can be introduced, and the final products can be evaluated equally. Therefore, experts from different fields of expertise in planning, design and art have been invited to participate to the workshop. On the other hand, student participants who will produce idea projects were invited through an open call to all undergraduate and graduate students who produce ideas related to urban space. Submissions evaluated according to the applicants' motivation letters, workshop experiences and other areas of interest. The Ideathon was attended by 27 students from the fields of architecture, urban planning, urban design, interior design, photography, painting, software engineering, sociology, graphic design, public administration, computer engineering, from various institutions. Mentors to assist the student groups during the workshop and jury members to evaluate the final products were selected from the fields of urban planning, urban design, visual arts and entrepreneurship, writing, stage design and scenic arts, and public administration.

5.2. Flow

On the first day, the first two phases of the Idethon process were addressed. In order to establish basic mutual understandings, debates on trends and uncertainties related to effects of sea level rise have been guided through political, economic, social and technological indicators. Since the workshop is a spatial inquiry and an inter-scaled study in the context of urban design, these multiple data set used in scenario building was categorized in two groups as *spatial and social indicators*.

After the thematic lectures and debates, lecturers and mentors highlighted the following concepts that emerged from all discussions, which were then used to identify extreme conditions for scenario building. These concepts can be grouped under the following headings.

- Adaptation
- Climate crisis and crisis response
- Planktonic approach
- Scenario building
- Balance

- Harmony
- Utopia
- Dystopia
- Sustainability
- User-centered design

The two main pairs of opposing concepts to be developed on the 2x2 prediction matrix were selected as a result of the clustering made in accordance with the connections established between the concepts.

- Adaptive and Resilient
- Utopian and Dystopian

The second day involved the scenario development phase. In this phase, four different future scenarios defined by the selected extreme condition concept were identified to form the 2x2 prediction matrix. Each group was asked to develop one of the four different future scenarios: Adaptive dystopian, resilient dystopian, adaptive utopian or resilient dystopian urban contexts. With the support of mentors, 8 groups of 2 to 5 students, decided which concepts in the scenario building matrix would intersect to envision the urban space of the future. Accordingly, they chose a coastal area on the Bosphorus and started to envision how the spatial and social qualities of this area would be shaped within the scope of the future scenarios they chose. This phase stands out as the phase where the part-whole relationship was questioned, supported by brainstorming, discussions and sketching. It is also the phase where storytelling tools suitable for narration were selected.

The third day involves the use of storytelling as a tool for developing the design idea. The groups were directed to narrate how the scenario they had identified affected the social organization and spatial structure from the individual to the community and society, how it changed and transformed coastal areas, and how these areas could become *liveable urban spaces*. Each group adopted their own narrative tools and defined their proposed *new urban system* in a *part-whole relationship*. It is important for the storytelling to question the proposed fictional context with continuous feedback. In this way, the feedback process needed in the design process is also implemented.

On the fourth day, the completed team works were evaluated by the jury members. The presentations and evaluations were announced through an open call and scheduled to be visible to anyone who wanted to participate online or in person.

5.3. Evaluations

Eight groups made their final presentations in a public session in front of the audience and jury. Presentations finalized with a question and answers session. The jury evaluated the proposed idea projects on the basis of the following five criteria, taking into account their ability to present a holistic and coherent new urban space.

Evaluation criteria of the idea projects:

- Consistency of the constructed idea.
- Scenario built through different perspectives.
- Multi-layered elaboration of the fiction of Istanbul.
- Originality of the idea.

- Quality of the visual presentation.

	CONSISTENCY OF THE CONSTRUCTED IDEA	SCENARIO BUILT THROUGH DIVERS PERSPECTIVES	MULTI-LAYERED ELABORATION OF THE FICTION OF ISTANBUL	ORGINALITY OF THE IDEA	QUALITY OF THE VISUAL PRESENTATION
GROUP 1	●	●	●	●	●
GROUP 2	●	●	●	●	●
GROUP 3	●	●	●	●	●
GROUP 4			●		
GROUP 5		●	●	●	●
GROUP 6	●	●	●		
GROUP 7		●	●	●	●
GROUP 8				●	

Figure 2. Evaluation of the idea projects.

According to the evaluations (Figure 2), 88 percent of the groups built their scenarios considering the perspectives of different disciplines in addition to architecture and planning. The diversity of the workshop offered a perspective that brought together social sciences, art and technology in the design process and made the proposals unique and innovative. The predominance of projects that emphasize how different species can coexist in interaction in urban space, can be considered as a result of this diversity. Generating a common vision from the perspectives of different disciplines increases the comprehensiveness of the design process.

75 percent of the idea projects developed creative ideas to confront wicked problems beyond conventional spatial project proposals. This can be associated with the fact that while developing the story, the proposed solutions evolve along with the narrative, and that all actors, from the individual to the community and all elements interacting with the space, are included and considered in the story. In this way, the problem is no longer just a *structural design* problem.

The relatively low presentation quality of the stories, at 65 percent, can be explained by the inadequate use of scenario tools and the fact that only one day was allocated to narration. The group discussions focused on the production and elaboration of the original scenario so that there was not much time for visualization due to time constraints. This situation shows that more time should be allocated to storytelling in similar workshops, and that rapidly developing artificial intelligence tools should be used more effectively to support design processes. On the other hand, it has also been observed that scenario development and storytelling may potentially risk *becoming an objective* rather than *a tool* to support design thinking. This can be considered similar to the problem of *Rendering Architecture* overwhelming the idea of architectural design. Therefore, it was seen how important the support and guidance of mentors is for establishing a balance in the use of these tools.

As a brief summary of the evaluations, it can be said that the participants were asked to imagine the future with multi-layered aspects of daily life in a limited time and that the program was supported with conceptual and technical lectures to increase creativity. So, the participants worked in a highly concentrated process. The outcomes of Ideathon aim to define the space and its components contextually, rather than using technical norms and standards as in a

conventional workshop. Although the theme of the climate change and the new crises was chosen with reference to a dark future, most of the groups proposed creative solutions and holistic proposals that carry hope for the future. This can be considered as an effect of promoting new inclusive methods, comprehending the problem in the whole context and developing creative ideas first, rather than looking for solutions to singular spatial problems. The components that construct the space and future habitat were proposed in a comprehensive and interrelated manner instead of being analysed in a fragmentary manner. It was observed that all idea project presentations developed a system proposal based on a liveable future. Hence, even if the future is a dystopia, the necessary conditions for adaptation can be achieved and that the power of imagination and holistic thinking by establishing inter-scale relations contribute to the re-establishment of ecological balance on a global scale. Different disciplines have different ways of problem solving. The integration of scenario building and storytelling tools for the development of design ideas has created a platform that brings these differences together to create solutions in a collaborative way.

6. Conclusion

The complex problems of today are indicators that we may face more complex problems tomorrow. It can be said that the role and responsibility of the designer and conventional design processes have to change in the presence of an unpredictable future context.

The method proposed in this study aims to improve the process, not the design itself. It enables the definition of a future context that minimizes uncertainties before moving to a design solution. The priority here is to project the future context and, accordingly, the design concept and the set of criteria for solving wicked problems (Figure 3). The hybrid scenario building and storytelling process guides the interdisciplinary design team to abstract the uncertainties of the future and imagine a coherent and holistic urban space through co-creation and conceptualization. In urban design, this hybrid methodology emphasizes the social, political, economic and ecological values of urban space, thus transforming the perception of urban design from a simple relationship of form and function.

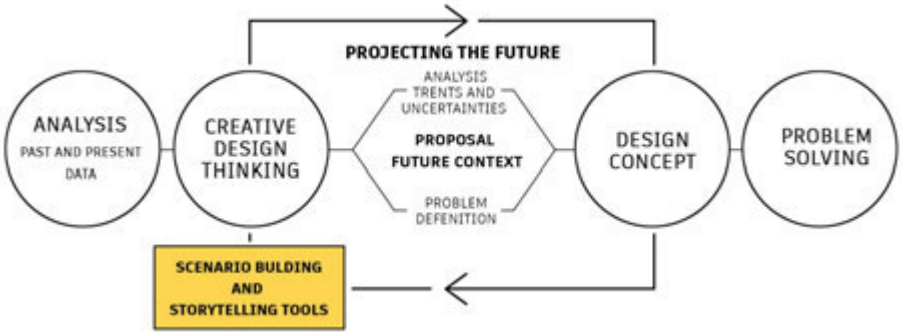

Figure 3. Problem solving process integrated with hybrid use of scenario building and storytelling tools.

The Ideathon format workshop is designed as a meeting, learning and idea generation environment for students from different disciplines to support their education. It aims to provide a creative exercise that emphasizes the diversity of scientific and artistic approaches to design

and a systems approach. Instead of defining a problem through limited analysis and synthesis data in a focused area, it is built on the development of a holistic perspective and creative design thinking that emphasizes understanding the trends and uncertainties at the source of the problem and thus the context of tomorrow.

A general evaluation of the study reveals that today it is increasingly difficult to predict the future in complex systems such as cities, and the negative impacts of constructing urban space through a single discipline or individual expertise. The need for an interdisciplinary perspective in education is clearly seen in order to prevent these difficulties. In professional practice contexts shaped by the conventions of the past, singular project-oriented thinking cannot devote sufficient time and energy to such endeavours of visioning. Similarly, in short university education, practices for vision and strategy development may be limited or there is not enough time to realize the idea of bringing together different disciplines, which is an important tool for achieving this. In order to design the future urban space, there is a need to develop an interdisciplinary and multi-perspective approach, which requires the interaction, exchange and co-creation of the knowledge and experience of different fields of expertise.

As in the experience shared in this paper, it is seen that supportive tools can be developed to close this gap by encouraging mixed studies, such as the hybrid use of scenario building and storytelling tools through short-term workshops. In the development of creative and innovative projects in design education, regardless of their theme and scale, it is important to evaluate them in the interaction of time and space with all their components, from the unit to the whole, from the individual to the society. This method has an important potential to perceive and comprehend the context of the future holistically and to produce solutions in the face of unexpected, wicked problems.

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Scenario Planning Method in Conceiving Future Development of Peripheral Areas: Island – City – Spatial Interconnecting for the Sustainable City of Tomorrow

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Abstract
Islands and island archipelagos, as typical peripheral areas, are of particular interest for both researchers and spatial planners. In this research the importance of the scenario method, especially in the education of future spatial planners is emphasised. The Zadar Island archipelago in Croatia was chosen as a case study for which eight possible scenarios were proposed. According to the evaluation the best rated scenario was developed in the long-term vision. Necessary activities in the form of different models (housing, transport, economy, green infrastructure) and related development projects were proposed for a period of next 25 years. Proposed models, with some modifications could be applicable to areas with similar characteristics.

Keywords: development vision, education, islands of the Zadar archipelago, scenario planning, strategic thinking and planning

1. Introduction

Peripheral areas of Europe as well as areas with geographical specificities, including islands and island archipelagos, are particularly interesting and challenging for both researchers and planners. Since the inner peripherality is the result of multiple combinations of features and processes in the space and different development dynamics, such spaces can also have significant development potential limitations. Conventional peripherality, as a result of physical geography and remoteness, is strong and in fact difficult to improve. As peripherality is determined also with non-spatial processes and factors, it is necessary to comprehensively look at and conceive appropriate development strategies, as well as policies and measures in order to achieve better accessibility, better economic potential and access to services of general interest, and consequently a better demographic situation for such areas (ESPON, 2017; ESPON, 2019).

Based on the sustainable development goals of the UN Sustainable Development Programme 2030, the Republic of Croatia created the *National Development Strategy of the Republic of Croatia until 2030* (2021), which determined four development directions (Sustainable economy and society; Strengthening resilience to crises; Green and digital transition and Balanced regional development) and thirteen related strategic goals, as a contribution to global sustainability goals. (Figure 1)

Figure 1. Connection between the Strategic Framework of the National Development Strategy of the Republic of Croatia until 2030 and the UN Sustainable Development Goals. Source: Official Gazette (2021)

In accordance with European development policies for balanced regional development, the Republic of Croatia wants to reduce internal differences in the level of development and make all parts of the country better and more desirable, while achieving permanent growth, demographic recovery, strengthening social justice and social trust. Goal 12 "*Development of supported areas and areas with developmental peculiarities*" is aimed on undeveloped areas, which refers to areas with developmental peculiarities - hilly and mountainous areas and islands. The main development of such areas is related to the unfavourable economic structure (weak role of the private sector and large presence of the state sector, insufficiently developed human capital, low entrepreneurial culture, insufficiently efficient institutions), depopulation, emigration and aging of the population. In addition, islands and hilly-mountainous areas are faced with specific challenges such as insufficient transport connections and seasonal infrastructure overload.

The national development strategy envisages *Development of smart and sustainable islands*. The concept is based on an integrated approach to the development and digitisation of island resources and management, taking into account the specifics in terms of traffic, energy, security and risk prevention, as well as the availability of infrastructure and public services. The goal is to encourage integrated passenger transport, interconnecting of the islands and their connections with the mainland. The planned structural changes of the island economies aim to strengthen the island's capabilities and capacity to implement innovative solutions in response to key social challenges (climate change and environmental protection, clean energy and traffic,

health and quality of life). In order to revive the island economy and vitality, emphasis is placed on the digital economy, tourism, availability of public services, renewable energy sources, fishing, food production and processing. Investments in the development of digital infrastructure are supported as a prerequisite for successful digitisation and digital transformation of island communities. Strategic connection of the islands with entrepreneurs and universities is planned in order to define and implement sustainable solutions for specific problems, including the concept of "smart islands".

The National Development Strategy (2021) sets the following policy implementation priorities on development of smart and sustainable islands:
• smart and sustainable management of island resources and environment, fight against climate change and risk prevention
• sustainable development and structural transformation of the island economy
• smart mobility and connectivity
• development and construction of optical broadband infrastructure and high-capacity communication networks
• improvement of life quality through development of public infrastructure (utility, water supply, transport, business and social infrastructure), support of housing and public services development.

In order to choose the most suitable development direction for islands and island archipelagos, it is necessary to consider the national and regional development plans, think strategically about the space and look at the long-term needs of inhabitants, as well as possibilities and spatial potentials on the local level.

The aim of this work is to emphasise the importance of the scenario method in planning as a par excellence tool for the future development. Its importance in the education of future spatial planners is pointed out so that they can think strategically about space, and to design and valorise possible scenarios of cities and regions in the 21st century (ECTP-CEU, 2013).

2. Education of Spatial Planners and Scenario Method in Spatial Planning

According to the UNECE (2008) spatial planning is a key instrument for establishing long-term, sustainable frameworks for social, territorial, and economic development both within and between countries. Its primary role is the enhancement of the sectors integration, and the improvement of national and local systems of urban and rural development, while taking into account environmental considerations.

As ECTP-CEU (2013) point out spatial planning, as a discipline, operates at different scales, from European, transnational, national, regional to local plans. Therefore, the principal education of spatial planners must be conceived in the way they get the abilities to cope with different scales and different levels of territorial planning.

As cross-disciplinary, spatial planning involves different professionals and actors. The planner’s role responds to planning developments in society and laws and policies. Primary focus of spatial planning is on the interest of society, the settlement and the region, and their development in long-term. The spatial planners are committed to protect the general interest of society. They analyse, draft, implement and monitor development strategies, supporting policies, programmes and key projects. They are engaged in the various phases and scales of the planning process. In planning, the role of the planner as a mediator is important, because

planning is not only concerned with plan preparation, but is part of the process where public and private interests need to be balanced. Ability to mediate and to negotiate are therefore important in planners' education. In order to support and guide the public planning process, the planner's role requires increased design, synthesis, managerial and administrative skills. Besides it demands a scientific approach, the achievement of social dialogue and agreements. The challenges of the 21st century require planners to undertake the commitments as leaders of change, political advisors, designers, urban managers and scientists in order to lead the way in making the changes that are needed for cities and regions to achieve the Vision and to apply the principles for sustainable development. (ECTP-CEU, 2013)

According to the ECTP- CEU the planners' core commitments, embodied in the Charter of European Planning, include research and analysis, advocacy and mediation, the ability to envision, evaluate and promote potential future options for urban, spatial, and territorial development. University-based recognised planning courses for spatial planner are combining scientific and creative conceptual thinking with practical approaches in order to harmonise society and environment at various territorial levels. The ECTP- CEU (2017) has identified the framework of guidance based on three needs and the related eight core competences of spatial planners:

- Critical thinking and understanding of the rationale of planning and its theoretical and legal basis (The Rationale od Planning)
- An understanding of the spatial systems (Socio-economic systems, The Built Environment, Environmental systems)
- Technical and creative competence needed to engage in planning practice (Planning Techniques, Planning Instruments, Planning "Products" and Independent Research).

Spatial planners therefore must have a range of core competences and a commitment to ethical standards of conduct. Understanding, knowledge and skills of the following are required: the economic, social and environmental spatial context for planning decision; the political and legal framework within which decisions are taken; the ability to initiate and implement plans and policies; analytical, design and communications skills to inform choices, including the application of research knowledge; and the ethical challenges including the need for inclusive approaches and reflective learning; and the ability to collaborate and in co-working. (ECTP-CEU, 2017)

As it can be seen on the Figure 2 that the planning process is continuous and cyclical because spatial systems change, and planning needs to adapt to these changes. Further the preparation of the planning product is informed by research into socioeconomic, built, and natural spatial systems. The planning product is implemented by the use of legal, financial and administrative instruments. That will have an impact on the spatial systems as these change as a result of planning intervention. Those changes in the nature of the spatial systems will require renewed intervention, or changed intervention that will require updating planning policies. Since planning is more than an administrative or bureaucratic process, planning intervention is not always necessary and must be justified. (ECTP-CEU, 2017)

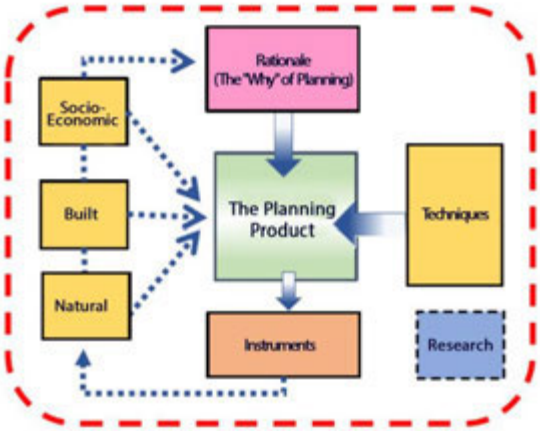

Figure 2. Aspects of Planning Practice. Source: ECTP- CEU (2017)

In order to determine the future development possibilities of a certain area the scenario method is used as a par excellence tool in planning especially regarding encouraging strategic thinking and helping overcoming thinking limitations. As the scenario method is the subject of numerous research, there are many definitions depending on the authors and their areas of application. The founders of future studies and scenario planning, Kahn and Wiener (1967) define scenario as "a set of hypothetical events set in the future constructed to clarify a possible chain of causal events as well as their decision points". Scenario is also perceived as a description of the future state and the sequence of events leading to the future state (Godet and Roubelat, 1996). Shearer (2005) points out that the scenario is a mean to achieve the desired state, and not a "variant of the future".

After the WWII, the use of the scenario method expanded, when it was linked to military planning at the RAND Corporation. During 1960s the methodology was used for the purposes of social forecasting, public policy analysis and decision making. In the 1970s, scenario planning gained a new dimension especially in the private sector. Bradfield et al., (2005) point out that during the last decades, the use of scenario method has particularly increased also in the field of spatial planning.

Depending on the level of spatial planning, Kok et al. (2006a, 2006b) stress that scenarios created for lower levels are based on scenarios from higher levels. Higher-level scenarios are usually developed by scientists and stakeholders on the regional and national levels, while local scenarios are developed by local stakeholders. Scenarios can be presented in textual and graphic form as pictures, graphs, maps, etc. that enables better perception and understanding of the future (Rothman (2008). Ljubenović et al. (2014) stress that quantitative numerical accuracy is typical for simulations, while scenario planning usually provides a more qualitative description of how the present will evolve in the future. They point out that in the scenarios the range of possible outcomes resulting from uncertainty is explored, while creating a vision builds a picture of desired future together with strategies for achieving goals. Friedmann et al. (2004) believe that how we are questioning the future for optimal decisions in the present that have to

be based locally. In order to enable the assessment of the outcomes and effects on different aspects of sustainability, in the context of different assumptions or scenarios a detailed investigation of strategic issues is necessary. Radeljak Kaufman (2016) points out that the scenario method is useful in spatial planning because of the creation process during which knowledge about development trends and spatial elements is expanded, but also because of the final results that are important for management strategies and measures.

In the education process, students as future spatial planners are directed to strategic thinking and the use of the scenario method, that presents an efficient tool to articulate concepts of an uncertain and complex future. This tool serves as a basis for defining an integrated vision of development of cities and regions. The application of scenario planning based on Intuitive logics school, which does not use any mathematical algorithms, stimulate students′ intuition and creativity, which is the methodology proposed by Stanford Research Institute International (SRI). The advantage of the SRI approach is the development of flexible, internally consistent scenarios from an intuition and logical perspective (Huss and Honton,1987). Besides the importance of flexibility in the process of creation of a spatial development vision, has to be taught as well as the need to create at least four scenarios which enable an open discussion and the combination of different interests of stakeholders in the process of defining the preferred model and creating a common development vision (Vogelij, 2010).

In the process of education, students are directed to elaborate strategic visions that are considered as the basis for creating high quality places and delivering a more sustainable future for communities as well as to achieve their long-term needs. Using comprehensive planning, as an effective tool for enabling communities to formulate strategic visions of their future development goals, future spatial planners are taught to apply the integrative approach that allows an evaluation of the strengths and challenges of the specific area, the definition of opportunities and scenarios, and selection of optimal vision and spatial policies for the future development.

At the Faculty of Architecture of the University of Zagreb during the Undergraduate and Graduate Studies in Architecture and Urbanism students encounter various tasks in the field of urbanism and spatial planning. On the third semester of the Master Study in Architecture and Urbanism students have the opportunity to choose between fourteen workshops led by professors from the Faculty of Architecture. Workshop 3 - Spatial planning is one of three workshops led by professors of the Department of Urban Planning, Spatial Planning and Landscape Architecture. The main goal of the course is to propose a vision of the spatial development of chosen area (region or city) based on the principles of sustainability and the proposed topic depending on the academic year. The first stage of students′ assignment includes a consideration of theoretical starting points and a detailed analysis of the existing situation, spatial planning documentation and strategical document, which ends with a SWOT analysis as a basis for the second stage. They are directed to perceive spatial strengths, weaknesses, opportunities, and threats considered from different perspectives, immersing themselves in the different roles played by various actors. Besides they are encouraged to use surveys to determine the key issues and needs of residents and users of the subject area. In the second stage, students independently or in group research conceive various scenarios for the future development, taking into account complex systems and numerous processes. Based on the set criteria, the evaluation of development scenarios is made and development vision as well as a concept for the subject area (graphics, model) is proposed. In the third stage, a more detailed elaboration of the program for the selected location and the proposal of strategic and development projects are made.

3. Case Study: Islands of the Zadar Archipelago

For this research, the islands of Zadar archipelago were chosen as a case study, because of its specific geographic characteristics as well as socio-economic processes, as depopulation and emigration, and the relatively old population. The project was made within the Workshop 3 – Spatial Planning in the Academic year 2022 / 2023 (students: Lucija Kustić and Marta Marelić, mentor: Associate Professor Lea Petrović Krajnik). The goal of this project is to set up a revitalisation model for (Croatian) islands, that is, to create a model that is applicable to other areas with similar characteristics and similar challenges.

Figure 3. Position of Zadar County and Islands of the Zadar Archipelago. Source: Kustić and Marelić (2023)

3.1. Specificities of Zadar County and Islands of Zadar Archipelago

The Zadar County (area 7,276.23 km² and 159,766 inhabitants) is located in the central part of Adriatic Croatia and has an important role in transport connections within the country, but also on the European level, since it is located at the intersection of two important transport routes (the pan-European transversal North - South and the future Adriatic - Ionian longitudinal) and is the location of the shortest international ferry connection with Italy. (Figure 3)
Zadar County includes 34 local self-government units, of which six are cities and 28 municipalities. The largest city and administrative centre of the county is Zadar, the fifth largest city in Croatia (70,779 inhabitants). Zadar is the urban centre of northern Dalmatia and the administrative, economic, cultural and political centre of the region.

Zadar County is specific for the number of islands, the indented coast, the fertile zone of Ravni Kotari and hilly - mountain area. It is made up of seven spatially developmental and geomorphological units regarding its natural-geographic features (Zadar urban region, Zadar islands, Ravni Kotari coastal area, Sub-Velebit channel area, Bukovica, Lika-Poun area and a part of the island of Pag). One of the units is the islands area, which is formed by the northern

fragmented group (Silba, Olib, Premuda, Ist, Škarda, Molat te Tun), the Ugljan-Pašman group (Ugljan, Sestrunj, Rivanj, Ošljak, Pašman, Babac te Vrgada), and the Dugi otok group (Ravu, Iž, Zverinac, Lavdaru te Katinu). The island archipelago represents one of the most sensitive and endangered areas of the county with specific demographic and developmental problems of aging and displacement of the population and the consequent decline of economic activities. (Ministry of Economy and Sustainable Development, 2024)

The *Spatial plan of Zadar County* (2023) and the medium-term strategic planning act of importance for Zadar County, *Zadar County Development Plan* (2022), which defines special goals for the implementation of strategic goals from long-term strategic planning acts were used as the basis for the analysis of existing and planned situation, development needs and potential of the county and the determination of development goals.

The analysis of the demographic structure of the population of Zadar County indicates that settlements on the mainland have a better ratio between old and young population, while all the islands of the archipelago have less than 20 percent of young population. This trend was evident in three previous population censuses. One of the reasons for such a trend is centralisation, which encouraged the emigration from the islands, and represents one of the most significant topics.

The road infrastructure on islands varies depending on the size, the number of inhabitants, tourism development and other factors. Due to unplanned development, some areas are not equipped with sufficient transport infrastructure, there is a deficit of parking space, which is often organised in inappropriate locations, and public transport is insufficient. The island of Silba is an example of an island where cars are prohibited. Ferry and boat connections to the island depend significantly on the number of permanent residents and tourists, and the number of lines is significantly higher during tourist season. The maritime connection between islands is weaker because all lines are primarily directed towards Zadar and some of these lines interconnect different islands in order to be more profitable.

The total of 34.48 percent of county's area is covered by the NATURA 2000 ecological network, of which Public institution Natura-Jadera is responsible for 25.33 percent. Conservation areas important for birds cover 26.4 percent of county's surface and conservation areas important for species and habitat types cover 24.76 percent. There are several protected categories of nature on islands, one of which is the Telašćica nature park, three special reserves on Pag and one on Dugi Otok, significant landscapes on Dugi Otok, the island of Pag and the island of Ošljak. The natural environment of islands of the archipelago is well preserved because of their partial isolation.
The geographical position of the county and climate conditions favour the production of energy from renewable sources. The area of Zadar County is exposed to strong winds, especially in the area at the foothill of Velebit, where 8 wind farms have been built, which make up 23 percent of the total power of all wind farms in Croatia. In addition, out of twenty small hydropower plants in the Republic of Croatia, four of them are located in the county. The largest is HPP Velebit located in Zadar County, which is also the second largest hydropower plant in Croatia. In order to realise the plan of the Republic of Croatia to increase the share of renewable energy sources to more than 50 percent by 2030, the planning and construction of solar panels and the use of solar energy, which the country is abundant of, began. Zadar County has almost 2,500 hours of sunshine per year, which significantly favours the use of solar energy. Out of a total of nine large, non-integrated solar power plants built or planned so far, two of them are located in Zadar County - Obrovac and Stankovci.

In significant economic indicators, the economy of Zadar County accounts for approximately 2.5 – 3 percent of the economy of the Republic of Croatia, except in sectors of tourism (where the share is up to 14 percent), maritime transport (up to 40 percent) and mariculture with over 70 percent of country's total capacities. The structure of the Zadar County economy according to total income, in addition to other activities, is dominated by trade, processing industry, tourism, fishing and mariculture (although limited by natural resources and legal catch limits) and shipping. In addition to the food industry based on raw materials from the sea and Ravni Kotari, the export-oriented processing industry relies on the production of metal components for the automotive and pharmaceutical industries.

In the area of Zadar County, according to data from 2015 / 2016 there are 80 kindergartens, 38 primary schools, 79 regional schools/facilities, 21 high school and one high school dormitory (in Zadar). Almost 80 percent of the total number of schools are located in the city of Zadar, while the rest are located in the cities of Biograd na Moru, Benkovac, Obrovac, Pag and the municipality of Gračac. Pag is therefore home to the only high school on the island in the county. There is one university in Zadar County - the University of Zadar, with a total of 25 departments, four research centres and two teaching centres. Primary School Zadarski otoci - Zadar has three regional departments on the islands (Veli Iž, Silba and Olib). A preschool program also takes place on islands Veli Iž and Silba.

There is a potential for development of numerous adventure sports on islands, both for the purpose of tourism and for the local population. Analysis of existing sports and recreation infrastructure indicates that only larger settlements have certain sports facilities mostly football and/or basketball and handball fields, and less often tennis courts.

Based on detailed research a SWOT analysis was created as a database for further scenario planning. In addition, the conclusion of the analysis is given, and there are certain topics that have a distinct mutual influence and indirectly related topics (Figure 4).

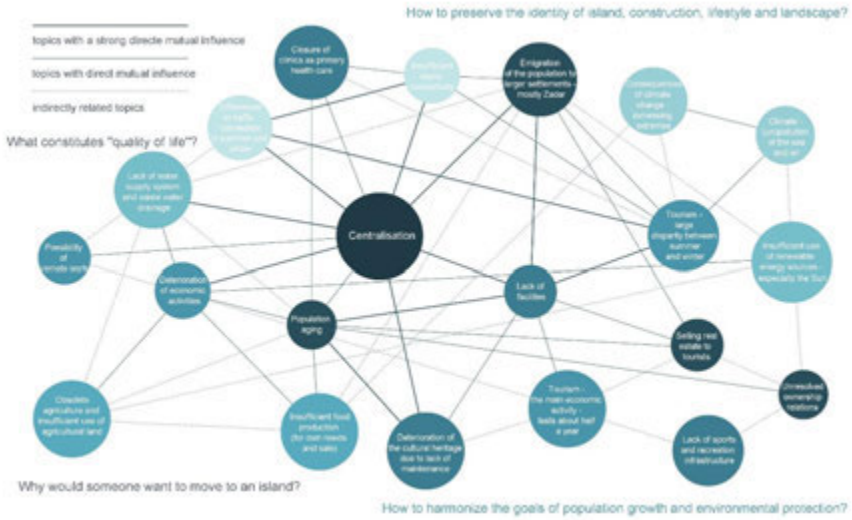

Figure 4. Main Topics for Consideration and Problematic Issues. Source: Kustić and Marelić (2023)

3.2. Development Scenarios of Islands of the Zadar Archipelago

Taking into account the goals of sustainability, the current situation, and the inhabitants needs, the basic goals to be achieved in the long term by the project were to limit the emigration and aging of the population, to offer new facilities, modernise life on islands, but also to recognise the quality that this way of life offers, with an emphasis on (self)sustainability which is to be achieved through the integrity of the approach to planning future development.

Based on the detailed analyses, eight scenarios were proposed as possible directions of development. (Figure 5)

The "Status quo" scenario continues the current trends in the area characterised by the aging and emigration of the population. All island settlements will continue to gravitate towards Zadar as the centre. The islands will remain–poorly connected by traffic, so there would be no cooperation or complementing each other with facilities, which would be an undesirable and unsustainable scenario.

The scenario "Strengthening the existing island centres" - Pag, Ugljan, Dugi Otok and Pašman, is based on the idea of partial decentralisation of Zadar, because the centres are formed around larger settlements. Residents primarily move to these places and to these islands, which results in smaller islands becoming abandoned and available for conversion and renovation with the appropriate purpose - agricultural, production, tourist, cultural or recreational islands.

The "Networking" scenario - the islands as a whole - the city, envisages interconnection - both in terms of traffic and various facilities, at the level of all the islands of the observed area. The intention of this scenario is for the islands to be seen as neighbourhoods within a larger whole - the "island-city", which aims to increase the availability and sustainability of the facilities and attract residents to permanently move to islands and to be less dependent on Zadar.

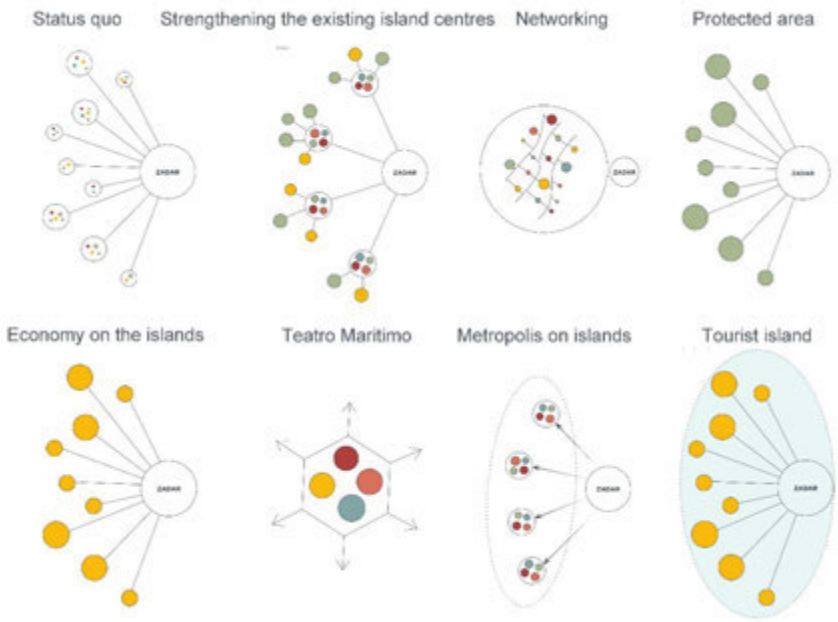

Figure 5. Eight Possible Scenarios for the Islands of the Zadar Archipelago. Source: Kustić and Marelić (2023)

The "Protected area" scenario envisages the relocation of residents and facilities to Zadar. In this way, islands would be natural protected oases. All the islands of the archipelago would become part of Zadar, and would represent a protected landscape used for research purposes, sports and recreation, and tourism.

The "Economy on the islands" scenario predicts further development of Zadar as a centre, due to which the population moves to the city, while islands remain abandoned. Islands of the archipelago with great potential become a part of Zadar economic zone intended for development of clean industry, modern agriculture and energy production from renewable sources. The number of permanent residents is decreasing, as well as the aging trend, as the necessary workforce is immigrating.

The "Teatro Maritimo" scenario is based on Aldo Rossi's idea of a floating theatre, i.e. public facility that floats to the user, instead other way around. In this way, the number of necessary daily commuting would be reduced, and at the same time the availability and profitability of the facility would be increased (due to larger gravity).

The "Metropolis on islands" scenario is based on the premise that life in existing cities becomes so poor and/or even impossible (due to pollution and the consequences of climate change) that the population moves to islands in search of better living conditions. The islands of the archipelago become cities where the necessary infrastructure, facilities, residential construction are built, and existing ones are renovated. This scenario is the riskiest (out of the above) as it could result in devastation and environmental pollution.

The "Tourist island" scenario is based on the idea of turning islands of the archipelago into Zadar tourist zone, due to further centralisation. It is based on the assumption of year-round tourism, various supporting facilities and the necessary infrastructure. It is characterised by complete subordination to tourism. Permanent residents of islands are necessary for the maintenance of the entire infrastructure, while the rest of users travel to islands for work.

Figure 6. Comparison of Eight Scenarios. Source: Kustić and Marelić (2023)

Eight scenarios were rated based on 19 elements (population, housing, quality of life, economy, tourism, energy, food production, traffic, climate, risks, environmental protection, waste, dependence on a larger centre, waste, health, water supply, education, culture, administration and politics) and compared with each other. The graphs (Figure 6) show the evaluation of individual scenarios. The scenarios, although extreme, have some good elements that could be used in further planning. Based on the comparative analysis of the effects, the comprehensive "networking" scenario was chosen as the optimal. In the following, the scenario was elaborated into a vision in which some elements of other scenarios were included.

3.3. Development Vision - Spatial Interconnecting for the Sustainable City of Tomorrow

The vision of development is based on networking which implies interconnection - both in terms of traffic and various facilities, at the level of islands of the Zadar archipelago. The islands are seen as neighbourhoods within a larger whole - the "island-city". In this way, an effort is made to increase the availability and sustainability of facilities, and to attract residents to permanently move to islands, which would result in less dependence of island residents to the

city of Zadar. On each island there are facilities necessary for its function. Certain islands are assigned with one "main" purpose, resulting in creation of a larger centre (an "island-city"), which is well connected to other islands. The mutual traffic connection of islands is realised by public shipping and a network of autonomous electric boats that enable accessibility within the archipelago. (Figure 7)

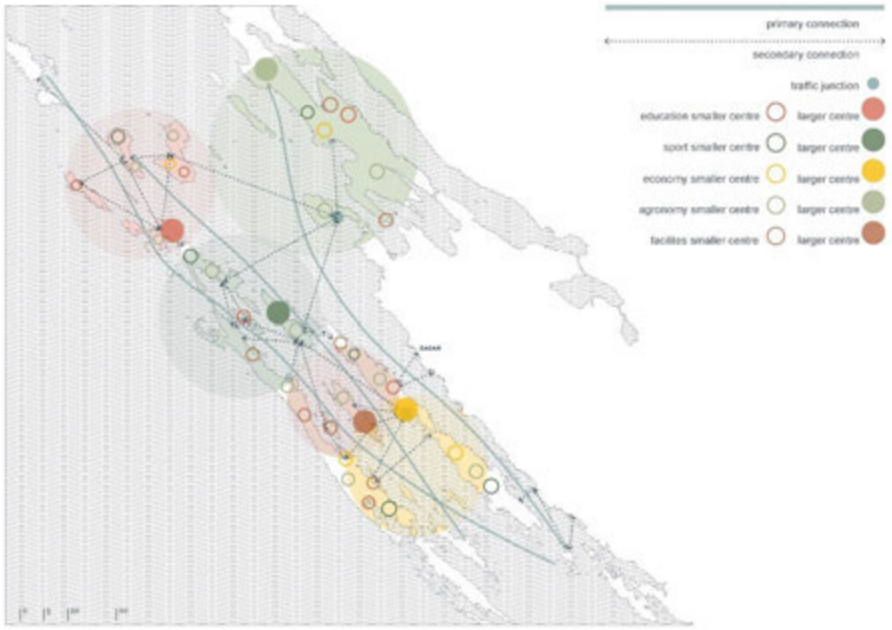

Figure 7. Development Vision for Islands Archipelago. Source: Kustić and Marelić (2023)

In order to enable the realisation of the vision for development of islands of the archipelago, four models were set as a part of the elaboration, namely: housing; traffic; economy; green infrastructure and facilities.

The housing model is based on the idea of flexibility, in order to meet the housing needs of people of different ages. In contrast to the usual acquisition of a housing unit that meets the needs of only a certain part of life, the model of rental housing is proposed. The first step is the valorisation of existing construction in order to determine which is suitable for renovation and reuse. After the energetic and structural-architectural renovation, the application process for residential unit begins, and units are allocated according to the needs, at acceptable housing prices. This would enable satisfying the needs and wishes of the residents. In the second step, there is a construction of new residential buildings according to the principles of bioclimatic approach and sustainability - modular, flexible and adaptable construction with the use of renewable energy sources and given location (e.g. solar energy for passive heating, greenery for passive cooling, sea water for cooling/ heating, rainwater, etc.). The model aims to create a community with facilities like urban farming, i.e. shared gardens, spaces for socialising and recreation, shared transportation, etc. This approach would reduce the unnecessary expansion of the construction area, and thus further devastation of valuable space. (Figure 8)

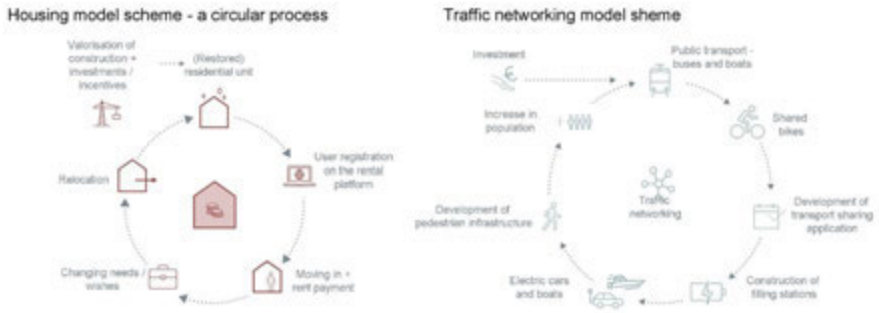

Figure 8. Housing and Traffic Model Schemes. Source: Kustić and Marelić (2023)

The concept of development of islands in the archipelago is based on their networking and observation of the entire area as a city. The transport solution is designed with two modes of transport - public and shared. Public transport includes electric autonomous (mini) buses and (fast) electric semi-autonomous boats, which get their energy from renewable sources. Another form is shared transportation, which includes bicycles, electric bicycles and scooters, cars and (small) electric boats. The boats used in the system are autonomous, although users still need a permit. The system is based on application which enables reservation and pick-up of a vehicle. In this way, the cost of living is reduced because the need to own a personal car and a boat on the island is significantly reduced. A long-term increase in the population is predicted, which will require further development of the transport network and an increase in the number of lines that would become more profitable in the future. This solution frees up areas used for parking, which are often located by the sea, and is repurposed into walkways and bike paths, areas for recreation and green infrastructure. (Figure 8)

The economy model is focused on the development of several economic areas. It is based on transport connections, since islands create a whole in terms of production process in which tourist, agricultural and other economic activities are distributed. A "clean" industry with as little negative impact on the environment as possible is planned by incentives awarded to entrepreneurs. The development of technology enables online jobs, for which a good network connection is a basic prerequisite. Renovated buildings house specialised research institutes that attract experts and (future) entrepreneurs. Thanks to good traffic connections, it is possible to link tourist attractions into a network, creating a good basis for the development of year-round tourism. Agriculture is planned to be modernised, to ensure an easier and more favourable distribution of products, which is also contributed to by the concept of "urban farms" on islands where the local population grows food on a smaller scale. The production of electricity on islands of the archipelago implies the creation of producer communities, energy infrastructure renovation and construction, which reduces energy needs. In addition to wind energy, thanks to the large number of sunny hours, the construction of solar farms is encouraged. (Figure 9)

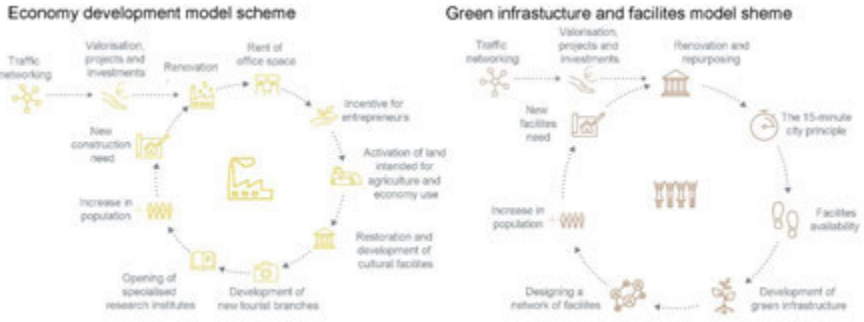

Figure 9. Economy and Green Infrastructure and Facilities Model Schemes. Source: Kustić and Marelić (2023)

The green infrastructure and facilities model is based on the creation of island and inter-island green networks. First, the arrangement of the existing green infrastructure is planned, and in the second step, the development of a new one. Outdoor sports and recreation facilities are directly linked to the green infrastructure arrangement plan, along with planning indoor sports and recreational facilities. This vision of development of islands of the archipelago increases its gravitational area, so public and social facilities become more sustainable and profitable. Development of new facilities continues on previous networking and is primarily based on the renovation and repurposing of existing construction stock. The archipelago was designed according to the principle of a 15-minute city and is based on the premise that each island should have facilities necessary for everyday life, upgraded by the "system" of public and social facilities in the archipelago. (Figure 9)

4. Discussion

Whether it is planning at the regional or local level, special attention should be directed both to protected areas and to areas with developmental peculiarities, i.e. peripheral areas, such as hilly and mountainous areas and islands and island archipelagos, and the planning itself should be approached with utmost sensibility. With conventional peripheries resulting from physical geography and distance, which is a factor per se, what needs to be considered are non-spatial processes and factors, and it is necessary to approach them comprehensively in order to design appropriate development strategy, policy and measures. Documents and studies on European level provide a guidance on how to enable better accessibility, better economic potential and access to services of general interest, and consequently a better demographic situation.

In addition, national strategic documents, such as the *National Development Strategy of the Republic of Croatia until 2030*, emphasise the importance of such areas and strive to ensure balanced regional development by planning activities in those areas. In the National Development Strategy of the Republic of Croatia, one of the strategic goals is "*Development of supported areas and areas with developmental peculiarities*" which, along with other challenges of depopulation, aging population and less favourable economic structure, face insufficient traffic connections and seasonal infrastructure overload. With the concept of *Development of smart and sustainable islands*, priorities for the implementation of policies related to the management of island resources, the transformation of the island economy, the establishment of smart mobility and connectivity, the provision of modern electronic

communication networks and the provision of public infrastructure and services to raise the quality of life have been set at the national level. National and regional strategic goals become the basis for further considering and planning development of the area in question.

In addition to gathering theoretical knowledge, future planners should be involved in practical activities. The education of future planners is based on a combination of scientific and creative conceptual thinking and a practical approach, and through practice courses, such as the spatial planning workshop, the ability of research and analysis, advocacy and mediation, the ability to envision, evaluate and promote potential future options for urban, spatial, and territorial development is learned. Working in a group develops the ability to cooperate and work together, which is a necessity for planning. Students are encouraged to think critically and understand the logic of planning and its theoretical and legal basis. They are taught to understand spatial systems that, in addition to the built and natural environment, include socio-economic systems. During the planning process they improve the technical and creative skills necessary for their inclusion in the planning practice. Above all, the workshop is a place where, through the planning process, the importance of strategic thinking and planning on different levels is pointed out.

The use of the scenario method in the education process, as a practical application in workshops, is particularly significant because it encourages strategic thinking, development of intuition and helps overcoming thinking limitations. Development of several possible scenarios is particularly important in order to enable a comprehensive overview of the needs and possibilities, aspirations of various stakeholders, and an open discussion and flexibility in the process of creating a spatial development vision.

In this case study, eight possible scenarios for future development of the island archipelago are proposed. Creation of various scenarios enables a better overview of spatial possibilities, while the appropriate selection of criteria and their assessment in accordance with the initial goals develops the ability to make decisions that will influence further development of the area. Conceiving scenarios based on the sustainability goals indicates an awareness of the importance of development based on global trends, which through planning and intervention at lower levels contribute to the achievement of global goals.

This paper shows how the work which was focused on the local and regional development and revitalisation scenarios for islands of the Zadar Archipelago is focused in the next step on the development vision and the elaboration of models that enable its realisation. The vision of development and revitalisation of the islands of the Zadar archipelago set a broader framework for planning development of smaller settlements on islands. Based on knowledge about the specificity of islands as peripheral areas, with respect for national guidelines for such areas defined by the *National Development Strategy of the Republic of Croatia until 2030*, separate models that refer to important topics (highlighted at the national level as priorities for policy implementation related to the concept of *Development smart and sustainable islands*) have been set. The intention is to set up models that can be applied with minor modifications on other islands and island archipelagos with similar spatial systems and characteristics. The realisation of strategic and development projects in accordance with the proposed vision and models (housing, transport, economic and green infrastructure and content) in a period of 25 years would lead to revitalisation of settlements and improvement of quality of life at the local level, the revitalization of economic activities in the region, while at the national level it would contribute to the achievement of one of the strategic goals of national development – "*Development of supported areas and areas with developmental peculiarities"*.

5. Conclusion

In addition to the theoretical knowledge of spatial planning acquired during studies, practical application is necessary in order to prepare the future planner for the roles that await him in professional practice. The spatial planning workshop is one of the platforms where students in the final phase of their studies practically apply the knowledge and skills they have acquired. On different scales, they practice strategic thinking, research, analysis, synthesis, critical thinking and understanding of spatial systems, forecasting and planning development of selected area.

The methodology of scenario planning is used in the education of spatial planners in order to enable them to deal with the complexity of predicting the future development of cities and regions, and to see the possible consequences of spatial interventions. In addition, this is an opportunity to use a tool that encourages creativity and intuition and enables future planners to think one or more steps further into the future. The grounding of projects on European documents on sustainable development as starting points, and consideration of national, regional and local strategies and plans, as well as existing spatial planning documentation, is the basis for further consideration and planning. Through education, the continuity and cyclicality of planning processes and changes in spatial systems that require adaptation and flexibility is pointed out.

Students are encouraged to take a comprehensive look at spatial systems and other elements of the development process and to determine the criteria for evaluation of scenarios as a basis for development of a long-term vision concept. Working in a group allows critical thinking and questioning of planning decisions, while understanding causes and results of concrete development projects serves as a basis for creation of new spatial planning documents. In order to harmonise all requirements and their changes over time with the long-term development goals and the legislative framework, flexibility in planning is insisted upon in order to achieve the overall long-term sustainability of the selected area, both on the local and the regional level.

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Utopias as a design-thinking key for counter-hegemonic ecological transitions

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Abstract (up to 125 words)
Present times are marked by structural crises and social alternatives appear increasingly implausible. Planetary urbanisation intertwines global society and ecosystems amidst social, ecological and rational crises accounting for unprecedented challenges. Discourses shift from reform versus revolution to ecological transition and resilience approaches within a scenario of turmoil. A workshop taking place in Goias City, Brazil, employed 'utopias' as lens and delved into counter-hegemonic urban ecological relationships. Concepts, such as Neoliberal contradictions, Decolonial approaches, Coexistence, Ethics of Care, Mobility of frontiers and Co-poiesis of Nature were assessed and led to three dialectical utopias — Queer planet, Matriarchal Society and Afrofuturism. Design thinking was used to envision alternative futures by integrating these concepts to utopian experiments addressing contemporary contradictions and societal trends.

Keywords: ecological transition; utopian imagination; design-thinking.

1. Introduction

We are witnessing times of structural crises when no alternatives to the current system seem reasonable. On the one hand, planetary urbanisation connects global society and earth ecosystems in a series of crises. This is an unprecedented social crisis that opens room for rising social inequalities. Yet, lack of confidence in political institutions tears apart old compromises. There is an ecological crisis experienced as we enter the *capitalocene*, which threatens us with climate change, mass extinction and environmental disasters. On the other hand, there is a rationality crisis that cannot acknowledge non-instrumental ways of thinking. At the same time, fake news, robots, and artificial intelligence threats undermine science as the way to structure society.

Besides this context of great changes and social unrest, environmental changes are inevitable, society fails to produce viable alternatives and to implement new approaches to social changes. In any case, changes will happen due to collapse or adaptation. The old polemics between reform or revolution, meaning light social adjustments or complete social transformation, are now dominated by the ecological transition theory, which highlights circular economy, energy efficiency and sustainable practices towards a new social-natural contract. However, we still lack viable images for future changes. The main theories available in environmental thinking, such as Resilience, Nature Based Solutions, Ecosystem Services, among others, deal with how

to best adapt to unknown eminent changes. Nonetheless, they are stuck in the pragmatic reform paradigm and in an apolitical approach. Accordingly, the only question is whether the environmental collapse will be handled, overcome or creatively explored. Are there ways to overcome the reform-revolution paradox?

The aim of the present article was to explore an action research carried out during a one-week workshop in Goias City - Brazil. 'Utopias' were used as keys to read counter-hegemonic urban ecological relationships capable of providing possible images of alternative futures. We developed six main approaches to the contemporary condition to explore other ways out of this paradox, namely: Neoliberal contradictions, Postcolonial approaches, Coexistence, Ethics of Care, Mobility of frontiers and the Co-poiesis of Nature, as well as developed three dialectical utopias: Queer planet, Matriarchal Society and Afrofuturism. That was done to rearticulate new possibilities in a world filled with blind fields.

2. Goias City and the urban nature paradoxes

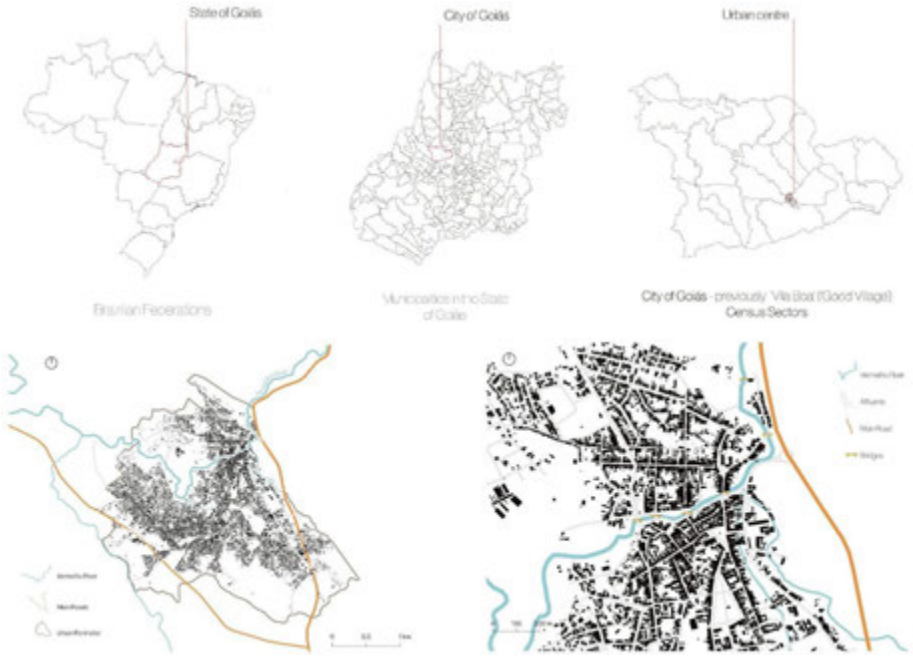


Image 01: Goias City and Vermelho River

Goias City was founded in 1727 as an 'arraial' (village) and thrived on gold mining along its riverbanks in the first years of its existence. The city developed far from the river due to hazardous conditions and slave labour. It became the capital of 'Capitania de Goiás' in 1748 and witnessed urban expansion and the construction of key infrastructure. Nature was viewed as both menacing and divine in the colonial era. On the one hand, wild landscape was denied and the city was an 'anthropized' space with no greenery. On the other hand, orchards and gardens were carefully controlled in private backyards.

Gold production declined from the 1780s onwards. Brazil proclaimed its independence right after that, in 1822. A series of governmental policies aimed at establishing a new order for the new Brazilian empire were implemented in the 19th century, and social attitudes towards nature shifted. These interventions led to modern labour practices and introduced green spaces as leisure places. Although the city shifted from gold to livestock farming, its space remained unchanged for one century, but an idyllic nature meant for pleasure and bucolic landscaping became accepted in urban spaces.

In 1869, a new road to the Central Market changed the city's river connection. Before that, a line of backyards would be the transitional space between the city and the river. Nowadays, the urban space is wide opened to the river. However, the road remained mostly empty, with few modern buildings by it. Later on, in 1999, the Environmental Film Festival was launched and, in 2001, the city and mountain ranges were designated as UNESCO Heritage Sites. This title highlighted the river's ecological significance. Contemporary environmental concerns have reshaped perceptions about urban nature and residents have adopted new practices and attitudes towards them. The river has become a central point in the city and it attracts new businesses and stands out as one of its main images.

Thus, we are dealing with a very peculiar situation: the same city and the same nature took different social performances. Although the environment was the same, it was differently perceived; it had different values and propelled different interactions. At first, the Natural elements were seen as dangerous, diabolic and as something to be explored, but also as God's gifts. Now, they are objects that could be manipulated to generate idyllic delights for free subjects and as complex ecosystems to be preserved, beyond human interests. This is one phenomenon among many phenomena we might call 'metamorphosis of nature'. However, it does not simply mean that our interpretations change. Nature assumed a political role because it reinforced subjectivities and structured habits.

Here an external example might help understanding this paradox. Hilary Angelo (2021) presented the German River Ruhr case, exploring the interconnections among concepts of nature, space production and political subjectivities. In the Industrial Revolution, the Essen region became a network of cities structured around the river as source of energy and natural resources. On the one hand, nature became an instrumental object explored to its limits. The dominant logic was human centred and it maximised investments and outputs without taking the ecosystem into consideration. On the other hand, a series of Garden Cities were built for the working class; they were refuges from industrial spaces' contradictions. These idyllic places, nonetheless, had specific rules for the use of nature creating healthy habitats for workers.

The impact on nature was paradoxical, since nature was seen both as an economic externality and as a controlled good used for individual delight in backyards. This was a one-directional double objectification of nature. On the one hand, in concrete terms, it meant a maximum exploitation of both things and humans, without any regard to environmental logic. On the other hand, in abstract terms, it became an utopian ideal to impose a social life on workers and to normalise modern social behaviours. Although the spirit of the time is the same, it does encompass contradictory feelings towards nature, both disregarded and valued. These paradoxes underline different instrumental subjectivity towards nature.

According to Hilary Angelo (2021), the global order changed in the postwar period and the region faced a deindustrialisation process. Production moved to global peripheries and factories were abandoned; this process was followed by economic decay and unemployment. New

paradoxes emerged. On the one hand, local communities started to organise themselves based on community initiatives and informal work. Backyards in old Garden Cities underwent a radical metamorphosis and, from places of bourgeois delight, they became places of rural production. Chickens, pigs, and vegetable gardens dominate the landscape. On the other hand, urban planning evolved and became a comprehensive tool. This region was then viewed as an integrated system of social, economic and natural spaces. Propositions aimed at controlling development, protecting nature and to keep Garden Cities as heritage.

Comprehensive knowledge clashed with community reality. In addition, another conflict emerged between the abstract view of Garden Cities as heritage landscape and the living reality of people who (re)appropriate gardens as community-based alternatives for economic survival. Nature became a field of multiple dimensions, a palimpsest and not simply a fixed stage where different actors play free roles upon. Actually, nature became a plastic field changing from the inside out, a field of possibilities engraved through different times, upon which history, culture, and knowledge can act upon to reveal new potentials.

Yet, according to Hilary Angelo (2021), when we moved towards the neoliberal context, nature once more changed its roles. The new configuration of global markets made the cities' image key elements for attracting investments in an international network of competition. Thus, abandoned factories became parks and nature started occupying old industrial ruins to create new bucolic scenarios. Punctual interventions aimed to create landmarks with global identity. The shift from comprehensive planning to strategic planning saw a new mix of spectacle and 'Disneyfication' of leisure and tourism, and nature became a commodity for marketing. The financialisation of spatial production meant that regions had to build brands to attract the global capital. Flexible work features, communication and transport technologies gave the regions a new potential to expand to vast territories and to get connected through new infrastructures.

Traits of this green gentrification also appeared in Goias City. As access to nature turns from right to commodity, a new dilemma exacerbates social inequalities. This phenomenon not only commodifies green spaces but also perpetuates disparities by deepening the division between socio-economic classes. This phenomenon overstates existing inequalities in Goias City, displacing local inhabitants from the city centre to its peripheries by pricing out marginalised communities. Consequently, we are transitioning from the right to nature to market-driven privileges. New residents moving in further raised real estate values and the proliferation of second-hand homes emptied the city centre. This displacement involves environmental injustice matters, since it does not only deprive communities from access to new green spaces but also disrupt their social networks and community ties.

According to Matthew Gandy (2022), we need new approaches to deal with these urban roles of nature. Positivist approaches based on absolute universals cannot handle their social metamorphoses and roles. *Neovitalists* are non–humanist, although they are always trapped in pseudo-ecocentric approaches. Object-oriented ontologies are both neo-romantic and animist. Relational anthologies take one step further, but they might submit to relativism. Arguably, we should go beyond modernism contestation and move away from language-oriented post-structuralism, which is lost in endless semiotic hermeneutics, and we should head towards a post-positivist evidence-based creative (poetic) materialism.

Matthew Gandy (2022) sees Eyal Weizman's forensic architecture theory as a way to 'give voice to things that nature gave no Voice' to. We could see Earth itself as a global scale 'crime scene' by advancing Bruno Latour's (2004) role of scientists as political representatives of

nature in a new politics that includes non-humans. This process means going beyond human sensorium and social spectacles. The environment can be seen as a recording device engraved with social history, although it is messed in entangled traces. This approach to the environment as material traces shifts the focus on individual humans as subjects of knowledge to men as aesthetic observers. This perspective changes the causality issue as the environment becomes an indirect, distributed and extended field of casualties that are spread over space and time.

Arguably, this neonature filled with urbanised reminiscences pictures a multilayered matter. It depicts both symbolic and spectral distances, whose past and future manifest themselves here and now. If the way we see nature has political consequences and frames how people interact with themselves and with the environment, the construction of a new aesthetics focused on nature will play the role of building new social-environmental arrangements. In order to do so, we need to understand the transitions we want, how they change our understanding of nature and what kind of images they may project to the future.

3. Approaching context and desires, and the nature of co-poiesis

We developed a series of lectures to approach the specific context of Goias City and its relationship with nature. The topics were addressed in flipped classroom assignments, which counted on six main concepts to observe the current contradictions between cities and nature, namely: Neoliberal Contradictions, Decolonial Approaches, Coexistence, Ethics of Care, Mobility of Frontiers and the Co-poesis of Nature.

Interactions among these concepts aimed at elaborating a critical cartography of the observed web of conflicts. Neoliberal Contradictions highlight tensions inherent to the context. Decolonial approaches are both lens and procedure to challenge dominant narratives and power structures. Mobility of Frontiers establishes physical and conceptual borders' fluidity and dynamism. These mobile borders shape human interactions with both society and the environment. Coexistence as an axiom aims at overcoming the traditional gap between human and non-human entities by fostering the need of thinking about the global integrated dependence among them. Ethics of Care foregrounds the direction nurturing empathy and responsibility that, in their turn, should guide all actions. Finally, the Co-poesis of Nature underscores the interconnectedness and co-creative dynamics of social and environmental systems. Together, these concepts plot a 'critical' cartography, an ecology of knowledge, which is featured by integration, interaction and conflict.

The aim of this cartography is to challenge conventional understandings of power, knowledge and nature. It provides an alternative framework for envisioning and navigating our relationship with the environment. This critical cartography invites us to engage in complexity, to embrace diversity and to confront the systemic injustices and inequalities shaping our societies and the environment.

3.1. Neoliberal Contradictions

Although the neoliberal contradictions exceed the scope of the current article, they help better understand the current moment and better see nature as a field of possibilities and conflicts. We aimed at unveiling the contradictions and at tracing counter-hegemonic sensibilities by drawing on critical theory approaches (David Harvey, ; Henri Lefebvre, ; Michel Foucault, ; Jason Moore, ; among others) and decolonial thoughts (Arturo Escobar, ; Frantz Fanon, 1961; Achille

Mbembe, ; Donna Haraway, 1988; Glissant, 1990; Mignolo, 2007; Enrique Dussel; among others).

Contemporary spatial production derives from a series of entailed processes linked to sensibilities and concepts that, in their turn, result in concrete practices and spatial devices. The idea was to get a grip on the hegemonic cultural logic - such as the instrumental logics, the parasitic exploitation of nature, the commodification and objectification of both nature and subjects, the financialization, consumerism, individualism and spectacle - only as strategy to imagine counter-hegemonic configurations.

According to Williams (1973), in Gramscian terms, hegemony is the dominant culture in action at a given society. It is rooted in 'common' sense, rather than in something singular. This prevailing way of thinking is experienced and embodied in daily life; moreover, it influences people's expectations and perceptions of reality. The hegemonic thinking reinforces the perspectives of dominant classes, institutions, and individuals, as well as continuously adapts to the social frameworks. According to Williams (1973), culture is a continuous of residual (traces of past events) and emergent cultures, which may either get integrated to the hegemonic culture or remain excluded from it. Consequently, new cultural elements can show regressive and progressive tendencies. Moreover, the term ‘alternative’ simply highlights ‘differences’ and it can be embodied as hegemony by the cultural discourse. Williams conceives ‘counter-hegemony’ as critical cultural practice aimed at being oppositional to the dominant culture.

Lefebvre (1976) argued that capitalism has managed to avoid crises by reproducing the social relationships of production. This reproduction is achieved by both destroying traditional spaces and reproducing the instrumental logics into new spaces. Several authors, among them, Marx (1996), Adorno and Horkheimer (1996), and Lukács (1971), have discussed this instrumental logic. According to Lukács, this way of thinking builds 'facts' and forms a pragmatic discourse about truth. It operates by asserting the *status quo* and the existing objects as natural absolutes. It demands overlooking social processes and the historicity of social relationships, turning what 'exists' into unconditional mythologies (Lukács, 1971). Thus, even those who want to protect the environment reproduce the parasitic exploitation of nature. If we understand nature as an external object, we can only act on it in terms of distant protection or exploitation.

The second key contraction of the neoliberal condition is a simulacra condition. Jean Baudrillard (1994) famously advocated that we live in a hyper-real world where reality is nothing but simulations. We only create new false representations of reality when we try to unveil the mask of ideology that hides reality. Although this approach leads to a sort of contradiction in terms (since any theory of reality is nothing but simulation), it also allows critically approaching the construction of reality. Although authors like Jacques Ranciere (2005) and Henri Lefebvre (1967) developed the idea of nature as socially created (poiesis), a critical approach can also enable seeing that it is at the same time a simulacrum (hiding its artifices) and a creative force developing new potentials to reality. Thus, we nowadays live in a world of fake news and spectacles that outspread instrumental views of nature and, simultaneously, financialisation and individualism are fantasies that have concrete and direct impact on the production of new social inequalities. Arguably, we should explore further the creative alternatives to this condition.

3.2. Decolonial approaches

Decolonial approaches provide a more nuanced framework to assess the intricate cross-sections of human society and the environment. These approaches provide a unique perspective that unveils contradictions, vested interests and power dynamics underlying the environmental discourse. Spatial concepts shape distinct realities that are tailored to specific contexts. However, new concepts can emerge from encounters between different knowledge systems and preserve the diversity of perspectives. For that, it should emerge from the 'here and now' of encounters and collisions between knowledge paradigms to preserve differences between subjects. These encounters highlight the lack of universal agreement and emphasise the need of acknowledging and managing divergent epistemic practices. Negotiating agreements amidst conflicting visions and paradigms does not rule out collective differences, but rather brings them to light.

The decolonial project represents a realm of divergence where disagreements remain. Entities do not want to relinquish what they deem crucial in conflicts over shared objects or interests. Spatial knowledge within the decolonial project embodies this divergence and acknowledges that common objects like rivers or mountains are inevitably influenced by several interests, perspectives and desires in contexts where multiple collectives and spatial production practices converge. The integration between knowledge practices and entities should maintain the dimensions of excess, misunderstanding and divergence.

The concept of ‘Dark Ecology’ in this realm, as articulated by Timothy Morton (2016), delves into the obscured and often unsettling aspects of ecological discourse, emphasising uncertainty, ambiguity and the unforeseen consequences of human actions. This is particularly important because it acknowledges that our knowledge is always imperfect, and the blind fields of our current epistemologies might lead to new social-environmental alternatives. Accordingly, the exchange of different scientific and traditional knowledge types gains a new and reinforced role. Morton's concept challenges traditional notions of nature as something separated from humanity. It rather highlights the entanglements and complexities inherent to ecological systems. Dark Ecology underscores the urgency of acknowledging and addressing the planet's ecological crises. These decolonial analyses can allow insights in the complexity of environmental issues and the dynamics of power at play by focusing on the unknown elements within our approaches to ecology (i.e. dark ecologies).

Mary Douglas (1992) outlined several 'nature myths,' including the 'myth of capricious nature', the 'myth of strong nature' and the 'myth of fragile nature'. The fragile nature is encompassed by spatial policies that rely on technical-scientific methods to manage interactions between society and the environment. Ecopolitics, like all forms of politics, is linked to entitlement, obligation, enforcement of rights, and decision-making authority issues. In a world characterised by both diverse spatial landscapes and significant social disparities, decisions and actions have disparate impacts on different people and places. Decolonial thinking does not focus on the decolonization of colonialism; it rather focuses on addressing the enduring condition of coloniality. Coloniality is not colonialism, it is the ‘dark side’ of modernity.

A whole variety of new endeavours have emerged in recent years, notably in the Ecuadorian Amazon, and they have deeply influenced the environmentalist discourse. These initiatives include agro-forestry projects, efforts to revive degraded forests, sustainable harvesting and sales of forest products, as well as adopting innovative forest management techniques. Simultaneously, there has been the trend to implement ecotourism policies and attempts to register indigenous territories. These actions have led to the creation of tourism zones with clearly defined boundaries. Tourism has been increasingly viewed as a means of economic

opportunity for indigenous communities since the 1990s. It fosters the hospitality industry and traditional crafts' growth. However, these shifts have resulted in different outcomes: some clans prospered from their engagement in such activities, whereas others have experienced impoverishment or displacement to remote jungle areas.

If one thinks of decoloniality in terms of existence and space, it means imagining it as an archipelago of enunciation points, as a constellation of micropolitics, and as experimental arenas shaped by subjective positions and cultural dispositions. Decolonization entails acknowledging that reality can be kaleidoscopic, fragmented and inherently ambiguous by defying simplistic representations through fixed cartographic projections. It transcends mere perspectivism to focus on points of action and enunciation places. Hence, the decolonial project is inherently linked to the sense of coexistence.

3.3. Coexistence and dependence

Peter Sloterdijk's (2011) concept of Coexistence provides a fresh perspective on the intricate web of relationships defining our contemporary society. It explores the dynamics of living together by highlighting the cohabitation and interdependence of several entities within shared spaces. This framework not only makes the understanding of diversity and the complex relations inherent to modern society easier, but also acknowledges the deep interconnections between human and non-human processes. We should think in terms of "terrestrials" rather than of oppositions, such as human/non-human and artificial/natural, to propose a new theory of inter-dependencies between society and nature, and to emphasise our embeddedness within broader global processes.

Dependency is an ethical issue, and a fact. We depend on Earth's habitable conditions, and the assumption that we could free ourselves from this reliance is a simple matter of fantasy. According to Peter Sloterdijk (2011), modern knowledge paradigms draw identifiable and manageable segments of the world within socio-spatial configurations. Social and ecological interdependencies in modernity have been overcome by isolated entities or 'spheres of independence' that are often seen through binary lenses. However, by taking Earth's overflowing of life into consideration, it is possible stating that this vitality stems from interconnected relationships among entities, subjects and ecologies. The shift from independence to the establishment of interdependent spheres within project practices means we need to attempt a transgression of current modes of imagination.

The idea of dependency in the social studies field has been commonly used to analyse non-Western societies as means to highlight a model of the subject who opposes the Western liberal idea of supposedly autonomous individuals. The concept of dependency has recently become a central topic in anthropological theory. The work by Ferguson (2013; 2015) has disclosed the contrast between specific European desire for autonomous freedom and alternative concepts that define systems of dependency as the very basis of being.

Dependence is not about living in harmony, in empathy with natural agents. One should acknowledge the dependence on various agents, without seeking universal agreement by avoiding the misconception, according to which, living in empathy and harmony with all things is feasible. According to Latour (2017, pp. 290-29), modern humans saw themselves as continuously emancipated from past constraints. As an alternative, one should not aim at reduction or harmony, but at expanding the list of involved agents and the interests in them. Thus, we should think about all terrestrials in general, exploring their limits together.

The concept of DELINKING aims at generating a series of disjunctive synthesis, as argued by Viveiros de Castro and Roy Wagner (2017). Accordingly, divergence and distance are their causal factors, rather than similarity or identity. Coexistence and interconnection entail separation and differentiation, rather than mere blending and fluidity. The objective is to delineate contact zones between various ecological forms of spatial production within a 'pluriverse' framework and to explore the potential of 'multi-situated' and networked life practices. Therefore, coexistence is not synonymous with harmony. It resembles language in its requirement for noise, messiness, fuzziness, granularity, vagueness, and slipperiness, so meanings can emerge. Similarly, the space of coexistence between differences must be closely articulated in itself, as well as present abundant fuzzy situations and mediating devices. Thus, by envisioning the unfamiliar coexistence we need a new concept of thresholds and blurred spaces.

3.4. Mobility of frontiers

Gilbert Simondon's (2013) concept of frontiers is linked to the differentiation process within complex systems. According to him, frontiers are not merely static divisions but dynamic interaction and transformation zones where entities undergo becoming and differentiation processes. Simondon views frontiers as tension, exchange and integration sites; thus, they are not fixed delimitations, but fluid interfaces of ongoing evolution and adaptation. Simondon's concepts emphasise the interconnectedness between adjacent domains, and it highlights the continuous information, energy and matter flow, which is a key element in the shaping and the emergence of new structures.

The Mobility of Frontiers concept (Hissa, 2002) expands Simondon's concepts by highlighting the interconnectedness between human society and its environments, since it suggests that frontiers are not only shaped by physical geography but by cultural factors, as well. Simondon's concepts tend to focus more on the material aspects of borders, often neglecting their historical and cultural construction. Hissa's framework points out that frontiers are historically constructed by our epistemology and aesthetics. This profile builds a non-binary framework that acknowledges the complexity of the society/ecology dialectics. Cássio Hissa's (2002) fluid interaction zones acknowledge a continuous historical movement and negotiation through the borders, and it challenges the traditional sense of fixed territorial divisions.

Similarly, Descola (2013) empirically and conceptually questions the dichotomy between nature and culture. This division is rooted in modern thinking and works as an ideological construct employed by Western societies to categorise and dominate other cultures and non-humans. Descola asserts that many cultures do not adopt the distinction between human (deemed superior) and non-human (seen as exploitable). In addition, chemist James Lovelock and sociologist Bruno Latour have similarly questioned the sense of an Earth system by arguing that the biosphere is a delicate mix of many conflicting complexities. Latour (2017: 87) describes Earth as an 'anti-system' composed of agents that resist unification into a single cohesive entity.

Decolonial thinking operates from the epistemic frontiers of modern thinking by questioning Eurocentric or Western spatial planning and design forms. Accordingly, the concept of Border Thinking (Anzaldúa, 1987) becomes relevant, mainly when it comes to design practices. Border thinking (Mignolo, 2007) is understood as situations where subjects, collectives and social groups living on the margins produce knowledge to be transferred from one place to another,

which is seen as a way of escaping modernist binary thinking. Therefore, decolonising the project means looking for where "frontier thinking" can question hegemonic knowledge and paradigms departing from externalisation paradigms. Anzaldúa (1987) investigated the contradictions and material conditions of life "on the borders and the margins", and revealed the joy that can be derived from so much suffering: the sensation of being part of something alive, the change of identity that awakens areas of otherwise dormant awareness, which is never felt at ease, but nevertheless at home.

3.5. Ethics of Care

The Ethics of Care allows refraining from individualistic approaches and acknowledging the role of others, both human and non-human, in fostering a caring society aware of diversity and collective risks. Interdependence and relationality are rooted in empathy, and this ethical framework prioritises subjects' well-being within their social and environmental contexts. This perspective emphasises nurturing relationships, mutual support, and responsiveness to others' needs by challenging traditional moral theories centred on abstract principles or rights. However, the Ethics of Care underscores the importance of context, emotions, and concrete actions in ethical decision-making. It advocates for an inclusive and compassionate approach to address social injustice and ecological challenges.

Sociologist Donna Haraway suggests that all knowledge and research are "situated" (Haraway 1988). This understanding encompasses not only the cultural context of research but also what Shawn Wilson refers to as the axiology of researchers, which encompasses morals, values, and ethics. These factors play crucial roles in shaping research processes and in influencing the selection of research questions, methodologies, design strategies, and dissemination modes.

However, when urban discourse (research/design) is influenced by issues, such as feminism, black studies, subaltern studies, queer thought, decolonial theories, body, and indigenous thoughts, it faces the challenge of establishing new legitimacy and authority for a given project. This process leads to questioning the Western project, design, research, and teaching practices. Contrary to the traditional goal of rationally organising the environment, this line of thinking views urban projects as more akin to chemistry - a discipline focused on studying changes, modifications, decompositions, and transformations.

3.6. Co-poiesis of Nature

In a seminal essay, Arturo Escobar (1996) clarified the social construction of our concepts of nature. He emphasised how these perspectives, which are featured by the political aesthetics and social enactments of nature, can actively reshape both society and the natural world. Bruno Latour (2004) has reinforced this theoretical understanding by acknowledging the hybrid nature of objects and relationships and by bridging the gap between the natural and the artificial.

The co-poiesis approach develops Maturana's concept of auto-poiesis to acknowledge how nature is produced in a political aesthetic. Copoiesis emphasises a collaborative and dynamic process of co-creation between human and non-human entities. It involves the mutual shaping and transformation of agents within a complex system, by emphasising interconnectedness and interdependence. Copoiesis highlights the active role of both human and non-human elements in shaping the environment, by fostering a deeper understanding of reciprocal relationships and emergent properties within ecosystems.

According to Lefebvre (1967), poiesis refers to an idea's ability to shape reality. Unlike praxis, which belongs to practical experiences; and mimesis, which deals with ideal representations in the mind, poiesis involves the generation of tangible experiences through conceptual frameworks. This understanding emphasises how ideas can actively change reality by focusing on the underlying principles, processes, and decisions involved in creating truth or reality. Lefebvre argues that the driving force behind changes in reality lies in building new possibilities. He compares this process to that of a seed, whose potential to become a tree transcends its current state; this process illustrates the significance of its virtual reality - the possibility of transformation. He argues that every epistemology has 'virtualities' and 'blind fields' (Lefebvre, 2003b, pp. 23-44) and, furthermore, he (1967, 375-377) advocates that poiesis creates a new reality by operating in residual fields that were left untouched by previous epistemologies.

The aforementioned process implies exploring unique capabilities of each epistemology, whereas certain aspects of reality might remain undiscovered. These unexplored aspects represent potential actions that have not been articulated, so far, although they work as the boundaries for any form of reasoning. From this perspective, poiesis reveals the hidden and obscure parts of reality, thereby reshaping it. Consequently, epistemology's limitations catalyse the rise of potential new realities. Arguably, the role of design-thinking can be conceived as exploring the gap between blind-fields and virtualities – i.e. to both visualise reality anew and to conceive future solutions. The next section uses the concepts discussed, so far, to recombine environment and subject, what resulted in three dialectical utopian experiments (Queer planet; Matriarchal Society; Afrofuturism) aimed at exploring current contradictions and at formulating new imaginaries of what could be the alternatives to current social trends.

4. Reimagining futures

The classic study by Ernst Bloch (1986) argues that utopia is fundamental because it is a 'principle of hope': once one understands that the reality of 'things' is not as natural as it seems, then hope can create a different reality for things. In his book 'Spaces of Hope', David Harvey (2001) advocated for the concept of dialectical utopias, which avoids the simple 'imagination' of alternative worlds. This perspective would be conceived as counter-utopia, as a device negatively related to reality that allows imagining future alternatives rooted in concrete reality.

Similarly, in his book, 'The Right to the City', Henri Lefebvre (2000) proposes an experimental utopia developed in an intellectual operation called by him 'transduction': the theoretical production of possible objects taken as references, as strategy designed to transform society - 'urban revolution' was his most famous 'possible object'. Accordingly, the aforementioned workshop aimed at investigating the role of design and architecture in developing immanent possibilities and social-environmental alternatives. It explored design-thinking methods to visualise the hidden aspects of urban nature through cartographies, critical representation, diagrammatic interpretation and photographic *dérives*, as well as to envision new possible futures through a transductive utopian imagination.

This Utopia emerges from perception and imagination convergence, according to which, the lens of present reality meets the canvas of an idealised reconfiguration. This convergence transcends the mere spatial and social revolutions, and delves into the depths of societal vulnerabilities, while aspiring towards collective improvement. Inspired by writers, such as Octavia Butler, and by the contemporary Solarpunk movement, utopias represent our right to

collective existence to envision worlds where flaws are acknowledged, vulnerabilities are embraced and community engagement thrives.

These utopias focus on the dialectical nature of relationships. Conflict is not an obstacle, but a catalyst for collective imagination to flourish by steering society towards community engagement and transformative action. Indigenous writer Ailton Krenak (2019) advocates that 'postponing the end of the world' is urgent. We need to rethink our relationship with the environment and embrace the most diverse ways of living. Integrating traditional practices and worldviews to modern solutions is imperative to navigate the socio-ecological goal of surviving the impending catastrophe.

However, the journey towards utopia is fraught with challenges, mainly because of entrenched capitalist paradigms and the ecological crises. Despite advances in quality of life, the continuous-growth narrative perpetuated by capitalist systems masks existential threats and perpetuates dystopian imaginaries. Yet, it is within the cracks of this dystopian reality that literature and fiction illuminate pathways to utopian futures by providing resilience, adaptation and societal transformation narratives.

One of the Workshop activities aimed at conceptualising and imagining utopias to explore the relationship between humans and non-humans in urban environments based on the fiction's ability to incorporate utopianism into crooked realities. Participants were divided into three groups and asked to apply the main concepts of design-thinking methods. They used the brainstorming technique to unravel the intricate intersections between human societies and the environment by exploring the contradictions, power dynamics and spatial concepts shaping distinct realities.

Results showed the need of converting concepts into imaginaries, which had to be represented in textual narratives and collages of three utopias, namely: Queer Planet, Afrofuturism and Matriarchal Society. Each group provided a free mix of theoretical concepts into immanent worlds by addressing complex socio-ecological challenges through playful explorations. These utopias made participants engage in critical reflections on the pressing issues of our times rather than just envisioning alternative futures.

4.1. Queer planet

The Queer Planet prioritises individuals' well-being within their intricate social and environmental contexts by embodying the ethics of care. This perspective nurtures symbiotic relationships and reciprocal support networks anchored in empathy and relational elements by transcending conventional moral frameworks entrenched in abstract principles. The Queer Planet utopia sought an inclusive and compassionate *ethos* aimed at addressing prevalent social inequities and ecological imperatives by embracing innate diversity and collective vulnerabilities inherent to the human condition.

The Queer Planet boldly challenges the entrenched senses of fixed territorial demarcations by embracing the dynamic concept of mobility of frontiers. It sets the concept of frontiers as fluid and permeable zones of interaction and transformation, where new configurations emerge from both conflict reconciliation and the fusion of diverse elements. This utopia propels co-evolutionary dynamics between human society and its surrounding environments by stressing the multifaceted historical, cultural and epistemological dimensions disclosing the different perspectives of the world.

The profound concept of co-poiesis of nature lies on the very core of the Queer Planet where the collaborative and dynamic interplay between human and non-human entities holds paramount significance. The active agency of human and non-human elements in shaping the environment is duly acknowledged by fostering reciprocal relationships and engendering emergent properties within ecosystems. The Queer Planet decisively challenges the rigid nature versus culture and human versus nonhuman dichotomies by presenting a visionary portrayal of reality as intricate and interconnected tapestry of life, which is rich in complexity and interdependence.

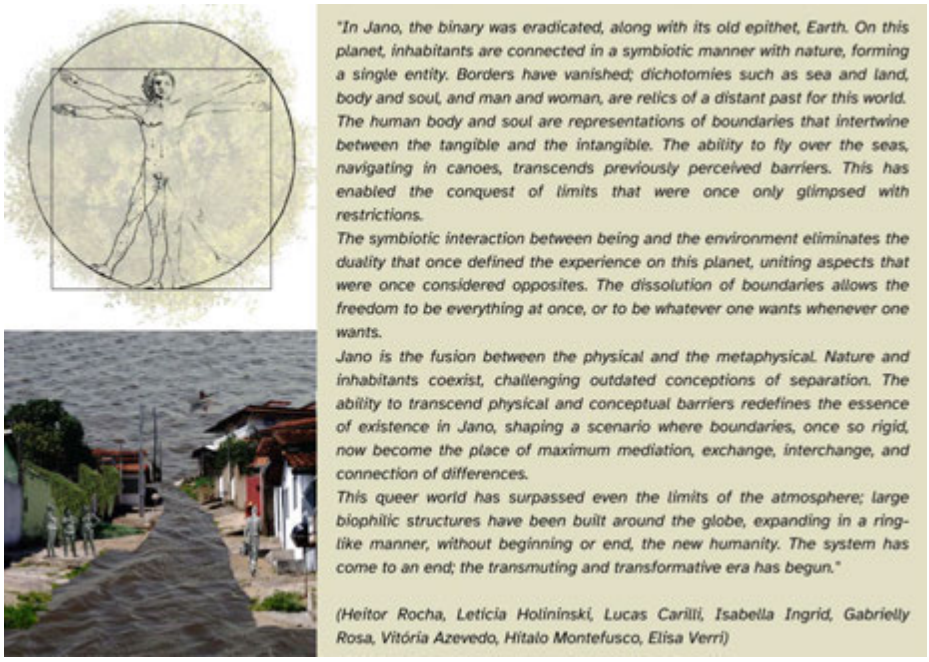


Image 02: Queer Planet Utopia

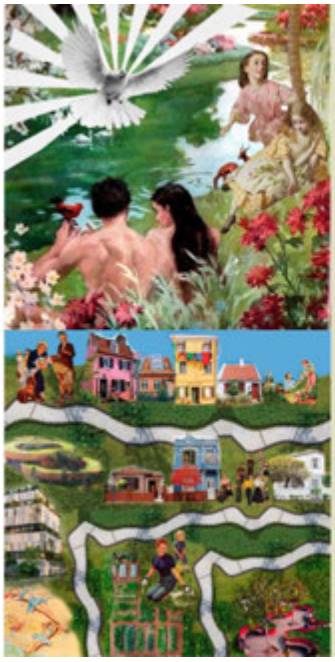
4.2. Matriarchal Society

The Matriarchal Society utopia embodies the *ethos* of care as a fundamental principle. Individuals' well-being in their intricate social and environmental contexts takes precedence. Nurturing relationships and mutual support networks are not only encouraged but intricately woven into the societal fabric. This paradigm challenges traditional hierarchical structures by advocating for empathetic and relational modes of governance that prioritise collective well-being over individual gains. Care, in this utopian construct, transcends the mere virtue of becoming a guiding principle capable of shaping every aspect of social interaction and decision-making

Acknowledging coexistence and dependence is in the centre of the Matriarchal Society utopia. These elements underscore the interconnectedness between humans and the environment, as well as among different human communities. Mutual respect and reciprocity work as fundamental values of this coexistence by guiding relationships. Individuals acknowledge their

strong dependence on the natural world and strive to live in symbiotic relationships that sustain both human society and the ecosystem. Humans coexist with non-humans as stewards, rather than as dominators in this utopia; they nurture biodiversity and ecological resilience through reciprocal interactions.

The Matriarchal Society embraces the concept of co-poiesis of nature by engaging in the collaborative and dynamic process of seeding, rather than in that of creating. Humans actively participate in the environment in this utopia by acknowledging their role as caretakers, rather than as exploiters. They contribute to the flourishing of ecosystems by fostering biodiversity through these reciprocal relationships. This approach transcends traditional nature/culture dichotomies by fostering the sense of interconnectedness for all living beings in the intricate web of life.



"In a world shaped by patriarchal norms and structures, the Matriarchal Society emerged as a beacon of hope and transformation. For centuries, the voices and experiences of women, non-binary individuals, and marginalised genders were silenced and overshadowed. But within the embrace of the Matriarchal Society, a new narrative unfolded—a narrative of empowerment, equality, and communal care.

Gone were the days of hierarchical dominance and oppressive systems. Instead, the Matriarchal Society thrived on principles of inclusivity, cooperation, and respect for all beings. Women, long relegated to the sidelines of history, took centre stage as leaders, innovators, and visionaries. Non-binary individuals found acceptance and affirmation, their identities celebrated rather than erased. Together, they forged a society where every voice mattered, decisions were made collectively, and where the well-being of the community was paramount.

Nature flourished under the stewardship of the Matriarchal Society, as humanity embraced its role as caretakers rather than conquerors. Sustainable practices and reverence for the Earth guided every aspect of life, from agriculture to architecture. The wisdom of indigenous cultures was honoured and integrated, offering a blueprint for harmonious coexistence with the natural world. In the heart of every village and city, lush green spaces and vibrant ecosystems thrived, serving as reminders of humanity's interconnectedness with all living beings."

(Heitor Rocha, Letícia Holininski, Lucas Carilli, Isabella Ingrid, Gabrielly Rosa, Vitória Azevedo, Hítalo Montefusco, Elisa Verri)

Image 03: Matriarchal Society Utopia

4.3. Afrofuturism

The Afrofuturism utopia emphasises the struggles and complexities of concrete life. Thus, the **decolonial approach** provides the lens through which to scrutinise the dynamics of power and knowledge. Afrofuturism challenges dominant narratives and Eurocentric standards by fostering spaces for marginalised voices to express themselves. Encounters between diverse knowledge systems unveil contradictions and power dynamics by highlighting the need of managing divergent epistemic practices in this utopian vision. Afrofuturism disrupts colonial legacies and preserves the most diverse perspectives by envisioning a world where alternative futures can flourish by embracing African diasporic perspectives.

Peter Sloterdijk's concept of coexistence echoes the intricate web of relationships defining society through the Afrofuturism utopia. His narrative depicts a world where entities cohabit and are dependent on one another. The Earth itself becomes a central character embodying both dependence and agency. Afrofuturism rejects the fantasies of emancipating from this interdependence and embracing the vision of interconnectedness and mutual reliance. It challenges binary divisions and presents an alternative to simplistic narratives on harmony through cohesive sets of functions and movements.

The Afrofuturism utopia also lies on the concept of co-poiesis of nature, which emphasises the collaborative and dynamic process of co-creation between human and non-human entities. Thus, nature is not a passive element, it is dialectically shaped by human actions and cultural dispositions. Afrofuturism fosters reciprocal relationships and emergent properties within ecosystems. Based on Arturo Escobar's sense of social construction of nature, Afrofuturism actively reshapes society and the natural world by providing a visionary portrayal of the environment as contextualised reality.

"Within a world of conflicts and divergences, the figure of the oppressed has always been exploited, and mystified to justify the myths of charity and meritocracy. One day, after many days, after centuries and hours of negotiation, little was done and almost nothing changed. Everyone spoke and few listened; there were so many layers of omission, resentment, and dander that reaching any consensus seemed impossible, and indeed it was.

Even within the unity of the oppressed, the pursuit of consensus was fading, but the desire for disruption grew. The Global South rebelled, not in wars or endless conflicts, but through conscious disdain and irony that stripped the system of its inability to see and control everything. Unlike Diogenes, blacks, Arabs, Latinos, women, queers and workers no longer wanted to seek out an honest man to save them, instead, they engaged to seek their autonomy, to accept blurred divergences while exposing inconsistencies and developing new ways of living.

The oppressed bodies retreated into the quiescency of nature and cast new standards of comfort in new ways of life. They developed free and authentic technologies, dialogued with the transparency of a cynic, and overthrew sheriffs and coronels by asserting their sincere ideology in contrast to absolute truths. From within entropy, they created small syntropic utopias, which, during heatwaves, vibrated in green and freshness."

(Heitor Rocha, Leticia Holininski, Lucas Carilli, Isabella Ingrid, Gabrielly Rosa, Vitória Azevedo, Hitalo Montefusco, Elisa Verri)

Image 04: Afrofuturism Utopia

4.4. Discussion: Theorising Experience

Arguably, effective counter-hegemonic ecological transitions cannot be defined without developing innovative ways of knowledge production capable of engaging actors, entities, collectives with experience of struggle. As Santos clearly states, an "epistemological shift" (de Sousa Santos, 2018) is needed to reinterpret the world through dialogue between producers of different types of knowledge.

The fuzzy concepts of 'co-creation' and 'co-production' are increasingly present in our disciplinary lexicon (Voorberg et al., 2015). One of the main aims of our approach is to

reconceive Co-Creation as a method of collaborative knowledge production by seeking to develop 'dense narratives' to enhance our understanding of spatial justice and social inclusion. This production is linked to Chantal Mouffe's (2007, 2013) notion of "agonism", in which agonistic actions and projects have the potential to open "cracks in the system" and allow for the establishment of forms of relationships different from those to which we are accustomed" (Mouffe, 2013: 97). Our hypothesis is that through the adoption of different points of view and 'ways of knowing', an agonistic understanding can be developed that has the potential to think about and configure more socially inclusive spaces and environments.

Therefore, a key innovation in our approach requires the active engagement of all participants, both academic researchers and members of local communities, in a practice of knowledge production that challenges the hierarchy between researcher and 'researched', as well as the rigid binaries between established knowledge/popular knowledge. This is not to deny that there may be power asymmetries deeply rooted in Brazilian society, which it is, of course, necessary to acknowledge. Although Co-Creation is underpinned by notions of equality and inclusion, its practice inevitably takes place in an arena of diverse and sometimes conflicting interests.
.
A further issue for the co-creation of an ecology of knowledge is the need for all participants to consider the positionality, as well as the reflexivity, knowledge production and power relations that are inherent in research processes. If successfully executed, this approach to co-creation recognises the tensions and power relations that are likely to exist between participants and can create an environment of mutual trust. These experiences illuminated the importance of having awareness of both the links and possible conflicts between socially engaged collaborative practice and project action, and the potential tensions between the many ways of producing knowledge.

We therefore argue, in line with Chantal Mouffe, that the ultimate goal is to promote "agonistic spaces", i.e. public spaces in which "conflicting points of view confront each other without any possibility of final reconciliation" (Mouffe, 2013: 92). In 'agonistic spaces' the different perspectives of actors are brought to the fore and contested, not with the aim of an 'antagonistic clash between enemies' but rather an 'agonistic encounter', a struggle between adversaries, in respectful conflict with each other (Landau, 2019: 16).

Design and politics are two inextricably interconnected domains. Design practices participate in the constitution and maintenance of a given symbolic order or its questioning, and thus can play a critical role by fostering agonistic public spaces in which to launch counter-hegemonic struggles against neoliberal hegemony. It is necessary to make visible what the dominant consensus tends to obscure and erase, in giving voice to all those who are silenced within the framework of the existing hegemony so as to disarticulate the framework in which the dominant identification process takes place (Mouffe, 2013: 93).

The agonistic approach to place-making is thus an innovative way of addressing conflicts around the relationship between dwelling and nature, between territory and practices, by involving residents and local actors in activities foregrounding alternative representations of places, communities, collectives. Thus, we argue that these agonistic and disruptive place-making practices can be important components of action and change in the relationship between city and nature, as they generate a deeper understanding of different perspectives on space, ecologies, and ultimately social justice. In short, the endeavour aimed to produce new ways of political thinking and practice.

5. Final considerations

Current systems appear inadequate, in a world grappling with interconnected challenges and structural crises. Planetary urbanisation intertwines societal, ecological and rationality crises that escalate social inequalities and the ecological *Capitalocene*. In this context, the present article reported an action research carried out in Goias City, Brazil, which delved into the concrete aspects of these crises by employing utopias as lenses to explore counter-hegemonic urban ecological alternatives. Based on the six herein addressed concepts, we strived to forge pathways towards alternative futures in a landscape fraught with uncertainty.

This co-poietic hiper-nature is intertwined with urbanised reminiscences, besides being a complex tapestry embodying both a field of symbolism and spectral presences, and a field of obscure possibilities and political intentions engraved in different times. Thus, shaping perceptions of nature holds political significance, since it influences societal interactions with the environment. Embracing a new aesthetic towards nature is pivotal for fostering new social-environmental frameworks that require understanding the desired transitions and their implications to our relationship with the environment.

Here, the key element is the experimentation provided by these utopian exercises. By revisiting the question of experimentation through the lens of an operational field defined by the six key concepts, an ecology of knowledge was created in an agonistic dimension, as conceptualised by Chantal Mouffe (2013). This approach discussed in Goias City did not seek immediate and universal solutions for managing the river and its nature, but it rather aimed at revealing the conflicting nature arising from diverse desires and imaginaries projected onto these elements.

This imaginary interweaving seeked to establish non-extractive utopian images by delving into methodologies such as the sociology of absences and emergencies, the ecology of knowledge, and the craftsmanship of practices. The perspective it aimed at creating heads towards the decolonization of environmental thinking and towards the prioritisation of cognitive justice. This process regards adopting an epistemological transition towards solidarity to those seeking to change the terms with which we have traditionally known the world.

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Integrating Metaphors for a Planning Ecology. Evaluating the Work of a Local Quality Platform

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Integrating Metaphors for a Planning Ecology. Evaluating the Work of a Local Quality Platform

Jan Schreurs

Abstract

Multi-actor collaboration is a major condition within planning situations which include not only analysis, research and design, but also action programs, communication, and implementation. For the sake of integration, five metaphors are introduced to frame a major change in an ongoing planning process, to guide projects towards coherence, and to offer a medium for coordination. The installation of a quality platform offered opportunities for transdisciplinary action research. Through the lens of a *planning ecology* the paper focusses on the fabric and dynamics of correspondence between contextualized planning actors.
After introducing theme, approach and method, the paper elaborates on the notion of 'planning ecology', then problematises the case Beringen-Mijn, next reflects on findings concerning metaphors mobilized for and of collaboration. Conclusions reflect on the findings and evaluate the relevance of 'planning ecology' as approach.

Keywords
collaboration, metaphor, planning ecology, correspondence

1 Introduction

1.1 Collaboration As Challenge

Reflecting on means and ways of managing local change must investigate 'collaboration'. Multi-actor collaboration is a major condition within planning situations which include not only analysis, research and design, but also operational aspects such as action programs, communication, and implementation. Actors have to work in processes of joint problematization and building shared meanings (De Blust, Devisch and Schreurs, 2019). 'Co-creation and co-production also relate to the broader challenge of combining different types of knowledge and experiences in collective learning trajectories' (Medina-Garcia, 2024, p.14). Indeed, many stakeholders need to be informed, motivated and mobilised before they are prepared to invest their creativity, time, money… in realising a project. Their diversity in terms of values, knowledge, resources, means, experience, … does not help to bring stakeholders easily on the same track. Moreover, actual (global) turbulences urge planners to include and integrate knowledge and goals from an increasing number of specialist fields of research and practice: climate, biodiversity, water, energy, health, food, justice…. In addition, within participatory processes, stakeholders arrive with diverging models and images of what it means 'to collaborate': To be part or to take part? To work in a complementary way? To invest (care) in a common project? Different attitudes, aims, interests and (knowledge of) means only reinforce tensions between those images.
Collaboration is co-laborious. Nevertheless, during the complex quest for concepts, strategies and instruments, collaboration is a crucial factor. Rightfully, it is promoted by many scholars and professionals (Albrechts, 2012). But the practice of collaboration is not obvious. The circulation of a multitude of terms collaboration is dealt with in literature (co-creation, co-production, collaborative, coalition, collective….) is an indication of some confusion concerning meaning, relevance, and applicability of this concept.

1.2 Collaboration Is Interaction

Let's explore a promising image of (and for) collaboration. Since a bunch of threatening environmental and social issues provokes the need to plan more effectively, we need to understand better the interactions within and between biophysical and human ecosystems. Many ideas, proposals, reflections, and discussions about making a better – more healthy, resilient, robust, enduring, sustainable, just – environment, appeal to 'ecology' (cfr. References for e.g.). Advocating that 'urban, design and ecological thinking emerge as important disciplinary threads that need to be intertwined' (McGarth, 2013, p.9), clearly indicates both the importance of ecology and the intensity of the interaction needed.
In planning, even the best ideas (concepts, scenarios, designs…) need to be 'processed' within intricate constellations of many, diverse actors. To process not only means to innovate and articulate, but also to exchange, combine, negotiate and deliberate, and thus always involves qualified interactions with others. Understanding better the logics and mechanisms behind actors' (ex)changing interactions can help to get good ideas and concepts implemented. Within the available research, not much attention has yet been paid to the fabric and dynamics of interactions between contextualized planning actors, in other words, to what I will call a 'planning ecology'.
Convinced that local change is heavily depending on productive collaboration, central questions are thus:

- How can we stimulate diverging lines of attitude, thought and action to converge during collaborative planning processes?
- (How) can the notion of *planning ecology* contribute to generate insights into collaborative dynamics?

1.3 Metaphor As Art Of Integration

As a hypothesis, answers to these questions can be generated by focussing on metaphors, for three reasons. As creative device, metaphors create similarity (Lakoff and Johnson, 1980). They make us see sameness notwithstanding difference (e.g. *argument is war*, *ideas are objects*). Thus, metaphors integrate by making connections between unlikely ideas, aspects or objects, often in a novel and unexpected way, creating new understanding. As framing device, metaphors can serve to reframe thoughts and practices (e.g. learn to see *argument as dance* and not *as war*), thus offering a similar perspective to different actors in a coordinated way. As epistemological device, metaphors can be integrative because of the unifying character of their 'vehicle' or referent that conveys the comparison (e.g. 'love is a collaborative work of art').
For the case analysed in the paper, generative metaphors (Schön, 1979) will help to look in a systematic way to the planning ecology at stake. Five referents will be metaphorically mobilised. *Learning ecology* and *meshwork* generate perspectives to analyse the case. *Ship*, *beacon* and *wayfaring* generate frames which played a role within the planning ecology of the case. These are introduced to respectively frame the intended change of the planning process, to guide diverse projects towards coherence, and to offer a medium for coordination of ideas and activities.

1.4 Participant Observation As Action Research

Looking for answers to the central questions, a case is analysed. In a medium Belgian town, Beringen, a public-private-partnership (PPP) was founded to restore, renovate, and repurpose

a former mining site. Looking for a 'director of projects', the local government asked me to take the responsibility to mediate between private developers, city government and administration, Flemish Government Architect, heritage associations and inhabitants. Moreover, as chair of a multi-disciplinary quality platform (with external experts representing the disciplines industrial heritage, architecture, urban design, landscape design, strategic planning, mobility, participation, local governance), which helps to mediate the planning process in terms of steering for coherence, I'm sitting in the first row to observe and assess what is going on in a real-life instance of collaboration.
This situation offers opportunities for transdisciplinary action research. Because of the setting – PPP and quality platform – every project within the case develops according to the string: action-observation-evaluation-reflection-action… Within each (part of a) project, steps can be intentionally induced because of my tasks and responsibilities. Whenever appropriate, transformational imaginary (e.g. 'mine-landscape') or co-creative actions (e.g. research by design) could be introduced to generate change of ideas or practices. Resulting dynamics are at least partially motivated by such steps in the projects. Linking those effects to infused imaginaries and actions allows to learn for next (steps in) planning processes.
This action research is partially self-induced within the case: learning by doing and understanding in practice. Therefor an objectifying counterpart was created by an initiative of self-evaluation by the quality platform. Several drafts and successive discussions iteratively evolved into an informal evaluation document. After completion, this was discussed with key stakeholders (mayor of Beringen, director of development company NV be-MINE, director of investment vehicle LRM, municipal strategic manager of environment & city development, and local coordinator inclusivity) to learn from their experiences with the quality platform. This assessment started after two and a half years and was finished within half a year. The paper firmly builds on that evaluation, which is enriched by a metaphor-based analytical frame of reference.
The paper first elaborates on the notion of 'planning ecology', then problematises the main lines of the ongoing case, next reflects on findings concerning metaphors mobilized *for* and *of* collaboration. Conclusions reflect on the findings and evaluate the relevance of *planning ecology* as approach.

2. A Lens On Planning Ecology

While turning the centennial page, 'ecology' became a dominant discursive term within man-environment-studies. One could argue that 'ecology' replaced 'sustainability' as a leading idea behind arguments favouring much needed transitions (Waldheim, 2016). In search for complex interventions, science, politics, activism, and professional disciplines such as urban design and planning, seemed to find common ground in 'ecology' (Niemelä, 1999).
Without going into detail, three aspects of mobilising ecology in this case-study should be touched upon. To avoid misunderstandings, it makes sense to explicitly differentiate the vested term *ecological planning* from *planning ecology*. Furthermore, in preparation of the case discussed, a central concern needs to be highlighted: bringing coherence between projects, and productive coordination between stakeholders. Finally, perspectives on improving coherence and coordination are created by generative metaphors that serve interaction and integration.

2.1 Ecology As Logic Of Interactions

Ecology is no longer solely interpreted in the original, biology-focused way as 'the study of the complex relations between organisms and their environment' (Lister, 2010, p.536). In a

certain way, ‘ecology’ has even become an empty signifier because the term has been overdetermined. Niemelä (1999) identifies at least four different meanings of ‘ecology’. As science, ecology investigates interactions within nature's ‘economy' (flows of matter and energy or distribution and diversity of organisms). As nature, ecology has become the resource base for humans and an object of science. As movement, ecology refers to ‘green’ political attitudes and activities focusing on ecological and environmental issues. As concept, ecology views human existence in relation to the science ecology (e.g. ‘human ecology‘). Consequently, a clear meaning of the term ‘ecology’ is lacking. Using the term ecology does not hint in an evident way towards intentions, expected roles, nor its agency. Thus, a focus is needed.
As a key-concept within the biological sciences, ‘ecology’ has given impetus to the broader science of living systems. Relationships between humans and their various environments – natural and constructed – became a plausible subject. With ‘urban ecological design’ in mind, Palazzo and Steiner include human species, noting: ‘Ecology involves the relationships of all organisms, including humans, to one another and to their environments’ (Palazzo & Steiner, 2011, p.18). As noted by Lister (2010), ecology can be even broader ‘used in the vernacular plural to describe human relationships with everything from urbanism, culture, and religion, to food, fear, and pizza’ (Lister, 2010, p.536). For our purposes, ecology will be primarily used as metaphor or as model for social and conceptual interactions.

2.2 Planning Ecology And Ecological Planning

Evidently, as disciplines with a focus on the environment, urban design and spatial planning are at the front of harvesting concepts on the ‘ecology’ field. The term ecology has pervaded academic literature in the field of urban and landscape design and planning. Lister notes e.g. ‘Ecology is now central to the vocabulary and language of the contemporary landscape.’ (Lister, 2010, p.536; cfr. also References) As Waldheim notes, ‘ecological planning’ is a ‘long-standing tradition of planning the city through ecological knowledge’ (Waldheim, 2016, p.6), and stands for ‘environmentally and ecologically informed planning practices’ (Waldheim, 2016, p.8). According to Palazzo and Steiner:

> ‘Ecological planning may be defined as the use of biophysical and sociocultural information to suggest opportunities and constraints for decision making about the use of the landscape’ (Palazzo and Steiner, 2011, p.18)

A similar concern to combine environmental and sociocultural knowledge can be found within ‘ecological urbanism’ that develops ‘the capacity to incorporate and accommodate the inherent conflictual conditions between ecology and urbanism’ (Mostafavi, 2010, p.17), by developing frameworks ‘through the conjoining of ecology and urbanism’ (Mostafavi, 2010, p.13). *Ecological planning* can be defined as a projective culture, focusing on interactions among living species and between living species and their environment, combining environmental and design knowledge.

Looking for *planning ecology* instead, literature is sparse. According to Browne and Keil, ‘[p]lanning ecology is understood as an exercise in planning democratic participation.’ (Browne and Keil, 2000, p.159) This definition is broad and vague. Also their ambition to ‘yield a set of sharp tools to understand urban environmental politics in Los Angeles‘ (Ibidem) shows their focus on (political) environmental issues, which makes the concept too small and sharp for our purpose. Focussing on ecology to help understand conditions and ways of decision making within urban design and planning processes, seems like studying an

ecology of knowledge. No wonder that Star's definition of 'ecologies of knowledge' comes close to what I have in mind:

> Ecologies of knowledge […] means trying to understand the systemic properties of [planning] by analogy with an ecosystem, and equally important, all the components that constitute the system. This is not a functional (or functionalist) approach, with a closed-system organic metaphor at its core. As Sal Restivo (1988) notes in his description of science as a social problem, we want to approach [planning] as a set of linked interdependencies inseparable from "personal troubles, public issues and social change agendas. (Star, 1995, p.14; [planning] = my intervention)

Since science as well as planning thrive on knowledge, it is not surprising that replacing 'science' by 'planning' in this quote, simulates rather accurately my imaginary of the term 'planning ecology'. Interestingly, public, social, but also personal issues enter such an ecology. This offers room for an approach which considers persons in complex situations. I stick to the term 'planning ecology' however, because the singular focus on knowledge would distract from the intense interactions within and between several ecological registers: environmental processes, social relations, and human subjectivity (cfr. Guattari, 2000; Lister, 2010; McGrath, 2013), within spatial, social, and temporal contexts. Thus *planning ecology* further refers to (interactions between) multiple ecological processes between diverse actors within a specific, multidimensional planning context. Different from *ecological planning*, *planning ecology* would rather invite a research culture focusing on how 'ecological logics' (Ellin, 2013, pp.61-63), and systemic dynamics, both of 'natural' and human ecosystems, play a role within projective cultures, such as urban and landscape design and planning.

2.3 Integrating Metaphors For A Quality Platform

As an analytical frame, this investigation uses a composite lens to describe, analyse and asses the *planning ecology* in a case. This lens is composed of metaphors, because metaphors make us see, albeit in a certain way (Lakoff and Johnson, 1980). Ecology is the basic metaphor. Looking at a planning process as an ecology makes us see only part of it. Because ecology is all about interaction, this lens will make us primarily look for relations. This will help to focus on major challenges of the case study: collaboration of people and coordination of projects. To see different aspects of that planning ecology, the lens can be polished into several facets. These facets offer different perspectives, which might help to articulate a planning ecology more precisely. For the case study, two perspectives are used: 'reading' the context and 'writing' interventions.
The reading perspective, in section 3, will explain the case Beringen-Mijn in an essential problematisation. To reveal different perspectives on coherence and coordination, *learning ecology* is mobilised as main metaphor, and *meshwork* as subordinate one. These metaphors are mobilised *for* the case, not *in* the case. They are part of my theoretical framework, and thus available before the analysis.
The writing perspective, in section 4, recalls three main attempts to stimulate coherence and coordination *in* the case Beringen-Mijn. According to the project director and the quality platform, three metaphors frame respectively: the favourable way of working, (*projects are a fleet*), the goal every project should reach for (*mine-landscape is a beacon*), and ways to find common ground for coordination and coherence (*designing is wayfaring*).

2.3.1 Learning Ecology

In this reconstruction and assessment of a planning case, ecology is evidently the driving metaphor. Eager to better understand how planning works, we look at the situation as (if it is) an ecological system. This is similar to Lynch, who describes a neighbourhood as 'local system of social groups, behaviour, mental images, and physical form' (Lynch, 1981, p.330). His reflections on how to make 'Good City Form' with these components, rely on the view of a city as an 'ecosystem of human groups', or as a 'learning ecology' (Lynch, 1981, pp.328,115). Indeed, 'cities are the product of beings who can learn' (Lynch, 1981, p.97). Thus, they can learn to care for continuity and connection as basic conditions for a qualitative learning ecology:

> So that settlement is good which enhances the continuity of a culture and the survival of its people, increases a sense of connection in time and space, and permits or spurs individual growth: development, within continuity, via openness and connection. (Lynch, 1981, pp.116-117)

Being open to development, a good city is an 'evolving "learning ecology"', richly characterised by Lynch:

> To the familiar ecosystem characteristics of diversity, interdependence, context, history, feedback, dynamic stability, and cyclic processing, we must add such features as values, culture, consciousness, progressive (or regressive) change, invention, the ability to learn, and the connection of inner experience and outer action. (Lynch, 1981, pp.115–116)

2.3.2 Lines And Meshwork

If 'change, invention, the ability to learn' are characteristic for a learning ecology, this must be a living ecology. But what does it mean 'to live'? One of L's returning themes develops 'the idea of life as lived along lines, or wayfaring' (Ingold, 2011, p.xii). To give this a more concrete, and collective dimension, his key concept is 'meshwork, understood as a texture of interwoven threads' (Ibidem). This concept replaces the strongly distributed idea of network of connected points. In the 'web of life' (Ingold, 2011, p.63), this 'meshwork of wayfaring, […] the lines of the meshwork are not connectors. They are the paths along which life is lived.' (Ingold, 2011, p.151)

> Proceeding along a path, every inhabitant lays a trail. Where inhabitants meet, trails are entwined, as the life of each becomes bound up with the other. Every entwining is a knot, and the more that lifelines are entwined, the greater the density of the knot. (Ingold, 2011, p.148)

It is easy to see an ecology in this web of life. But how then, do inhabitants learn in that learning ecology? Learning involves exchange of knowledge. Misguided by the famous 'conduit' metaphor, we take it for granted that ideas are objects (Lakoff and Johnson, 1980), which can be transferred as a product from one person to another. But true learning needs learning *with* and *from* (Ingold, 2013, p.2). Knowing, and broader, learning and being cannot be separated. Knowing 'belongs, at the heart of being' (Ingold, 2013, p.6). Since life develop along lines, so does learning. We take it that an ecology of learning is developing along interacting lines, with others on entwining trails, meeting into a meshwork of relational interactions.

2.3.3 Correspondence

Thus, as a metaphor, *learning ecology* highlights complex planning processes as the weaving together of storylines about better environments, from engaging actors, enacting ideas, programs, and values into collective practices of correspondence. From that perspective, *planning ecology* turns out to be the generation, transformation and survival of knowledge, actions, and attitudes of all relevant stakeholders. In the words of Ingold, it is 'an ecology of correspondence' (Ingold, 2015, p.155)

3. Problematising A Case: Beringen-Mijn

One way of grasping the accuracy of 'collaboration' in a critical way, is to learn from cases. Since collaboration is a practice as well as a principle, valuable lessons can be learned from dialogues between facts and frames. Therefore, the paper looks at a specific PPP planning practice, where collaboration is a structural condition, reflecting on ongoing practices developed during several years. This case is 'Beringen-Mijn', a district in a moderate Belgian city, developed out of a huge coal mining plant. From motor of prosperity, this miner's district became a monumental burden in terms of physical problems (large derelict land, empty impressive industrial buildings, abandoned heritage, a worn-out garden city, …), social tensions (spatially isolated and socially divided communities of migrants and newcomers, …), and mental disruption (loss of work and collective ethos, traumatic history, emptied signifiers, …). Typically, such burdens also have a huge potential for new developments. To capitalize on this potential, a specific multifaceted planning approach has been introduced by the city government. Typical for this approach, the idea of integration steers the heart, head, and hand of the stakeholders.

3.1 A (Re-)quest For Coherence And Coordination

Desperately seeking someone to interrelate and coordinate ongoing and upcoming interventions in the historically important former mine site, was probably the reason why I received an email form the administration of Beringen, in august 2020. Would I be available for co-operation with the city government of Beringen, a town of 50.000 inhabitants, with an enormous, valuable mine-heritage? Three weeks later, after a site-visit, together with the mayor and the strategic manager city development, my role as 'director of projects' was outlined, and the installation of an ambitious 'quality platform' ('*kwaliteitskamer'*) was prepared. Both decisions were formalized in October.
These decisions of the Municipal Executive (Board of Mayor & Aldermen; in Dutch: *College Burgemeester & Schepenen*, or *CB&S*) had a context. As a result of a tumultuous trajectory, the development of one of Europe's most important mine sites had to prepare for a drastic turn. Now, three and a half years later, my experiences offer much to reflect upon how to approach a strong change in regime. Essentially, development had to shift from fragmentation to coherence, and from autonomy to coordination.

3.2 Coal Washing Plant As Stumbling Stone

On October 28th, 1989, status, conditions and perspectives of the historical mine site tilted. Its enormous heritage became a heavy financial burden in the pockets of the central government, who had to take care for the social passive, and for buildings and infrastructures. Dwellings in the 'cité', the miner's garden district, were sold rather cheaply, preferentially to renting inhabitants. The empty industrial buildings and warehouses deteriorated while being 'mined'

by copper thieves and urban explorers. From dynamic productive machine, the mine turned into a complex of massive buildings, listed in 1993 and 1994. Considerable amounts of subsidies became available for this protected heritage, but this came with an ambitious vocation. Indeed, from the seven coalmines in the Flemish Campine region, Beringen was selected as the only lasting complete testimony of former grandeur, technical functioning, and socio-spatial organization. Being listed as a heritage implied conserving a coherent image of a complete mine plant, enabling to demonstrate, to explain and to experience its former role and functioning. This huge expectation was motivated by the production unit's representativity, age, completeness of buildings and installations, architectural and technical value of interventions, state of preservation, compactness, clarity, present complementary activities, the presence and location of two slag heaps (Team Vlaams Bouwmeester, s.d. [2019]). The immense coal washing plant was the main reason for this entrusted vocation. With its four parts, it was formally and functionally the heart of the industrial complex (Figure 1), and Beringen was the only place of preservation.

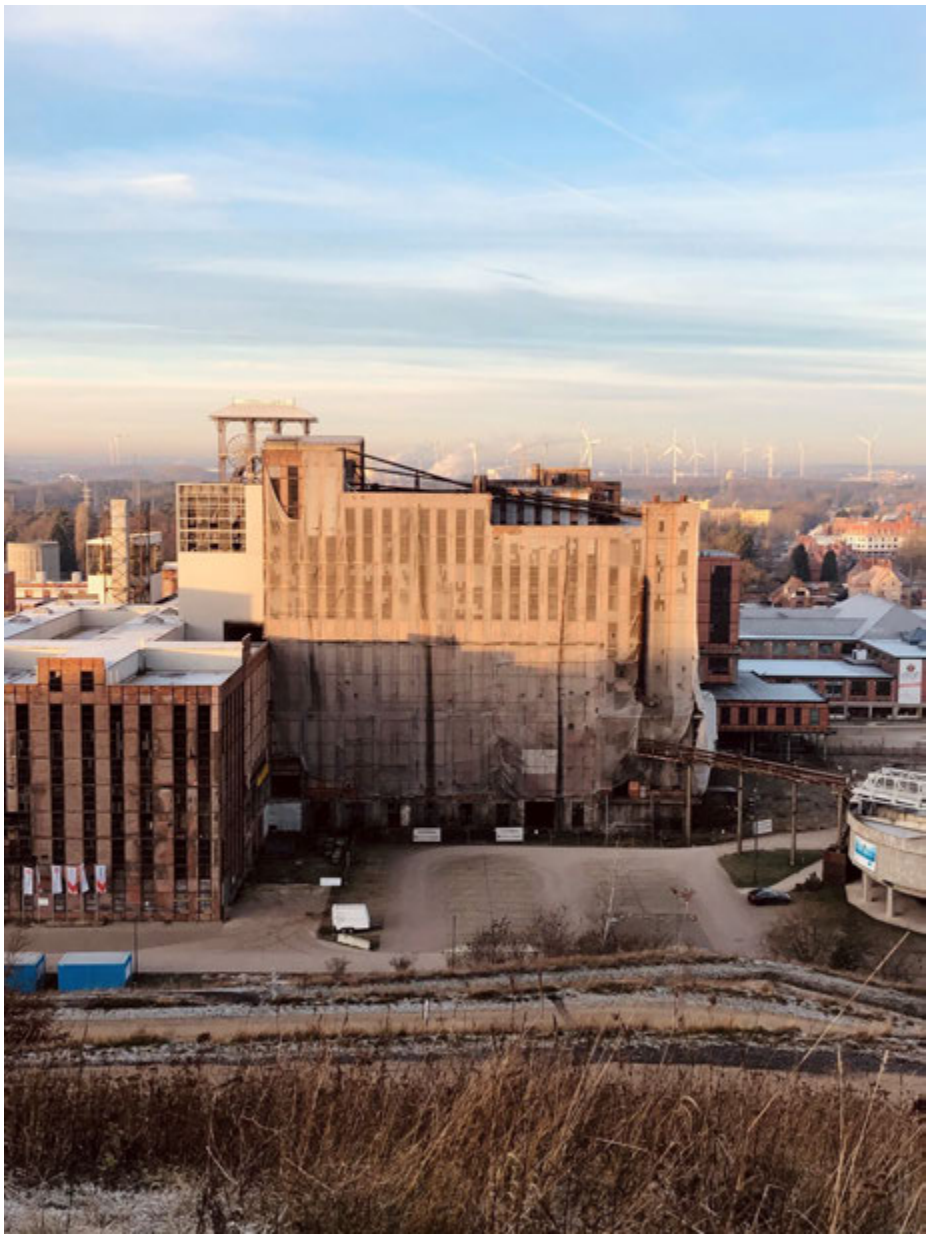

Figure 1. Part of mine site with huge coal washing plants

To implement this vocation, a reconversion plan was made by a PPP, formalised as a public limited company, named NV be-MINE. From then on, the vocation of the mine site was labelled as a touristic-recreational project. It had to comply with a local legally binding plan (Bongaerts, 2000) that defined the location as zone for urban development. The restauration

and re-use of the plant was gradual implemented. When the PPP asked the responsible minister to drop the heritage label for two of the four parts of the coal washing plant, the project took a dramatic turn in December 2018. According to the developer, lifting the conservation status was necessary because the combination of lamentable physical conditions and complicated spatial situations made reconstruction not affordable. The entailed compulsory public investigation provoked a gulf of national and international protest and pressure, and resulted in 1.311 notices of objections. Instead of coming to a head using legal procedures, the minister preferred to find common sense amongst the development consortium and heritage associations.

3.3 Coal Washing Plants As Pars Pro Toto

To find a way out, in May 2019 Minister Geert Bourgeois asked the Flemish Government Architect, Leo Van Broeck, to play a mediating role in this open conflict. He was asked to guide a participatory trajectory with all relevant stakeholders, trying to find consensus. Bilateral and collective discussions ended up in a hopeful report (Team Vlaams Bouwmeester, s.d. [2019]). Van Broeck perceived common support for a scenario of principles. Further designerly research and stabily studies would be needed to find out if that consensus would withstand.
Together with this optimism, the Flemish Government Architect ventilated severe critique on the way the PPP was managed. His report assessed lack of coherence and of coordination between the stakeholders and their initiatives as one of the major objectionable matters of the ongoing development on the mining site (Team Vlaams Bouwmeester, s.d. [2019]). Precisely this argument convinced the Municipal Executive of the city of Beringen to take bold measures. Enlarging and qualifying drastically the former '*kwaliteitskamer'* (quality chamber) and installing a '*projectregisseur'* (project director) explicitly aimed at fully integrated development in coproduction (CB&S, 2020a). In line with the advice of the Government Architect, success should be built upon two pillars. Synergy and added value should be found within an overall long-term vision on a larger scale. Coherence between projects should be steered on a systematic base by an overall vision and supported by all relevant actors. It would be the project director's responsibility to guard sufficient coherence among all current and future projects, both content- and timewise, while pursuing cross-pollination and societal added value (CB&S, 2020b). By this decision of the Municipal Executive, a trajectory of redirection was launched, and the direction was clear. A long-term vision for the larger scale focussed on a much broader work field than the coal washing plants and was extended towards the complete mining site. Simultaneously the Executive enumerated a list of at least 15 projects that waited for coordination. The Government Architect's plea for coherence and coordination did not fall on a cold stone.

3.4 The Ex-mining Territory Fragmented

The Government Architect's evaluation quite precisely assessed the situation on the field. The ex-mining territory had been compartmentalised into lots, while the fragments were declutched under separate ownerships. About 11 ha. were split off to realise 'Houtpark', serving a new housing district for approximately 600 houses, apartments, and service flats. On plots around the listed historic buildings, a private swimming pool, a restaurant and a shopping boulevard had been constructed. Besides the existing tourist reception and small mine museum, parts of the old mine buildings had been reused for nursery classes, a climbing hall, a banquet hall, a bike shop, and offices. The former thickener of the coal-washing process had been transformed into a diving centre. The largest part of the listed buildings was

still empty. However, plans were already on the table. The main spaces would be used for an experiential museum, focusing on the 'path of the miner', to be run by the province of Limburg. The technically worst part would be partly opened to invite trees, light and rain ('re-NATURE'), and partly turned into a casco to be sold piece by piece. Depending on the partial project on the site, 'ownership' was already given to different stakeholders: NV be-MINE, province of Limburg, city of Beringen, region of Flanders, social housing company, school community, private families, investors. Only NV be-MINE had a clear development model: restore listed buildings supported by subsidies, find a new, fitting program, transmit (part of) the building to third parties, by selling or establishing a long term right in rem (e.g. long lease). Despite all those realisations and plans, the PPP expected to be confronted with a large unused (and probably unusable) surface in the coal washing plants at the end of the development term. Without doubt this would become a burden for a yet-to-be-created management structure. Without intervention, the demonstration of a complete and coherent coal-mining history, as the minster was expecting when listing the building, would not be the obvious result of the ongoing development.

4. Diving Into A Planning Ecology

4.1 Projects As Ships

From section 3.4 we learn that levers for easily steering on the coherence of all projects, were already gone when the project director could start to remedy. Because of the distributed 'ownership', the situation was an amalgam of actors, each with 'own' goals, means and trajectories. To cope with this situation, I suggested a twofold approach to the Municipal Executive: conceptual and process oriented. It combined Hajer's conviction that socio-spatial transitions need a shared 'imagery' (Hajer, 2016), with Bruggemans' three-step approach for a 'sabbatical detour' (Brugmans, 2016). Therefore, I conceptualised the diverging projects as individual *ships*, with autonomous commanding officers. These should instead think and act as a *fleet*, heading for a common destination: to realise the vocation of the ex-mine site, each for his part. To reach out for the same *beacon*, would demand a decisive 'turn', a specific twist in each ship's trail. The suggestion of the Government Architect to instrumentalise the 'power of designerly research', (Team Vlaams Bouwmeester, s.d. [2019]), would find a productive 'locus' in three successive workshops with the crucial stakeholders. Each workshop would deal with one of three cohesive questions. First: What do we aim at? How do we look at the city-district Beringen-Mijn (including the ex-mining site)? Second: What can we aim at? How can we together discuss and articulate the qualities aimed at for Beringen-Mijn? Third: What will we do? How will we work together, while developing Beringen-Mijn? This proposal was approved as a working program by the Municipal Executive (CB&S, 2020b).

4.2 Mine-landscape As Beacon

At the first meeting of the quality platform, developing shared imaginaries as 'beacons' to co-orient the 'noses' of 'ships' was presented and discussed as success factors for coproduction. As guide for a qualitative development of Beringen-Mijn, the quality platform formulated a mission-and-vision statement concerning the expedient rectification of ongoing trails of the *ships*. In line with the Government Architect's suggestions, this text expresses enduring concerns about a mutual attuning of projects, in space and time. That mission is taken up by a vision which promotes to work within interdisciplinary, integrating frameworks. The basis of their articulation is the explicit ambition to work towards sustainable development and socio-

spatial qualities, but first and foremost towards a coherent *mijnlandschap* (mine-landscape), articulated at different levels of scale. Open spaces, heritage and community are seen as its most important facets. The focus is on links between and within these facets, both on short term (masterplan, project) and on long term (strategy, management). The text also formulates an unambiguous intention: 'The quality platform's way of working should lead to incorporating its vision as an evident dimension of ideas and practices of crucial stakeholders and actors' (Kwaliteitskamer Beringen-Mijn, 2021). This ambition to share ideas was actualised by many long conversations and dialogues, while constructing stories about interaction, coherence and coordination, and by designerly research, while drawing and representing imaginative mine-landscapes. Analogous to the idea of *landscape*, elements were systematically situated within their context, and not given meaning without that larger picture. E.g. as a result, one of the coal washing plants was systematically valued as a complement to the three others. And the relevance of building new dwellings was explained in terms of what the housing quarter will receive from, and what it will offer to the lager environment.

4.3 Design As (Co-creative) Wayfaring

An always uncompromising practice of priorities and agendas was responsible for a less strict scheme than the 'sabbatical detour' had in mind. The trajectory of the projected 'turn' involved more than three steps. Although aims did not really change, partners did fluctuate, depending on evolving dossiers, progressing insights, and personal affinities. In practice, the three thematic questions (aims, articulations and actions) intertwined, functioning in an iterative way, thus in-betweening for correspondence. This was not unexpected: gradually formulating qualities more clearly, and reshuffling coalitions of practice, can lead to different ways of seeing the territory and its vocation, as well as each other's ambitions and attitudes. Nevertheless, two factors were kept constant: the middle of the table was always occupied by maps and plans, pencils and pens, while the landscape was never obliterated.
During the first, internal workshop, the quality platform prepared a vision framework. Inspiration was found in a situation scan prepared by the team of the Government Architect (BUUR, 2021). This is a tool offering a socio-spatial diagnostic to local governing bodies, highlighting spatial and executive strongholds and weaknesses about the communal territory. Stimulating a local agenda-setting of projects and policies, the scan articulates potential strategic projects. The most appropriate of these projects - *augmenting living quality and improving the spatial structure of Beringen-Mijn* - was assessed and evaluated. Collective brainstorming produced alternative design ideas suggesting new green connectors at the scale of Beringen-Mijn, which would also strengthen cohesion between green and blue structures to the East and West of the central nucleus. (Figure 2)
As a next step, a week of design and dialogue was organized. Developers, associated designers, inhabitants, external experts, administrations, and aldermen collectively contributed by offering ideas for and comments upon the strategic project. (Figure 3) Simultaneously *designerly imaginations* produced a first version of what would be elaborated later into a spatial structure sketch for Beringen-Mijn. The central landscape structure contains two parallel north-south axes: a functional urban boulevard with services, and a recreational green connector for soft mobility. This idea was complemented by a set of possible actions to interconnect these axes and the surrounding cité (Figure 4).

Figure 2. Quality Platform collectively generating ideas for Beringen-Mijn
Figure 3. Design presentation and dialogue during design week

Figure 4. Structure sketch for Beringen-Mijn (© BUUR PoS)

Next, a series of advisory *design workshops* was organized, bringing together NV be-MINE, city administrators and representatives of the quality platform. Spread over several months, this group developed innovative but feasible proposals for use and lay-out of coal washing plants number 1 and 3. Breaking away the worst parts of the structure should enable to incorporate nature, enjoying it while growing. Although invasive, this intervention would serve later as flag and symbol for a 're-nature' strategy, ambitiously framed as philosophy and essence of the whole redeveloped ex-mining site.
Finally, intensive *research by design* played a decisive role in an intensive program of meetings and workshops, aiming to complete the necessary plan for receiving a permission to develop the new living quarter Houtpark. Starting with a declaration of intent, signed by NV be-MINE and the city of Beringen, these partners launched a steering committee, also incorporating members of the quality platform. After ten months of coproduction, the result was 'Houtparkboek', a well-illustrated quality-guideline. With its qualifying descriptions and visual references, this book gives designers and administrators tools to grasp wanted qualities of buildings and generous landscape connectors between the existing cité and the new quarter.
Although turbulent at times, the results of the 3-year process show progress. Two projects, formerly heavily criticised, the reconversion of two listed coal-washing plants and developing a new living quarter, were given formal permission to start implementing. According to the quality platform, aspects of social and spatial sustainability improved substantially. The design-and-dialogue week was emblematic. A co-produced structure sketch shows opportunities for strengthening spatial and functional coherence between new projects and the district of Beringen-Mijn. Actions needed to operationalise those opportunities were identified. Moreover, designing the structure sketch demonstrated dimensions of the new mine-landscape: industry, infrastructure, city, suburbanisation, heritage, centrality… and the open heath landscape were all this settled. Innovative ways of interacting between developers, city, inhabitants, external experts, and the quality platform, established intensive coproduction: a design week, collective biking, visiting coal washing plants and relevant projects, designing with the Government Architect. Words and images of many participants were carried along entwining flight lines, by open ideas and reflections, not necessarily meeting in a final design. They rather develop along and with each other, in an ongoing dialogue, sometimes converging, sometimes not, meeting as interweaving lines, a meshwork as memory of collective learning.

5. Conclusions: About the Relevance of 'Planning Ecology'

The paper describes the rationale of an ecology-inspired approach to urban planning, assesses the way it is accomplished in a case study, and evaluates its results.
As 'director' of projects within an ex-mining city, I describe a local *planning ecology* as it has been developing over the last three and a half years. The motivation to do so is twofold. Primarily it is an attempt to assess and evaluate the mediating role of a quality platform, and its results. Such evaluation is useful, especially in case the city decides to continue this process. Second, I hope this assessment also reflects the relevance of using the concept 'ecology' as metaphor and model within processes of urban planning and design. The following conclusions reflect on the findings and evaluate the relevance of 'planning ecology' as approach.

5.1 Reflections

This investigation is based on a case study. It involves a meaningful confrontation between abstract frames of reference and concrete processes in the field. Investigating a process by someone with personal involvement has pros and cons. According to Ingold, participant observation is 'knowing *from the inside*', opening up 'our perception to what is going on there, so that we, in turn, can correspond to it' (Ingold, 2013, pp.5-7). This subjective relation of '*correspondence*' receives a compensating inter-subjective check by also relying on an evaluation by the quality platform, which brings this information *of* the world back *into* the world.

Conclusions are preliminary. First because the projects discussed are not finished yet. At this moment, they only recently received a building permit or a go to start developing. The relative positive results might be tempered after detailed designs and constructions. Second, the approach is young and hesitant: I have no previous experience in diving into the intricate interactions of a planning ecology. Thus conclusions concerning the agency of metaphors and the characterization of planning ecology are tentative.

5.2 Relevance of Approach

Problematising collaboration in planning generated as first research question: *How can we stimulate diverging lines of thought and action to converge during collaborative planning processes?* Since metaphors have integrative power, two sets of metaphors are mobilized as theoretical framework. Together, they form a composite lens to describe and analyse the case Beringen-Mijn. *Learning ecology* and *meshwork of lines* act as generative metaphors *for the case*. Together they help to read the contextual situation (city, actors, projects, …) and modes of interaction between actors. They provide a guide for focusing on socio-spatial coherence. A second set of metaphors, *projects are ships*, *(mine-)landscape is beacon* and *designing is wayfaring* have been deliberately brought *into the case*. They serve specific but varied intentions: to offer an imaginary for the dynamics of projects, an image for the feasibility of converging autonomous projects, and a medium for correspondence between diverse actors.

Many converging and constructive interactions could be identified within the planning process. The intended 'sabbatical detour' was incorporated within the decisions of Municipal Executive, as articulation of the transformative *fleet* imaginary. This imaginary was presented and discussed during the first meeting of the quality platform. The mission-and-vision text prepared by the quality platform articulated the 'mine-landscape' as *beacon* for that *fleet*, and explicitly formulated that imaginary as an evident goal to be incorporated in every project or action. Several long trajectories of designerly research and dialogues amongst overlapping groups of actors, effectuated a productive correspondence within a *meshwork* of activities. As result of a collective design-and-discuss week, a structure sketch was produced, synthesising the concerns and wants of a broad array of various participants. This sketch is constantly referred to within the following projects.

Thus, three 'functional' metaphors have helped converge Municipal Executive, developers, quality platform and – indirectly other stakeholders. The hope that the project leaders, the captains of *ships* would implement the 'turn' needed to orient all projects towards a coherent whole, was redeemed for the projects described in the paper. Coproduction amongst stakeholders of the two most delicate and precarious projects gradually improved. All stakeholders finally agreed with the plans made up during and after many dialogues on the quality platform. However, one important project never surpassed the consultation stage, and fell out of the fleet.

The second research question, *if and how the notion of 'planning ecology' can contribute to generate insights into collaborative dynamics?* is harder to answer. This question was launched with the aim to better understand how collaboration works at the micro-level of

urban design and planning. Although the condition of transdisciplinary research based on participant observation was promising, the available time, and the rather closed character of some niches in the planning ecology, were limiting factors. Investigating at the micro-level needs time to observe and interview many actors, many times. Availability, mutual understanding (literal and figurative), and – more important – mutual trust, are necessary conditions, which can only be realised relatively late in the process.

The sphere where these conditions are fulfilled rather well, are intense occasions of research by design. Design-week, substantial and/or successive workshops, where ideas and designs gradually try to correspond, without the need to come to a conclusive decision, offered favourable conditions for creating multiple collective trails, and offer valuable insights about density and intensity of active meshworks. At least, design proved to serve the intention of making lines of thought intertwine.

A conclusion from these observations also is, that continuous lines are the better trails. During the process, several persons changed position, disappeared or entered the scene. The consequences of such discontinuities are sometimes dramatic because they hamper trust. Moreover, because ideas are not objects which can be handed over to someone else, but results of correspondences amongst multiple lines of thought, discontinuity hinders imagination and ambition.

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Figures

Figure 1. Part of mine site with huge coal washing plants
Figure 2. Quality Platform collectively generating ideas for Beringen-Mijn

Figure 3. Design presentation and dialogue during design week
Figure 4. Structure sketch for Beringen-Mijn (© BUUR PoS)

Unravelling a sustainability vision in the national spatial plan

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Abstract
There is an increasing demand for a new generation of planning frameworks capable of delivering long-term sustainability outcomes amidst the escalating uncertainties (Becker 2023, Kivimaa 2023). European policies reshape the territorial dimension at the national level, fostering policy debates through downscaling emerging initiatives and measures (Böhme et al., 2022b). Estonia's National Spatial Plan has undergone a significant transformation, shifting from traditional growth paradigms to a sustainability vision. The research evaluates the plan's inception and framework, addressing challenges posed by climate change, regional disparities, and national security while striving for a resilient and sustainable future. The inception phase establishes principles, selects themes, and outlines impact assessment methodologies, along with identifying necessary studies. Rethinking climate policy, particularly in the land-use sector, involves aligning policies with decarbonisation, climate and biodiversity implications, simply minimizing land take and acknowledging spatial scarcity. The plan should set clear land use priorities, providing conditions and guidelines for local comprehensive plans, seeking climate-proof and low carbon land uses and enforcing brownfield development for reducing aggressive land take. A nuanced approach incorporates cross-cutting planning principles and sustainability dilemmas, plus national deference urgencies. The research highlights potential gaps in the plan's adaptability to the transition mode and underscores uncertainties regarding high territorial dynamism, navigating tensions between flexibility and stability. This initial phase of national planning is crucial as it sets the ethos and tone for the entire planning system and process.

Introduction

European nations reassess their national strategies and planning frameworks in light of pressing sustainability concerns. It is compounded by the importance of innovative and automated planning methods with Big Data and AI as well manifesting a deliberate participatory governance paradigm for civic society (Oldbury and Isaksson 2023). In addition, the convergence of COVID-related disruptions, energy crises, and geopolitical tensions has accelerated deglobalisation trends, prompting nations to reassess their reliance on global supply chains and trade networks (Böhme et al 2022a). This shift reflects a growing emphasis on regional self-sufficiency and economic resilience in the face of heightened uncertainties and vulnerabilities in the global landscape related to the economic and energy transition (Sivonen and Kivimaa 2024). Research community claims rethinking the relationship between humans and the environment through a systemic perspective that encompasses dynamic inclusion, vitality, purpose, and value (Davelaar 2021). Transitioning to a new sustainability paradigm requires new foresight and strategic planning schemes as well replacing conventional systems thinking with a comprehensive metaphor of nested leverage points. The 'beyond growth' debate expands examining economic and socio-ecological challenges replacing economic primacies. European policies aim to mitigate negative growth impacts, focusing on innovation, and the

European Green Deal. Additionally, beyond growth relates to social challenges emphasizing concepts like justice, fairness and sufficiency. The EU discussion papers highlight obstacles for EU policymaking and underscores the importance of values and implications of globalisation in transitioning towards sustainability (Jensen 2023). In addition to degrowth thinking, another neologism narrated recently and tackling regional gap at European and county scale territorial strategies is 'left behind' places (Fiorentino et al 2024).

Thus, old problems need new solutions to all-for-all wicked problems: climate change, national security, urbanisation, resource depletion, poverty. While current trends and uncertainties may paint a rather pessimistic picture the planners have begun looking outside of the box, challenge our traditional assumptions, and stop trying to solve the same problems with the classic approach and tools. Larger, targeted sets of projects and policies create new socio-technical realities (Berglund-Snodgrass et al 2020). Contemporary research stresses the importance of governing with intent, i.e., with clear objectives and an understanding of the anticipated impacts of new strategies, business models, services. e.g based on digitalisation and platformisation (Oldbury and Isaksson 2023).

Böhme et al 2022 discuss the need for increased territorial resilience in the face of rapid changes and uncertainties. Emphasizes the importance of navigating under 'new' uncertainty, a shared sense of direction, and supporting territorial resilience has become a priority in strategic territorial visioning in European Union, channelling discussions on Territorial Agenda 2030. This can be achieved through capacities such as foresight, the ability to react and transform, and a willingness to change, as well as through cooperation, coordination, and a common vision for Europe's future. There is an increasing demand for a new generation of planning frameworks capable of delivering long-term sustainability outcomes amidst the escalating uncertainties, in worst case shocks and declining security (Becker 2023, Farinós 2020, Kivimaa 2023). It concerns also national and regional territorial agendas as elaborated below.

Estonia's National Spatial Plan has undergone a significant transformation, shifting from traditional growth paradigms to a sustainability vision. The 2012 concept of low-density urbanized space, integrating compact cities, suburbs, and traditional villages to support diverse urbanized lifestyles, is proposed to be replaced by an optimised, densified cohesive pattern centred around cities. The research evaluates the plan's inception and framework, addressing challenges posed by climate change, regional disparities, and national security while striving for a resilient and sustainable future.

The inception of national spatial planning

The inception phase of the planning establishes principles, selects themes, and outlines impact assessment methodologies, along with identifying necessary studies. The national spatial planning is positioned in both the spatial planning system and the strategic planning at the national scope (Fig 1). The critique of spatially blind strategic planning has been mitigated by strengthening spatial principles, territorialisation, and targeting regional gaps in the national

spatial planning process and methodology.

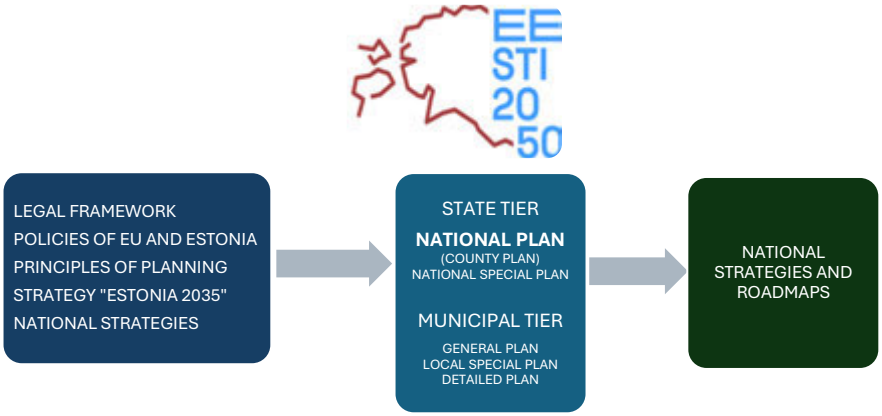

Figure 1. The strategic planning process – the scope of national spatial plan.

The starting point for national spatial planning is the emphasis on sustainability paradigm. This holds significant symbolic importance in the current stage of societal development in addition to emerging strict and ambitious legislative obligations. The pro-sustainable themes dominate in the plan's structure (Fig 2).

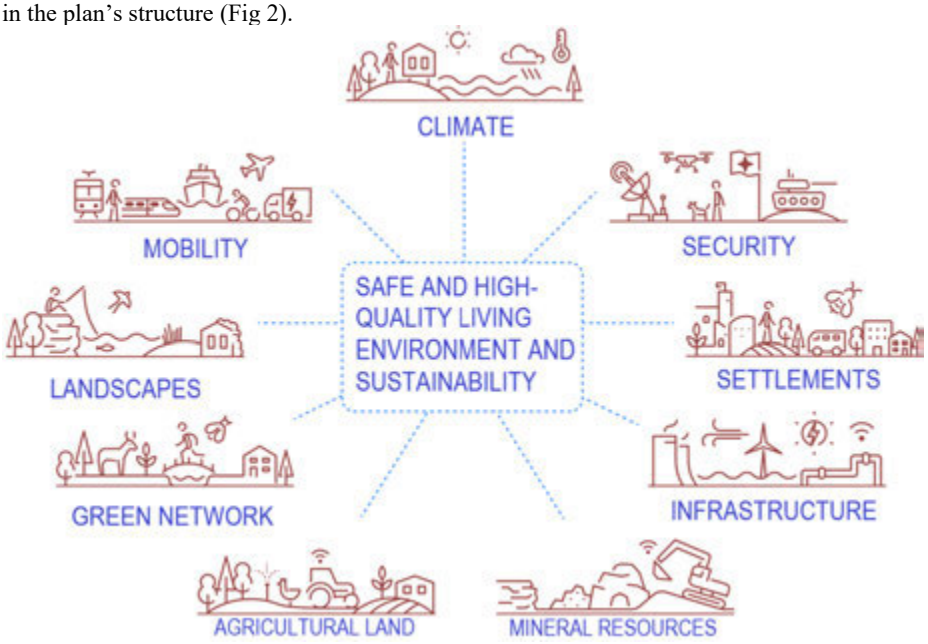

Figure 2. Focus themes of the national plan.

In light of the climate crisis and imperatives of heightened national security, there has been an intensification of spatial rivalry of land uses – conflicting interests regarding land use both in specific locations and in contrasting spatial networks of residential areas effects (Li et al 2024). Despite Estonia being sparsely populated compared to most European countries, competing interests of land use occur. National spatial plan prioritizes land use changes based on national interests. Climate policy and the limitation of natural resources, including the loss of biodiversity, will increasingly and significantly shape land policy and regionalisation. Furthermore, attention must be paid to the temporal axis of spatial processes, their sudden acceleration. Also, the plan determines the fundamentals of settlement pattern. It relates to the services, mobility, infrastructure, natural resources, ensuring the preservation of cultural heritage, sustainability, and the environmental burden. Based on settlement trends, guidelines are provided for shaping sectoral spatial networks and combining them to seek positive synergies and effects. National plan should serve as a basis for drafting sectoral development plans and other strategic development documents.

In regard the Estonia's geography and size, the plan intends to strengthen Estonia's position internationally. The planning process unpacks the spatial impacts of international agreements. The planning process supports Estonia's competitive advantages by focusing on a safe and high-quality living environment that considers all needs as an export commodity. Additionally, it identifies and activates the international economic networks in relation to territorial principles. The national plan accepts Estonia's maritime spatial plan, including Pärnu and Hiiu county maritime plans.

Traditionally, strategic territorial plans have mostly been based on land use-based approach, simplifying territory in robust two-dimensional terms. Recent planning practice introduces network-based approach, based on the systemic relations on territorial phenomena and theme, launched already by the Torremolinos Charter in 1983. In addition, the discourse of high-quality living environment has become prominent.

The evolving the sustainability context

The most significant global megatrends affecting Estonia and their impacts are addressed in the national spatial plan prioritise climate crises and green policies. This relocates the economy and activities, emphasis in nature conservation and resulting migration pressures, limits the use of fossil energy and mitigates negative impacts on land take. Digitalization means territorial polarisation, both concentration and dispersion, deepening regional competition, while also re-setting technological progress for more dispersed life and economic activities. In Estonian case, geopolitics should be number one in global trends, causing multitude of new globalisation and regionalisation outcomes, creating new walls and barriers in the territories. Cultural turn intensifies the struggle for quality space, with growing multiculturalism, generation etc divides in civil society. Convergence and trends of welfare society continue in Estonia as the Nordics set the pathways.

The EU Green Deal aims to drive the transition to a sustainable and climate-neutral economy across member states, while the Climate Law sets binding targets for reducing greenhouse gas emissions, fostering climate resilience, and promoting sustainability (Dupont et al 2023). Despite massive progress since 1990s during the transition decades, decarbonisation aims fall short of the target set by the Climate Law. Estonia needs to implement additional measures in various sectors to bridge the gap in meeting Effort Sharing and LULUCF Regulations targets.

Renewable energy's share in final energy consumption is expected to increase significantly by 2030, covering the total internal electricity demand. Energy security is highly important also in terms territorial development, as detailed plans for diversification are elaborated. While efforts to phase out fossil fuels, in particular oil shale for energy generation are underway, Estonia is increasing commitments on climate and biodiversity. Draft climate law of Estonia claims that nature conservation area should increase up to 30% from current 22% (Fig 3).

The sustainability domain of the national plan aims to create liveable environments across Estonia, addressing regional disparities. The Planning Act aims for rational, feasible, and sustainable land use, participatory planning and public hearing with the wide public, balancing and integrating interests, multifunctionality of land uses and evidence-based planning and adequacy of information.

Rethinking climate policy, particularly in the land-use sector, involves aligning policies with decarbonisation, climate and biodiversity implications, simply minimizing land take and acknowledging scarcity and availability of land resources despite the low population density and seemingly unlimited agricultural, forest and wetland land. This paradox on land conversion limits progressive and cohesive planning for multifunctional uses.

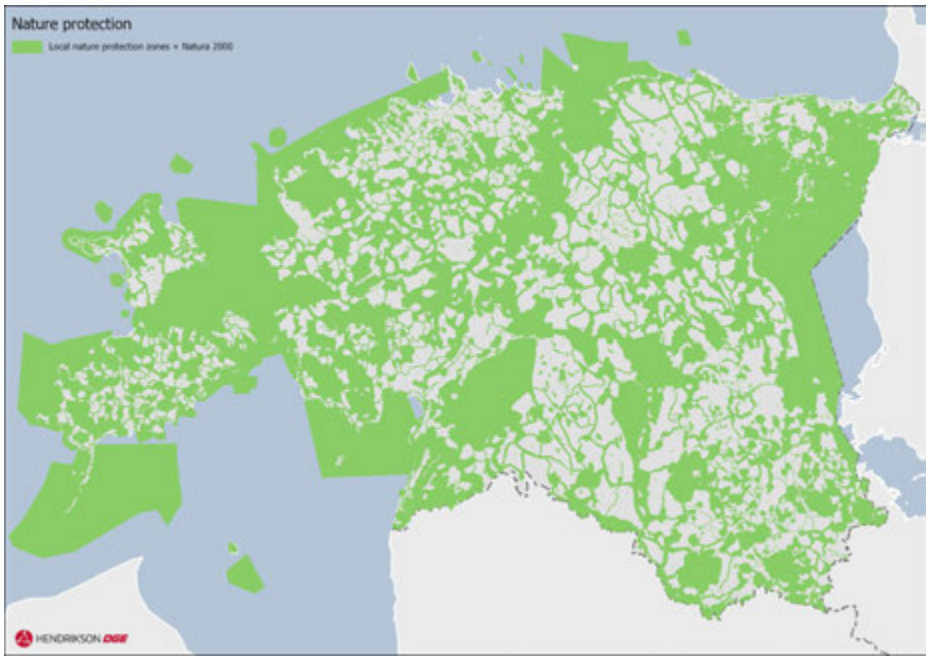

Figure 3. Nature protection areas (Data: Environmental Agency).

The plan should set clear land use priorities, providing conditions and guidelines for local comprehensive plans, seeking climate-proof and low carbon land uses and enforcing brownfield development. Fulfilling climate and biodiversity goals sets heightened expectations for the functioning of green networks, including urban green areas. At the same time, there is increasing pressure from construction activities on green network areas, especially near large cities. Nature conservation, more sustainable land management, and the restoration of forests

and other ecosystems offer the greatest economic potential for buffering and mitigating climate change, with immediate benefits from preserving carbon-rich habitats such as wetlands and forests on peatlands. Though, the discursive contestation and decision-making practices are shaped by political logics of levelling up or growth and ecological logics on climate change and biodiversity (Fearn 2024).

Aligning regional specialization with energy transition imperatives will be challenging in the deindustralised oil shale mining region as well in the wind powered western Estonia. Energy transition causes phase-out of oil shale industry and diffuses the energy system and infrastructure. The plan must also develop a climate resilience model for various urban areas and their vulnerabilities. A nuanced approach incorporates cross-cutting planning principles that comprehensively account for climate risks across sectors and land uses.

Resetting new regional structure in urban and rural territorialities

Besides improvement of the living environment the Planning Act aims for rational, feasible, and sustainable land use, participatory planning and public hearing with the wide public, balancing and integrating interests, multifunctionality of land uses and evidence-based planning and adequacy of information.

Estonian spatial policy takes into account positive net migration leading to population growth, which is accompanied by population aging and increasing cultural diversity. Continued concentration of population and economic development in the capital region, metropolisation of Tallinn continues causing the several major territorial changes (Fig 4). The future work and pastime trends guide towards micro-mobility and mobility as a service. It is also a challenge to ensure security throughout Estonia in the light of global trends. Spatial mobility, multi-location living and expanding home-work commuting areas increases due to remote work facilitation and security considerations, leading to the use of previously abandoned residences in rural and small-town areas (Fig 5).

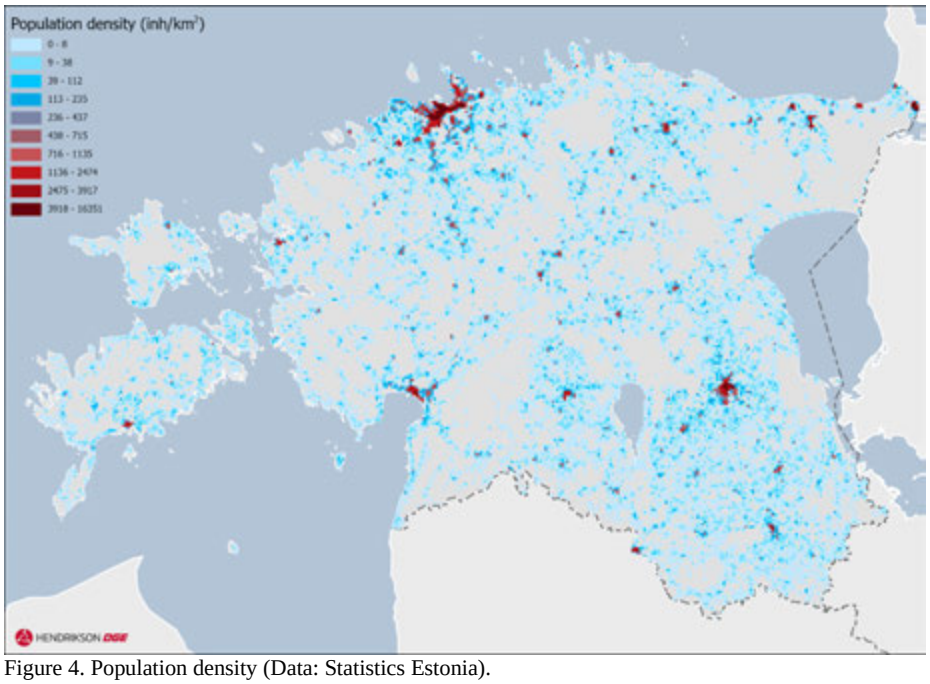

Figure 4. Population density (Data: Statistics Estonia).

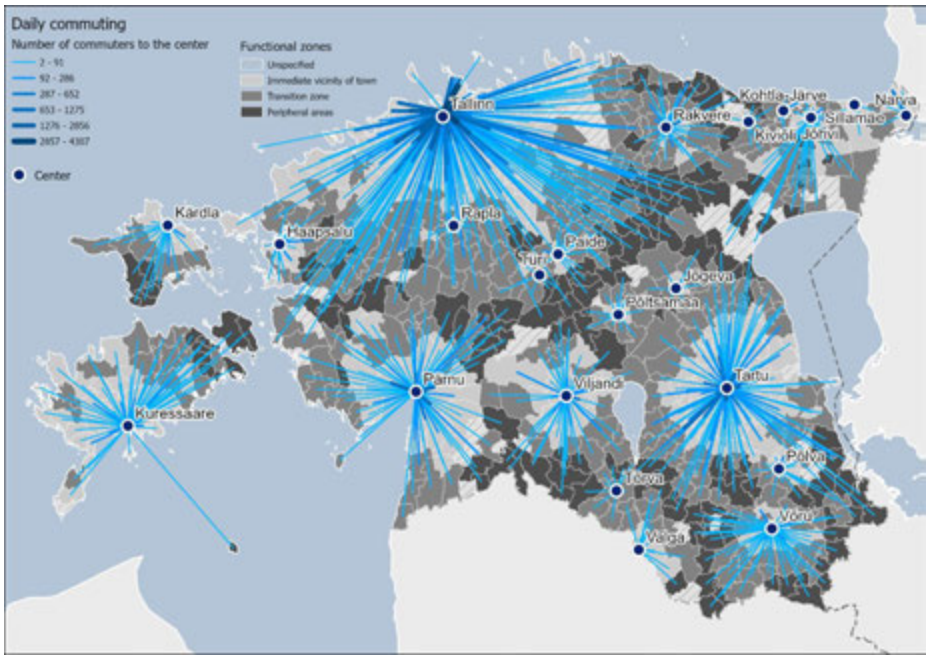

Figure 5. Daily job-related commuting (Data: Statistics Estonia).

The analysis of settlement scenarios and strategic solutions define the generic principles for directing the regional development, and the hierarchy of functional regions and settlement systems. The plan elaborates on the nature of a quality living environment across different types of settlements, the basis for land re-use and brownfield development. It defines centres based on territorial capacities, regional strengths and other networked principles. The major city regions are set for the international competitiveness. Also, the shrinking is strongly addressed in the plan.

Defence priorities

Escalation of the security situation in Estonia as a border state disrupted territorial tiers eastwards. The main challenge is to propose strong guidelines and find a territorial solution for ensuring national defence and the impact of national defence activities on people's well-being (Fig 6).

The plan intends to provide guidelines for determining land use for national defence, military training grounds 40,000 ha extended in Nursipalu, Sirgala and Klooga extensions), in addition, extended risk areas for tactical exercises in the state forest areas. The use of weapons and ammunition need further land allocations. Considering this, the expansion of the opportunities for practicing long-range weapons is preferably done as an extension of the existing training grounds. Land uses for marine-coastal exercises should be designated. Relevance of renewable energy restrictions resulting from national defence is another major discussion.

Figure 6. Overview map of national defence and safety (Data: Ministry of defence, Rescue Board).

Based on those implications, cross-cutting themes and conditionalities emphasised across the national plan to be multidimensional spatial approach, quality space, ensuring security and

safety, improving international competitiveness, mitigating contradictory trends in demography, mitigating climate impacts and enhancing biodiversity.

As a result of the above stated principles and growing dynamism and uncertainties in key themes, the professional stakeholders identified the needs of targeted research, which should refine settlement pattern and scenario, enhance green and blue network, redefine valuable landscapes and set contemporary innovative territorial monitoring and assessment framework.

Discussion

European policies reshape the territorial dimension at the national level, fostering policy debates through downscaling emerging initiatives and measures (Böhme et al. 2022b). Critique extends to contextualizing national territorial policies within the European climate ambition and cohesion policy (Farinós-Dasí 2023). While advocating for experimentation and adaptation to uncertainties, the study questions the feasibility of new approaches and planning solutions. Sustainability demands a more robust vision and an empowerment of the planning instruments, incorporating policy making, foresight, mapping and communication techniques (Berisha et al 2021). Climate targets and sustainability ambitions are not necessarily evaluated in relation to land uses and current functions in human activities, economic and technical infrastructure, energy security as well nature conservation. Sivonen and Kivimaa (2024) argue challenges of reducing reliance on Russian fossil fuel imports as well compromising climate policies in promoting renewable energy production while emphasizing national security and sustainability. The planning solutions highlight potential gaps in the plan's adaptability to the transition mode and underscores uncertainties regarding high territorial dynamism. This initial phase of national planning is crucial as it sets the ethos and tone for the entire planning system and process.

In terms of plan qualities, the content of the plan, as well as its spatial solutions, must be based on universally understood and consistently considered principles of societal development. Considering the global and EU strategic, regulatory, and business environment, as well as the choices made in the Estonia 2035 strategy, these fundamental principles should revolve around the principles of sustainable development. This includes the need to plan for sustainability, abandon inefficient land use, densify built environments, and reduce the area of artificial spaces. Plan intends to define temporally territorial interventions at the strategic scales to amplify positive trends. The plan takes into account game-changers associated to conditional territorial interventions. It defines criteria to determine whether a planning and land use condition is met. One of the game-changers as emerging policy streams, it can be metaphorically labelled as flipping the hourglass, is net zero land take.

Spatial plan is a vision document, defines the basis for the entire spatial development and policy in Estonia, and implements a wide range of planning instruments. Territorial visions for different regions is to be consistently presented, along with measurable objectives. A suitable selection of other planning instruments is made based on the nature of the theme, answering the question of how to most appropriately direct the development of a territorial part in the spatial plan.

There is a risk that public bodies fail to address the primary governance and planning challenges posed by new climate policies introduced by new economic models, circularity, platformisation (Oldbury and Isakkson 2023). This could allow market actors' agendas or controversially NIMBY activists to dominate instead. To ensure greater and committed involvement of public actors, strategic planning at national scale should actively acknowledge the competing and conflicting scales inherent in these processes, multitude of factors, to be settled by ad hoc and

flexible decision-making and planning schemes. Strategic planning needs to contain a clear attempt to recognise competing and contradictory dimensions of scale in these processes.

Reflecting the change in the planning paradigm of Southern Europe, austerity and crises create under pressures territorial policies and planning cases that favours inequality, aggravates left behind places, is market-oriented stronger than before against cohesion. If quick direct instruments are used, regulation is frowned upon, and strategies excluded or revised flatly (Tulumello et al 2020). A similar understanding tends to spread in Estonia and across Eastern Europe in 2020s with deepening tendency (Nowak et al 2023). At the same time, climate and biodiversity issues inevitably require a higher level of regulation and concise decisions (Dupont et al 2023).

This research reveals that national spatial plan, rather than serving as flexible coordinating intermediaries, legitimize their role in territorial and regional development processes across arenas, sectors and territorial units. This outcome creates possibilities for agreements, compromises, new ways of planning as well clear-cut trade-offs. The variance of solutions and window of opportunity can be extended. While beyond the scope of this paper, the quest for stronger legitimacy and institutional framework raises questions about the strengths and strategic power of national spatial plan. The findings in the inception phase of national planning illuminate trends, pathways and priorities of territorial transformations in Estonia at the external border of European Union. These spatial transitions and regional transformations reflect differing perspectives across society and sectors in the contemporary uncertainties. The national spatial plan will navigate tensions between flexibility and stability within the national and sub-national context.

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Prototyping Future Scenarios For Urban Planning Through The Production Of Virtual Reality Scenes

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Abstract
Designing 3D urban scenes for Virtual Reality (VR) offers the opportunity to transfer future scenario narratives to multiple publics involved in urban planning. Nevertheless, there is a current lack of conceptual frameworks to produce VR environments out of future scenarios. This research explores how scenarios might be enhanced and communicated through VR narrative environments. It elaborates and test the Scenarios-to-Scenes' framework, encompassing three steps: (i) generation of future stories; (ii) real/virtual places; and (iii) VR experiences. The framework was tested with urban planners, academics, and media communication experts in two collaborative workshop settings. This process illustrated the frameworks' capacity to enable the expansion of scenario contents out of diverse participants' interpretations and to transfer key narrative and design elements for the VR scenes.

Keywords: scenario prototyping, Virtual Reality, narrative environments, 3D urban scenes

1. Introduction

Urban planning is an activity deemed to the co-production of endurable future by multiple actors. Scenario writing, as the dominant technique for representing futures in scenario planning methods, offers the potential to engage the natural ability of humans for making sense of stories (Burnam-Fink, 2015), creating a common understanding about urban change. But it is the design of narrative environments (von Stackelberg and Jones, 2014), using a wider array of forms to experience the future –perceptually, cognitively, emotionally–, which may foster the transferability and usability of scenarios across different professional and non-professional domains in urban planning.

The concept of scenario prototypes encompasses all those narrative forms – i.e. stories of the future – that bring abstract or partial ideas/images of conventional future-scenario narratives into a present experience of such future. The here called *narrative prototypes* use fictional/speculative stories as mechanisms to explore and tests complex concepts. In science-fiction prototyping, such concept probing depends on how scenario narratives deploy one *novum* or multiple *nova*, that is, "primary points-of-reference" that make readers to distinct fictional futures from their home reality (Raven, 2014): e.g. disruptive technology, concept, event... Immersive Virtual Environments are being explored as the ultimate means of producing scenario prototypes, combining Virtual Reality (VR) capacity for sensory immersion and spatial presence with the natural capacity of humans for building their own stories about places (Stepanovic and Ferraro, 2020).

The production of VR 3D urban scenes using scenarios to transform present places into virtual futures offers the opportunity to expand scenario narratives towards richer narrative

environments. Nevertheless, there is a current lack of conceptual frameworks to deal with two main challenges of VR scenario prototyping: interpreting scenario narratives in multiple geographical contexts, enabling its localisation; and adapting scenario contents to visual communication of VR scenes, balancing "spectacular" realism with efficient 3D-scenes design.

The first challenge has been addressed from a narratological perspective. How futures are experienced from multiple audience is mediated through narrative elements embedded in scenario prototypes (Raven and Elahi, 2015). The first element is the *story-world*, or the spatial and temporal setting of the events. Beyond a mere "context for the story", future changes can be translated into a sequence of spatially and temporally relevant places in the synthetic VR space (Vallance and Towndrow, 2022). The second element is the *story* or "plot", as the sequence of contingently related actions having an identifiable beginning, middle, and end (Shearer, 2004) – typical "story arc". The focus on "actions" and "actors" and finite story arcs may contribute to create interpretative frames for explaining complex causation underlying future change – e.g. motivations, triggers, contingencies… (Derbyshire and Wright, 2017). The third element, *narration/storytelling*, involves the form of the narrative discourse – i.e., the explanation of why something happens (Shearer, 2004) – in connection to alternative narrative strategies (Raven, 2014; Raven and Elahi, 2015). On one hand, strategies focusing on realism though comprehensive worldbuilding connects better with the paradigmatic forms of presentation (i.e. exposition, argumentation) of technical/academic environments. On the other hand, those strategies highlighting the story rely on the description of actors and their actions, in line with narrative presentation (von Stackelberg and Jones, 2014).

The second challenge involves how previous narrative elements are translated to the codes and languages of VR scenes. Despite urban scene ontologies offer a full menu of choices based on functions and architectural typologies (Berta, Caneparo and Rolfo, 2020) or identified objects (Zhang *et al.*, 2018), such ontological frameworks are not enough to anticipate the multiple meanings captured by scenario narratives (Wu *et al.*, 2022). Interpretative frameworks may require the adoption of semiotic approaches to VR, which distinguish between previous *syntaxis/sematic* levels of communication, capturing the structure and meaning of content to be decoded by the user (i.e. the 3D scene model), from the *pragmatic* level, or how VR users "decode" such content (Barricelli *et al.*, 2016). Highlighting the later, VR scene production (as other computer interface designs) is a generative process, that is, it creates a representation of the message together with a "model user" able to interpret it (Barr, Biddle and Noble, 2004). Classic narrative semiotic models based on actors' participation into actions (as subjects, objects, senders, receivers, helpers, opponents… in Greimas' actantial model) may become useful tools, in combination to the abovementioned narrative strategies, for anticipating how publics create meaning through key transformations (Hebert and Eveaert-Desmedt, 2011). In the same fashion, virtual environments deploy a set of affordances and visual stimuli (i.e., a perceptual map) that guides VR users through a set of discoveries, barriers and rewarding experiences. The same grammars used for analysing narrative strategies in 3D games and virtual environments can turn into generative systems to produce them (Fencott, 2001).

Considered the previous challenges, semiotic principles and analytic tools, this research aims to design and test a framework for converting *Scenarios to Scenes* (StS framework). This framework relies on expanded scenario narratives and 3D urban scene concepts as prototypes for creating immersive VR narrative environments, as explained in Section 2. In addition, the applicability of the StS framework was tested in 2 sequential collaborative workshops (see Section 3), exploring contributions and limitations of the StS process from three main dimensions (see Section 4): the capacity of participants to translate original narratives into a set of specific changes, events, and actors; their capacity to connect the narrative with real and/or

virtual places; and their capacity to elaborate communication strategies that explicitly consider how users interact with given places in order to gain understanding about the original narrative.

2. Designing The Scenario-to-Scenes (StS) Framework For Prototyping Future Scenarios

The aim of the *StS framework* is to support the use of any conventional scenario narrative to elaborate full-fledged narrative strategies based in the production of VR narrative environments. The framework relies on the design of two complementary narrative prototypes: the expanded scenarios and the 3D-scene concepts. *Expanded scenarios* consist of more detailed account of key future events and actions, as a future story illustrating main scenario changes in specific places and moments. The *3D urban-scene concepts* (henceforth "scenes") encompass a set of visual and logical specifications of the model representing the place, mapped by a set of visual stimuli and interactions of an imagined VR user's experiences. The StS framework guides the design of both prototypes by enabling three generative processes[1] triggering each other (Figure 1): the future story generation, the place generation, and the VR experience generation. Each process is interpreted through alternative *story models*, as described below.

The future-stories generation process rise the general question "What happens in the scenario World?" It aims at the generation of future themes (henceforth *themes*) capturing how the original scenario narratives represents their underlying image of the future (in the mind of scenario authors). Themes are "controlling ideas" that help to elicit the shape, value – intrinsic, instrumental, symbolic– and direction of narratives (von Stackelberg, 2011). Using archetypical Greimas' actantial roles[2] as interpreters (Hebert and Eveaert-Desmedt, 2011), we translate the generation of future themes through the 3 types of associations between actors. The *action themes* refer to an *agent* introducing a key *change* for understanding the future – i.e., *novum*: e.g., a pedestrianisation project (change) proposed by city planners (agent). The *transformation themes* define the nature of change, in connection to two actors: the *system* receiving the change, and the *regulator* motivating the agent to perform it. In the previous example, car congestion problems (regulator) motivate city planners to perform the pedestrianisation of some commercial street (system). The regulator has the role of activating and deactivating the agent at the beginning and the end of the story. The *transition themes* define how the agent performs the change, as enabled by *helpers* and hindered by *barriers* to change: e.g. the plan faces retailers and car-drivers complains (barriers), that address by increasing environmental awareness (helpers). Each theme enables a new interpretation of original scenario narrative, which can be expanded into new future stories.

The *place generation* process consists of representing future stories through complementary "where" questions. Place concepts (from now, "*places*") are those settings required to interpret abstract thematic actors as concrete symbols, icons, indexes, or metaphors that can be apprehended by a figurative observer. According to the meaning transferred, places encompass (Agnew, 2011; Zhang *et al.*, 2018): *locations*, as generic or specific sites of reference where key changes of the story happen (e.g., the city centre streets in the previous example); and *story locales*, as concrete urban entities – workplaces, homes, shopping, streets, people, vehicles –

[1] While conventional semiotics studies the interpretation of signs, generative semiotics revert the semiosis process to generate signs. The current approach is based in the infinite semiosis process described through the Pierce semiotic triangle: object, representant, interpretant (Barr et al., 2004).

[2] The Greimas' actantial model defines 6 pairs of complementary roles that can be taken by actants (disregarding their figuration: i.e., human or non-human, material or abstract): *subject/object*, *sender/receiver*, and *helper/opponent*. Any archetypical story takes a subject that gets some object of value, motivated by a sender, to take it to the receiver. The success of the quest is supported by helpers and hindered by opponents.

representing main actors' states, activities or behaviours (e.g., the pedestrian areas representing the plan). Places can be direct references to the elements that will be represented in 3D urban scenes (virtual places), so they can extent location with a set of details aimed at building a sense of reality through future routines. Narratively, such *sureties* will act as reinforcers of *surprises* in VR experience generation (Fencott, 2001). The expansion of places may encourage the generation of new future stories.

The *VR experiences generation* process is driven by the question "what happens in the VR scene?" VR experiences define alternative stories on how imagined VR users interpret previous places by interacting with them. The VR user's story model uses the actantial model in combination with the *surprises* of the Perceptual Opportunities model (Fencott, 2001) to define 3 types of *VR experiences* in the 3D scene. The *exploration experiences* are based on a VR user *activity* reaching some *reward*, namely a memorable opportunity for immersion, presence, and embodiment: e.g., for the previous future story, discovering that people in a near street are not moving because heavy traffic. *Discovery experiences* use *attractors* that direct users towards the activity (*retainer*); e.g., user sees/hear a distant crowd waiting. Attractors can be just calls for attention or work as more complex retainers of the reward (being also a rewarding experience by themselves). *Navigation experiences* (E3) create *connectors* - paths, movements, challenges and decision points - taken by user-explorers in their progression toward the reward; e.g. main street axis, people moving from/towards reward's direction. VR experiences are final interpreters of the whole StS process, so they may trigger re-interpretations of places, themes, and even original narratives.

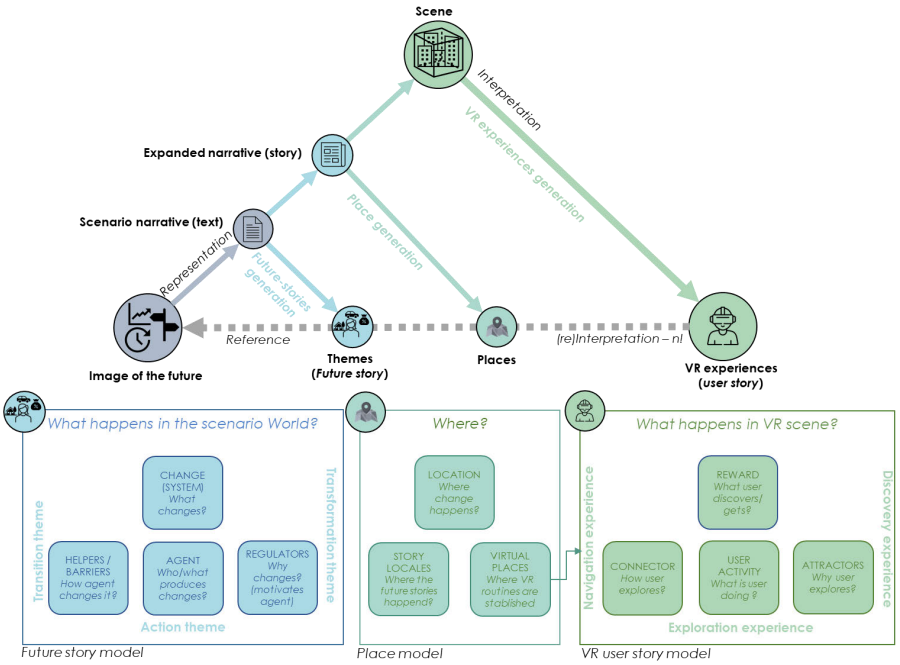

Figure 1. StS Framework overview for producing VR narrative environments.

3. Implementing And Testing The StS Framework

This research aims at assessing the applicability of the StS framework for building VR narrative environments enhancing scenario communication. The StS was tested in 3 participative workshops of 2-hours length (approx.), with 4 participants each. The aim of those workshops was to generate expanded narratives and VR experiences' concepts based on the development of VR scenes from Project TRANSURBAN's narratives. Those narratives addressed the original project's aim of generating disruptive scenarios about land use and transport integration scenarios for the Henares corridor in 2050. For convenience, only one of the three different future-scenario narratives, *High levels of insecurity in urban areas*, summarised in Soria-Lara et al. (2021, p. 8):

> [The future] is strongly affected by a high level of insecurity in urban areas. Walking and cycling are not advisable. The modal split would be drastically altered, with the private car dominating all daily trips –work, shopping, and leisure. There would be also preferences for increasing the level of car sharing, as well as for the promotion of clean and autonomous vehicles with zero emissions. Public green areas would be removed and recovered for car infrastructures. There would be a preference by high-income families for living in the city periphery in private communities. Land uses would be highly segregated in homogenous areas connected by motor[ised] infrastructure. City centres would be mainly transformed into work destinations, with most employees commuting from the city's periphery. Low-income families would also tend to live in those insecure city centres.

Two types of workshops were planned in sequence. The first kind, here-called *consultancy workshops*, focused on the future story and place generation processes before conceptualising VR experiences; and the second kind, called *VR production workshops*, focused on validating and expanding proposed VR experiences from consultancy workshops according to their communication opportunities. Participants' engagement was equally directed to experts and practitioners familiarised and not familiarised with the geographical context of the scenario narratives, integrating both at the end. None of them knew the TRANSURBAN scenario narratives, to ensure their genuine interpretation.

Two consultancy workshops were held independently, one involving academics (Workshop 1), and the other, practitioners and policymakers (Workshop 2). In each case, participants' expertise covered either urban and transport planning areas (or both). The central activity consisted of selecting and developing future stories and potential locations out of the reading of TRANSURBAN's narrative, creating newspaper future headlines to capture it in a future story, and voting them either by credibility, relevance, or degree of surprise. Participants used the future story model to analyse the most voted news and to expand actors and themes. Then, they proposed place models connected to previous themes, adopting the perspective of a future photographer illustrating the headline's story. A first unstructured attempt to ideate VR experiences was made, creating chains of routines and surprises for imagined VR users' interactions. Participants were encouraged to agree on central actors, locations, and avatars before enriching stories and connecting elements.

The results of consultancy workshops fed a *VR production workshop* (Workshop 3) targeting VR/3D environment designers and visual media communicators. This workshop was focused on the intricacies of developing the VR experience and the 3D scene prototype. Dynamics for this workshop mostly consisted of the selection, validation, and refinement of ideas from previous workshops. Firstly, facilitators presented participants with a synthesis of 2 VR user stories resulting from the first workshops, consisting of a set of story maps pointing at relevant interactions and decision points. Then, facilitators asked them to suggest main messages, interesting places, and moments of each user story. After comparing user stories with the

original future stories, presented as conceptual maps similar to Figure 2 (see section 5.1.), participants chose 1 story and focused on elaborating VR experiences using the complete VR user story model. Finally, results were synthesised on a raw storyboard representing potential user pathways and key scene elements.

During all workshops, the research team acted as facilitators, guiding participants through the StS process, moderating discussions and providing with different materials: templates, boards and post-its and pins to place over them. The team recorded the audio and video and collected the filled materials. The analysis of all these contents consisted of the writing of ethnographical notes describing key events in the interaction of participants with the assumptions, models, and processes of the StS framework (see previous section); this process was supported with the elaboration of more structured conceptual maps representing the story models (see Figures 2 and 3 at the end of Section 4), and semantic maps representing elicited connection between themes, places, scene elements and VR experiences (not included in this publication, but used internally to offer some of the insights of section 4).

4. The StS Framework In Practice: First Insights And Learnings

4.1. Interpreting And Expanding Future Scenario Narratives

For the first stage of the StS framework, the *future-stories generation process*, we tested the capacity of consultancy workshops' participants (W1 –academics– and W2 –practitioners–) to translate original narratives into a set of actors and themes. Future story models were expected to work as flexible narrative structures capturing how participants interpreted as a group what is happening in the world of the original scenario narrative.

Participants read original scenario-narrative at the beginning the abovementioned workshops and were encouraged to focus on certain aspects to individually create news' headlines about the Henares Corridor in 2050. Most of the proposed headlines offered paradigmatic presentations of social changes depicted in the original narrative. In W1, the most voted headline was titled "The new urban walls", highlighting spatial segregation into "two cities", based on social class differences. In W2, participants chose the headline "Health issues increase due to lack of contact with outdoor environments", which brought isolation and public space deterioration as core themes. Both choices were influenced by its perceived credibility, and, in W1, also by its relevance.

The selection of headlines clearly shifted the thematic focus of the narrative towards social issues, which occupied the centre of the analysis and development of both headlines. Figures 2 and 3 (upper part) show the future story models proposed in W1 and W2, respectively.

Looking at the action themes (i.e. agent-change axis), social dynamics were seen as cause of the main future change in W1, the "urban wall" concept. Similar social dynamics (encapsulated in "society" as an actor) became the agent of W2's change: citizen isolation. The agent in W1 was defined by merging other headline proposal ("Delocalised"): a "disruptive technological innovation" exacerbating class differences in access to services. Nonetheless, the nature of this disruption was not defined until the place generation stage. Defining the central change was especially difficult in W1, where one of the participants (well familiarised with scenario-planning methods) resisted the linearity of the model and highlighted the complex feedback loops between social, economic, and technological systems. Similar dilemmas on causal loops between insecurity, isolation, and public-space deterioration rose in W2. This time, facilitators amended some of these issues by improving the explanation of the whole model, offering narrative examples based on a popular tale, and by emphasising the idea that, for convenience,

the choice must accept the perspective of the headline, even if there are "many ways to tell the same story".

Concerning the transformation themes (i.e. regulator-change axis), regulators were mainly depicted by organisations, collectives, and institutions (policymakers and planners). The interpretation of the "regulator" role was fitting in W1, where participants defined a new world order led by tech companies as the motivator of the technological disruption. Conversely, in W2, the figure of the regulator was connected to multiple sources of regulation and decision-making without too much reflection on its implication in a society becoming isolated. Playing with the flexibility of the story model, this problem was fairly solved by implying that such organisations are part of society at large. But the lack of connection to action probably influenced failed attempts to portray such regulators in place generation.

Transition themes depicted a wide range of helpers and barriers connected to central social transformations. Central topics of the original scenarios, such as insecurity, transport, and telematic activities were included here. Interestingly, the topic of civic insecurity was extended to other sources of insecurity in W2, such as climate change and heat waves making public spaces unsafe and abandoned. In both consultancy workshops, the negative connotation of the central change made participants to struggle with the connotations of the "helpers" (positive) and "barriers" (negative) to such change. As in the case of the regulators, this had to do with the choice of name for the actantial roles. With the facilitators' support, participants interpreted barriers as positive aspects, such as good public space design, social policies, or the regulation of tele-activities, whose absence explained the central changes.

In this phase, participants took advantage of the flexibility of the story model, allowing actors to adopt multiple roles and shapes. On the positive side, participants openly referred them as "characters" of the story, reinforcing abstracts and non-human forces (e.g. climate change) as narrative figures. Technology and society were placed as protagonists of change, which recalls the central novum of classic science fiction stories. In W2, the model also opened interesting reflections of the accountability and agency of actors in those scenarios. On the negative side, actor choices were often too abstract and symbolical, making next StS stages more difficult. This was associated with the resistance to abandon argumentative modes, particularly high in W1, instead of offering a simple narration and description of actors of the future story-world. A possible reason is that the scenario references (e.g. inequality as a source of crime and insecurity) and auto-referential concepts ("the Wall") emerging in discussions building the alternative world were mixed with multiple external referents: professional experience and dilemmas, cases from other geographical contexts, theoretical models (5-helix innovation, 15' cities…).

4.2. From Themes To Places: Localising The Scenario Narrative

The StS potential to enable the representation of future stories through real and/or virtual places was also tested in consultancy workshops during the *place generation process*. Reciprocally, our analysis pay attention to how place generation expanded and nuanced original themes, despite time limitations in workshops leave no room for encouraging this exercise. Figures 2 and 3 (middle part) summarise main locations and locales.

The location-locale relationship was more flexible that the story model and subjected to variations between W1 and W2. Firstly, participants agreed some locations giving a common perspective for the imagined photographer illustrating the news headline; then, they proposed locales (place objects, events, activities…) observable from the photographer's position, connected to central themes. Facilitators proposed a rule limiting photographer's movements, so to keep the exercise focused. Nonetheless, many locations emerged as parallel referents of

discussions. Those referents included real locations and locales in the geographical context (e.g. emblematic cites and architectural elements, places of innovation), city models (e.g. suburban models, Latin-American cities), and even fiction works (e.g. Stephen Kings's *The Dome*, the *Snowpiercer* show). Some of those places were early introduced as referents to themes as well.

In W1, the urban wall concept quickly led to the idea of private spaces and gated communities (also referenced in the original narrative as "segregated residential areas"), defining a conceptual location called: "new fortified urbanisations". The physical wall and security access control system (i.e. camera control, security guards) were the main locales defining this location. Other important locales represented the disruptive technological innovation: autonomous delivery systems based on drones and autonomous vehicles. Discussions at this stage helped to clarify the nature of the technological disruptor, described as a change in food production based alternatively on private facilities for self-supplying food (such as private greenhouses) or on pills for easily carry all nutritional needs to citizen. The class-differences theme started to gain prevalence at this point of the discussion. On parallel, urban borders of Alcalá de Henares inspired a sub-location of "transition between two cities", happening along a "segregator element" (e.g. road, change of urban pattern). This transition concept was expanded during VR experiences generation, defining locales by contrast inside and outside the residential area. Abandonment and isolation, as well as physical public-space design were added to the themes at this point, after proposing some locales reflecting urban space abandonment (e.g. abandoned children play area, degraded local retail…).

In W2, changes in social dynamics and isolation were quickly referred to an image of social meeting areas already described by the author of the selected headline. The selected location was the Alcalá de Henares' Town Hall square desolated at noon on Saturday. This specific spatial and time reference was an interesting choice if compared with W1's. Some indexes of voluntary lockdown, such as close commerce and empty bar terraces, easily represented the central action. The sub-location of an empty park permanently sealed off by police was finally included to represent the barrier associated with the lack of public space improvements and its abandonment. E-commerce's influence was represented by a futuristic image of historic streets full of autonomous vehicles and drones making deliveries, following a similar pattern than W1. These elements also signified, according to participants, distances, and digitalisation themes, together with companies as regulators related to mobility (a relationship somewhat forced during the workshop dynamic). Climate change was represented in combination to a degraded bus marquee with a thermometer showing extreme temperatures, a decision that manifests the participant efforts to make efficient choices. In this phase, a central theme of the original narrative emerged with an interesting interpretation: how car mobility dominates public space and cause its abandonment, with public insecurity as a reinforcement of this process.

The future photographer dynamic and the location-to-locales concept worked better in W2, where participants gave quick impressionistic and intuitive images after agreeing a point of observation. In W1, there was still a tendency to discuss and analyse conceptual urban settings. Challenges to represent abstract or conceptual actors (distances, disruptors, climate change…) were better solved in this phase. Some locations, such as parks, were given alternative definitive interpretations in each workshop, as a luxury (W1) or as abandoned place (W2).

4.3. From Future Stories To VR-User Stories

The potential of the StS framework to help anticipating how VR users (adopting an avatar perspective and role) might interact with places so to capture central themes was tested in all workshops. In the consultancy workshops, this final stage aimed at validating and completing previous themes and places, while the VR production workshop (W3) focused on the user story itself, improving opportunities for its communication, selecting key moments from proposed

experiences and mapping potential "game mechanics". Figures 2 and 3 (bottom part) show the main paths proposed by workshop participants between different VR experiences.

In W1, the use of the simplified routines-surprises model encourage participant to select and expand locales, this time perceived from the perspective of two avatars: a resident of the fortified urbanisation; and a visitor wanting to access inside but prevented by the wall's security measures. As observed in Figure 2 (bottom part), this unstructured array of experiences was an opportunity to stress the contrast between the luxury world inside the urbanisation and a conflictive neighbourhood in the city outskirt. Near the end of the W1, a coherent user-story idea emerged where the resident leaves the security provided by the residential area and gets lost in the conflictive neighbourhood, where she hears gunshots in the distance or sees evidence of drug dealing. An interesting experience was the need to get assistance from locals to return home, overcoming the fear of an apparent hostile environment before setting out to explore empty spaces in an old commercial street while looking for help.

In W3, after the initial reading of the story map elaborated by the research team, participants found this urban-transition concept appealing, despite the motivation of the resident to get out the "bubble" was missing. Other important aspect was the lack of markers of being in the future. "This could be United States in the 1980's" some participant pointed out. It seems that the participants did not capture the idea of the gated community as a transformed location in Alcalá de Henares. Most amendments tried to highlight the technological disruptor theme or the new technological order, both missed in the user story, by adding car and house technologies: access panels or a trademarked AI-assisted car navigation system.

W2's participants elaborated more lineal user stories (Figure 3, bottom part), encouraged front the beginning by a "Yes… and" improvisation dynamic that did not work in W1. The first story took the perspective of a journalist with the mission of making photographs, moving through selected places but finding nobody. The second story featured a delivery android trying to reach its destination, facing delays and conflicts with other vehicles, and finally breaking down due to over-heating. At the end, participants hardly distinguished from routines and surprises. As a result, most proposals depicted inflection points in the user stories, or just offered a tour through the already generated places. Both user stories stressed at some point conflicts of mobile avatars experimenting different modes of transportation, in line with the expertise of some participants. Ideas for advanced game mechanics appeared at the conclusion of the workshop, along some reflection on the dehumanisation linked to digitalisation. Participants showed some preference for the journalist story but recognised the potential of an encounter between the 2 avatars. This inspired the research team to create a story with a mixed proposal.

Conversely, W3's participants found that the journalist's mission was "difficult to translate to 2050", whereas the point of view of the android avatar was original and suggested a message of "abuse" of technology, clearly aligned with W2's themes. Nonetheless, the presence of technology reflected solitude, but also freedom, which conflicted with the core theme of insecurity. In this case, the presence of "too advanced technology" caused concerns about the overall credibility of the depicted world. The leaps between traditional city locations and advanced logistics hubs were also confusing.

Because of previous issues, W3's participants agreed on working with W1's user story. The dispersion of experiences and the problem of "where do you want the user to look at?" anticipated the need to emphasise "call to actions" for motivating exploration, which aligned with the purpose of the VR user-story model. A proposal was inspired from the experience of looking a sad child in a window wanting to go out. In this new proposal, the child is trapped inside the house after the failure of some access control system, which demands the parent to

find help outside of the residential area. This solution portrayed a moment when the resident experiments technology as a wall itself. The VR-user-story model assisted in creating a tensional sequence around the main activity (accessing the house) and the reward (saving the child). The attractor was interpreted as the "problem" or initial "call-to-action": the child calls to the avatars' mobile. Connectors deployed challenges during exploration (i.e. go out with the car and getting some technology to repair the car and the house), which quickly led to sub-stories (e.g. the broken car) not easy to structure under the story model (see Figure 2, bottom part). Even in the preparation of storyboards, when participants were expected to thematically enrich the background with new scene elements, they were still solving emerging conflicts and gaps in the narrative structure of the story. Consequently, most scene elements obeyed only to this purpose. Some technical aspects of VR, such as movement methods, and the interface format were discussed at this point.

In consultancy workshops, the VR experiences generation encouraged participants to abandon paradigmatic presentations to propose places and interactions from a more creative approach. The choice of imagined avatars helped them to build the story-world. Nonetheless, the main issue was the difficulty to contain brainstorming and counteract the path-dependency of some ideas deviating from central themes (e.g. the technological disruption theme disappearing from W1's user story). In the VR production workshop, the inversion of the StS process – i.e. reading the experience first and comparing it with the original future stories later –, created some confusion, but helped to recall central problems of interpretation. The map showing the future story models (i.e. themes and actors) was found particularly helpful by communicators for keeping the central messages, detecting the actors that were missed. The VR user-story model triggered appropriate questions along the process: "how do we point at where the solution is?", "is this a reward or not?" Although the story model was not able to capture complex sub-stories, it aligned to participants emphasis on the importance of planning the scene exploration, using narrative elements to produce it.

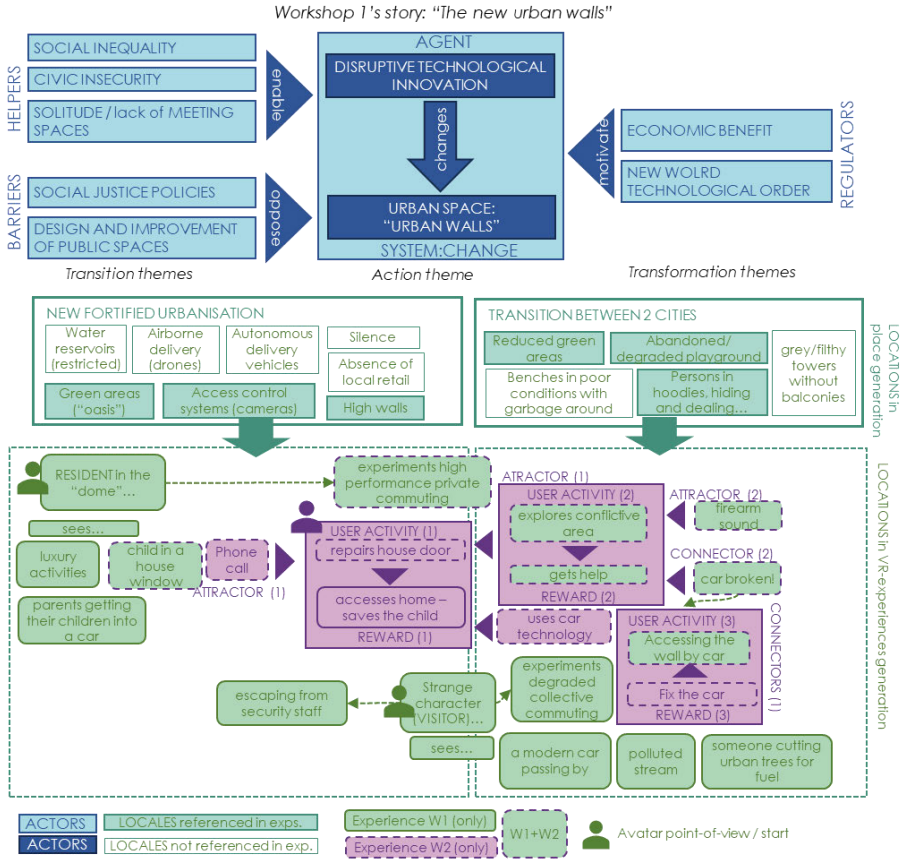

Figure 2. Synthesis of future stories, places and VR-user story models proposed by W1's participants and expanded by W3's participants.

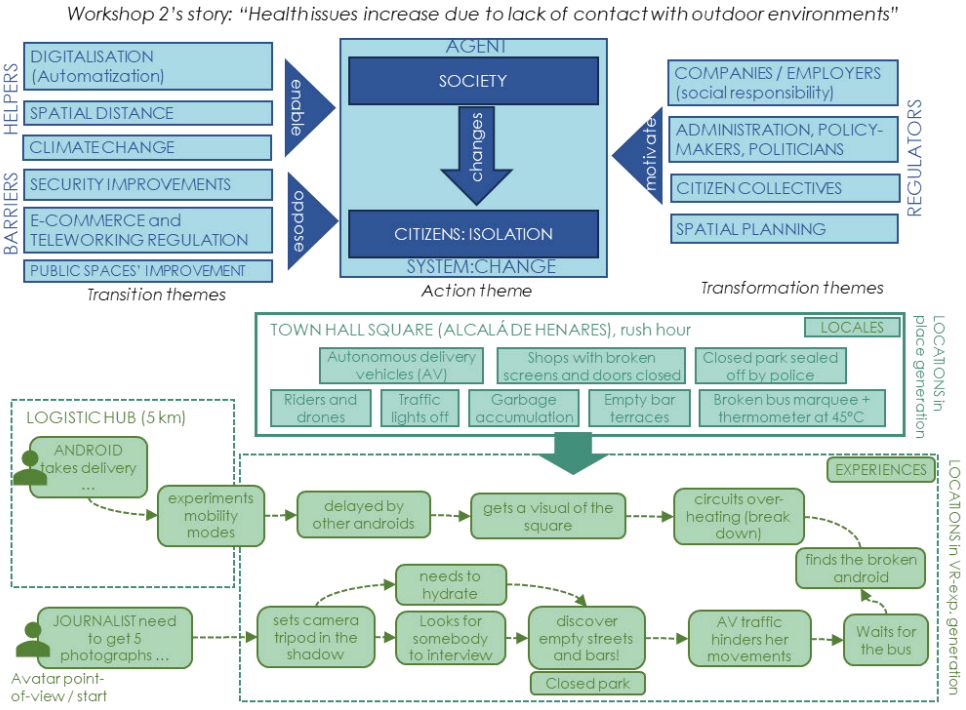

Figure 3. Synthesis of future stories, places and VR-user story models proposed by W2's participants.

5. Conclusions

This research explored how conventional scenario narratives might be enhanced and communicated by using Virtual Reality Environments through the production of 3D urban scenes. A Scenarios-to-Scenes (StS) framework was proposed as way to build scenario prototypes expanding and consolidating a narrative environment. Three expected contributions of the StS framework were tested in participative workshops with urban-planning practitioners and academics (consultancy workshops), media communicators and VR experts (VR production workshops): (1) the translation of original narratives into a narrative structure connecting scenario transformations and actors along specific themes and stories; (2) the localisations of such stories in a map of specific real and virtual places; and (3) the integration of the VR experiences and user stories in the narrative environment.

Firstly, concerning the translation of the original scenario to a narrative structure, the StS framework proved effective and flexible enough to bring out alternative interpretations of the original future narrative, materialised in participants' discussions about the nature and role of actors. These discussions, at the end, contributed to expand the original narrative and bridged some important gaps (e.g. social inequality as a cause of insecurity). Although the use of the future story model in consultancy workshops showed a slow learning curve, the effort paid off in sharing key aspects of the story-world with the VR production workshop. Both urban experts and communicators converged in underlining conflicts between technological and social actors, a narrative structure already used in other narrative prototyping experiences (Burnam-Fink, 2015). Secondly, the localisation of future stories helped in defining the nature and shape of previously identified actors, in part meeting its purpose of mediating between the previous

phase and the VR-experiences' generation. Nonetheless, places and VR experiences complemented each other to build a structured "story-map". Lastly, the VR experiences reinforced visualisation and emphasis on storytelling through the avatars' roles but failed to capture potential "model VR users" (publics, audiences….) connecting to the central message. Probably, this perspective-taking exercise should have been done earlier, along the pre-definition application contexts proposed by participants at the end of workshops: e.g. educational purposes, and urban project/plan showcases embedding narrative elements.

Some of the limitations of the StS process may be addressed by testing them in processes longer than 2-hours workshops, with frequent validation and revision of materials (as represented in the cycle of Figure 1). In the future, the StS framework is expected to guide procedures and protocols for prototyping Virtual Reality Environments by keeping track of main design hypotheses and testing them with real VR users. To that end, the story models need some amendments in the naming and its communication must be improved to understand their contribution to the VR production process.

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Spatial Scenarios As A Tool For Future-Proof Spatial Planning In The Netherlands

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Abstract
In spring 2023, the PBL Netherlands Environmental Assessment Agency published the research project *Spatial Outlook 2023* with four spatial scenarios for the Netherlands in 2050. In this multidisciplinary scenario study, a combination of story lines, maps and other forms of visualisations is used to explore and describe how the country could look like after the transition towards a climate-neutral and circular society. This paper describes the method of how the scenario story lines and the related land use maps were developed by applying a new mixed methods approach that combines participatory and multidisciplinary scenario development, GIS-based land use modelling and creative tools of research by design. Moreover, the paper discusses the use of spatial scenarios in the context of regional and national spatial planning.

Keywords:

Spatial planning; Scenario method; Sustainable land use; Research by design; Multidisciplinary research

1. Introduction

The Netherlands faces a number of major challenges in the fields of spatial and environmental planning. Social, political and economic changes and unpredicted events, such as the COVID-19 pandemic and the war in Ukraine, are contributing to increased levels of complexity and uncertainty. In order to help policymakers and planners deal with a growing level of uncertainty and to shed light on possible spatial interventions, the PBL Netherlands Environmental Assessment Agency (PBL) has developed four spatial scenarios for the Netherlands in 2050 (see Figure 1) in the project *Spatial Outlook 2023* (PBL, 2023). In this multidisciplinary scenario study, a combination of story lines, maps and other visualizations was used to explore and describe how the country could look like after the transition towards a climate-neutral and circular society.

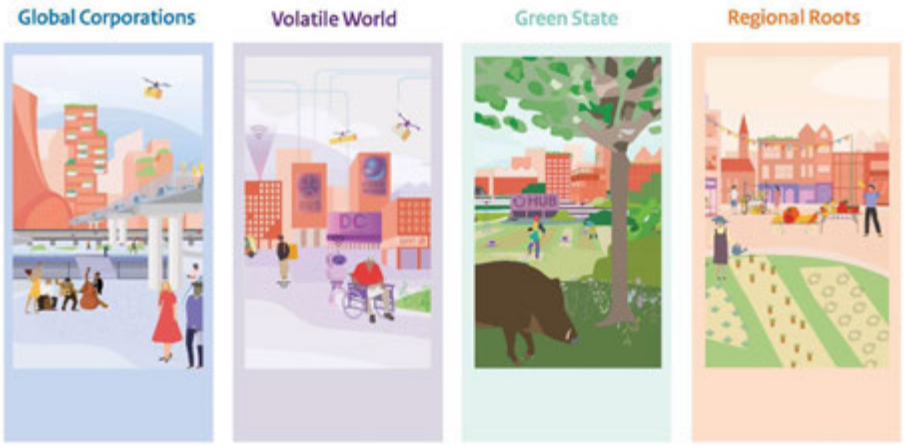

Figure 1: Impressions of the four spatial scenarios, source: PBL.

The four scenarios of the study show how land use in the Netherlands might look like in the year 2050, specifically looking at the following questions: Where do spatial conflicts arise? Where do opportunities lie? Who will take the lead? Policymakers can use these scenarios to respond to the uncertainty inherent in long-term policymaking. Using the scenarios, policymakers can explore robust strategies: which approaches fit into multiple scenarios? They can also explore the possibilities for adaptive policies: what adaptation options are available and conversely, how can 'lock-in' situations be avoided? These scenarios of the *Spatial Outlook 2023* enable policymakers and planners to understand, explore and discuss advantages, disadvantages and possible conflicts of spatial choices related to the scenarios.

The development of the story lines of the scenarios and the related maps was an interactive and participatory process together with experts and stakeholders, including policymakers from national, regional and local level. However, it is important to mention that the scenarios and maps should not be seen as blue prints for future developments. The scenarios can be further developed and adapted for different spatial contexts or serve as an inspiration for policymakers. To support this after the publication of the scenario study, the PBL project team organised numerous presentations and workshops with municipalities, provinces and different departments of ministries.

This paper describes the method of how the scenario story lines and the related land use maps of the *Spatial Outlook 2023* were developed by applying a new mixed methods approach that combines participatory and multidisciplinary scenario development, GIS-based land use modelling and creative tools of research by design. Moreover, the paper reflects on experiences with using spatial scenarios in the context of regional and national spatial planning.

2. Complex Spatial Challenges In Times Of Uncertainty

2.1 Old And New Planning Tasks Accumulate

In the Netherlands, a range of spatial challenges accumulate on a limited territory. The Netherlands is a relatively small country, which is threatened by rising sea levels and has ambitious national policy goals to become a circular and climate-neutral society by 2050. While there are traditional short-term spatial planning tasks, such as creating and maintaining space for living and working as well as protecting nature and improving the environmental and landscape quality, new planning tasks have emerged concerning long-term transitions related to climate adaptation, energy transition and the circular economy. The accumulation of urban, rural and infrastructural developments on the same relatively small territory contributes to the country's increasing difficulties in achieving all of its goals.

2.2 Growing Uncertainty

In addition to the above-mentioned spatial challenges, there are other developments that have an influence on spatial planning. For instance, rapid technological developments are taking place in information, communication and transport technology. These technological developments influence daily lives as well as institutions (Van Dijck, Poell and Waal, 2016; Crang and Graham, 2007). In addition, social, political and economic changes take place, all of which increase the level of uncertainty facing policymakers and planners.

More recently, the COVID-19 pandemic and the war in Ukraine have shown us that unexpected events on top of the more structural changes and developments contribute to even greater spatial challenges. The war in Ukraine and the related effects on energy prices and security might be a turning point that leads to an acceleration of the energy transition with an increased demand for wind farms, solar farms and energy-related infrastructure. Furthermore, the war in Ukraine has led to increased migration flows and a re-evaluation of military areas in the Netherlands. Whereas in the past decades, military areas were reduced and transformed to other functions, in the future, they might need to be expanded for increasing military activities.

2.3 A Complex Puzzle

Addressing the spatial challenges in times of uncertainty is a complex puzzle for policymakers and planners in the fields of spatial and environmental planning. After all, suitable land has to be found and designed for very diverse functions with often mutual, and possibly conflicting, interactions. The following questions highlight this: How can residential areas not only be built quickly, but also in such a way that they use less energy and can withstand longer periods of drought, heat and heavier rainfall? How can the transformation of agricultural land contribute to both reducing nitrogen deposition in natural areas and addressing desiccation? And how can wind turbines and solar panels be given a place without damaging landscapes to a certain extent, while simultaneously receiving public support?

An answer to questions such as these will require a balancing act from policymakers in the near future. As the balance has tilted increasingly in the past decades towards the economic use of space, the carrying capacity of the ecosystem (e.g. soil, water, and biodiversity) has come under great pressure. For example, the construction of large suburban residential areas (so-called VINEX-locations), commercial areas and logistic parks has contributed to increased soil sealing and more car use and traffic congestion. Some of the recent urban developments are located in areas below sea level that are vulnerable to soil subsidence. In this respect, the spatial development of the Netherlands is far from being future-proof. In addition, there is too little attention paid to how citizens experience space. Their perspective does not always align with that of policymakers and planning professionals, and their opinions are not necessarily taken into account in spatial decision-making processes. Especially now that the Netherlands is facing major challenges, there is an increasing need to strengthen society's support for major spatial interventions, both in residential and rural areas.

3. Scenarios As A Tool To Deal With Complexity And Uncertainty

Complexity and uncertainty are facts when considering future developments. Acknowledging this can make policymakers and spatial planners feel uncomfortable, as they often argue that their day-to-day planning tasks are complicated enough. Having to take into account the uncertainty of new developments (e.g. working remotely from home), possible discontinuities of trends (such as shifts in mobility patterns), and changes in the outlook on urban and spatial developments (related to migration and uncertain demographic prognosis) make spatial planning processes even more complex. The complexity can make it tempting to ignore uncertainty in the development of spatial planning strategies. However, not exploring possible new challenges, views and policy options will only yield 'present-proof' policies rather than 'future-proof' ones. In this regard, future-proof policies are defined as policies that lead to spatial developments that contribute to a circular and climate-neutral society and are resilient to possible changes and risks in the long term.

In order to help policymakers and planners to develop future-proof policies and plans, it is necessary to gain insight into and anticipate a diversity of plausible future developments. Therefore, the PBL Netherlands Environmental Assessment Agency has developed four spatial scenarios for the Netherlands (see Figure 1). In these scenarios, we explore what the Netherlands might look like if all planning tasks were to be addressed. Where do spatial conflicts arise? Where do opportunities lie? Who will take the lead?

Policymakers can use these scenarios to respond to the uncertainty inherent in long-term policymaking. Using the scenarios, policymakers can explore robust strategies: which approaches fit into multiple scenarios? They can also explore the possibilities for adaptive policies: what adaptation options are available and conversely, how can 'lock-in' situations be avoided?

Before we describe the scenarios in more detail in the second part of this paper, we will summarise the characteristics of spatial planning and the main spatial challenges in the Netherlands in the following section.

4. Spatial Planning In The Netherlands

4.1 The Most Planned Country In Europe

The Netherlands has an internationally acclaimed reputation for comprehensive and effective spatial planning, often referred to as 'comprehensive integrated approach'. According to Dutt and Costa (1985), the Netherlands is the 'most planned country in Europe'. The performance of the Dutch planning system has been attributed to a strong national consensus on a set of interrelated and enduring notions on spatial configurations and development strategies, and how they should be implemented. In the synthesising report of the 1990s EU Compendium project, the Dutch system was characterised as "…a very systematic and formal hierarchy of plans from national to local level, which coordinate public sector activity across different sectors…" (Commission of the European Communities, 1997, p. 36).

4.2 Decentralisation Of Spatial Planning …And Back To Stronger National Coordination

However, in the past 25 years, the strategic national spatial planning culture that had emerged in the post-war era gradually came to an end. The coordination of spatial planning and the protection of natural areas were mostly decentralised to regional and local authorities. Besides this, the role of planning in Dutch society also seems to have changed in this period. General trust in government and faith in expert opinion has diminished, not unlike developments in many other countries (Albrechts, 2006). Citizens have become more vocal, and civil society more polarised. And finally, the growing importance of the regional and EU levels has led to an increasing questioning of the national level as the locus of spatial planning (Zonneveld, 2016).

In recent years, however, there has been a resurgence of demands for a more directive national spatial planning. Although some of the issues facing the Netherlands can be tackled regionally, some developments require decisions in conjunction with the national level (PBL, 2019). Advocates point to the complexity and urgency of national spatial issues such as the acceleration of housing programmes, the energy transition, climate adaptation, and environmental protection.

The current national policy for spatial planning is contained in the NOVI: the National Strategy on Spatial Planning and the Environment (BZK, 2020). With the NOVI, the national government wants to give direction to the major tasks that will radically change the face of the country over the next 30 years. This policy document shows a sense of urgency but does not yet make sufficient substantive choices. Decisions on a number of spatial issues are needed, including concrete and coherent implementation strategies. Currently, the NOVI is in the process of being elaborated in collaboration with the 12 Dutch provinces, with a special focus on 16 designated so-called NOVEX areas where complex spatial challenges accumulate. PBL's spatial scenarios can be used to explore regional options for coherent future-proof developments and can help to develop a comprehensive spatial vision for the Netherlands.

5. An Overview Of Spatial Challenges In The Netherlands

In the first phase of the scenario study, we have analysed and described the spatial challenges concerning five main themes that are mentioned as central themes in the NOVI (PBL, 2021). These central themes are urban development in cities and regions, vibrant rural areas, climate adaptation, energy transition, and sustainable economy (see Figure 2). In the following sections, we address the main challenges for each theme and the implications they have for future spatial developments.

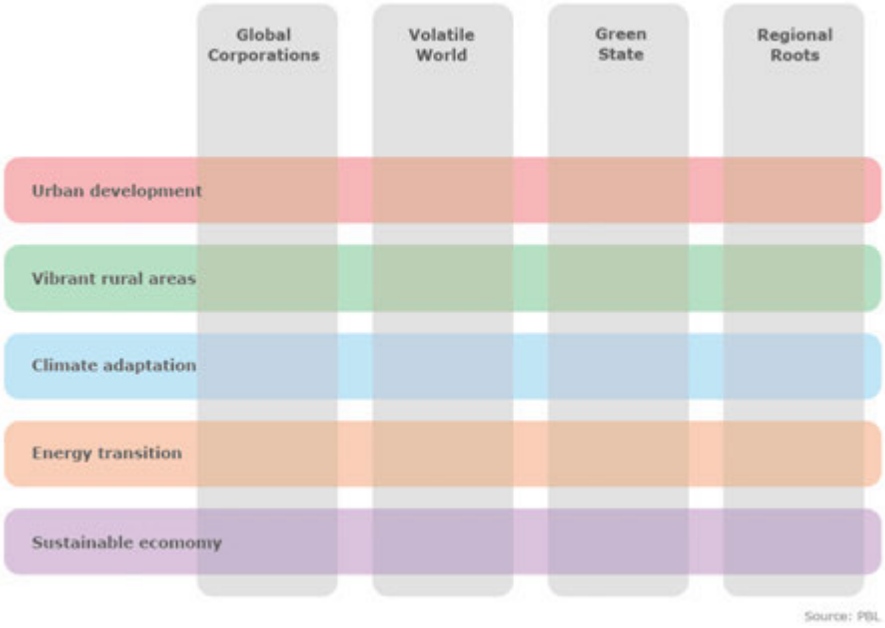

Figure 2: Four scenarios and five themes, source: PBL.

5.1 Urban Development

The Netherlands has a major urbanisation challenge. The affordability of houses is under pressure and the government wants to increase housing production. However, there is limited suitable land, a lack of skilled workers and construction prices are rising. Yet increasing the housing production in urban areas – linked to urbanisation – raises other issues, including those concerning the nature of economic development, soil conditions, rainwater and river water use, traffic congestion, the relationship between urban and rural areas and various social themes. For example, in order to create a future-proof spatial development, the limited available land must simultaneously accommodate economic activities apart from housing, without neglecting soil conditions and traffic congestions.

Not surprisingly, the spatial distribution of housing and economic activities is a central spatial topic here, both across as well as within regions in the Netherlands. This involves, for example, a decision to concentrate living and working in existing urban areas in the western part of the country or, on the contrary, their dispersion in and around smaller towns throughout the country. The distribution of living and working also has consequences for the required infrastructure. Currently, there is discussion about possible plans for new large-scale suburban residential areas, some of which are located on vulnerable soil conditions.

5.2 Climate Adaptation

Climate change is accompanied by rising sea levels, more extreme rainfall and longer droughts. The layout of cities and rural areas has not yet been designed to cope with the effects of climate change. Further climate change will increase the need to adapt spatial planning in the country and the various areas within it. One issue that arises with climate adaptation is where and to what extent soil and water conditions should act as guiding principles in the spatial planning of cities and rural areas. The extent of climate change is uncertain but climate adaptation measurements such as higher dyke systems and larger flood protection areas might require a lot of extra space.

5.3 Energy Transition

As a result of the global climate agreements of Paris and Glasgow, the Dutch government is aiming for a climate-neutral society by 2050. Energy transition is an important part of this. The transition involves fundamental changes in energy generation, energy storage, transmission networks and energy consumption. These will include: local electricity storage (batteries), regional generation of clean electricity (wind and solar parks), large-scale, national electricity generation (offshore wind) and international connections of transport networks. Conflicting spatial interests on a limited territory, however, make the realisation of such goals more complex. For example, local residents might oppose the construction of wind parks in spatial proximity to their homes for reasons that concern the surrounding landscape aesthetics.

Recently, the war in Ukraine has put the Dutch planning of the energy transition under extra pressure. In the short run, there is the risk of a setback as a result of an increase in the use of coal for electricity production. In the long run, however, higher (fossil) energy prices can make renewable energy production more attractive. The spatial effects of the energy transition will vary depending on the prioritisation of the main goals of energy supply and the scale at which energy systems are optimised.

5.4 Sustainable Economy

The Dutch government is striving to create a sustainable economy. An important part of this is the transition from the linear to a circular economy by 2050. The circular economy involves the use of raw materials in production and consumption processes – and the effect the entire life cycle of products has on the living environment, both inside and outside the Netherlands. In the linear economy, many raw materials are wasted, and pollutants are emitted, leading to mountains of waste, climate change and biodiversity loss. With rising global demand for raw materials, the raw materials problem is becoming increasingly urgent. Moreover, geopolitical supply risks and the risk of price fluctuations are increasing. One issue that arises is what spatial effects the transition to a circular economy will have. It is not only about the spatial effects arising from the transition, but also about which spatial-economic structure policymakers are aiming for, as well as the spatial scales (from regional to global) of the life cycles of products. What is important is which priorities policymakers set: reduce waste and emissions, strengthen the competitive position of companies, or reduce supply risks and price volatility.

5.5 Vibrant Rural Areas

There are different kinds of urgent tasks in rural areas. Climate change requires climate adaptation and mitigation, the tense relationship between agriculture and nature requires balanced choices in land use, and ongoing (sub)urbanisation requires additional space. The issues are multiple: greenhouse gas emissions, nitrogen precipitation, increasing drought,

biodiversity loss, subsidence, and salinisation. This shows that the limits of the physical system of water, soil and ecology have been reached and sometimes far exceeded. Policymakers face the task of setting new priorities and making choices, including spatial choices. One of the questions that needs to be answered is in what cases and in which areas prioritisation of space use is needed, and in which cases multiple space use (combining functions) is possible, the latter providing opportunities for synergy.
Conflicts and challenges in land use

To summarise, the living environment in the Netherlands is under a lot of pressure. There are all kinds of conflicting spatial interests that often cannot be solved in isolation. This makes it increasingly difficult to find space for traditional land use functions, such as living and working, but also for new functions related to renewable energy and climate adaptation. Intensive use also puts pressure on the resilience of the ecosystem in the Netherlands. In many cases, soil and water conditions were neglected, causing problems such as desiccation and eutrophication. In socio-economic terms, uneven distribution of demographic and economic growth has increased regional disparities. This is also the case within regions, for example, between more and less affluent neighbourhoods. The COVID-19 crisis has shown not only how vulnerable we are in terms of public health, economy and social interaction, but also how important the living environment is to us. For example, the lockdowns and spending more time at home has increased awareness and appreciation for street life, park life and the vibrancy that defines the city with its public, semi-public and private spaces (Sepe, 2021).

5.6 Spatial cohesion

A key topic in discussions on sustainable spatial planning relates to the concept of spatial cohesion. Activities that policymakers can undertake to achieve spatial cohesion include aligning the land use of sectoral functions, aligning interests at different spatial scales and synchronising the allocation of functions (or making them follow each other at logical points in time). These kinds of activities help to resolve spatial conflicts, exploit spatial synergies, avoid spatial lock-ins, and implement so-called spatial ‘no-regret’ actions. ‘No-regret‘ actions are actions by institutions and communities that can be justified from economic, and social, and environmental perspectives whether natural hazard events or climate change take place or not (Hallberg, Siegel and Jorgensen, 2009). These actions can be achieved by involving a wide range of actors, including citizens, in the formulation and implementation of spatial and environmental planning processes.

6. Methodological Underpinnings Of The Scenarios

As mentioned in the first section of the paper, PBL has developed four spatial scenarios for the Netherlands in 2050 (see Figure 3). These scenarios enable policymakers and planners to explore possible solutions to the problems mentioned in the previous section and to discuss advantages, disadvantages and possible conflicts of certain spatial choices. The scenarios and the maps of the *Spatial Outlook 2023* have been developed in a two-year long process between 2021 and 2023 with a multidisciplinary team of the PBL in collaboration with experts from Wageningen Environmental Research (WUR), Deltares and other advising offices. The transition to a circular and climate-neutral society plays a central role in all four scenarios. The year 2050 was chosen because there are specific policy ambitions to reduce carbon emissions and the use of natural resources significantly by 2050. Furthermore, the project could make use of existing demographic and economic projections for 2050, which were an important input for the GIS land use modelling that was applied to develop the maps.

6.1 Societal Values

The four scenarios of the *Spatial Outlook 2023* are based on four different sets of societal values, previously published by PBL in the report *Rehearsing The Future* (PBL, 2020). In the research underlying the four scenarios, existing developments were traced back, interpreted and extended into the future. Also, new trends were identified as well as so-called ´weak signals´ to indicate possible changes in trends. The research included expert interviews, a literature review and media analysis from newspapers, magazines, websites and social media. Depending on society's preferences, the transition paths and spatial patterns emerge differently. And because sustainable development does not happen by itself, specific institutional changes were assumed in each of the four scenarios.

6.2 Mapping The Scenarios

Whereas the report *Rehearsing The Future* didn't include maps of the possible future spatial land use, the ambition of the *Spatial Outlook 2023* was to create four integral maps of how the land use of the Netherlands could look like in 2050, including all five main themes of the research and also including the Dutch parts of the North Sea which is often neglected in spatial studies of the future. Maps, with their ability to convey spatial relationships and patterns, are powerful tools to develop spatial scenarios and to help to communicate and discuss the content of the scenarios with policymakers, planners and the public (Salewski, 2012).

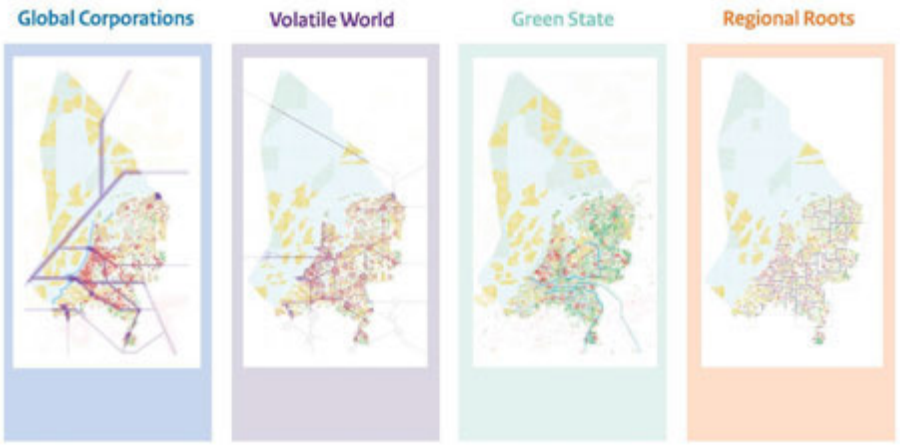

Figure 3: Conceptual maps of the four spatial scenarios, source: PBL.

At an early stage of the research, sketch maps for the four scenarios were drawn with colour pencils on top of printed base maps of the country. These initial rough sketch maps helped to communicate basic spatial developments and features related to the story lines of the scenarios in meetings with the project team and in the national workshops with stakeholders. After the initial phase with the sketch maps, detailed maps were generated based on land use modelling by applying the models Land Use Scanner (PBL)and the Model for Nature Policy (WUR). And finally, the detailed maps derived from the GIS modelling were enriched, edited and graphically stylised by a team of urban designers to create comprehensive and readable maps.

The central ambition for the scenario maps was to give general input for the national spatial and environmental planning strategy as well as more detailed map information for local and regional planning strategies. Therefore, the decision was made to create two types of maps for the publication: detailed maps and conceptual maps (see Figure 3). After the detailed maps were produced by a combination of GIS land use modelling and research by design methods, the designers made a strongly simplified and stylised version of the maps. These conceptual maps have a more iconic character and only show the most important spatial elements. That makes the them more easy to read for policymakers and the general public.

6.3. Participation In The Development Process Of The Scenarios

The development of the story lines of the scenario's and the maps was an interactive and participatory process together with experts and stakeholders, including policymakers from national, regional and local level. In a series of national and regional workshops, preliminary scenario narratives and maps where tested, discussed and refined (see Figure 4). After the workshops, the project team finalised the narratives of the scenarios and the maps for the publication of the project in a book and a website with an interactive map viewer.

Figure 4: A scenario workshop in progress, source: PBL.

7. Characteristics Of The Four Scenarios

In the following paragraphs the main societal, economic and spatial characteristics of the four scenario are described. All four scenarios have advantages and disadvantages, and show possible conflicts and dilemmas.

7.1 Global Corporations

According to the Global Corporations scenario, Dutch society in 2050 has a strong performance-oriented, hedonistic and individualistic character. Dominant values are work, success, pleasure, self-development, self-reliance and personal responsibility (PBL, 2020). In terms of sustainability, it is more about 'prosperity' than 'people' and 'planet'; the Netherlands is prosperous in a material sense. There is high prosperity and spatial inequality, but there is a minimum level of welfare and quality of life for all. Because of agglomeration effects, large international companies concentrate mainly in central business districts, main ports and green ports, but they operate in extensive global networks. There is a big contrast between the extended Randstad area (the most urbanised part of the Netherlands) and the periphery.

7.2 Volatile World

In the Volatile World scenario, Dutch society is fragmented. Different lifestyle communities live parallel lives. The groups organise themselves digitally. They arise quickly, but also change and disappear quickly. The communities therefore have not only a dynamic but also a volatile character. Depending on the group, 'prosperity', 'people' or 'planet' is paramount. There is great confidence in technology, also for sustainable solutions. The Netherlands is prosperous, but the differences between digital groups are large and changeable. For many people, the virtual world is more important than the physical world, which has a somewhat messy and ever-changing character.

7.3 Green State

Green State is a scenario in which people see themselves as part of nature and see sustainability challenges as a collective public mission. Ecological boundaries are respected, and the social base is well maintained. 'Planet' has priority. Natural solutions dominate. Technology should contribute to ecosystem improvement. Achieving green goals justifies limiting individual freedom of consumption. The Netherlands is prosperous, but not primarily in a material sense. Building is concentrated around major public transport hubs. There is multifunctional use of space here. Due to compact urbanisation and nature-inclusive agriculture, there is plenty of space for nature and recreation. Water and soil have a high priority in this scenario.

7.4 Regional Roots

In the Regional Roots scenario, local and regional communities call the shots. Continuity and security are important. Profits must not come at the expense of community spirit and ecology. The concept of 'people' comes before 'planet' and 'prosperity'. Communities take care of nature, primarily understood as beautiful, recreational landscapes in geographical proximity to people's homes. Society focuses on local and regional self-sufficiency, as far as possible. Urban development takes place throughout the country. Large cities have expanded on a small scale, smaller towns and villages have grown organically and the functions of living and working are mixed as much as possible.

8. Using Scenarios In Long-term Spatial Planning

8.1 Towards A New Balance

The war in Ukraine is having a strong impact on economic developments and migration flows in Europe and the Netherlands. It is unknown how long the war will last and how large the spatial effects will be. However, in the long term, the biggest challenge will be to find a new balance between urbanisation and economic growth and a sustainable and healthy living environment. In the Netherlands, the physical living environment is being used more and more intensively. So intensively that both ecological sustainability and social appreciation of the living environment are under pressure. A new balance is required between the utility value (economic use), amenity value (citizen's perspective), and future value (ecological sustainability) of space in the Netherlands (PBL, 2021). Policymakers and planners are faced with the task of incorporating new land use in their environmental policy (and coordinating it with existing land use), while at the same time improving the quality of the environment, and increasing citizens' involvement in the policymaking and planning process.

The major transitions facing the Netherlands are guaranteed to span several legislative periods. By considering the transitions using a scenario approach, administrators and policymakers can seek different paths to robust future-proof policy choices and adaptability. Based on the four perspectives developed in our scenario study, we make recommendations to this end. In the following two sections, we give an example of two recommendations. Firstly, one in respect of the soil and water system and, secondly, one concerning citizen participation.

8.2 Soil And Water System As Structuring Principle For Spatial Planning

The current urban and rural areas in the Netherlands are not designed to cope with climate change. This is already having serious negative economic, ecological and social consequences, and these will increase further without adaptation to worsening conditions. The ever-increasing drought problem, especially in areas with sandy soils, is a case in point. Also, failure to meet internationally agreed targets inhibits economic development, for example the exceeding of the nitrogen limit values in vulnerable, protected natural areas, which has already caused a construction freeze in several sectors, including housing, infrastructure and industrial areas. If more attention is not paid to the carrying capacity of the ecosystem, the risk of ecological and economic damage increases. The carrying capacity of the ecosystem should therefore be more central to future policy. Given that urbanisation, climate change, nature, water management and agriculture share soil and water as a common substrate, the preconditions set by the water and soil system for spatial interventions and the points of leverage from that same system for climate adaptation should be much more central to spatial and environmental policy than it has been in past decades. Indeed, all four scenarios also show a need for this.

8.3 Improving Participation Processes

Spatial and environmental policy not only encounter physical boundaries, but social boundaries as well: one only has to think of protests (e.g. against wind farms), inadequate citizen participation (in planning), and the 'dropping out' of population groups (e.g. due to distrust in government). In addition, signals from citizens about 'system failures' do not always get through to government and policy in time. Examples of this are the stalled consultations with local residents on the noise pollution of Schiphol Airport in the Amsterdam region and the painstaking process of building repair and financial compensation in the wake of the earthquake damage caused by gas extraction in the province of Groningen. Citizens feel unheard or sometimes even misled. There is also an issue of justice here: some citizens experience the distribution of benefits and burdens as skewed. For example, in the case of the benefits and

burdens of wind turbines, citizens simply feel that big companies gain, whereas local communities lose.

Involving society in the formulation and implementation of spatial and environmental policy will therefore require extra attention in the future. Public support for the necessary spatial interventions requires a substantial government effort, on all spatial levels. Citizens' involvement and trust in government policy require long-term goals, clear frameworks, and an in-depth understanding of the living environment from a citizen's perspective in various policy domains.

9. Conclusions: Spatial Scenarios As A Useful Tool For Spatial Planning

In times of growing uncertainties, working with scenarios helps to create greater awareness the necessity to explore multiple long-term perspectives in spatial policymaking and to develop future-proof spatial strategies that can be adapted in the case of unforeseen developments. In this paper we have discussed the major spatial challenges in the Netherlands and the development of four spatial scenarios and how the scenarios can enable policymakers and planners to take into account future uncertainties. The current Dutch national planning strategy already contains many ambitions and starting points for finding a new balance in spatial and environmental policy. However, some of these ambitions are still quite vague and need to be worked out for specific regions and cities in the Netherlands. In this process, we can expect discussions about spatial options to arise. The spatial scenarios that we have developed in the *Spatial Outlook 2023* enable policymakers, planners and stakeholders to explore and discuss the advantages and disadvantages of a variety of spatial choices, at both the national and the regional scales.

However, it is important to mention that the scenarios and the related scenario maps should not be seen as blue prints or simple solutions for the future developments. The scenarios can and need to be further developed and adapted for different spatial contexts or just serve as an inspiration for policymakers. To support this after the publication of the scenario study, the PBL project team held several lectures and organised numerous workshops with municipalities, provinces and different departments of ministries. In the lectures and workshops, the use of scenario maps had an important function to explain the spatial patterns and to explore the scenarios in different spatial contexts with stakeholders. The maps made complex planning concepts more accessible, fostering greater understanding and transparency about the scenarios and the related spatial patterns.

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The PBL Netherlands Environmental Assessment Agency is the Dutch national institute for strategic policy analysis in the fields of the environment, nature, and spatial planning. The institute contributes to improving the quality of political and administrative decision-making by conducting outlook studies, analyses, and evaluations in which an integrated approach is considered paramount.

Track 13: Theories

THEORIES - PLANNING THEORIES AS A GAMECHANGER?

Chairs:

- Ben Davy, TU Dortmund University
- Xavier Desjardins, Sorbonne Université
- Luciano Pana Tronca, Istituto Universitario di Studi Superiori, Pavia

Keywords: *planning theories, planning practices, planning academia, theory-building, planning*

This track invites the bold explorers of the game-changing potential of planning theories to share their ideas on creative destruction, disruptive knowledge, inventive borrowing, and turbulent polyrationality with respect to spatial planning theories. Leaving behind the final frontier of a Pure and Unified Theory of Planning, the track normalises and mediates a wide variety of theoretical approaches to planning. Moreover, it welcomes reflections on how planners employ or are disappointed by theories that address the methods, processes, and substances of planning.

Planning theories are the expression and foundation of planning knowledge and planning performance. However, these theories are not static but inspire constant change and development. The track highlights how planning theories change the game in favour of just and sustainable regional and urban developments. This track expects that questions of planning and theory will be raised and discussed in all tracks: it specifically encourages:

- unfolding the different meanings of planning and theory as object and subject of planning theories,
- contributing to a better understanding of the interconnections between planning practices, planning theories, and planning academia,
- understanding the strategies and dynamics of theory-building in planning theories,
- deconstructing the relationships between truth, the political, and ideology in planning theories, as well as
- stimulating a debate on the suitability of planning systems and approaches to encounter today’s big topics and raise awareness for needful changes.

This track offers experienced as well as young planning academics an opportunity to engage with plural planning theories in a turbulent world. Their contributions will examine the scope of planning theories, the integrated or fragile knowledge shared by planning theorists, and the obstacles within planning theories. Recognising that theoretical narratives often are lost in translation and have vague meanings, the track also invites to improve quality through more precise and explicit language in planning theories.

Theorizing State Dispossessive Planning vs. Community Self-Determinative Planning: The Case of the Al-Bostan Palestinian Community Struggle against the Israeli Planning in East Jerusalem

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Abstract (up to 125 words)
The Jerusalem Municipality recently launched the King's Garden Plan to transform Al-Bustan, a Palestinian neighborhood in the heart of East Jerusalem. The Plan called for demolishing Al-Bustan's buildings, displacing its residents, and constructing a park, named after the Biblical King David. The Al-Bustan community objected fiercely to the Plan, resisting it through a political campaign, preparing an alternative plan, and undertaking various measures to prevent their displacement and ensure their continued presence. This paper investigates what I call dispossessive planning, contrasting it with the self-determinative planning developed by communities in response. Dispossessive planning is a regime of practices that dispossesses and displaces relatively disadvantaged groups, weakening the material foundations of their affective and existential security, as it deliberately constructs a new reality. In response, self-determinative planning, as I conceptualize it, involves the development of forms of autonomy in their place, as dispossessed urban populations assert their right to produce and control their spaces of existence autonomously.

Keywords: Planning theory, Palestine, Israel, Jerusalem, Displacement

Introduction

In 2009, the Municipality of Jerusalem launched the King's Garden Plan, to transform Al-Bustan, a Palestinian neighborhood in the heart of East Jerusalem. The Plan called for demolishing Al-Bustan's buildings, displacing its residents, and constructing a park, named after the Biblical King David. The Al-Bustan community objected fiercely to the plan, resisting it through a political campaign, preparing an alternative plan, and undertaking various measures to prevent their displacement and ensure their continued presence.

This paper is based on a longitudinal study that incorporates observation and data collection from 2009 to the present, concerning this spatial conflict between the Palestinian residents and the Israeli Jerusalem Municipality. This paper raises some critical questions regarding state and community planning, the state's planning, and the encounter and conflict between it and the community. It asks what accounts for their differences and interactions. Elaborated with respect to the same place, they present different and conflicting visions of future planning and development, and in some ways are negations of each other. How can we best understand a type of state planning that directly involves the harassment, dispossession, and displacement of disadvantaged groups? And how to best understand the spatial, political, and social actions and protests of the communities facing the state planning, and the encounter between them?

Planning literature has a long history of criticizing the dark side of planning, holding that zoning and land use policies are in many cases unjust, discriminatory or exclusionary, disempowering or disenfranchising, or otherwise doing other harm to, various population groups (i.e. Flyvbjerg, 1996; Gaffikin & Morrissey, 2011; Howitt & Lunkapis, 2010; Huxley, 2010; Rothwell &

Massey, 2009; Scott 1999; Shertzer & Walsh, 2015; Wilson et al., 2008; Yiftachel, 2006). There are also many discussions of alternative planning approaches, such as "advocacy planning" (Davidoff, 1965), "radical planning" (Grabow and Heskin, 1973), "insurgent planning" (Miraftab, 2009), "hegemonic planning" (Jabareen, 2017), and "insurgent informality" (Jabareen and Switat, 2019). However, there is a necessity for more elaboration on how to comprehend best the political, spatial, and social actions and protests of the communities facing state tyrant planning and the encounter between them.

Thus, this paper aims to conceptualize contradictory planning approaches for the state and community, taking into account that they usually are at work simultaneously, in the same place, and in conditions that are deeply conflictual ethnically and politically. It then proposes a methodological framework for capturing, analyzing, and conceptualizing an alternative planning approach rooted in community practices of autonomous self-determination.

I suggest that these respective planning approaches each involve their own specific and coherent 'regime of practices', which can be captured through interrelated 'logics', which function independently to reach convergent ends. By a 'logic' I mean to indicate a specific "kind of statements that we make about phenomena." Thinking through such logics enables us to investigate the "possibilities of phenomena" disclosed in their domain and the statements that can then be made about them in various spatial and temporal contexts (Glynos and Howarth, 2007: 134). In discussing the two types of planning, I will aim to distill their respective logics. Tracing that logic allows us to understand the central ideas and practices involved in the respective type of planning. This means that one goal of empirical work is to identify these logics. Understanding them can certainly help us grasp how the differing approaches relate to each other, what the problems are with currently dominant ones, and what the alternatives might look like.

In this paper, I consider state planning as *dispossessive planning*; it displaces and dispossesses people from their properties (land and dwellings), as it transforms and capitalizes on them through the planning endeavor. Communities encountering the state planning approach may engage, often in response to the former, in *self-determinative planning,* involving (collective) political practices that often begin with, and may aim at, protecting the community from the tyranny of state actions taken through its planning activities. I argue that each of these approaches involves a *specific coherent regime of practice*, which can be understood through its interrelated logics. These logics, as will be seen, are political, spatial, aesthetic, and economic.

The next section of this paper presents the context of the study. The second section deconstructs the state planning currently involved in Al-Bustan, and the third describes the planning efforts developed by the community of residents in response. The fourth section conceptualizes dispossessive and self-determinative planning and presents their logics. The final section discusses the findings and elaborates further on the framework of the architecture of dispossession.

Context of the study and data collection

The case study involved here focuses on Al-Bustan, a Palestinian neighborhood located in East Jerusalem, in the part of the city that was occupied in 1967 by Israel. The 1948 war over Palestine resulted in the establishment of the state of Israel and the displacement of some 780,000 Palestinians (Abu-Lughod, 1971). Jerusalem was divided, West Jerusalem coming under the control of Israel, while East Jerusalem, including the Old City, fell under Jordanian

rule. In 1967, Israel occupied Palestinian East Jerusalem, and in 1980, annexed it through its "Basic Law: Jerusalem, the Capital of Israel," which formally declared the "whole and united" area of East and West Jerusalem to be "the capital of Israel." In response, the U.N. Security Council unanimously adopted Resolution 478, which declared the annexation to be in violation of international law (Mayer and Mourad, 2008).

Jerusalem is thus a divided and conflicted city, and is highly segregated along ethnic lines between Palestinians and Jews. It is a frontier city subject to a deep bi-ethnic conflict around sovereignty, identity, narrative, and territoriality (Bollens, 2000; Jabareen, 2010). Israel's institutional planning, and its judicial and other national institutions, have been working to transform the demographic and territorial structures of East Jerusalem, aiming at control of the eastern part of the city, united under Israeli laws (Jabareen, 2017b; Jabareen et al., 2019; Yacobi, 2015). Since 1967, Israel has converted about 66 percent of the territory of East Jerusalem into open green lands and new neighborhoods built for Jews (Jabareen, 2020). The demography of this part of the city has been dramatically changed, such that about 40 percent of the population today is Jewish (CBS, 2024).

Al-Bustan, a Palestinian neighborhood that is home to 1,500 residents, is located in East Jerusalem near the Old City of Jerusalem, in the city's Holy Basin. The Old City of Jerusalem and the "Holy Basin," which has a rich history involving the three religions (Judaism, Christianity, and Islam), has been a major target for spatial and demographic transformation sine its occupation in 1967. This paper traces the Israeli institutional spatial planning of Al-Bustan and the reaction of its community to these plans, from the occupation of East Jerusalem in 1967 up today (2024).

It does so based empirically on an extensive data collection undertaken over a long period of time. This includes: (a) an analysis of all institutional spatial plans relating to the Al-Bustan neighborhood between 1967 and 2024; (b) an analysis of the alternative spatial plans developed by the Al-Bustan community; (c) a review of collected documents and protocols related to Al-Bustan planning. The sources of data and documents are as follows: (a) the Department of Planning and Infrastructure Administration of Jerusalem Municipality; (b) the Jerusalem Local Planning and Building Committee; (c) the Jerusalem District Planning and Building Committee; (d) the City Engineer of the Jerusalem Municipality; (f) the Al-Bustan Popular Committee, which was established in 2005; (g) the protocols regarding the meetings between the lawyers and planners of the Al-Bustan Popular Committee and the Jerusalem Municipality's representatives; (h) observations from four meetings between the representatives of the Al-Bustan Popular Committee and two consecutive Mayors of the Jerusalem Municipality; (i) observations of community reactions to the Israeli plans for Al-Bustan, which took the form of public meetings and protests in Al-Bustan's Tent of Protest.

The King's Garden Plan

In this section, I discuss the state planning endeavors in the Al-Bustan neighborhood, and specifically the King's Garden Plan, in order to understand the logics behind the planning approach.

Excluding the residents

Between 1948 and 1967, East Jerusalem was controlled by Jordan. During this period, the Municipality of East Jerusalem prepared a Master Plan for the entire eastern section of the city, which designated the area of Al-Bustan for residential use (Rapoport, 2005). However, since its occupation, the Israeli national, district, and local planning institutions, along with the

Jerusalem municipality, the Ministry of the Interior, and the Justice Ministry, have been engaged in concerted efforts to demographically and territorially transform East Jerusalem and its historic areas, including the Holy Basin, where Al-Bustan is located. The idea is, indeed, to ensure a solid Jewish presence in this section of the city.

In 1976, the Jerusalem District Planning and Building Committee approved the plan, 'EM/9-Local Master Plan for Ancient Jerusalem and its Surroundings' (State Controller, 2009: 688). The aim of this plan was to tighten, and put restrictions and obstacles on, the housing and economic development of the Palestinian residents, in order "to protect the urban landscape, and the religious properties of the Jewish religions and others, and to preserve the archeological sites within the area of the plan" (EM/9, 1977: 3). According to the EM/9 Plan, as Figure 1 shows, Palestinian neighborhoods, including Al-Bustan, were designated as "green open spaces" even though they were in fact inhabited (mostly by Palestinians).
Figure 1. Plan no. EM/9

Capitalizing on dispossession
In 1995, the Jerusalem Municipality decided to capitalize on the dispossessed space and make a profit from it. Accordingly, the Jerusalem Municipality and the Ministry of Tourism

established a Steering Committee for Tourism Development in Jerusalem to prepare the city for the "3000 years of the establishment of Jerusalem."[i] The main recommendations were to develop tourism in Jerusalem to transform the city into "the most important tourist center in the Middle East" and make it "an economic lever for tourism development throughout the country" (2015: p. 30).[ii] The committee proposed a plan called *King's Garden: 3000 Years of Jerusalem* (p. 108). About a decade later, the City Engineer of Jerusalem decided to implement the *King's Garden* plan and, thus, to destroy the entire Al-Bustan neighborhood, under the excuse of ending "illegal building in the Garden." The idea was to empty the neighborhood of housing and allow the municipality and the private sector to capitalize on the dispossessed neighborhood, instead of allowing the residents themselves to enjoy and share the benefits of its economic development.

On September 9, 2009, the Knesset's (Israeli parliament's) Finance Committee approved a budget of NIS 600,000 to promote a plan to build a national park in the King's Garden following Safdie's plan. Accordingly, Nir Barakat, the Mayor of Jerusalem, launched *The King's Garden Plan* on March 2, 2010. The plan has been called "a first-class national project" (Jerusalem Municipality and Jerusalem Development Authority, 2010, 5).[iii] Since then, the Jerusalem Municipality and local planning institutions have been striving to promote this plan despite the objections of many residents of the Al-Bustan neighborhood, who were almost unanimously opposed.

The *King Garden's Plan* (2010: 6) makes claims regarding a religious Jewish "history," integrating it with the capitalization of the spaces, considering the space as the site of a *business initiative*, and mixing this with a reinvented historical narrative in order to colonize what was then an authentic Palestinian space in Eastern Jerusalem:

> As part of its vision to develop the city, the Municipality of Jerusalem is making every effort to preserve and restore these green areas as part of this commitment and responsibility to the values of nature and environment, *a historic commitment*, which the inhabitants of Jerusalem have stood by steadfastly in the past, and that we will continue in the present for the future. (*King's Garden Plan*, 2010: 9)

The Plan presents as its overriding objective "to restore the King's Garden to its historic state as a major world and tourism site"; the "Plan's vision is to turn the King's Garden into a blossoming park that will flourish alongside a residential neighborhood, in which there will be restaurants, artists' studios, souvenir and local-art shops and more" (*King's ;Garden Plan*, 2010: 14-15).

Aesthetic justifications

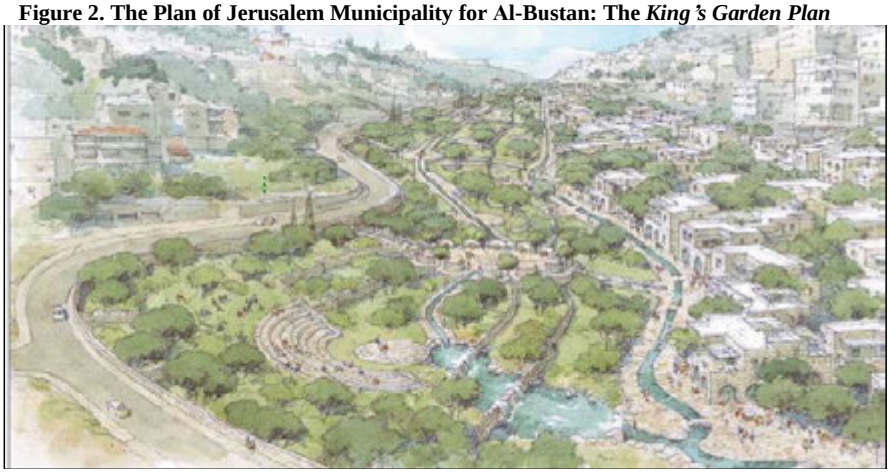
The King's Garden Plan involves a specific aesthetic discourse that justifies the dispossession of the residents and the demolition of the neighborhood. It uses Biblical language to describe the neighborhood as an ancient landscape:

> Traditionally, it was in this place that the kings of Israel established their gardens. It is commonly believed that this is where King Solomon planted his garden, and where, sitting in the shade of its trees, he wrote the book *Ecclesiastes*. (*King's Garden Plan*, 2010: 9).

The Mayor of Jerusalem, Nir Barakat, claimed that:

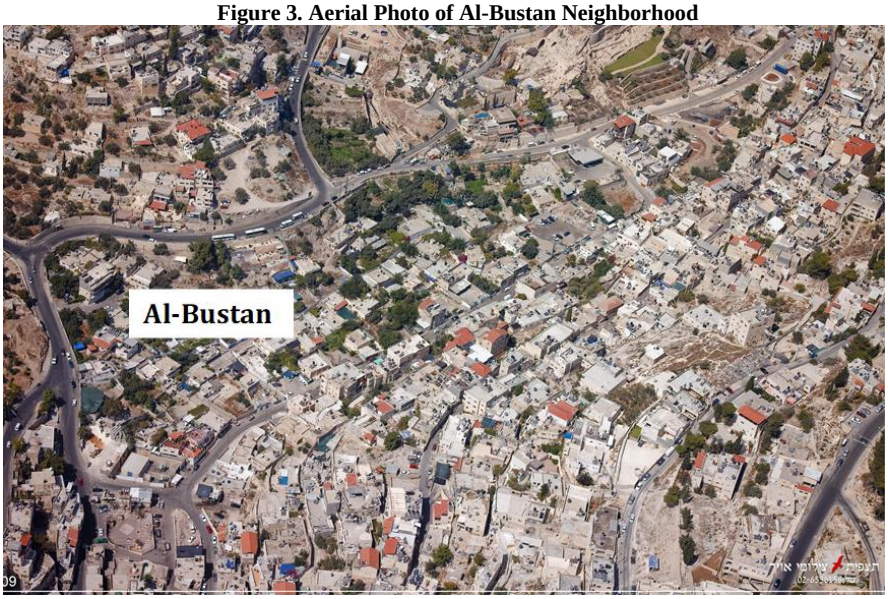
> The initiative to restore the area of the King's Garden to its ancient glory is part of our fundamental commitment and responsibility to preserve and safeguard Jerusalem, its landscapes and vistas, historic and scenic sites for the sake of future generations. For thousands of years, the King's Garden was an island of green, a site of agriculture and water, as part of systems of valleys and wadis that surrond the Old City – ancient Jerusalem. (Jerusalem Municipality and Jerusalem Development Authority, 2010: 5)

Figure 2. The Plan of Jerusalem Municipality for Al-Bustan: The *King's Garden Plan*



Source: Jerusalem Municipality. *Launch of King's Garden Plan*, 2.3.2010.

Figure 3. Aerial Photo of Al-Bustan Neighborhood



Self-determinative planning in practice

The Al-Bustan community had been opposing the state's King's Garden Plan since it was first launched by the Jerusalem Municipality. This section analyzes the community's reaction to the plan, based on an ethnographic longitudinal study. (This included in-depth interviews with Palestinian residents, and members and leaders of local community and grassroots organizations, which I was unable to publish, because quoting them would have a great potential to endanger them and also lead to the immediate demolition of their homes. It should be noted that since the eruption of the current war between Hamas and Israel, on 7 October 2023, the Jerusalem Municipality has increased the demolition of houses in the neighborhood and in the city. As Hasson and Solomon (2024) have reported in their article aptly titled "Israeli Demolitions of Palestinian East Jerusalem Homes Spike amid War," there was "a 60% surge in demolished homes reported in 2023." I also had to decide not to use in their entirety any texts from the WhatsApp group in the community that I am part of. Alternatively, I have used the Arabic and international media, and observations from the community meetings, which were publicly held.)

Becoming a political community

The Palestinian Al-Bustan community had not been collectively organized and did not have a grassroots organization until the rise of the new threat to demolish their neighborhood, and from the beginning of its occupation in 1967 to 2005, there was almost no collective mobilization against the state planning and the housing demolition policy. In 2005, the residents of the neighborhood decided to establish a grassroots organization called the Al-Bustan Popular Committee. The people of the neighborhood elect seven representatives to constitute the committee, which then represents the community's residents as a group. The Popular Committee has been responsible for the community, social, and planning actions that are related to the city plan of King's Garden.

As a result of the decision of the Municipality to destroy the neighborhood, the residents of Al-Bustan submitted a new plan to the District Planning and Building Committee in 2005. The Popular Committee hired an architect to prepare a zoning plan for their neighborhood. At the end of 2005, they submitted City Plan Scheme #11641 to the District Committee (District Planning and Building Committee, 2005). In 2009, the District Planning and Building Committee rejected the plan, arguing that "the plan is situated under City Plan AM/9, which designates the site as a public open green area; there is no room for qualifying the illegal buildings; the area of the plan is located in part of the sequence of open spaces," which "should not be allowed to be harmed, given their scenic sensitivity and their great importance due to their location." Furthermore, the committee claimed that the area has a "a scientific and tourism potential," and "sensitive open space," where the existing Palestinian "buildings that were built without a permit" should not be allowed to remain. Furthermore, the representative of the city stated that "the position of the City Engineer is that the plan should be rejected, since it proposes construction in the valleys, in violation of the planning policy and the Master Plan.

In 2009, when the Jerusalem Municipality launched the King's Garden Plan, the Al-Bustan Popular Committee members realized that it would not be enough to submit a plan to the Israeli planning institutions, and that they needed a new approach to oppose the city's new plan and the effects it would have on their neighborhood. Thus, they moved from a simple resistance to a plan for a new mobilization strategy. The community of Al-Bustan decided to take a wide-range of planning, social, and political actions aimed at opposing the King's Garden plan and constructing a new reality.

The struggle for recognition

In response to the city's plan, the Popular Committee established a Steering Committee in 2009 to manage the case and advise the Popular Committee on legal and planning issues. The committee includes members of the Al-Bustan Popular Committee, leading political figures from Jerusalem, and representatives of grassroots organizations. The Steering Committee included political figures and civil society leaders, in order to construct a consensus around the activity of the Popular Committee and provide it with political legitimacy. In addition, the committee assigned a Chief Planner, who headed a team of practitioners and was asked to prepare an alternative detailed plan for Al-Bustan. In addition, three lawyers were selected to legally advise the planning team and the Steering Committee. The overriding objective of the Popular Committee was to achieve statutory recognition through promoting a three-part strategy: achieving political reach, developing an alternative plan, and building local self-determination and autonomy.

Political reach

The first strategy was to put international political pressure on the Mayor of the Jerusalem Municipality and the Israeli government to halt the proposed plan and stop the demolition of the neighborhood. Obtaining international support was crucial in this. Since its establishment, the Popular Committee has also been updating United States Congress members, Senators, the Secretary of the State, and many other European governments political leaders. As East Jerusalem is considered by the international community a city under Israeli occupation, the United States and other Western countries consider themselves somehow obliged to protect the rights of Palestinians in the city and prevent Israeli territorial and demographic transformations (Badran, 2023).

In this regard, when the Jerusalem Municipality launched the King's Garden Plan in 2010, the Al-Bustan Popular Committee occupied a public building in the neighborhood, built a large tent on the roof, and announced that the building was 'The Tent of Protest." This occupied building, considered an illegal building by the Israeli legal and planning institutions, has remained the communal site of social, cultural, religious, and political activities (Photos 1-3).

On March 2009, US Secretary of State Hillary Clinton, visiting Jerusalem and the Palestinian Tent of Protest, intervened in an effort to prevent the demolition. As a headline put it, "Clinton criticised Israel's plans to demolish dozens of homes in Arab East Jerusalem," stating, "Clearly this kind of activity is unhelpful and not in keeping with the obligations entered into under the 'Road Map'," and that "[I]t is an issue that we intend to raise with the government of Israel and the government at the municipal level in Jerusalem" (McCarthy, 2009).

Clinton refused to meet the Mayor of Jerusalem, Nir Barakat, because of his announced plan to demolish Palestinian homes to make way for a tourist park. In an expression of support for the Al-Bustan community, she chose instead to visit the Al-Bustan Tent of Protest. Jerusalem's mayor "became embroiled in a high-profile conflict with Secretary of State Hillary Clinton over his intention to demolish the homes" (Hasson, 2010). There was then pressure from Europe and the U.S. to prevent Israel demolishing the neighborhood.

The alternative plan

The creation of an alternative plan for Al-Bustan was based on wide public participation within the community. The city's planning and its results were presented in the Protest Tent. The alternative plan was eventually approved by the Al-Bustan Committee and the people of the neighborhood attending a community convention, establishing what was called the Popular

Community. In part to obtain recognition, the Popular Community proposed the renovation and beautification of the neighborhood, making use of the professional terminology of planning:

> Our vision is to create a socially, culturally, economically, environmentally and spatially vibrant and sustainable community at Al-Bustan and promote a place that enriches, uplifts, and inspires the human spirit (The Plan Report, 2010).

The plan would implement an aesthetics based on local Palestinian and historic Islamic architecture in Jerusalem. This would mean a landscape based on gardens and green routes, flowing water in canals, and a focus on protecting the environment. These features are meant to enhance the community environmentally and aesthetically as well as economically, and are a response to the recognition that the community's struggle concerns social and spatial conditions that it could aim at improving, while hoping to end the state's antagonism towards it.

Constructing autonomy

The Popular Community (PC) has been sustaining and strengthening the Al-Bustan community socially, physically, and environmentally, constructing a type of urban autonomy aiming to serve the central goal of preventing the demolition of the neighborhood and achieving recognition and approval for the alternative plan. Community cohesion, solidarity, and collective action have become central to the political and planning cause of the neighborhood. A sense of shared risk, feelings of deprivation, and national pride created conditions for mobilization and collective action that had been in a standstill since the city launched its plan in 2010.

The PC has conducted activities on a wide social, cultural, and environmental spectrum**.** Since the Jerusalem Municipality does not provide any services to the neighborhood, the Popular Community promoted various projects to improve the living conditions of the residents, including renovating the neighborhood's narrow paths, constructing a children's playground, painting the walls of the buildings facing the main road, drawing graffiti paintings to present the story of the neighborhood and show its durability, renovating a building for a kindergarten, cleaning the neighborhood streets, and building a mosque.

In fact, the community has taken the place the place of the municipality in providing municipal services. The occupied building became a community center for cultural and social activities, in which the committee provides courses and public lectures for residents. The building has its own "Tent of Protest" on its roof. This tent has been used for collective meetings, and is a popular site for visitors from elsewhere in the city as well as international diplomats.

Figure 4. Graffiti in the occupied Tent of Protest

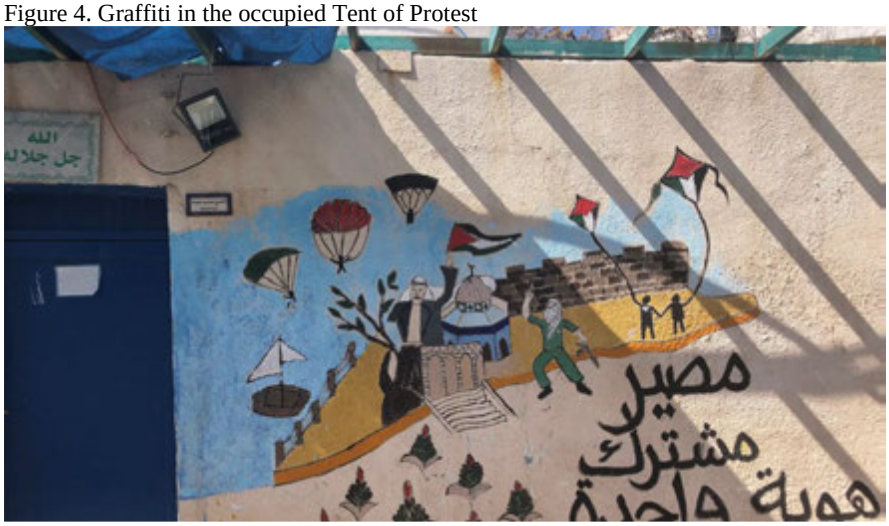


Figure 5. Graffiti in the occupied Tent of Protest

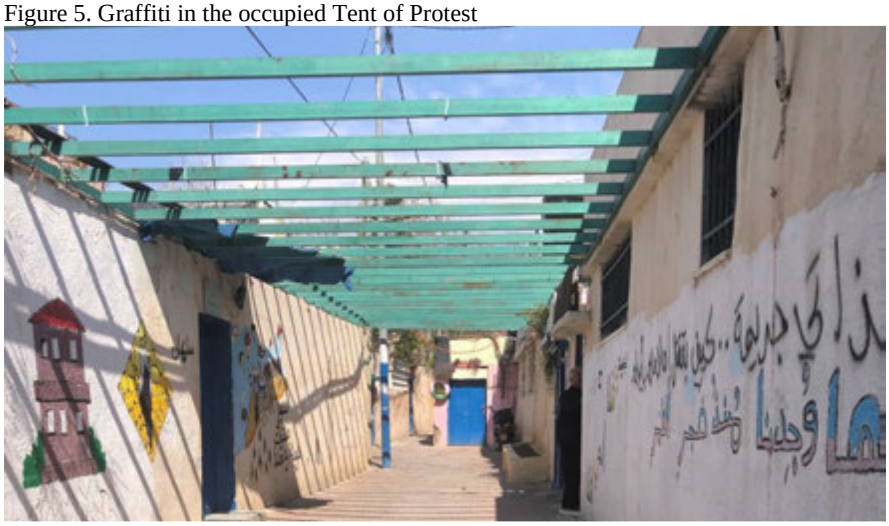


Figure 6. Community Meeting at the Tent of Protest (2023)

Figure 7. The Community Members Volunteering in the Mosque Area

Conceptualizing dispossessive vs. self-determinative planning

In analyzing the framework of the planning of dispossession, I am looking at the *logics* of the regime of practices of the architecture of dispossession. Each "logic" is meant to grasp specific aspects of the architecture of dispossession, which they together constitute (Glynos and Howarth, 2007). Based on the underlying empirical work, this study identifies as three logics involved in dispossessive planning *accumulation by dispossession*, the logic of *exclusion*, and the logic of *aesthetics*.

The logic of *accumulation by dispossession* captures the economic aspects and capitalization of the dispossession through spatial planning practices. Harvey (2001, 2003, 2008) proposes that "[w]hat accumulation by dispossession does is to release a set of assets (including labour power) at very low (and in some instances zero) cost," following which, "over-accumulated

capital can seize hold of such assets and immediately turn them to profitable use" (Harvey, 2003, 149). *Accumulation by dispossession*, Harvey contends, is "the mirror-image of capital absorption through urban redevelopment," a process of displacement that lies at the core of urbanization under capitalism. This process is backed by the strong state, and state power is always a major player in accumulation by dispossession. At present, most policies of dispossession are what are widely called neoliberal policies. Accumulation by dispossession occurs in many ways, including displacement of people, privatization (converting public assets into private property rights), and commodification of cultural forms. Thus, following Harvey, the logic of accumulation by dispossession suggests that spatial strategy and capitalization interact to ensure both the alteration of a space and its use for capitalization and profit.

Thus, the state in Al-Bustan first demolishes the buildings on the grounds of the illegality of land uses, then confiscates the land, displaces the residents, and launches a new development project, aimed at tourism, in the dispossessed place. Dispossessive planning involves uses of planning in two ways: first, to legally justify the demolition and displacement, and secondly, to propose a new plan of economic development. In this way, planning serves the state in justifying the displacement of people and rationalizing future economic development of the dispossessed assets.

The *aesthetic logic* captures the politics of the aesthetic of transformation of places; specifically, the way in which dispossessive planning uses aesthetics to justify its *creative destruction strategy*. Aesthetics in this case is a matter of appearance. Rancière (2010) suggests that what is called "art" is always political, because in proposing ways of seeing reality, which can include the arrangement or rearrangement of spaces, it is engaged in the construction of (contingent and contested) "forms of life." The effort to construct an aesthetically pleasing, and thus valuable, new or renovated "reality" through changes to a place provides one way of understanding planning through dispossession and accumulation: the place and its uses are transformed, and increased in "value" in a sense that can both be appreciated and enjoyed, and be financially profitable.

In this case, the King's Garden Plan neglects the existing aesthetic qualities of the Al-Bustan neighbourhood, dismissing the fact that the residents protect, sustain, and use its running water, and have made the neighborhood greener than most, if not all, other neighborhoods in Jerusalem. Al-Bustan, which means "the garden" in Arabic, is instead represented as a collection of illegal houses, built on public lands, whose designation as a green park is contrary to its proper uses. Furthermore, the aesthetic images used in the official plan involves an untrue historic narrative, lacking any archaeological evidence, and plainly ideological, in claiming that "[t]raditionally, it was in this place that the kings of Israel established their gardens," and that it is where "King Solomon planted his garden, and where, sitting in the shade of its trees," whose ancient glory is even described in mythically paradisiacal terms as the place of the "Gates of the Garden of Eden" (The King Garden Plan, 2009: 9).

The *logic of exclusion* captures the way dispossessive planning excludes the very presence of the dispossessed, the excluded "others." In *The Politics of Dispossession*, Edward Said describes the use of concepts of absence/presence in which the dispossessor's presence is justified by the supposed absence of the dispossessed, an absence that has been conceptually transformed from a displacement into a supposed non-reality. Similarly, Butler (2013) conceptualizes dispossession as involving a dialectic of presence/absence "whereby presence (or a presence-effect) is produced by being constantly haunted by its spectral absences or (mis-)recognized presences" (Butler 2013, 16). The presence to be removed is represented as an

absence, but it is also haunted by it, since its negation is an uncertain, and troubling because troubled, project. Furthermore, "being dispossessed refers to processes and ideologies by which persons are disowned and abjected by normative and normalizing powers that define cultural intelligibility and that regulate the distribution of vulnerability" (Butler 2013, 2). The dispossession is normalized by a discourse that denies the existence of what it violently attacks.

Dispossession can be thought of as a way in which human bodies are de-materialized through these practices (Hirsh, et. al., 2020; Jabareen et. al., 2017). It is both a reality and a process, and it involves both a material process and a resulting sense of being "deprived of the ability to have control over their life" (Butler 2013, 3). Accordingly, dispossession, "whether it be colonial or neocolonial, capitalist, and neoliberal, endures by reproducing … the violence inherent in improper, expropriated, and dispossessed subjectivities" (pp. 18-19).

Exclusion through the process of dispossessive planning is a violent act, whose effects on the dispossessed include the creation of an ontological insecurity . In Al-Bustan case, the people living there must spend their days and nights under the threat of the demolition of their homes. On any given morning, officers of the Jerusalem municipality may come with the police to demolish a house. The residents are often asked to participate, by demolishing their own houses, failing which the Israeli authorities will destroy them and the displaced must pay the demolition costs.

Dispossessive planning is a coherent regime of spatial, aesthetic, legal, economic, and socially exclusionary practices of dispossessing and displacing a disadvantaged group of people in order to construct a new and "better" reality. The aesthetic logic of dispossessive planning represents this as creating a pleasing and attractive place for tourists and settlers. The logic of *accumulation by dispossession* captures the capitalization of dispossession through spatial practices of place alteration for economic redevelopment. The *exclusionary logic* captures the reasons given for the exclusion of specific people and places, which may be based on social differences and antagonisms. Dispossessive planning is a form of state violence that understands itself in these three analogous and convergent ways.

Conceptualizing self-determinative planning

Self-determinative planning is a regime of practices that normally emerges to counter the apparent injustice of institutional planning policies. Central to self-determinative planning is the *logic of becoming a political community*, which may arise through efforts to cope with actions that are interpreted as destructive of the community that is then substantially formed in response. The community may become constituted politically in the context of 'friend-enemy ' relations, in this case provoked by the opposition of the state. This has been found to occur in many places around the world where states have displaced communities for the sake of redevelopment and urbanism. In this case, the state has been antagonistic to Palestinian communities in Jerusalem, in various spheres including planning, housing, development, and issues of citizenship.

Dispossessive planning itself depends on a friend/enemy formation. It follows the logic identified by Schmitt (1932: 26), according to which "the phenomenon of the political can only be grasped by referring to the real possibility of friend and enemy groupings," which are the most intense and extreme political antagonisms (1932: 23). For Schmitt, the state is an organized political unit that depends on a friend-enemy decision. In East Jerusalem, the state has made a decision to clearly distinguish between two ethnic groups, Israeli Jews and Palestinians. The resulting antagonism "manifests itself in all sorts of tactics and practices"

(Schmidt 1932: 23), including, in urban development, what we can recognize as *dispossessive planning*. Thus, political community arises when its members collectively make a distinction between friend and enemy, the one expressing "inward" relationships and the other "outward" ones. For the community in this case, this means, internally, constructing a collective political identity in the face of the antagonism of the state's projects. Schmitt argues that every political community requires a substantive collective identity, which is independent of, and can exist outside, the established framework of constitutional rules, or the state itself (Vinx, 2015).

Under these circumstances of severe state antagonism, a community becomes political in aiming to mitigate, or dismantle and dissolve, the tyranny of the state and its institutions and policies over spatial production. It may even be thought that the antagonism of the 'friend-enemy 'divide constitutes the ontological foundations of self-determinative planning.

In our context, collective identity and solidarity derive from the shared common interests recognized among the community members, and these common interests are necessarily recognized in opposition to the state political authority, which opposes them and brings them together as a community sharing this situation. The community collectively produces, out of a sense of grievance, a collective "we" facing a "they," in this case the Israeli state, which is held responsible for its grievances. Becoming political is a response to the actions of a state apparatus as an "enemy" that is poised to do (and does) harm to the community. In the literature of collective action and protest, identity, injustice, and efficacy are sometimes said to be among the core concepts of social psychology of protest, with group identification fostering protest participation (Klandermans, 2002). The shared sense of becoming an urban political community provides its members with opportunities to take control over its spaces, conferring meaning on the choices and tasks involved. Self-determinative planning supports a sense of autonomy, solidarity, of belonging to the place, and destiny.

A logic of recognition reflects some of the political ends of the self-determinative planning approach. One objective of the community is achieving recognition for its demands, including its alternative plans regarding its space planning and production. Fraser (2000) conceives recognition as a question of social status, where the demand for recognition is about the status of individual group members to become full partners in social interaction. Thus, misrecognition involves not only the depreciation and deformation of a person's group identity, but also social subordination—in the sense of being "prevented from participating as a peer in social life" (p. 113). Understanding the important role of recognition as such, some scholars have called for more "substantial forms of recognition," without which, in one way or another "our lives are at risk," as Judith Butler put it (quoted in Willig, 2012: 139). Thus, Eizenberg et al. (2021) propose a framework of *urban space of recognition to* foster a more just and inclusive society.

A logic of autonomy or self-management describes the political settings of self-determinative planning. A political community embodies a collective identity it has constructed, originally, around the friend/enemy divide, and the sense among the community's members that it is a political entity that may have real power either to influence elites and state powers or of direct self-governance. If they find that they have some real strength in local, national, and sometimes international, contexts, they may then be able to oppose themselves to the state authority of the larger society.

Henri Lefebvre proposes, in his case by reworking the Marxist concept of the "withering away of the state," with its implication that this would equally involve "the decline of the Party as a centralized institution that monopolizes decision-making" (Brenner and Elden, 2009: 136), the

concept of self-management *(autogestion)*, which he takes as implicit and incipient each time a social group "refuses to accept passively its conditions of existence," and consequently forces itself "not only to understand but to master" those conditions (p. 135). This makes it a means of struggle that is also a "means for reorganization of society" (p. 149). This can force the state in reply to submit some of its own power "to 'grassroots' democratic control." The ideal or utopian character of this, which Lefebvre calls "the opening toward the possible," may be "only one element of a political strategy," though it may be significant in being, as he believes, the only way "members of a free association can take control over their own life" (p. 150).

The logics I have identified as involved in state dispossession are countered in those involved in the framework of what I call *self-determinative planning*, which may be provoked by them. Dispossession both wields and invokes an inescapable friend-enemy divide. In this context, people who have begun to organize themselves together in resistance may develop new forms of autonomy (as well as strengthening old ones), as well as seeking recognition, including from the state that acts otherwise as enemy, for their own demands and plans they are forced to develop as alternatives.

Self-determination as a social and political ideal can be rooted in liberal political theory as well as elsewhere. Classical liberal theory is based on the rights of individuals. Governments are expected to provide protection for those rights, failing which, people have the right to resist, as well as to emigrate or secede (Freeman, 1999). In radical versions of liberal theory, self-determination is justified when necessary to ensure liberty or protect civil or human rights (Beitz, 1979; Freeman, 1999). Similarly, psychological theories of self-determination ground its desirability in personal "needs": people are said to have needs for autonomy or self-governance, a sense of mastery or competence, and a sense of belonging and connection, that are best met by collective processes of self-management (Ryan & Deci, 2020). It may be held that "individuals experience greater psychological well-being through the satisfaction of these three psychological needs, and conversely feel highly fragmented, isolated, and reactive when their needs are not met" (Chiu, 2021). People may thus be seen as possessing rights to collective political self-determination that are grounded intrinsically either in their nature as human beings or in the extant political formations to which they are already subject. Thus, forms of urban planning that are manifestly destructive of these very principles may facilitate their assertion in part precisely because they were implicit to begin with.

Kymlicka (2012) suggests that "national minorities and indigenous peoples typically view themselves as 'peoples' or 'nations' and, as such, as having the inherent right of self-determination. They demand certain powers of self-government," and "they want to govern themselves in certain key matters to ensure the full and free development of their cultures and the best interests of their people." While it may appear that ethnic or national identity is here the basis on which the desire for self-government is founded, it may also be that the latter is prior or that the two are "given" together. National communities may derive some of their importance from the fact that they are the most available sites for possible collective self-government. At the same time, cultural "accommodation rights" that depend on minority status, may remain important as long as there are persistent cultural differences at the same time that governance remains linked to an ethnic or cultural identity that is held in common.

Self-determinative planning is a form of self-determination that involves a community's production and reproduction of its member's individual and collective property rights, and its physical space, which they may normally expected to be guaranteed by the state, and that may

be defended against if it is violated (including by or involving the state itself). In this way, planning may come to mean collectively seeking a mastery over the conditions of people's lives, in opposition to a state tyranny that undermines or threatens them. Self-determinative planning may thus be undertaken by members of a community that sees its interests as in an antagonistic relationship to state activities and institutions.

Conclusion

Planning literature includes frameworks that can be found useful by planners opposed to official state planning, such as "radical planning," "advocacy planning," and "insurgent planning." This paper conceptualizes the dominant state planning as a coherent regime of practices that function together, serving the political and economic purposes involved in the dispossession of an extant "foreign" population, in this case Palestinian citizens and residents of a neighborhood in East Jerusalem. A corresponding approach of self-determinative planning should, I am suggesting, be similarly composed of integrated political, economic, and aesthetic practices that are oriented to the local (Palestinian) community's continued residence rather than dispossession, autonomous self-governance, and maintenance of a satisfactory quality of life in the lived environment consistent with these ends. An appropriate regime of planning practices in situations and places like this would be the complementary contrary of the current one of dispossessive planning, and it is this whose coherent deployment I have called self-determinative planning.

As we have seen,, dispossessive planning involves a distinct and coherent regime of practices, which can be conceptualized through three interrelated logics. The aesthetic logic describes the way the dispossessive planning manipulates reality and creates a new reality through spatial, design, and aesthetic practices that are intrinsically political. The logic of exclusion is that of a violent practice that excludes the very presence of the dispossessed, negating their very existence. The logic of accumulation by dispossession describes the capitalization of the dispossessed spaces and places, which are then appropriated for profitable uses. Thus, displacing the poor or specific racial groups from specific sites in cities aims, in many cases, not only to create profits but also to 'clean' urban areas from undesired others. The purposes aimed at are functionally convergent, though through distinct "logics" with independent rationales.

Urban self-determinative planning must challenge dispossessive planning, on account of the uneven and distorted relationship between the planning apparatus of the state and affected disadvantaged communities. This tends to mean that it depends upon the community's resisting what must seem to it as state tyranny, and that resistance requires its becoming political by building specific forms of autonomy, if at first only to support the struggle for recognition of its members' needs and rights by the state. Planners attentive to the rights and needs of disadvantaged and minority populations to produce and control their very spaces of existence, a notion that the urban planning profession can hardly to fail recognize, as it would otherwise have to abandon all pretense of democratically being rooted in or responsive to the needs and interests of the inhabitants of the spaces being planned, perhaps in favor of something amounting to or approximating an act of war, must recognize the priority to their activity of the autonomous self-determinative political processes in the affected communities.

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Reviewing the applications and prospects of the concept 'Image of the City' in urban planning research

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Abstract:

In the 60 years since *Image of the City* was proposed by Lynch, it has been widely applied while also receiving various critiques and queries. However, recent developments of internet have led to new theoretical frameworks and research paradigms based on the classical *Image of the City*. To explore application transformation of *Image of the City* in urban planning over the past 20 years, this paper conducts qualitative and quantitative analyses based on 126 articles selected from the China National Knowledge Infrastructure (CNKI) and 244 articles selected from the Web of Science (WOS). It outlines an overview of research hotspots, trends, and significant changes in the study of *Image of the City* within the field of urban planning. The study reveals that Kevin Lynch's foundational work has been expanded to incorporate digital and cultural dimensions into *Image of the City* researches. Furthermore, it highlights the adoption of "big data," "images," and other relevant data, alongside advanced technologies such as "deep learning" and "convolutional neural networks." These technologies have progressively replaced traditional cognitive mapping and questionnaire methods in the study of *Image of the City*. This shift not only marks a significant methodological evolution but also broadens the scope of research in capturing and analyzing the complexities of urban environments.

Keywords: Lynch, Image of the City, CiteSpace, Applications and prospects

1 Introduce

The theoretical approach to urban imagery originates from the perceptual research methods proposed by Lowenthal (1961), yet it is widely acknowledged that Lynch's seminal *Image of the City* has become emblematic of the concept itself (Gu and Song, 2001). In the six decades following Lynch's publication, while his theory has been extensively utilized, it has also encountered numerous critiques and challenges. These criticisms have catalyzed the ongoing expansion and evolution of the *Image of the City* concept. In the digital age**,** the cognitive patterns, subjects, and theoretical underpinnings of the *Image of the City* are progressively transforming, prompting the development of new theoretical frameworks and research paradigms based on the original theory. Consequently, there is a pressing need to summarize and review the recent shifts in the theoretical content and research paradigms related to the *Image of the City* within urban planning.

To address this, the present paper utilizes CiteSpace as a bibliometric analysis tool, drawing on core journals from the China National Knowledge Infrastructure (CNKI) and the Web of Science Core Collection databases (WOS) to pinpoint research hotspots and trends in *Image of the City* studies over the past two decades. From this analysis, the paper delineates the shift in

Image of the City research paradigms within urban planning.

2 General Progress In Image Of The City Research

2.1 Data Resources

To gain a deeper understanding of the research progress on *Image of the City* in urban planning within both Chinese and international contexts, we conducted searches and downloads of basic data from CNKI and WOS, restricting the publication period to between 2000 and 2022.Utilizing the CNKI journal database, the search parameter SU='城市意象' (Image of the City) yielded 273 papers from SCI or EI indexed journals, Chinese core journals, CSSCI journals, and CSCD journals. To specifically focus on urban spaces, studies concerning urban imagery in literature and film were manually excluded, ultimately resulting in 126 relevant documents. In the WOS Core Collection, the search was conducted using TS="urban image", focusing on journal articles and conference papers, which initially provided 245 core journal papers. After an examination to remove irrelevant publications, 244 papers remained. This paper employs CiteSpace 6.1.R6 software to perform foundational bibliometric analysis.

2.2 Volume Of Publications

From the perspective of publication volume, Chinese scholars’ engagement with *Image of the City* studies in the field of urban planning appears limited, exhibiting a fluctuating trend with a slow rise and decline in recent years. Conversely, international scholars have demonstrated a steady increase in their research on *Image of the City*, particularly after 2016. This indicates a period of heightened activity and growing interest in the subject (Figure 1).

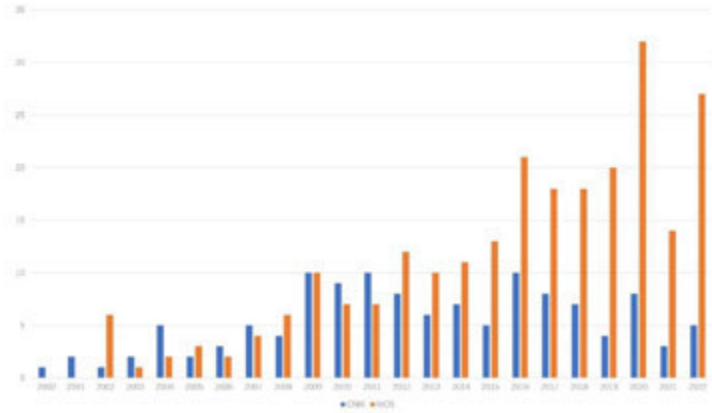

Figure 1. Comparison of year-to-year changes in the number of publications in CNKI and WOS papers

2.3 Research Hotspots

A co-occurrence keyword graph is instrumental in analyzing research hotspots and their evolution. In such graphs, each node represents a keyword, with larger nodes indicating higher frequencies of occurrence, thus highlighting the current hot topics in *Image of the City* within the field of urban planning. In Chinese research, besides fundamental topics like "spatial imagery" "cognitive maps" and "imagery maps" the main research topics include "urban

design" "urban tourism" "urban characteristics" and "big data" (Figure 2), focusing on the application of *Image of the City* theory in urban planning and design, such as identifying urban characteristics. Similarly, international studies on *Image of the City* also focus on "urban design" "urban planning" and "urban development," and like Chinese studies, show a notable interest in new big data-related technologies such as "deep learning" and "convolutional neural networks." However, international research differs by also emphasizing exploration of specific historical urban districts, with a focus on "urban historical district renewal" and "urban historical heritage preservation" (Figure 3).

Centrality in the keyword graph indicates the degree of connection between keywords, with higher centrality suggesting stronger links with other keywords. As shown in Table 1, besides primary nodes with high centrality such as "urban image " "Image of the City", keywords like "space syntax" "big data" and "deep learning" are emerging as secondary important nodes in both Chinese and international research spectra, indicating significant future research trends. Since 2016, related data such as "big data" and "images," along with new technological methods like "deep learning" and "convolutional neural networks," have been increasingly applied in *Image of the City* research, replacing traditional cognitive mapping and survey questionnaires, showcasing high centrality and becoming significant nodes within the research field. Thus, the paradigm of *Image of the City* research is shifting from traditional surveys and cognitive sketches involving small samples to utilizing computer algorithms to mine information from big datasets.

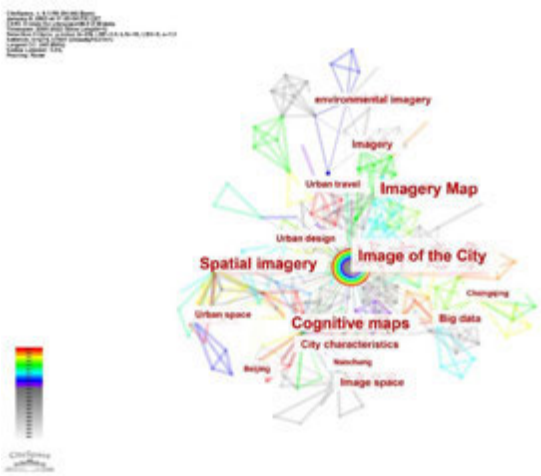

Figure 2. Co-occurrence keyword mapping in Chinese *Image of the City* researches

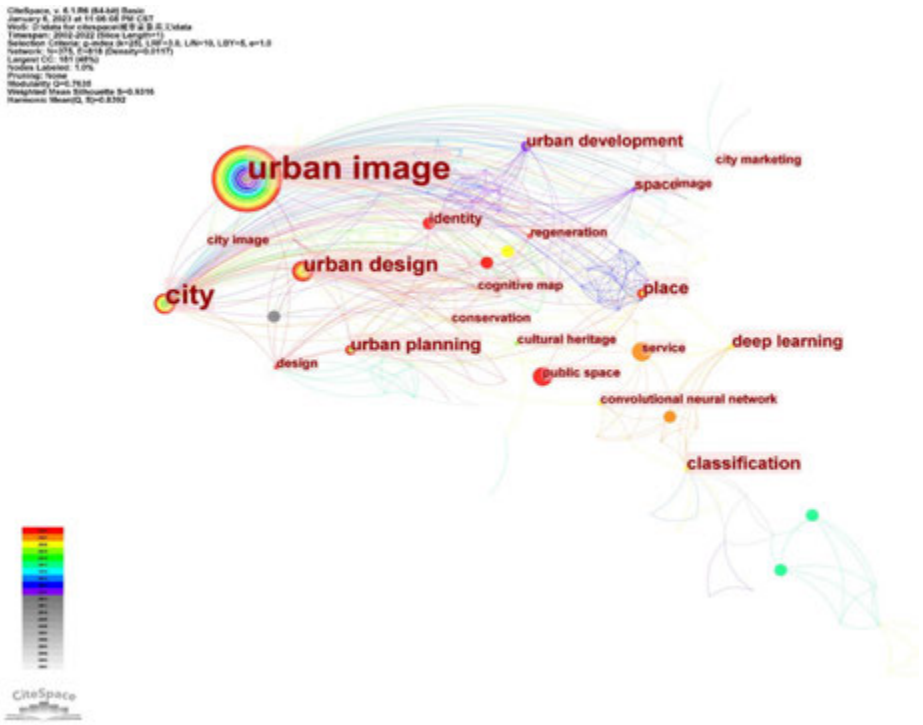

Figure 3. Co-occurrence keyword mapping in international *Image of the City* researches

Table 1. Keyword centrality of *Image of the City* researches

Keyword centrality of Chinese *Image of the City* research				**Keyword centrality of international *Image of the City* research**			
Order	**Centrality**	**Years**	**Keywords**	**Order**	**Centrality**	**Years**	**Keywords**
1	1.47	2000	**image of the city**	**1**	0.29	2002	**urban image**
2	0.13	2007	**cognitive maps**	**2**	0.13	2002	**city**
3	0.10	2006	**spatial imagery**	**3**	0.08	2009	classification
4	0.09	**2014**	**space syntax**	**4**	0.08	**2018**	**deep learning**
5	0.07	**2018**	**public space**	**5**	0.06	2012	urban design
6	0.05	2007	environmental imagery	**6**	0.04	2009	**image fusion**
7	0.04	**2016**	**big data**	**7**	0.03	**2017**	**design**
8	0.04	2014	urban space	8	0.02	2005	place
9	0.04	2004	space	9	0.02	2007	urban planning
10	0.04	**2019**	**deep learning**	10	0.02	2014	city image
11	0.03	2004	imagery	11	0.02	2020	**convolutional neural network**

12	0.03	2005	urban image	**12**	0.02	2017	**algorithm**
13	0.03	2003	map	**13**	0.01	2002	urban development

2.4 Research Trends

Chinese scholars' research on *Image of the City* can broadly be divided into three stages (Figure 4). The first stage (2000-2010) focused on applying and empirically testing classical methodologies of *Image of the City*. The second stage (2010-2015) centered on enhancing these classic methods through the integration of theories from environmental psychology and semiotics. The third stage (2015-present) has seen the adoption of multidimensional data such as online text, internet images, street view images, and big data. This data is analyzed using deep learning techniques to categorize and deconstruct in order to explore subjective perceptions alongside objective environmental analyses.

Internationally, research on *Image of the City* can be divided into two stages (Figure 5). The first stage (2000-2010) was characterized by keywords such as social capital, cultural capital, regional renewal, and negative imagery, applying classic *Image of the City* methodologies to the fields of regional renewal, city branding, and urban transformation. This phase emphasized enhancing distinctive urban features and employing city branding as a robust image-building strategy, which subsequently led to the exploration of creative cities and urban personality planning. The second stage (2010-present), similar to developments in China but starting earlier, utilizes images, remote sensing imagery, and other data sources, analyzed using deep learning, convolutional neural networks (CNN), and convolutional autoencoders (CA). This phase places a greater emphasis on culture, focusing on the cognition of urban culture, the protection of urban cultural heritage, and the preservation of historical urban environments.

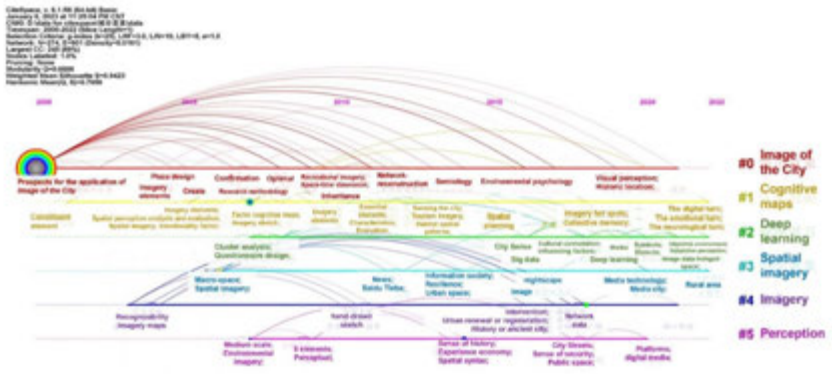

Figure 4. Time series map of keyword changes in Chinese *Image of the City* researches

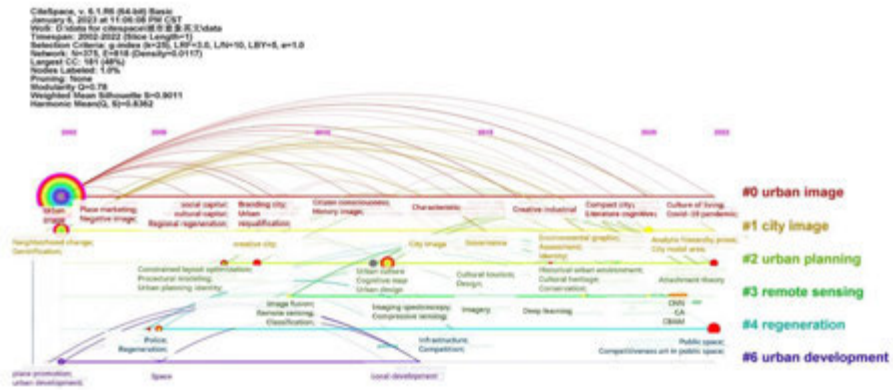

Figure 5. Time series map of keyword changes in international *Image of the City* researches

3 Paradigms Shifts In Image Of The City Research Within Urban Planning Studies

3.1 Evolution Of Theoretical Content Of Image Of The City

(1) Limitations of *Image of the City* theory

Kevin Lynch, in his seminal work "Image of the City", provided a comprehensive set of theories and methodologies related to urban imagery. Lynch posited that urban imagery results from the interaction between the environment and individuals, where perceptions are influenced by urban environments to create spaces of experience, either directly or indirectly. These perceived images, which residents can recall, constitute the "subjective environmental" spaces in their minds. Thus, individuals can organize and attribute meaning to everything they perceive. Lynch's research across cities like Boston, Jersey City, and Los Angeles distilled urban imagery into five structural elements: paths, edges, districts, nodes, and landmarks. And he proposed that residents construct mental maps of the city through path-dominated or space-dominated approaches (Lynch, 1960). Cognitive mapping and social survey techniques have been commonly used to obtain these mental maps of urban imagery, with studies varying in scale from city-wide (Xiong et al.,2011) to region (Miao,Li and Xu,2010) ,and campus levels (Topcu and Topcu,2012).

However, as a product of the 1960s, the suitability of Lynch's *Image of the City* theory for exploring subjective spatial perception in contemporary urban environments has been widely debated. First, Lynch's structural elements of urban imagery are focused on tangible aspects of urban design, leading to highly similar findings about urban characteristics that often appear repetitive and generic (Xu, 2012). Second, cognitive maps, as abstract schematic structures, detach from the cultural essence of the city itself, serving primarily for directional purposes and overlooking the motivations behind behaviors, thus failing to genuinely represent the holistic urban structure and to uncover the city's true character (Shen, 2004). Third, the sample bias in surveys does not reflect the perceptions of millions of urban dwellers but only those of a few

individuals (Wang, 2003).

(2) Expansion of *Image of the City* Connotations

With the transformation in information technology and transportation, *Image of the City* perception now integrates more culturally and emotionally valuable media. The cognitive models of *Image of the City* have evolved to combine visual and virtual cognition, with the objects of *Image of the City* cognition shifting towards urban spaces popularized by online platforms like TikTok and social media (Zheng et al.,2020). People's perceptions of the real world are influenced not only by physical experiences but also by interactive recommendations on social media, and by the rapid dissemination of literature, cinema, and short videos, gradually forming more fixed urban imagery within the digital realm. Gradually, the study of *Image of the City* has moved beyond just the interaction between observer and environment, focusing increasingly on the role of media imagery. In the digital domain, the transfer of digitized images eliminates physical distances between subjects and objects, making geographical traversal unnecessary for path-finding cognition, thus giving *Image of the City* perception an instantaneous and geographically unbounded sharing quality (Zhao and Chen, 2023).

3.2 Perception And Recognition Of Urban Image Based On Multivariate Data

Since the internet has become a common medium for large groups to share photos, information, and feelings, the images and text found online can reflect people's subjective perceptions of the physical environment to some extent. The advancement of digital technologies, artificial intelligence, and network information technology has significantly transcended the traditional "cognitive map" route for identifying *Image of the City*, shifting towards research that leverages "network media" to perceive *Image of the City*. Consequently, images and text are increasingly replacing small-sample data obtained through cognitive maps and survey methods as the primary data sources for urban imagery research (Table 2).

(1) Identifying Urban Imagery Based on Image Data

Long and Zhou (2025) introduced "Pictorial Urbanism," advocating that image data not only embodies the objective world and subjective perceptions but also can be applied on a large scale quantitatively in urban studies. Images, reflecting static visuals inherent in human vision, are extensively used to identify *Image of the City* elements and assess their features. Depending on their origin, images are categorized as online images (from the internet), street view images (from services like Baidu Maps, Google maps), and attributes of images (from photographic metadata).

Online images are widely utilized to explore the composition of *Image of the City* and identify its characteristics (Zhao, Xu and Li, 2015; Cao, Long and Yang, 2017; Li et al., 2017), street view images are employed for perceiving street spaces (Xu, Jiang and Chen, 2018). These image datasets are often analyzed using deep learning and machine learning technologies to recognize content, categorize features, and conduct quantitative analyses.

Attribute information such as shooting location, uploading practices, description tags, exposure parameters, and geographic information in the image can also be utilized to mine *Image of the City*. For example, Bahrehdar, Adams and Purves (2020) used a combination of user-generated

content from Flickr and street network data from OpenStreetMap to investigate urban perception and city elements such as paths, landmarks, districts, edges, and nodes.

(2) Identifying Urban Imagery Based on Text Data

Online texts, as mediums conveying daily thoughts and emotions, effectively express individuals' emotional and preferential responses to entities. Researchers have used online texts as raw data to analyze *Image of the City*. In China, sources of online textual data include Weibo, Baidu Tieba, and Dianping.

Research in this area often focuses on the imagery preferences of various demographic groups (Feng et al., 2011; Zhao and Liu, 2012) and the urban imagery of specific regions (Xie et al., 2017). Text data carries limited information, confined to content and coarse geographic details, making it less capable of extracting detailed information and suitable only for broad, qualitative spatial perception descriptions. Thus, research solely based on text data for identifying urban spatial imagery is uncommon. Text data primarily aids in enhancing urban imagery perception studies, for instance, Fan and Zhang (2022) used POI density to gauge functional perception, street view images for visual perception, and textual notes to extract emotional perceptions.

Table 2. Data basis of *Image of the City* perception and recognition in Chinese

Data categories	**Sub-categories**	**Combined with other data**	**Research content**	**Source**
Image	Online images	None	Identifying the composition, dominant direction, characteristic degree and similarity of *Image of the City* elements in 21 Chinese cities	Cao, Long and Yang, 2017
	Online images	Combining questionnaires and cognitive maps	The basic elements of the *Image of the City* Composition of Dingxing Ancient City	Fu et al., 2017
	Night Scene Web Image	Nighttime remotely sensed light intensity data	The main spatial characteristics of Zhuhai's urban nightscape Imagery and the tendency of popular Choice	Li et al., 2017
	Online images	None	Evaluation of feature recognition of 21 Cities in Guangdong province	Zhao, Xu and Li, 2015
Street view images	Baidu Street View map	None	Perceived safety of public space in Shanghai streets	Xu, Jiang and Chen, 2018
Online texts	word frequency of Weibo hot area	None	Image of the Beijing City	Xie et al., 2017

	microblogging text	None	Similarities and differences in chinese and western tourists' perceptions of Beijing's urban Imagery	Feng, 2011
	Economic news text, Baidu posting geographical term frequency	None	Differences and similarities between the media and the public on urban imagery of Shanghai's downtown area	Zhao and Liu, 2012

3.3 Reanalysis Of Urban Imagery Structures Based On New Computational Methods

The development in big data and computing has continually fostered new models for understanding Image of the City. Deep learning and machine learning, key branches of artificial intelligence, provide tools for extracting objective environmental imagery and the subjective perceptions of the public. These technologies are extensively applied in urban planning and related research. The primary significance of deep learning and machine learning in urban imagery lies in their ability to "mimic human learning" processes, autonomously learning from large datasets to derive patterns, particularly in analyzing image, text, and spatiotemporal data. Consequently, numerous scholars have attempted to employ these methods to develop new models for exploring *Image of the City*.

For example, Cao, Yang and Long (2019) used Weibo data comprising photos, texts, and location tags, combined with big data and deep learning techniques, to construct a model that deeply characterizes urban imagery across three dimensions: structure, types, and evaluation. Zheng (2021) utilized street view big data, machine learning, and both subjective and objective quantitative evaluations to quantify the objective environmental components and primary perceptual outcomes in Nanjing's central urban area, proposing a new set of five urban imagery elements different from Kevin Lynch's model: core, node, corridor, layer, and blind spot.

Internationally, Doersch et al (2012) based their study on large-scale street view data, using unsupervised computer recognition algorithms to identify elements representing Paris's urban environment. Their findings indicate that Paris's urban imagery elements are embedded in everyday culture rather than unique urban landmarks or structures. Liu et al (2016) applied deep learning techniques to categorize and classify photo content from Panoramio and Flickr by elements (e.g., green visual imagery, water visual imagery), exploring the *Image of the City* element types and spatial distribution characteristics in seven cities. Zhou et al (2016) used deep learning to identify and classify geographical photo data from 21 cities, investigating each city's urban imagery features and spatial characteristics, and further exploring the differences among these cities.

4 Summary

Image of the City is summarized in two adjustments in urban planning research:

(1) Theoretical Contributions and Expansions

Kevin Lynch's foundational work has been expanded to integrate digital and cultural dimensions into the study of *Image of the City*. The original elements of paths, edges, districts, nodes, and landmarks have been adapted to include digital interactions and cultural perceptions. This expansion is crucial as it acknowledges the changing urban experiences in the digital age,

where physical and virtual spaces converge. The incorporation of more culturally and emotionally charged elements into the study of *Image of the City* is a significant theoretical advancement. By acknowledging the influence of media and digital platforms, current research captures a more holistic view of how urban residents perceive their environments. This approach reflects a shift from a purely functional view of urban spaces to one that includes emotional and experiential dimensions.

(2) Methodological Innovations

The use of big data analytics, deep learning, and convolutional neural networks marks a substantial methodological shift. These technologies have enabled researchers to analyze large datasets of images and texts, providing a broader and more nuanced understanding of *Image of the City.* This approach contrasts sharply with the traditional methods of surveys and cognitive mapping, which often relied on smaller, less diverse samples. The transition to multivariate data analysis allows for a more comprehensive examination of *Image of the City.* By utilizing both image and text data sourced from the internet, researchers can capture a wide array of perceptions and interactions that were previously inaccessible. This methodological shift enhances the ability to analyze complex urban dynamics and understand the multifaceted nature of urban imagery.

5 Conclusions

This paper outlines the overall research progress on *Image of the City* within the field of urban planning and summarizes the research hotspots and trends. It further categorizes changes in research content, dividing it into the expansion of the connotation of *Image of the City*, perceptual identification of *Image of the City* based on multivariate data, and the re-discrimination of *Image of the City* structures using new computational methods. The study reveals that Kevin Lynch's seminal work has been expanded to incorporate digital and cultural dimensions into *Image of the City* research. Moreover, in terms of methodology, data related to "big data" and "images," along with new technological approaches like "deep learning" and "convolutional neural networks," have progressively replaced traditional cognitive mapping and survey questionnaires. Looking ahead, using deep learning, convolutional neural networks, and other computer algorithms in conjunction with large datasets such as text and images to further analyze *Image of the City* remains a key research direction. Applying these methods to historical heritage preservation, urban design, cultural tourism, and city branding holds significant potential. However, the complexity of online information and whether it can truly replace the perceptions of the majority of urban populations remains a topic for further debate and investigation. Therefore, future research should focus on enhancing the explanatory power of digital information for *Image of the City* theory.

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Planning as *magma*. Suggestions from the work of Cornelius Castoriadis

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Abstract
The philosophical work of Cornelius Castoriadis on the imaginary institution of society can inform planning theory today at a juncture of major transitions, unprecedented global urbanisation, multiple crises, and conflict. Planning as magma constitutes a dynamic world of social imaginary significations, which goes beyond plans, legal frameworks, administrative processes, and professional practices. This highlights the political dimensions of planning as thinking and doing interwoven with consensual or conflictual social dynamics, representations, desires, finalities, and affects. Derivative values such as indetermination, infinite potentiality, inexhaustibility, multiplicity, and difference may open paths to self-reflection, self-transformation, and radical imagination. Planning as magma means to elucidate planning goals and orientations, to conceive new social imaginary significations, and to constitute new methodologies, epistemologies, policies, and practices, toward sustainability and justice.

Keywords: planning theory; spatial planning; philosophy; magma; Cornelius Castoriadis

Introduction
In this paper, I find inspiration in the work of the Greek-French philosopher Cornelius Castoriadis to inform theoretical approaches to spatial planning. My emphasis lies on institutions (in the broader sense of the term) and current challenges in times of neoliberal globalisation, multiple crises, and conflict. Planning theory has often identified diversified connections of planning to philosophical and sociological endeavours developed in France around the 1970s, which revolutionised and radicalised social sciences in the context of wider social unrest, and critical dispute (often coined as May '68). Inspiration has been found in neo-Marxist political economy approaches on the right-to-the-city from the work of Henri Lefebvre (Chiodelli, 2013); in poststructuralist approaches on power and governmentality from the work of Michel Foucault (Flyvberg, 1992); or in psychanalysis, desire, and phantasy from the work of Jacques Lacan (Gunder, 2005). I wish to contribute to this thread within planning theory by suggesting ideas and concepts from the work of Cornelius Castoriadis.[1] Drawing from philosophy and psychanalysis, his work, as developed in France in the 1970s and 1980s, revolves around the notion of *institutions* and introduces key concepts such as the *imaginary institution of society*, *autonomy*, and the *magma of social imaginary significations*. I argue that Castoriadis's socio-historical lenses on institutions and radical imagination may provide helpful

[1] Cornelius Castoriadis (1922-1997) was a philosopher, an economist, and a psychoanalyst. Born in Constantinople (1922), lived in Athens (1922 -1945) and Paris (1945-1997). In 1945 he got aboard the ship Mataroa, together with other Greek intellectuals, writers, and artists, in order to escape from anti-communist prosecutions at the outbreak of the Greek Civil War, and migrated to Paris where he spent the rest of his life. He was the founder of the group and journal Socialisme ou Barbarie (1949-1966); worked as an economist at the Organisation for Economic Co-operation and Development OECD (1948-1970); joined the psychoanalytic group Quatrième Groupe; and worked at the Faculty of École des Hautes Études en Sciences Sociales (EHESS). He died in 1997.

insights into institutional approaches to planning with particularly relevant theorisations. We can derive notions that elucidate our understanding of today's critical challenges, transitions, and crises. They also suggest theoretical paths to imagine creatively beyond current trends and limitations.

Neoliberal planning paradigms

In a recent article, Benjamin Davy, Meike Levin-Keitel and Franziska Sielker (2023) suggested to 'cherish the diversity of planning' and spoke of 'plural planning theories' as necessary to deal with huge present transitions and a simultaneity of overlapping crises. In recent decades, in the era of neoliberal globalisation, planning has shifted orientation in its objectives and content. The accelerated flows of capital, people, goods, and information, the radical technological innovations, the unprecedented pace of global urbanisation, and, gradually, a succession and acceleration of crises mean sweeping changes for space and society. The emergence of global governance networks and the gradual expansion and dominance of a neoliberal ethos and policies have decisively influenced planning. *Spatial planning* emerged in the 21st century as a dominant planning paradigm in much of Europe (Gunder, Madanipour and Watson, 2018a, p. 5) through these sweeping changes intertwined with globalisation, albeit with significant variations among regions and contexts. Ideas and planning practices of growth, competitiveness, entrepreneurship, governance, strategic selectivity, and flexibility gradually formed a planning paradigm, which stood in contrast to 20th-century planning paradigms in the West, the East, and the South. Spatial planning, as a neoliberal planning paradigm, diffused globally throughout a post-modernist, post-socialist, and post-colonial world as a reform, good practice, and a factor in shaping planning cultures (Sanyal, 2005).

Institutional turn and planning

Not without reason, institutions and institutional reforms got inextricably entwined with the era of globalisation. In the political arena, terms such as 'institutional reforms', 'institutional change', 'institutional adjustment', and 'institutional development', became an integral part of discourses and policies initiated by international organisations and national governments (Verma, 2007). Planning literature speaks of a 'changing relationship between the institutions of power and the society and environment' (Gunder, Madanipour and Watson, 2018a, p. 2) while also mentioning an *institutional turn* (Moroni, 2010) in intellectual thought. This turn 'recognizes the centrality of institutional framework when dealing with social and economic phenomena' (ibid., p. 275) and has profoundly influenced planning theory (Salet, 2019). André Sorensen (2018) writes thoroughly about *new institutionalism*, highlighting the importance of theorising institutions to planning theory. He mentions different (and often overlapping) branches of institutional approaches, including (a) rational choice institutionalism, which connects to New Institutional Economics; (b) historical institutionalism, which emphasises path-dependency and embeddedness, development pathways, origins and genealogies, endogenous, and incremental process; and (c) sociological institutionalism, which connects to organisational sociology and brings to the fore social norms and conventions, cultural and normative settings, even legitimating myths. As can be noted, the notion of *institution* can have multiple meanings and contents. Following Douglass North's well-known distinction (North, 2010), an institution may refer to formal rules (written law, property rights, regulations) or informal settings (conventions, codes of conduct, unwritten laws, customs, and habits) that shape social behaviour, as well organisations (political, economic, social, religious, educational bodies) or groups of people bound by a common cause. A series of questions arise here. How does planning theory and practice change, towards where, and why? How is planning reformed, and why? How do planning reforms link to broader institutional transitions?

Reflecting on Cornelius Castoriadis

Initiating from the problematisation of *institutions*, in the most profound sense of the term, I will delve into the work of Cornelius Castoriadis on the *imaginary institution of society*, with a particular focus on the notions of the *social imaginary significations* and the *magma*. The philosophical universe of Castoriadis's ideas and concepts has been the focus of interest for an ever-growing body of philosophical, psychanalytic, and political science literature (Adams, 2014; Kioupkiolis, 2012; Ktenas and Schismenos, 2018; Memos, 2014; Schismenos, 2013; Stavrakakis, 2002; Tovar-Restrepo, 2012). In this text, I revisit some of Castoriadis's original works (translated into English) from a planning perspective while building on relevant theorisations in Greek-language planning literature (Mantouvalou, 2020; Triantis, 2020a). My theoretical endeavour wishes to contribute to the discussion on planning theories in the AESOP congress 'Game Changer? Planning for Just and Sustainable Urban Regions', held in Paris in 2024. At the same time, this pays homage to Cornelius Castoriadis, who developed his philosophical thought while living in Paris.

Reading Castoriadis: the magma of social imaginary significations

Social imaginary significations

In his seminal work, The Imaginary Institution of Society, Castoriadis challenges the functionalist-economic causal explanations of the creation of institutions, arguing that the understanding of institutions cannot be limited to fulfilling a society's functional needs. He argues that society's needs are historically and culturally constructed and that societies invent and define new ways of fulfilling their needs or creating new ones. Besides functionalist-economic explanations, he claims that societies also get instituted in imaginary ways. Institutions contain, all along, an imaginary part together with a functional part:

> The institution is a socially sanctioned, symbolic network in which a functional component and an imaginary component are combined in variable proportions and relations. (Castoriadis, 1975/1987, p. 132)

From this perspective, institutions are not abstract ideas discovered by society at any given time but, instead, are created each time by society, and are constantly under transformation through time. Castoriadis identifies the source of institutions in what he names *social imaginary*. This stands for the capacity each society has for creation. The *social imaginary* is this element

> which gives a specific orientation to every institutional system, which overdetermines the choice and the connections of symbolic networks, which is the creation of each historical period, its singular manner of living, of seeing and of conducting its own existence, its world, and its relations with this world, this originary structuring component, this central signifying-signified, the source of that which presents itself in every instance as an indisputable and undisputed meaning, the basis for articulating what does matter and what does not, the origin of the surplus of being of the objects of practical, affective and intellectual investment, whether individual or collective. (ibid., p. 145)

The *social imaginary* contains the *social imaginary significations*. The very existence of any society is interwoven with the creation of *social imaginary significations*. These hold together a society and answer fundamental questions the society poses to itself, its needs, and the world. Individuals (being always part of their society) incarnate or challenge the social imaginary significations of their societies. Castoriadis clarifies that *social imaginary significations* are *not* simply individual representations, ideas, or thoughts, but something much deeper which links

to the society, the individual, and even the *psyche*/soul. These form an integral part of what makes individuals members of society by all different means – from social learning to conflict:

> Significations *are* obviously not *what* individuals represent to themselves, consciously or unconsciously, or *what* they think. They are that by means of which and on the basis of which individuals are formed as social individuals, capable of participating in social doing and representing/saying, capable of representing, acting, thinking in a compatible, coherent, convergent manner, even if this be in the form of conflict. (ibid., p. 366)

Elsewhere, in the collection The Rising Tide of Insignificancy (texts: The Greek and the Modern Political Imaginary, and Culture in a Democratic Society), Castoriadis insists on the deep and complex theorisation of the social imaginary significations, and distinguishes a threefold role, which refers to representations, desires (or finalities), and affects:

> The role of these social imaginary significations […] is threefold. They are what structure the *representations* of the world in general, without which there can be no human beings. […] Second, these significations designate the *finalities* or ends of action; they dictate what is to be done and not to be done, what is good to do and not good to do. […] Thirdly, and it is this point that is undoubtedly the most difficult to discern, these significations establish the types of *affects* that are characteristic of a society (Castoriadis, 1996/2022, pp. 167-8).
>
> Signification […] is not a simple matter of ideas or representations, for it must gather together – bind in a form – representation, desire, and affect. (ibid., p. 272)

Subsequently, understanding a society's *social imaginary significations* is key to understanding society itself and its institutions. In different societies and times, social imaginary significations are different. This means that even similar institutions may have a different meaning as they link to different significations:

> Apparently similar 'institutions' can be radically other, since, immersed in another society, they are caught up in other significations. (Castoriadis, 1975/1987, p. 368)

For instance, when writing about capitalism in Western societies, Castoriadis identifies the centrality of the economic imaginary signification (ibid., p. 363). The institution of a capitalist society provides that *commodity* becomes an imaginary signification of crucial importance. As stated in Anthropology, Philosophy, Politics (The Rising Tide of Insignificancy):

> No one has ever seen a commodity: one can see a car, a kilo of bananas, a meter of fabric. It is the social imaginary signification commodity that makes these objects function in a commercial society. (Castoriadis, 1996/2022, p. 151)

The economic imaginary signification of the commodity links to capitalist *affects* such as the 'perpetual restlessness, constant change, a thirst for the new for the sake of the new and for more for the sake of more (ibid. 169). Nonetheless, although dominant, the economic signification is not the only one. In The Crisis of the Identification Process (The Rising Tide of Insignificancy), Castoriadis identifies two central significations that are in principle *antinomical* to each other: the capitalist, economic signification on the one hand, and, on the other, the signification of individual and social autonomy:

> On the one hand, there is the signification of the unlimited expansion of an allegedly rational alleged mastery over everything, nature as well as human beings. This signification corresponds to the capitalist dimension of modern societies. On the other hand, there is the signification of individual and social autonomy, of freedom, of the search of forms of collective freedom, which correspond to the democratic, emancipatory, revolutionary project. (ibid., p. 171)

At the same time, every society maintains the capacity to creation: *radical imagination* and the *social imaginary*, which is again theorised in ontological and psychanalytic terms:

> There is the radical imagination of the psyche – namely, perpetual upsurge of a flux of representations, of affects, and of desires, all three indissociable each from the others. (ibid., p. 145)

In turn, the notions of *radical imagination* and the *social imaginary*, along with the *antinomical* significations and conflict, the representations, the desires, the affects, and the idea of *autonomy* can further be elucidated through the notion of *magmas*.

> Every society creates its own world in creating the significations that are specific to it. Indeed, it creates a magma of significations. (ibid., p. 167)

The logic of magmas

Castoriadis introduces the notion of *magma* in The Imaginary Institution of Society. Although the term is mentioned earlier in the book, in the final chapter named Social Imaginary Significations (section i, The Magmas), he expresses his will 'to go beyond merely negative ontology and open up a path (or several paths) in order to think what is without confining ourselves to saying how it is not be thought' (Castoriadis, 1975/1987, p. 340). He then provides a theoretical conception of the magma:

> A magma is that from which one can extract (or in which one can construct) an indefinite number of ensemblist organizations but which can never be reconstituted (ideally) by a (finite or infinite) ensemblist composition of these organizations. (ibid., p. 343)

We can here mark some values of the magma, such as ontological positivity, openness, and indetermination. Another value he insists on is *multiplicity*. In that case, multiplicity is not conceived as a sum of singularities but rather as constituents inextricably assembled, interwoven, or bundled together:

> We have to think of a multiplicity which is not one in the received sense of the term but which we mark out as such, and which is not a multiplicity in the sense that we could actually or virtually enumerate what it 'contains' but in which we mark out in each case terms which are not absolutely jumbled together. Or, we might think of an indefinite number of terms, which may possibly change, assembled together by an optionally transitive pre-relation (referral); or of the holding-together of distinct-indistinct components of a manifold; or, again, of an indefinitely blurred bundle of conjunctive fabrics, made up of different cloths and yet homogeneous, everywhere studded with virtual and evanescent singularities. (ibid., p. 344)

In another point, Castoriadis explains his choice to employ magma as a metaphor, thus bringing to the fore values such as motility, liquidity, contingency, impetus, and alternation:

> [In the magma] there are flows that are denser, nodal points, clearer or darker areas, bits of rock caught in the whole. But the magma never ceases to move, to swell and to subside, to liquify what was solid and to solidify what was almost inexistent. (ibid., p. 244)

In a later piece of his work, The Logic of Magmas and the Question of Autonomy, Castoriadis (1983/1997) revisits the notion of magmas. He underlines the different logic that magmas have in relation to ensemble theory and mentions initial experimentations with other terms such as cluster [amas] and conglomerate before concluding with *magma*. He then specifically defines magma by the five following properties (ibid., p. 297):

Properties of magmas

M1	If M is a magma, one can mark, in M, an indefinite number of ensembles
M2	If M is a magma, one can mark, in M, magmas other than M
M3	If M is a magma, M cannot be partitioned into magmas
M4	If M is a magma, every decomposition of M into ensembles leaves a magma as residue
M5	What is not a magma is an ensemble or is nothing

Source: Castoriadis, 1983/1997, p. 297

Derivative values from these properties are, respectively, an 'indefinite potentiality', an 'inexhaustibility of modes of being (and of types of organisation)', an 'impossibility of separation', and an 'inexhaustibility of decomposability' (ibid., pp. 297-8). Among them, Castoriadis marks as most important and decisive property M3, namely that a separation of a magma is impossible and irrelevant. Two more theorisations are of particular interest to this paper. First, the 'absolutely universal' theorisation of magmas, which allows us to think about how the logic of magmas can apply to different epistemological fields and contexts: 'We can call magmatic every non-ensemblistic-identitary mode of being/mode of organization that we encounter or can think of' (ibid., p. 298). Second, the persistent clarification that the magma's indetermination is not a 'state of ignorance' or a 'statistical situation' but a possibility for creation:

> No state of being is such that it renders impossible the emergence of other determinations than those already existing. […] It is creation, namely, emergence of other determinations, new laws, new domains of lawfulness. (ibid., p. 308)

The quest for 'the new' and for 'creation' is crucial for Castoriadis and allows for political connotations. What becomes evident is that the notion of *magma* has a profound *political* content, which links to *radical imagination* and the *imaginary institution of society*. A central argument, which comes back in various wordings throughout Castoriadis's work, links *magma* to the *social imaginary significations* and the institution of society/the world. From this perspective, the *magma of social imaginary significations* is inextricably interwoven with the *doing* (*ποιείν/πράττειν*) and the *representing/saying* (*παριστάνειν/λέγειν*) of any given society, feeding pretty much everything from the soul and personal existence and behaviours to social cohesion and law legitimacy.

> The institution of society is what it is and as it is to the extent that it 'materializes' a magma of social imaginary significations, in reference to which individuals and objects

> alone can be grasped and even simply exist. Nor can this magma be spoken of in isolation from the individuals and the objects that it brings into being'. (Castoriadis, 1975/1987, p. 356)
>
> The institution of society is in each case the institution of a magma of social imaginary significations, which can and must call a world of significations. (ibid., p. 359)

Castoriadis' notion of the society's institution refers to processes of continuous transformation through complex and unequal social dynamics and 'an undetermined number of particular ends' which moves on implicitly and is not overdetermined by any superior structure or power – although sometimes perceived as such:

> The institution operates implicitly, is intended as such by no one, is realized through the pursuit of an undetermined number of particular ends, which are present and can be presented only in the social sphere, […] which subsequently prove to be overdetermined by this central signification, in the process of being instituted. The latter thus allows itself to be grasped, after the fact, as the non-real condition of the real coexistence of social phenomena. (ibid., pp. 363-4)

Within this philosophical universe, Castoriadis develops the idea of *autonomy*,[2] adding a distinct thread to similar theorisations within philosophy and political science. Although an approach of Castoriadis's idea on social and individual autonomy falls out of the scope of this paper,[3] I am interested in marking *autonomy*'s connection to *magma*. It is through the notion of *magma* Castoriadis enters the concluding chapter of the Imaginary Institution of Society to introduce the concepts of a *radical imaginary* and an *instituting society* – namely an *autonomous* society that institutes itself. In the ending sentence of his seminal book, he writes:

> The self-transformation of society concerns social doing – and so also politics, in the profound sense of the term – the doing of men and women in society, and nothing else. Of this, thoughtful doing, and political thinking – society's thinking as making itself – is one essential component. (ibid., p. 373)

This idea of autonomy is necessarily democratic, tragically risky, and essentially political. Autonomy is an 'opening', rather than a closure,

> a 'radical rupture, an ontological creation, the emergence of societies that put into question their own institutions and significations – their 'organization' in the most profound sense of the term. (Castoriadis, 1983/1997, p. 310)

The notion of a free and reflective society that *creates* its own institutions through *radical imagination* is central to Castoriadis's idea of *autonomy* and the notion of *magma*. Castoriadis names this radical, revolutionary notion of autonomy as *self-institution* (*αυτοθέσμιση*), *self-constitution* (*αυτοσυγκρότηση*), or *self-transformation* (*αυτομεταχσηματισμός*), in opposition to *heteronomy* and beyond the notion of *self-organisation* (*αυτό-οργάνωση*). What I want to stress is that the conception of a self-instituting, autonomous society is possible precisely because its institution materialises a *magma* with all these values mentioned above: 'indefinite

[2] Coming from the Greek word αυτονομία=autonomy and αυτόνομος=autonomous [αυτό/auto=self and νόμος/nomos=law], meaning one who has/makes their own law.
[3] Castoriadis is frequently mentioned as the 'philosopher of autonomy'. See: Kioupkiolis, 2012.

potentiality', 'inexhaustibility of modes of being (and of types of organisation)', 'impossibility of separation', multiplicity, indetermination, and so on. This point serves as the connecting link to issues of planning.

Selective influences on planning theory

Castoriadis's thought has been distinctively influential in various disciplines and social fields, academia, and activism, even to those interested in space and planning. Ideas about space, place, and the *City* (Polis) can be found in various parts of his work. For instance, in the subchapter The Philosophical Institution of Time/The Social Historical in The Imaginary Institution of Society, he theorised space as inseparable from time and rejected any philosophical distinction between them. For him, an important attribute of space is *difference*: 'If there were no *place*, not *topos*, how could what is different exist?' (Castoriadis, 1975/1987, p. 191). And further on: 'Space is the possibility of the difference of the same from the same without which there is nothing at all' (ibid., p. 194). Moreover, in the part Polis of The Rising Tide of Insignificancy (among others), Castoriadis employed the notions of *political imaginary* as essentially interwoven with a democratic society and the political institution of the City, also bringing to the fore issues of public and private spheres, and citizenship, having as reference the Athenian classical democracy.

Although Castoriadis's concerns were far from planning theory and his work does not directly mention planning, influences from his work can be traced down to various planning contexts and traditions. Jean Hillier (2005, p. 276) recognised Castoriadian thought among theories that 'have been rooted in what are fundamentally transcendent notions' along with those of Habermas, Lacan, Zizek, and Lefebvre). In Latin American contexts, a body of literature has found inspiration in the concepts of *social imaginary* and *autonomy* to explore the prospects of autonomist urban planning and management. Marcelo Lopes de Souza (2000) links these notions to examples of radical urban management, conflictual decision-making, and participatory budgeting in Brazil. Alexandre Bomfin (2019) turns to Castoriadis's idea of radical imagination to discuss the notion of a 'spatial imaginary'.

In South-European contexts, architect-planner Maria Mantouvalou – herself part of Castoriadis's social circle in Paris and Athens – has introduced Castoriadian ideas in her (Greek-language) work. In a text about the problematics of city centres, social inequality, and cultural difference, Mantouvalou (1996) employed Castoriadis's threefold distinction of public and private spheres, namely the Athenian *oikos* (private sphere), the *agora* (private/public sphere), and the *ekklesia* (public sphere) (Democracy as Procedure and Democracy as a Regime from The Rising Tide of Insignificancy), to discuss the changing socio-spatial organisation and public-private relations in European city centres. From a South-European perspective, she subsequently, advocated for urban policies and planning that maintain and foster social diversity/difference and cultural heterogeneity.

In her more recent text, Institutions, 'Overturns', and Stakes of Spatial Planning (2020), Mantouvalou further implies two connections between planning and Castoriadian thought. The first builds on the discussion on *institutions,* emphasising the catalytical influence planning may have on everyday life, ideas, social values, perceptions, cultures, administration, and institutions – in the broader sense. In times of neoliberal globalisation and the dominance of the capitalist social imaginary, she theorises spatial planning and planning reforms as a catalyst to wider institutional overturns and broader social changes (namely the neoliberal institution of the society), as entwined to factors that contribute to a continuous process of educating, changing, and transforming people and their relations. The second one reflects on the notion of

magma of social imaginary significations and reads it in parallel to the notion of *palimpsest* (a concept also used in urban design and planning), which links to values of multiplicity, diversity, co-existence, openness, and interweaves individuals and groups with particular places, social-historical layers, and social imaginary significations. She claims that the notion of planning as a *magma of social imaginary* significations highlights the political dimension of planning and brings to the fore social dynamics that either work together or are in conflict with each other. The magma ought to be understood along with the notion of creation and may elucidate the need for critical and reflective actions and the perspectives of the potentially new.

In dialogue with Mantouvalou's theorisations, I explored how the Castoriadian thought may enrich our understanding of spatial planning and institutions (Triantis, 2020a). I examined planning transitions in a post-socialist East European context, by focusing on fieldwork in Albania as a paradigmatic case study, to explore the interrelations of changing planning cultures and practices with institutions, social dynamics, and the production of space. I then attempted to summarise my research findings and theorise about planning in the era of neoliberal globalisation by reflecting on the work of Cornelius Castoriadis. My research particularly discussed the changing *social imaginary significations* of the post-socialist era. As became evident, the 'restitution' of private property, privatisations, the prevalence of exchange values, and the penetration of free market relations tended to render the *commodity* and *private property* as social imaginary significations of supreme value, guiding the transition towards the capitalist, neoliberal institution of society (Triantis, 2018). Various social and cultural norms and settings got destabilised: land and property relations, land use, organisation and management, the public and the private, what is socially accepted and what is not, individual and collective affects, needs, and desires, social problems and objectives, the very meaning of family and kinship, state, economy, and labour – all the above were changing in the whirl of the transition. At the same time, new significations were created (e.g. growth, competitiveness, entrepreneurship, development, consumption), and new social subjects were being formed, also shaped through trans-local networks of communication, information, technology, education, migration, and labour. These have been significant qualitative changes between space and society (Triantis 2020b), supported by institutional reforms but, in fact, referring to broader institutional transitions.

In this troubling, transitional context, spatial planning emerged as a contested field and a stake in institutional reforms and overturns. Understanding spatial planning as *magma*, following the Castoriadian thought, meant going far beyond planning reforms, the making of laws and administrative frameworks. This meant understanding planning as a dynamic, inseparable, indefinite, indeterminate, and inexhaustible entity of global trends and local particularities, discourses, perceptions, experiences, social dynamics, formal and informal practices, governance patterns, power relations, formal institutional settings and unwritten laws, customs, and relations of trust, and imaginary significations – along with their social and historical layers and in time and fragments from past eras. Within this magmatic condition, planning was understood, on the one hand, to virtually normalise – *in terms of normativity and normality* (Triantis, 2020a) – capitalist, neoliberal imaginary significations around land and property development along with broader and deeper social and institutional transformations. On the other hand, this magma contained contradictions across different geographical scales that permeated policies, perceptions, and social practices also including planning alternatives: From informality or conflict to critical reflection and the creative challenging of dominant imaginary significations.

Suggestions on the imaginary institution of planning

I will conclude with two suggestions that attempt to link the selective reading of Castoriadis's work on The Imaginary Institution of Society to planning theory. If we admit that planning is an institution, we may follow the Castoriadian thought to argue that, pretty much like other institutions, planning is instituted in imaginary ways. As should be noted, these are initial thoughts that would require further elaboration.

Suggestion 1: Revisiting planning imaginary significations

As academic literature has shown, planning is an institutional apparatus that links to diversified values and imaginaries (Gunder, Madanipour, and Watson, 2018a). In countries of the West during the post-war era of the 20th century, planning was intertwined with the Keynsian welfare state, redistributive policies, liberal democracies, and centralised state authority, and imaginary significations of modernisation, rationality, scientific efficiency, productivity, order, gendered divisions and social stratifications. Planning in the former socialist countries of the East formed an integral part of centralised economic programming and bureaucratic state authority, much more due to the limitations on private property. It was entwined with imaginary significations quite similar to the Western ones, while also associated with state provision and socialist ideas of equality, and social justice. Planning in formerly colonised countries of the South was assembled with colonial oppression, racial discrimination, orientalism, the transfer of Western institutional settings, and the imaginaries of Westernisation, modernisation, rationalisation, and Europeanisation.

In the era of globalisation, spatial planning emerged as a dominant planning paradigm, coined with neoliberal, capitalist imaginary significations of the commodity and the private property as supreme values, privatism, commodification, free market growth, consumption of natural resources, entrepreneurship, and competitiveness (Cahill *et al.*, 2018; Dardot and Laval, 2010/2017). Planning became a 'carrier' of neoliberal agendas (Davoudi, 2018), by introducing a neoliberal ideology and ethos through tools like public land privatisations, laissez-faire policies, city marketing, Urban Development Projects (UDPs), Public-Private Partnerships (PPPs), and entrepreneurial spatial management (Baeten, 2018), gradually transplanted across the globe. In this neoliberal context, spatial planning has often normalised certain principles, objectives, typologies, and modes of spatial organisation, development, and governance, along with commodity relations and the economic imaginary significations with which these are interwoven (Triantis, 2020a). This normalisation has been twofold. First, in terms of *normativity*, as spatial planning shapes rules, development, and building regulations and restrictions, it often translates to binding or guiding policies, legal documents, and maps. Second, in terms of *normality*, as spatial planning tends to create norms that serve as socially accepted principles, values, and standards for the organisation, development, and management of space. In this way, spatial planning contributes to the gradual change of deeper relationships between space and society, its representations, desires, and affects. To paraphrase Margaret Thatcher's infamous saying about economics: Planning could be a 'method; the object is to change the heart and soul'.

Yet, in the 21st century, threads of theory and practice question the legacies of this post-modernist, post-colonial, post-socialist, and profoundly neoliberal world. Suggestions to decolonise planning imagination (Miraftab, 2018), feminist and queer approaches, ecological and post-human theorisations, and also post-neoliberal manifestos like *Common* (Dardot and Laval 2019), *Care* (Care Collective, 2020), and a Green Democratic Revolution (Mouffe, 2022) open up new horizons to planning theory and practice. Following Castoriadis's notion of *social imaginary significations*, these 21st-century evolutions can be understood to be in principle *antinomical* to dominant neoliberal planning paradigms. From this standpoint, we could revisit

planning imaginary significations, in terms of representations, desires, and affects. Such an approach would possibly open up several paths to autonomous creation – doing, and thinking – in the Castoriadian magmatic sense of radical imagination and democratic self-transformation.

Suggestion 2: Planning as magma

Since the end of the 20th century, in much of Europe and other parts of the world, ideas about communicative and collaborative planning (Healey, 1997) have had a major impact on planning theory and practice. By drawing on Jürgen Habermas's notion of *deliberative democracy*, they were focusing on consensus building, the reconciliation of diverging agendas, the democratisation of planning processes, and the promotion of citizen participation. More recently, these theories have received criticism, which questioned the meaning and content of consensus insofar as this ignored power relations, exclusions, and structural limitations. Today, in times of multiple crises, armed conflict, rapid digital and material transformations, and a plurality of truths on the internet and social media, planning meets the challenges of goals and orientation, social legitimacy, post-truth validity, and multiple methodological and epistemological biases (Davy, Levin-Keitel, and Sielker, 2023). In post-colonial, global South contexts, and elsewhere, notions of *insurgent planning* and *insurgent citizenship* (Holston, 2008; Miraftab, 2018; Watson, 2012; Swyngedouw, 2018)) have explored alternatives of radical planning practices and new paradigms of citizenship which could be counter-hegemonic, transgressive, inclusive, emancipatory, and imaginative (Miraftab, 2009). Other threads of planning theory have turned to the thought of political theorists and philosophers like Alain Badiou, Ernesto Laclau, Chantal Mouffe, and Jacques Rancière to discuss neoliberal planning and governance as depoliticised, *post-political*, and *post-democratic* (Davoudi, 2018; Swyngedouw, 2018). A distinct thread (Metzger, 2018; Ploger, 2018) has specifically found inspiration in the work of Chantal Mouffe. Beyond the critique on consensus building and the post-political condition, these theorists have drawn attention to Mouffe's suggestions towards a democratically productive *agonism*, *agonistic pluralism*, a *conflictual consensus*, or a conflict-oriented model of radical democracy.

These notions of agonism, conflict, insurgency, and emancipation in a 'world struggling with a lack of consensus' (Davy, Levin-Keitel, Sielker, 2023, p. 2) can be understood as supportive of a need to *re-politicise* planning and bring us back to Castoriadis's political notion of *magma of social imaginary significations*. Castoriadis's logic of *magma* constitutes an open-ended path of thinking and doing with political connotations. Planning as a *magma* responds to an indeterminate, infinite, inexhaustible multiplicity of interwoven elements: ideas, discourses, perceptions, politics, social dynamics and practices, processes, and politics, from the local to the global level. It is much broader than laws, plans, and administrative frameworks. The elements that constitute the *magma* are not stable or equal; they do not hold the same power or significance and do not necessarily coexist in balance. They are bundled with power relations and unequal social dynamics; they contain contrasts and contradictions, contingencies, tensions, or even conflicts.

Interestingly enough, Mouffe (2022) recalls Castoriadis's notion of the *social imaginary significations* to develop her argument on the power of common *affects* and *passions* and the necessity of *identification politics* for what she names the 'green democratic revolution'. She acknowledges the critical affectual power of the democratic social and political imaginary, and she claims that ideas need to connect to what Castoriadis calls *social imaginary significations* to wake up affects that fuel politicisation and urge people to act. To understand planning as *magma* refers to an open-to-change scheme in which we can identify certain characteristics but

cannot prescribe its future course. Although influenced by dominant actors or power structures, it is not necessarily predetermined by them. It is rather created within social reality through multiple, complex, heterogeneous, and unequal social dynamics, being consensual or conflictual. Understanding planning as magma elucidates its political dimensions, which are inherent in (and constitutive of) democratic conditions. It further creates conditions for self-transformation through critical self-reflection, self-constitution (as *autonomy* rather than *heteronomy*) radical imagination, political thinking, and doing.

Conclusion

In this paper, I tried to show that the work of Cornelius Castoriadis can critically enrich our understanding of planning at a juncture of major transitions, unprecedented global urbanisation, multiple crises, and conflict. In a post-modernist, post-socialist, post-colonial, and profoundly neoliberal world we can rethink planning theories and practices as inextricably intertwined with institutions, broader ideas and conceptualisations, social dynamics, as well as different experiences of countries and regions across the globe. Castoriadis's notion of *magma* speaks of a dynamic and indefinite universe of *social imaginary significations*, which shapes on a case-by-case basis the institution of society with unique characteristics relevant to representations, desires, finalities, and affects. *Planning as magma* goes beyond plans, legal frameworks, administrative processes, and professional practices. It constitutes an open-to-change, under constant transformation, incremental, and complex outcome of multiple, heterogeneous, unequal, yet interconnected, interwoven dynamics: imaginaries, ideas, concepts, policies, social dynamics, and practices, which either work together or confront each other. This highlights the political dimensions of planning as thinking and doing. Derivative values such as indetermination, infinite potentiality, inexhaustibility of modes of being and types of organisation, multiplicity, difference, and vigorousness may open up future alternatives of creative questioning of norms and assumptions, self-reflection, self-determination, and radical imagination. In times of poly-crisis and perma-crisis, rapid global urbanisation, climate vulnerability, rising inequalities, and neoliberal governmentalities, to think of institutional change and institutions (in the most profound sense of the term) means challenging dominant planning imaginaries and paradigms. Planning as magma means to elucidate values, goals, and orientations, to conceive inclusive, post-colonial, feminist, post-human imaginary significations, and to constitute methodologies, epistemologies, policies, and practices, opening up a horizon of alternatives toward sustainability and justice.

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Subjective (social) well-being in the neighbourhood: A conceptual exploration

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Abstract

This paper explores the relationships between place and subjective well-being. Despite the substantial growth in studies on this topic across multiple disciplines, there is still a long road ahead for urban planning theory. This work introduces a novel conceptual framework that illustrates in a structured manner the interrelations between place and subjective well-being, uncovering the mediating role of sense of place and highlighting the transformative potential of micro- and small-sized businesses in shaping urban neighbourhoods' sense of place. The study emphasizes the significance of understanding subjective well-being at the neighbourhood scale for informed urban planning and policy making, contributing to the theoretical discourse on people-place relations.

Keywords: subjective well-being; neighbourhood; sense of place; social well-being; micro and small-sized businesses

1. Introduction

People and places are inseparable. Gifford (2014, p. 543) argues that an individual's whole life is interlaced with a place; "we are always nested within layers of place." This complex and dynamic relationship has bidirectional links: places are shaped by people, while where individuals spend their time shapes them (Ballas, 2021; Gifford, 2014; Healey, 2005; Stephenson, 2010). According to Gehl (2010, p. 9), "First we shape the cities – then they shape us."

The first part of this process (people shaping places) is often visible and direct. Consider this hypothetical scenario: one morning, you pass by a street that rarely crosses your path, a degraded district in the city. A few decades ago, several stores related to garment production would pile up here, and people would walk down the street. However, those days belong to the past. Today, this area is soulless and filled with shutdown stores, a void in the periphery of some busy streets. A month later, your journey takes you down this street again -it's always morning; as soon as the sun sets, you do not even think of passing from here. A pleasant change catches your eye: a pizzeria operates in one of the corners. Two people -most likely employees- are standing outside the store, chatting beside a couple of food counters decorated with a few flowers. A few weeks later, you return to the street with a couple of friends. This time, a crowd is enjoying their pizza, music is playing in the background, and people are chatting and laughing. This is not the gloomy street you used to know, and you notice that a handmade jewellery store has popped up across the street. This simple narrative underlines one of the many ways people may transform a place, change its meaning, and redefine an area's milieu.

On the contrary, how places shape people may be more difficult to comprehend. Often, these effects might be indirect, invisible or it might take time to show. The interaction between people and places may take multiple forms and be determined by numerous factors. Moreover, the experience and perception of this interaction may vary among individuals or social groups (Relph, 1976; Tuan, 1975), making it highly subjective. In recent years, the impact of place on people's subjective well-being (SWB) is increasingly recognized (Aslam and Corrado, 2012; Ballas and Dorling, 2013; Morrison, 2007). Fleury-Bahi et al. (2017) suggest that a person's satisfaction, expectations, and hopes, as well as frustrations and experiences, vary along urban contexts. Similarly, Ballas (2021) argues that the level of SWB is affected by the dynamics developed between personal circumstances, social interrelations, and geographical characteristics in proximity.

Exploring the relations between people and places within the urban setting is -or should be- at the limelight of the urban planning and development field. Yet, for years, the people dimension received limited attention (Gehl, 2010; Stephenson, 2010). Traditionally, the spatial dimension of subjective well-being, the focus of the herein study, has been overlooked (Morrison, 2007). Only recently have studies started to investigate this relationship, while only a paucity of these interweave the discussion simultaneously around the constructs of place, sense of place, and subjective well-being (Erfani, 2022). Ergo, there is an opportunity to delve deeper into the nuances of people-place relations. As we live at the peak of the urban era, we argue that investigating subjective well-being within the framework of cities, specifically the neighbourhood scale, is considered crucial for urban planning theory, applications, and policy making.

This paper investigates the relationships between place and subjective well-being. The theory synthesis methodology is adopted (Jaakkola, 2020), aiming to articulate the links and propose new relationships among these constructs. The relevant literature streams are critically reviewed, unravelling the key components of the concepts that allow the identification of common grounds. In attempting to achieve integration across the theories, concepts are being decomposed and re-approached through new theoretical lenses. The domain theory in this paper is subjective well-being. The method theories relate to the themes of place, sense of place, and micro- and small-sized businesses (MSBs) as components of the urban landscape. Despite today's expanded connectivity between people, we focus on the urban neighbourhood scale, as it remains the immediate socio-spatial context for most individuals (Agnew and Duncan, 1989).

More precisely, we explore the interrelations among the constructs of urban *'place'* and *'subjective well-being'* -we argue that the former impacts the latter*, 'sense of place'* -we argue that it has a mediating role in the aforementioned relationship- and *the role that MSBs play* -we argue that they have transformative potentials in developing sense of place at the neighbourhood level. The study introduces a conceptual framework, synthesizing and theorizing previously unconnected pieces of knowledge. Therefore, this work is expected to contribute to theoretical debates, expanding the frontiers of knowledge related to people-place relations and stimulating debates on the role of MSBs in urban form and development. It is expected to shed light on the spatial dimensions of SWB in cities, and ultimately facilitate planning and development processes and outcomes. The ethos guiding this endeavour is reflected in Jane Jacobs' 1958 article "Downtown is for People": "There is no logic that can be superimposed on the city; people make it, and it is to them, not buildings, that we must fit our plans." (Jacobs, 1958, p. 127).

2. From 'Space' to 'Place'

The notion of *'place'* became central to geography and urban studies during the 1970s. The perceptible difference between abstract space and the specific place is the meaning that people ascribe to the former, thus, transforming it into the latter. A 'meaningful location' could also be an alternative description for place. According to Cresswell (2004, p. 7), these are the locations that people are "attached to in one way or another", embodying their relationships with the world. Agnew (1987) argues that every space interpreted as a meaningful location is constructed by three structural elements: (a) *'location'*, i.e., where the place is; (b) *'locale'*, i.e., its palpable dimension where social activities develop; and (c) *'sense of place'*, which he interprets as the subjective and emotional attachment with a place. Locations exceed their tangible dimension and gain meaning when people give them names, identify them, and represent them (Cresswell,

2004; Gieryn, 2000). Thus, places are recognized in terms of their physical elements, but they also have a social and a psychological dimension as they can be "interpreted, narrated, perceived, felt, understood and imagined" (Soja, 1996, cites Gieryn, 2000). As Casey underscores, a "place brings with it the very elements sheared off in the planiformity of site: identity, character, nuance, history" (Casey, 1997, p. 14).

Cities, the "centers of meaning" according to Tuan (1975, p. 156), perfectly embody the concept of place as they are possibly the only environments created exclusively for human use. The motivation driving their development is the organization and facilitation of people's everyday lives. Cities are formed by smaller scale units, the neighbourhoods. This construction is considered one of the most important scales of research and intervention in urban studies and other place-related disciplines, constituting the "optimal level of abstraction" (Lewicka, 2011, p. 212). This is evident as a great amount of research related to people-place themes refers to the neighbourhood scale (Giuliani, 2003; Hidalgo and Hernández, 2001; Lewicka, 2011, 2010). According to Hallman, "a neighborhood is a limited territory within a larger urban area where people inhabit dwellings and interact socially" (Hallman, 1984, p. 3). Lee et al. define them as "social constructions named and bounded differently by numerous and diverse individuals" (Lee et al., 1994, p. 252). The above approaches imply that in neighbourhoods we found social connections and networks, attributes inherent also to the notion of community (Chaskin, 1997).

Accordingly, when hearing the word *'community'*, most people possibly understand that it refers to a concept incorporating a territorial dimension (i.e., the built and natural environment, but not limited to that), a social dimension (i.e., the people who live, work or are active in this setting), as well as the ongoing interactions between these two (i.e., the links, flows, and networks that develop) and the processes of collective actions (Farmer et al., 2016; Wilkinson, 1991). In fact, according to most definitions, three basic assumptions must apply to refer to a human community: first of all, it requires a group of people who are involved in interactive activities; second, these activities are expected to take place within the framework of a geographic territory; and third, often enough the involved people share some common values, beliefs or behaviours (Hillery, 1955). Even though the notion of community can be variously interpreted and understood, especially as we currently live in a globalized and virtually interrelated world that could situate the territorial element under dispute, it is our strong belief that the territorial dimension is present in every kind of human communities, even if not perceived in a traditional fashion.

Synthesizing the above, the current study approaches the *'neighbourhood'* as a concept that denotes *proximity*, *compositionality*, and *community*. *Proximity* is a spatial dimension that can be understood in both objective and perceived terms. The term *compositionality* reflects the unique mosaic of a neighbourhood where the "juxtaposition of the dissonant" (Massey, 1997, p. 213) and the similarities co-exist. It may refer to a variety of things, including the built and natural environment (e.g., the architectural style and infrastructures, the environmental characteristics, etc.), and the socio-economic environment (e.g., the demographic composition, the accessibility to jobs and services, the social networks and the alterity). It may also refer to the cultural or intellectual composition or other identity-related characteristics that infilter a place, as well as the composition of different narratives about it. The *community* represents the dynamic entity of people that formulates through the ongoing social interactions, the networks, and the flows formatted while at a place and in interaction with the place itself. The neighbourhood can often be experienced differently, at different times by different individuals or social groups.

3. Exploring Sense of Place

As mentioned above, the concept of *'sense of place'* is inextricably linked to the construct of a meaningful location, given that each place is related to people and their ability to produce and consume meaning individually and as communities. While an acknowledged phenomenon (Duggan et al., 2023), it remains a nebulous one as there is yet no universal consensus on the definition and theory behind it (Nelson et al., 2020; Williams, 2014), or whether there is meaning to measure it (Shamai, 1991). It could be loosely described as the multidimensional attitude people hold towards a place and the emotional bond they form with it (Guthey et al., 2014; Lewicka, 2011; Nelson et al., 2020; Rajala et al., 2020; Relph, 1976). Nonetheless, this remains a broad and abstract description of the concept. Despite its complexity, the dynamic and subjective nature of sense of place becomes apparent. It is anchored in the individual's and collective sensory and cognitive experiences and develops over time (Relph, 1976; Shamai, 1991) and in relation to time (Jackson, 1995). According to Tuan (1975, 1997) the experiential processes a person undergoes at and with a place serve as the paths for the development of emotional bonds with it. However, it is argued that sense of place is not limited to that.

Datel and Dingemans (1984, cites Shamai and Ilatov, 2005) emphasize that people, either consciously or unconsciously, ascribe to localities all sorts of complex meanings, symbolic representations, and attributes, and the amalgamation of all these represents sense of place. Entrikin (1997) and Eisenhauer et al. (2000) illustrate the mediating role of the cultural dimension in the experience of a place and the social phenomenon that it is, highlighting the impact of collective narratives in the formulation of sense of place. Often, it is not just an individual's experience but responds to a shared structure of feelings that are shaped and reshaped among groups and generations (Pred, 1983). As people change so does the way they make sense of place (Anderson, 2004). Following the approach of the social construct of space, some studies (Allen et al., 1998; Rose, 1995) argue that it is crafted through power and inequality. Considering that places can serve as means of inclusion and exclusion (Madanipour, 2015; McGregor and McConnachie, 1995), separating 'us' from 'others', the experience of a place and thus sense of place differentiates for 'us' and 'others'.

Sense of place is different from 'genius loci' – the spirit of place, though closely related. Genius loci denotes the character that a place has while sense refers to the perspectives and bonding a person develops about a place and its spirit (Meetiyagoda et al., 2024). At the other end of the spectrum, we find the concept of 'placelessness' introduced by Relph (1976). This concept represents the lack of any such bond with a place that, according to Relph (1976), is caused as a result of standardized landscapes that lack distinctiveness and authenticity and are subjugated by a homogenizing effect (e.g., suburbia). The intellectual discourse around the topic becomes quite perplexing as scholars often use the term sense of place interchangeably with that of place identity, place dependence, and place attachment (Duggan et al., 2023; Nelson et al., 2020). However, the recent literature recognizes them as three separate dimensions that clarify the essence of the overarching notion of sense of place and are often used to measure it (Domingues et al., 2021; Jorgensen and Stedman, 2001; Nanzer, 2004).

The concept of *'place identity'* was introduced during the 1970s in environmental psychology, defined as "a substructure of the self-identity of the person" (Proshansky et al., 1983, p. 59). According to Proshansky it is shaped in relation to people's physical environment and involves their "conscious and unconscious ideals, beliefs, preferences, feelings, values, goals, and behavioral tendencies and skills" (Proshansky, 1978, p. 155). This definition highlights the impact of a place's (and its attributes) interpretation on an individual's identity. Brown-Saracino

and Parker (2017) approaches it as "a collection of attributes or an identity assigned to a place, and as a collective self–understanding that rests on a particular locale". This stresses further the interplay between self-identity (or collective) and the perception of a particular place. Places may reflect a particular aspect of a person's (or a group's) identity (Anderson, 2004): given that an individual's self-identity develops around conscious (and subconscious) beliefs, interpretations, and evaluations of oneself, place identity constitutes an aspect of a person's identity (Nanzer, 2004). From the above emerges that place identity is found at the intersection between a person's (or group's) identity and the perceived understanding and interpretation of their surrounding environment. This convergence is the output of the experiences of a person (or a group) that involve interaction with a place. As the interaction changes the sense of place identity may change too (not necessarily in a positive way). At the neighbourhood scale, elements that may contribute to the formation of its identity could be the built and natural environment, the infrastructures, the residents, and their activities, as well as the meaning they produce, the institutions, and the commercial entities operating in the area, but also the memories and the narratives about the neighbourhood.

'Place dependence' responds to the more functional dimension of sense of place (Meetiyagoda et al., 2024). The notion reflects the connections and dependency developed with places on the basis of the activities, behaviours, and goals they facilitate (Jorgensen and Stedman, 2001; Stokols and Shumaker, 1982). Places are evaluated as important in accordance with the conditions they provide that enable and support these specific uses, goals, etc., and their ability to adequately provide these specific uses (Nanzer, 2004; Schreyer et al., 1981). Place dependence primarily focuses on whether a particular environment enables individuals to accomplish their objectives more effectively in comparison with known alternatives (Nanzer, 2004; Suntikul and Jachna, 2016). Inextricably this concept introduces comparability. To a degree, people's assessments of whether a place can support their choices and goals are made compared to other existing alternatives (Dameria et al., 2020; Nanzer, 2004; Stokols and Shumaker, 1982). Lastly, *'place attachment'* reflects the affective dimension of sense of place and constitutes a "complex, multifaceted concept" (Farnum et al., 2005, p. 3). According to Tuan, (1997, p. 159), "attachment of a deep though subconscious sort may come simply with familiarity and ease, with the assurance of nurture and security, with the memory of sounds and smells, of communal activities and homely pleasures accumulated over time". Low and Altman (1992), assert that place attachment is generated and maintained through interactions with the environment and affected by interconnected biological, environmental, psychological, and sociocultural processes. It may emerge individually or collectively through spending time in places and engaging in deeper local relationships (Bonaiuto et al., 1999; Cuba and Hummon, 1993; Suntikul and Jachna, 2016). Therefore, the length of residency influences the sense of place attachment (Bonaiuto et al., 1999).

4. Subjective Well-Being Beyond the Individual Level and the Impact of Place

Traditionally, subjective well-being (SWB) was appraised as an aspatial conception. However, multiple studies have challenged this view over the past decades, highlighting the role of place-related determinants (Aslam and Corrado, 2012; Ballas, 2013; Morrison, 2007). In fact, the inclusion of the spatial dimension in models has been found to enhance their explanatory power (Brereton et al., 2008; Oswald and Wu, 2010). According to Diener (2006), SWB encompasses all the different cognitive evaluations -positive and negative- people make over their life and its aspects, being an "umbrella term" that despite its "subjective" character its manifestations can be objectively observed. In the same fashion, the Organisation of Economic Co-operation and Development (OECD) argues that SWB is taken to be "good mental states, including all of

the various evaluations, positive and negative, that people make of their lives and the affective reactions of people to their experiences" (OECD, 2013, p. 10). OECD identifies demographics (including geographic information and urbanization), material conditions, quality of life indicators, and psychological dimensions as the broad categories of variables that could be impactful to the levels of one's well-being.

According to Manderson (2005), well-being is socially contingent, which implies a geographical dimension given that the immediate social context of people's lives is found in geographical proximity (Agnew and Duncan, 1989). Multiple efforts have been conducted to understand SWB beyond the individual level. Keyes (1998) referred to social well-being which is described as the perceptions of people related to the quality of their relationships with others, their neighbourhood, and their community. More recent literature identifies it as community well-being (CWB). According to Lee and Kim (2015), it refers to a group of people who are geographically linked. Often, they are the dwellers in a locality, such as a neighbourhood or a city, involved in direct or indirect interactions with each other (Lee and Kim, 2015). Whereas, one might assume that it is simply the aggregation of individual well-being assessments or simply a "sum of community and well-being" (Lee and Kim, 2015), social well-being is a multifaceted and complex construct. It captures individuals' well-being as nested within social and community contexts (Rollero and De Piccoli, 2010), incorporating numerous factors that can have a direct or indirect effect, while also impacting one another (Christakopoulou et al., 2001).

Chanan (2002, cites Lee et al., 2015, p. 2) highlights the complexity and abstraction that the notion involves:

> When community is identifiable with a locality, CWB/the quality of community life is intimately connected with: how well that locality is functioning; how well that locality is governed; how the services in that locality are operating; and how safe, pleasant and rewarding it feels to live in that locality.

Another indicative approach is that of Wiseman and Brasher (2008, p. 358), according to which community well-being is "the combination of social, economic, environmental, cultural, and political conditions identified by individuals and their communities as essential for them to flourish and fulfill their potential". This definition also emphasizes the contextual character of the notion defined by the population's evaluations and the place. Atkinson et al. (2017) argue that the conceptualization of community well-being must incorporate the experience of "being well together", i.e., the shared resources and experiences, that could include the provided services and the availability of public open spaces, the sense of safety and belonging, etc.

It becomes apparent that the concept is linked to a territorial dimension. However, only a scant of studies have investigated the connection between sense of place and subjective well-being beyond the individual level. Whereas, there are studies that indicate a connection between well-being and place influenced by the territorial sense of community (Albanesi et al., 2007; Cicognani et al., 2008) or place attachment (Afshar et al., 2017; Rollero and De Piccoli, 2010), there is still a long road ahead. Recently, there has been some effort in studying the links between sense of place and SWB (Li et al., 2023; Ng et al., 2022).

5. The Role of Micro- and Small-sized Businesses

It is universally acknowledged that micro- and small-sized businesses (MSBs) (together with medium-sized) constitute the 'backbone of the economy', representing around 90% of businesses, 60% of employment, and 50% of GDP at a global level, according to the World Trade Organization (2016). Apart from their role as drivers of economic development (Davidsson et al., 1995; Kuratko and LaFollette, 1987; Ribeiro-Soriano, 2017), they could also be described as cornerstones of the community and social life (Ayalu et al., 2022; Farmer et al., 2016; Fitzgerald and Muske, 2016; Ribeiro-Soriano, 2017). Additionally, the crucial role of MSBs in achieving the 2030 Agenda for SDGs has been identified by the United Nations General Assembly through adopting Resolution (A/71/279). The key idea underpinning this statement is that since MSBs and the networks of people involved, nurture and thrive within urban neighbourhoods, they inescapably contribute to shaping their visual and cultural identity while forming gathering places that enhance social bonds, capital, and resilience (NALCAB, 2019; Oldenburg, 1999).

Research suggests that when defining a neighbourhood's identity, its commercial character is equally, or even more (Felder and Pignolo, 2018), important to its residential qualities (Meltzer and Capperis, 2017). Being the "visible face of the neighborhood" (Zukin et al., 2016, p. 12), local MSBs have a fundamental role in driving the place's identity, but also reflecting it (Deener, 2007; Lloyd, 2010; Martucci, 2019). People often spend considerable time in businesses consuming products or services. This is particularly prevalent in locations with a shortage of public spaces appropriate for socializing (Gomez et al., 2015), adverse conditions (such as prolonged winter periods), or places where spending time in public spaces is not the norm. Consequently, they have a highly symbolic role as parts of the urban landscape. Local businesses contribute to residents' feeling of ownership (Martucci, 2019), generate a sense of familiarity and belonging (Duyvendak, 2011; Martucci, 2019), and add to the social and cultural capital of the neighbourhood (Fitzgerald and Muske, 2016; Oldenburg, 1999).

Further, Jacobs (1961) argues that local businesses are sources of safety and security in the neighbourhood ("eyes on the street") while Oldenburg (1999) places them at the heart of democratic participation and community vitality. Felder and Pignolo (2018, p. 98) concretely presented the essential role of local businesses in the neighbourhood: "shop's visible and concrete presence materializes the struggle over place identity". Their symbolic and highly important role within a neighbourhood is also reflected in the inclusion/exclusion regulatory power that businesses can have on a given street or area (Clark, 2003; Jacobs, 1961; Lamont and Molnár, 2002; Martucci, 2019; Zukin and Kosta, 2004). Messages are being communicated via aesthetic choices, prices, and the provided products, reflecting in that way specific lifestyle standards (Martucci, 2019). This results in excluding specific social groups from accessing the provided resources and opportunities in the given location (Clark, 2003; Lamont and Molnár, 2002; Zukin and Kosta, 2004). Additionally, the way MSBs are nested in the urban form, (e.g., pedestrian-oriented streets or drive to plazas or malls) also impacts the health and well-being of individuals (Gomez et al., 2015).

6. From Place to Subjective Well-Being: Developing a Conceptual Framework

The preceding discussion leads to the development of a conceptual understanding, framing the relationship between subjective well-being (SWB) and place. In attempting to advance this discourse, the study proposes a four-dimensional conceptual framework (Figure 1). This framework serves as an explanatory medium, unravelling the integration across the concepts and revealing their multidimensionality. It illustrates the relationships between place and SWB in a structured manner, facilitating understanding and unfolding what is expected to be

discovered through empirical research. In the proposed framework, each concept plays a distinct role. The first dimension, namely the place - neighbourhood, is presented as the explanatory element of SWB (second dimension) which in turn, is approached as the response phenomenon in the framework. The third one represents the micro- and small-sized businesses (MSBs) and illustrates the transformative potentials they have over sense of place (moderating role). The fourth dimension is sense of place. We argue that the relationship between place and SWB is mediated by the construct of sense of place through its three manifestations. It is approached as a holistic concept that glues together the concepts of place, SWB, and MSBs.

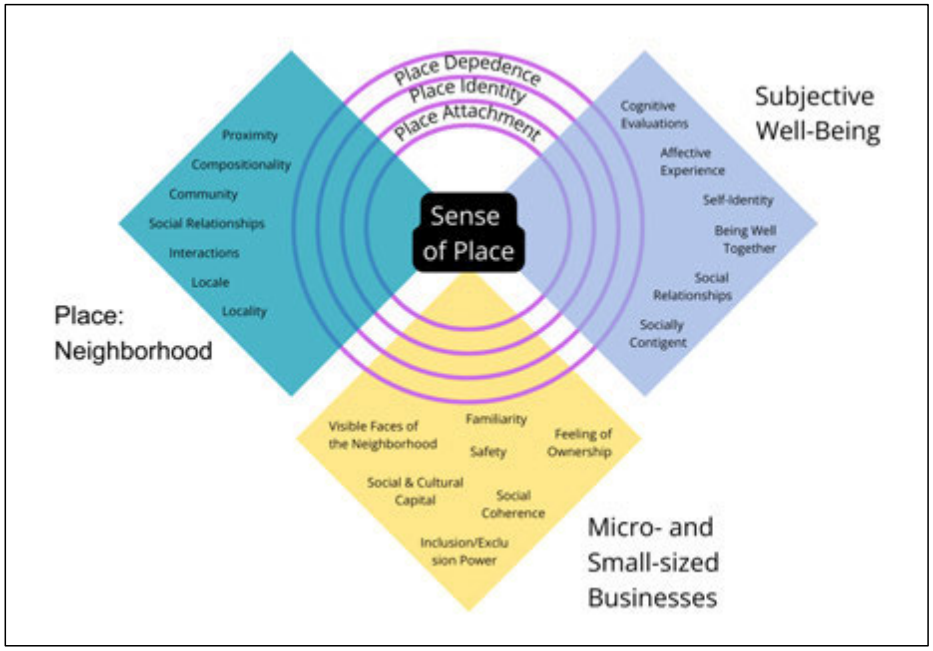

Figure 1. The proposed four-dimensional conceptual framework illustrates the interrelations between SWB, Place, Sense of Place, and MSBs

Neighbourhood (place) and sense of place: Our analysis identifies the neighbourhood as a meaningful location (place), denoting proximity, compositionality, and a sense of community. This suggests that the neighbourhood may influence sense of place, affecting how people relate to its environment and with each other. A neighbourhood's unique mosaic -encompassing a blend of the physical and built environment attributes and the social fabric- shapes people's cognitive understanding and experience of the place (meanings, feelings, narratives), thus, cultivating a distinct place identity (Bernardo and Palma-Oliveira, 2016). The physical and sensory engagement of individuals with their surrounding environment elicits perceptions and appreciations of its uniqueness (or lack of it), and the aesthetic, environmental and/or geological value (or lack of it). Through synergies and active participation, communities reshape places leading to an enhancement of the sense of attachment to the community and to place (Fang et al., 2016; Silberberg et al., 2013). Place attachment is further enhanced through the spatial opportunities provided for building networks and engaging in interactions with both other people and with the neighbourhood's environment (Fang et al., 2016; Low and Altman, 1992). Additionally, the duration of residency and the time spent engaging in activities in the

neighbourhood contribute to the sense of safety and belonging, leading to the enhancement of place attachment (Brown and Raymond, 2007; Lewicka, 2011; Mesch and Manor, 1998). The attributes a locality holds, creating the premises for individuals and groups to functionally satisfy their needs and accommodate their lifestyles may determine the sense of place dependence. Place dependence may also be subject to enhancement or retardment by the neighbourhood's capacity to support individuals or social groups in achieving their goals and engaging in desired and diverse activities (Jorgensen and Stedman, 2011). Collectively, the above neighbourhood dimensions may contribute to a strong (or a weak) sense of place, as well as satisfaction with the neighbourhood.

MSBs and sense of place: The proceeding analysis provided an overview of how MSBs can significantly influence all three manifestations of sense of place. The obvious is the functional aspect of MSBs that can support everyday life and the fulfilment of needs. This may influence the sense of place dependence by determining how well the neighbourhood meets the residents' needs and supports their lifestyles. Additionally, MSBs have a symbolic role and may play a distinctive role in formulating the sense of place identity in a neighbourhood. As indicated through literature, MSBs determine and act as a reflection of the neighbourhood's identity, cultural and social ethos (Felder and Pignolo, 2018; Martucci, 2019). Further, the symbolic role of MSBs and their impact on place identity is manifested through their inclusion or exclusion regulatory power, influencing who feels included in or excluded from the neighbourhood (Lamont and Molnár, 2002; Zukin and Kosta, 2004). Finally, MSBs contribute to the feeling of ownership and generate a sense of familiarity and belonging in a neighbourhood (Duyvendak, 2011; Martucci, 2019). They are at the heart of community vitality, serving as places where residents interact, strengthening social bonds, and creating shared experiences, while MSBs support the neighbourhood's safety, enhancing in these ways place attachment.

Sense of place and subjective well-being: SWB involves cognitive evaluations of life and its various dimensions and affective experiences. Among the various determinants, SWB is sensitive to place of residency (Aslam and Corrado, 2012; Morrison, 2007). Thereby, an individual's evaluations of their neighbourhood are expected to impact their overall SWB. Evaluation of residential satisfaction involves "residents' attitude toward their living space" and "feelings of gratification from living in a specific space" (Sirgy, 2012, p. 303). It is argued that sense of place affects the levels of SWB both through its influence on residential satisfaction and evaluations related to quality of life, including social life, and through their affective experiences. Empirical evidence (Li et al., 2023; Ng et al., 2022) demonstrates that individuals with a stronger sense of place experience higher levels of SWB. Since place identity constitutes an aspect of a person's identity, it is expected to influence their affective experiences. Further, how well a place accommodates a person's lifestyle, goals, and expectations (place dependence) is expected to interfere both with their cognitive evaluations of life as a whole or aspects of it, and their daily affective experience given that spatial competence relates to people's physical and psychological well-being (Kaplan, 1983). Moreover, SWB is highly affected by the social relationships people develop with their community (OECD, 2007), but also with their physical environment and social structures (Maricchiolo et al., 2020). This extends SWB beyond the individual level. 'Being well together' involves strong community ties which are among the major social predictors of place attachment (Lewicka, 2011, 2010). Inversely, place attachment may increase the willingness to get involved with the community and the neighbourhood (Shamai, 1991).

7. Concluding Remarks

The study of place and subjective well-being poses a challenge due to the complex and multifaceted nature of these constructs. This paper delves into an analysis that contributes to the enhancement of the conceptual understanding behind this relationship, revealing the mediating role of sense of place. Recently, there has been some empirical research investigating the links between place and SWB through the lenses of sense of place. The novelty of the herein contribution lies in the fact that it theorizes and illustrates in a structured manner the interrelations between place and subjective well-being, acknowledging the mediating role of sense of place. Additionally, it introduces in the discussion the transformative potentials of MSBs in shaping sense of place.

These interrelations require to be further investigated on a theoretical level and to be validated at the empirical level. However, it is argued that the development of this framework marks the first step in contributing to the theoretical debates and expanding the frontiers of knowledge regarding people-place relations in urban planning discourses. This framework may also have various implications for the application and policy making of urban planning. Gehl (1987) underscored the significance of urban planning in curating public spaces conducive to social interaction. Through creating the premises for experiential processes and social engagement, the role of urban planning can be pivotal to the development of individual and collective sense of place over time (Cartel et al., 2022; Erfani, 2022), which in turn can enhance subjective well-being at the individual level and beyond. To achieve this, it is considered imperative that a comprehensive understanding of the spatial dimensions of SWB in cities and urban neighbourhoods is achieved.

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Since when has regional planning been vague?

An analysis of textual data from 7 regional master plans of Ile-de-France region between 1939 and 2019

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Abstract

This paper explores whether discursive vagueness has been used for a long time in planning documents, in the case of the Ile-de-France region. To do so, we analyzed seven main regional plans between 1939 and 2019, with the help of textometry. What emerges is a major pivotal moment in the way regional planning is formulated, between the late 1960s and the mid-1970s. Two phases can be distinguished: (1) a "before" phase in which discourse and rules are intrinsically linked, in a normative and regulatory approach; and (2) an "after" phase in which regional discourse aims above all to support the actions of the various players, largely abandoning normativity and the definition of clear rules. We interpret these results as the reflection of a major change in the planning system in France in the late 1960s, as well as an evolution in the way urban planning norms are written.

Keywords: planning discourse analysis, regional planning, Ile-de-France region, planning norms, discursive vagueness

1. Introduction

Recent planning research has highlighted a strategic dimension of plans that had previously been rather overlooked: discursive vagueness (Buhler and Lethier, 2020; Chesneau, 2023). “Discursive vagueness” refers to a series of discursive devices such as the use of concessionary wordings, or the elimination of time and space references. This allows actors, and particularly local authorities, to deal with a subject imposed (often by their central government) without making too strong of a commitment when it is not intended (Kaza and Hopkins, 2009; Buhler, 2021)[1].

Vagueness in contemporary planning discourse may seem paradoxical at first sight, since the plan no longer functions (for some subjects) as a way of saying "what is planned", but as a mean for creating blurred zones, subjects where negotiation and other less "publicized" modalities of action take over (Kaza and Hopkins, 2009). These vague elements of discourse can also be interpreted as ways to maintain room for negotiation in order to avoid conflict with municipalities, landowners and developers (Levy, 2015).

This does not mean that any attempt to plan a city is doomed to end in vagueness. As Charles Hoch (2007, p. 21) puts it: “*plans that say little about how to turn policy into projects may be said to lack means-ends coherence*.” Rather, vagueness is one of the components of the plans' discourse, and its proportion has increased in the case of French local plans since the 2000s (Buhler and Lethier, 2020; Buhler, 2021). From this finding, two questions emerge: (1) is this growing use of vagueness also observed in other national contexts?; and (2 - if we restrict the focus to the French context) for how long these (vague) discursive devices have been in use? In this paper, we address this second question, which calls for a diachronic approach on planning documents themselves.

Indeed, several research originating from the “plans as signals” approach have identified that plans themselves are an ideal material for analyzing discourse and interactions between actors (Hopkins, 2001; Hopkins and Knaap, 2018, 2019). In the context of plan making, and for various subjects, these actors are seen as being able to either: (1) contribute, sometimes fully and transparently, to the discourse setting up, sometimes (2) in a rather encrypted way, or (3) not to contribute at all, in order to retain certain information. Following this theoretical framework, it seems that tracking a series of comparable plans over time enables us to distinguish discursive evolutions (stylistic, lexical …) that reflects institutional and political changes.

Constructing a diachronic reading of plans over a long period of time make it thus possible to test two hypotheses. We can assume (a) that use of vagueness in planning is recent and is explained by governance changes related to the emergence of neo-liberalism in spatial planning; or we can assume (b) on the contrary, that vagueness always has been present in planning discourse, because it is part of the broader genre of institutional discourses in which vague terms and devices are a major component.

To this end, we propose to examine the ways in which discourse is made in regional planning documents on a rather long period of time (80 years) taking as an example the capital region of

[1] The issue of vagueness/fuzziness in urban planning is not entirely new, since it has been the subject of previous developments, essentially focused on the objective of minimizing it during exchanges between planning actors (De Roo, 2007; Porter and De Roo, 2007).

France, Ile-de-France, through a corpus of 7 regional planning documents and their revisions (between the 1939 PARP plan to the latest 2019 SCoT-M).

The regional development plans for the capital region were chosen because they are - in France at least - one of the rare examples of temporal continuity (over a long period of time) in the development of plans that are made at on a comparable geographical scale[2]. These documents have of course changed in form (development plan, master plan) and have been embedded in different political contexts (Saez, 2021). However, these dissimilarities do not prevent their structural proximity: all these documents provide access to a diagnosis, orientations, statements, and arbitrations established among various stakeholders (Chesneau, 2023). The documents (see the list of plans considered in section 2.1) analysed in this paper are therefore comparable with each other. The corpus thus appears consistent and is suitable for examining how planning discourse have evolved over time in the Ile-de-France context using systematic tools, such as textometry.

In this paper, we will first present the methodology developed, including a detailed presentation of the corpus considered and the method developed. Then we will present the results obtained which convergently signal a major change in the regional planning discourse between the end of the 1960s and the mid-1970s. We then organize a discussion around several analytical hypotheses, with a specific focus on the long-term evolution of the written formulation of the “norm” in regional plans.

2. Corpus and Method

To answer the question of how long has vagueness been in use in the planning prose, we have compiled a series of urban planning documents that have shaped regional planning in the Ile-de-France region, from the first development plan for Paris region (PARP) in 1939 to the “Schéma de cohérence territoriale de la Métropole du Grand Paris” (SCoT-M) in 2019. Although urban planning in France dates back to the Cornudet Acts (1919 and 1924), we have excluded this tradition of municipal planning from our analysis and focused exclusively on regional plans and schemes[3].

2.1. A corpus of seven urban planning documents

The first plan considered is the " Plan d'aménagement de la région parisienne" (PARP) of 1939. It was drawn up at the end of the 1920s under the direction of Henri Prost, chief architect and

[2] Naturally perimeters are not exactly the same as the urban region has spread in the meantime.

[3] This series has been extracted from a textual database covering urban planning in the Ile-de-France region from 1919 to 2019. The database contains more than 355 digitised documents, 15% of which have been transcribed. Each town planning document is linked to the preparatory documents and discussions that took place during their preparation. This network of texts is the result of documentary research based on several sources: parliamentary documents published in the *Journal Officiel* (1919-1935), seven inventories of the ministries responsible for planning between 1910 and 1990 (National Archives), archives of the Ile-de-France Regional Council and Internet data for the latest documents. These textual data are currently being deposited on Nakala (IR* Huma-Num) and will soon be available to the public: Chesneau (2024). *Collection: Ile-de-France urban planning corpus 1919-2019*, NAKALA, DOI: 10.34847/nkl.78d52zja.

town planner of the “Comité supérieur de l'aménagement et de l'organisation de la région parisienne" (CSAORP). The two main aims of the plan were to replace the *laissez-faire* approach of the past, and to curb the region's urban growth, which was considered “monstrous”. Five years after its approval, the PARP plan was revised, but the war and the occupation prevented its completion. In 1950, the Minister for Reconstruction and Town Planning, Claudius Petit, presented a major report to the Council of Ministers entitled *Pour un plan national d'aménagement du territoire*, in which he announced the entire policy to be followed until the mid-1960s. Because of the importance of this text and the strong state control of planning at the time, we have considered it to be a quasi-revision of the PARP and have therefore included it in the corpus. The PARP was not revised until 1956, mainly by the urban planner Pierre Gibel, under the direction of Pierre Sudreau, the commissioner for reconstruction and urban planning for the Paris region.

After the election of Charles de Gaulle in 1958, and the establishment of the Fifth Republic, the government prescribed a “Plan d'Aménagement et d'Organisation Générale de la Région Parisienne” (PADOG) but left the existing institutions untouched. The same people who had drawn up and revised the PARP therefore set to work on this new plan. In fact, the PADOG was quickly validated in 1960, in line with the previous plans. One of the main contributions of this plan was to advocate a new form of governance for the development of the Île-de-France region and to encourage the creation of "a single regional authority capable of acting on behalf of both the central government and the local authorities" (Alduy, 1979).

A new team led by Paul Delouvrier created the “Institut d'aménagement et d'urbanisme de la Région Parisienne” (IAURP) in 1960 and the “District[4]” of Paris in 1961. This dynamic led to the drafting of a preliminary two-decade program for the Paris region in 1963, known as the “Livre blanc”, which served as the explanatory memorandum for the third document in our corpus, the “Schéma directeur d'aménagement et d'urbanisme de la région de Paris” (SDAURP) of 1965. In the history of development plans for the Paris region, this master plan represented a major doctrinal shift. The State took the view that it should voluntarily organize the distribution of the population in the region, in particular by creating “New Towns” (“villes nouvelles”). However, it was not officially approved in 1965 and, from a legal point of view, it did not officially abrogated PADOG. It was not officially approved until 1976, under the name SDAURIF, after two failed attempts of revision (1969, 1971).

From the 1980s onwards, planning falls out of favor. Shortly before the 1981 presidential elections, the government decided to revise SDAURIF, whose data were no longer up to date. However, the new government did not take up the initiative and it was not until 1986 that the Ile-de-France region relaunched the project. The Regional Council entrusted IAURIF with this task and, at the beginning of 1989, adopted the regional planning project entitled “Ile-de-France 2000”. Although the 1988 presidential elections did not change the political context, the government of Michel Rocard wanted to assert the predominant role of the State in the development of planning policy in the Ile-de-France region. After a long struggle between the State and local authorities, the SDRIF was finally approved by decree on 26 April 1994.

Following the adoption of a series of major laws between 1995 and 2000 (LOADT, LOADDT and SRU), the 1994 SDRIF was revised by decree in 2005, after it had being criticised as a kind of "super POS" that slowed down development rather than encouraging it. Regional workshops were then organised to bring the State into dialogue with local authorities and major public

[4] Districts are a past form of intermunicipal bodies.

institutions in the Paris region. On the basis of a consolidated draft SDRIF, the public consultation was launched at the end of 2007. However, following the legislative changes introduced by the Greater Paris Act (June 2010) and the Grenelle I and II Acts (July 2010), the "Conseil d'État" issued a negative opinion. Planning objectives, including regional objectives, had changed: the project is not part of sustainable development, to which France had committed itself in Rio in 1992, and the Greater Paris project required a rethink of planning scales.

After several unsuccessful attempts a new revision process was launched in 2011, starting with a consultation process known as the "Regional Territorial Conference". In 2012, the Ile-de-France Regional Council adopted the update of the SDRIF, entitled "*Objectif: Ile-de-France 2030*". As a preamble, the Council drew up a new version of the "Regional Vision", which was presented as "the social project that the Region wishes to build with all its partners, in the near future (tomorrow) and in the distant future (2030)". After receiving the opinions of the State, departmental councils, consular chambers, etc., and a public consultation, the project was adopted in autumn 2013 and approved by the Council of State in December 2013.

Finally, the 7th document in the corpus is the "SCoT Métropolitain" (2019). In the Ile-de-France region, the planning documents architecture was radically overhauled with the creation of the "Métropole du Grand Paris". It is now structured around the SDRIF, the "SCoT Métropolitain" and several intercommunal land-use regulatory plans called "PLUi". From a legal point of view, the SDRIF is binding on the SCoT-M, which must be compatible with it, but in practice the revision of the SDRIF in 2013 has been delayed by the current preparation of the SCoT-M. Although the boundaries are different, the planning issues overlap. In order to be able to cover the end of the 2010s, we have considered this plan[5].

Over these 80 years, these documents have changed form, from development plans to master plans, and have had different types of speakers. What they all have in common, however, is that they present, each in its own way, the broad development guidelines for a more or less distant future (5, 10 or 15 years, depending on the period), based on a diagnosis. Despite their differences, they have a number of similarities (Pincemin, 2012) and their "polyphony" (Perrin, 2004) can be seen as a means of collective representation.

2.2. Textometric reading

We used textometry for analysis the corpus, with the help of TXM software. The advantage of this software is that it can be used to describe and compare the formal characteristics of words and/or sentence segments and to model diachronic variations within the different partitions of the corpus. The semantic meaning of a theme then emerges from the confrontation between, on the one hand, global views derived from statistical processing (i), and, on the other hand, consultation of local contexts of enunciation, at a finer scale (ii). By combining quantitative and qualitative processing in this way, this method enables the identification of new information that would otherwise be inaccessible to the human eye (Rastier, 2011, p. 13).

Our work is based on this method in order to gain insight into the evolution of planning documents in the Ile-de-France region through a back-and-forth movement between the texts themselves and statistical data. To do this, we'll begin by observing the construction of discourse through the study of sentence components to better understand how writing has evolved in these documents over time. We will then look at their lexicon, in particular pronouns, which show

[5] We have not been able to integrate the SDRIF-E, which is currently being approved.

whether or not a speaker or writer is in charge of the discourse, as well as verbs (all tenses and modes) and common nouns, both of which provide information on the content and description of the elements highlighted in each document.

3. Results

To determine a possible chronological evolution in the discourse of plans, we have partitioned our working corpus into 7 parts (table 1), each corresponding to an urban planning document and, when applicable, its revisions.

Table 1: The corpus of planning documents from 1919 to 2019 divided into 7 groups

Corpus partition	Number of words
PARP and revisions 1950 and 1956	27 844
PADOG 1960	57 349
SDAURP 1965	84 000
SDAU 1976	63 464
SDRIF 1994	84 638
SDRIF 2013	61 887
SCoT-M 2019	103 232

The volume of these texts can fluctuate from one to four times their size, but they are still of a comparable scale, which makes the use of textometry possible. Furthermore, the statistical tools we use take this discrepancy into consideration, as they are based on the relative share of a given graphic form/term category in each document.

3.1 A discourse that becomes increasingly nominal

The analysis by grammatical categories enables us to study the construction of the discourse and avoid a reading guided only by circumstances and the lexicon. Indeed, the lexicon is dependent on current events and the circumstances of a particular period. It carries information – and we'll look at this later – but it is also the product of an era and its events.

So, to begin with, we observed the distribution of the various grammatical categories that make up discourse, according to the documents (i.e. plans) considered. CFA can be used to visualize a collection of numerical data linked to lexical units, generally organized in double-entry tables (also named contingency tables). These tables present words or categories of terms in rows and external categorization modalities in columns, such as year, author, title, category, etc. The CFA then provides a synthetic representation of the vocabulary distribution.

In a CFA, the proximity of a row point to a column point means that there is "an attraction between that row and that column" (Cibois, 2007, p. 28)[6]. Furthermore, "the closer a point is to

[6] All quotations translated by us.

the center, the weaker its attractions or oppositions. When a point is strictly at the center, this means that it is in a situation of independence with all the other modalities" (*ibid*.: 34).

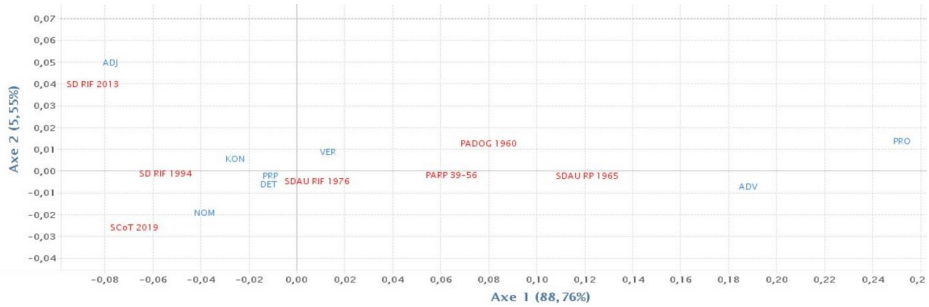

Figure 1: Distribution of grammatical discourse categories by documents (CFA)

We can observe a diachronic evolution in the construction of sentences in urban planning documents, dividing the corpus into two parts (see Figure 1) : on the right of the graph, the years 1939 to 1965 (PARP and its revisions, PADOG and SDAURP) present a discourse with a verbal consistency as evidenced by the presence of verbs (“VER” on the CFA), adverbs (“ADV”) and pronouns (“PRO”), while the years 1994 to 2019 (the two SDRIFs and the SCoT) present a more nominal discourse with an over-representation of nouns (“NOM”), determiners (“DET”), adjectives (“ADJ”), prepositions (“PRP”) and conjunctions (“KON”). The year 1976 (with the SDAURIF plan) stands out as a pivotal year, on the ordinate axis.

The shift from verbal to nominal discourse is typical of the evolution of institutional discourse (Krieg-Planque, 2012). Nominalization is an argumentative tool, presenting the relationship between two terms (noun + noun complement) as necessarily existing. In other words, it imposes a pre-construct, referring to an "object of the world already there, pre-existing the discourse" (Sitri, 1996), and has the "effect of erasing the agent, verbal aspect and modality of the previous statement" (ibid.). This evolution of urban planning discourse thus demonstrates a desire for enunciative erasure (Rabatel, 2004): the discourse is disembodied and no longer carried by a defined speaker or group of speakers.

3.2 A discourse that gradually avoids clear expression of the speaker's identity

This observation is confirmed by the use of subject personal pronouns in the corpus:

Figure 2: CFA of the distribution of personal pronouns by corpus documents

Chronologically, the pronouns *je* and *on* (*you/one* or *we/they/people*) attract the first part of the corpus (1939-1976) to the left-hand side of the graph, while the two SDRIFs (1994 and 2013) are polarized by the pronouns *il*, *Elle*, *Elles* and *Ils (he, she* and *they*) (see Figure 2).

Although axis 2 contributes less to understanding the distribution of pronouns within the CFA, the particular case of the 2019 SCoT leads us to return to the text to observe the uses of the pronoun *nous* (*we*). Thus, the examples below show that the use of *nous* in this part of the corpus does not reflect an enunciative assumption of responsibility but presents a general value corresponding to the population of the territory concerned:

> 'We are all metropolitans, we live at the pace and scale of the Metropolis, we travel through it every day, we live here, work and study there, we take part in cultural or sporting activities elsewhere, and we use all kinds of means of transport to come and go.' [7]

> 'No matter where **we** are in the metropolis, being able to find a job, suitable housing, but also the services, shops and facilities **we** need on a daily basis should be a matter of course.' [8]

[7] The authors' translation for the following paragraph : "**Nous** sommes tous métropolitains, **nous** vivons au rythme et à l'échelle de la Métropole, **nous** la parcourons chaque jour, **nous** habitons ici, travaillons et étudions là-bas, **nous** pratiquons des activités culturelles ou sportives ailleurs et **nous** utilisons pour cela toutes sortes de moyens de transport pour aller et venir."
[8] The authors' translation for : "Quel que soit le lieu où nous sommes dans la métropole, pouvoir trouver un emploi, un logement adapté, mais aussi les services, les commerces, les équipements dont nous avons besoin au quotidien doit relever de l'évidence."

The gradual elimination of 'I' variants, offset by the emergence of more frequent uses of 'we' and 'he/she/it', marks a transition towards: (1) more frequent use of passive voice, as well as (2) more descriptive sentences and (3) pronouns that allow first-person speech without precisely defining the speaker ('we' and related written forms). This last feature is characteristic of institutional discourse, which endeavors to formulate a discourse 'emanating from a collective entity presented as indivisible while being the product of negotiation among various points of view'

3.3 Prescription and rule-setting gradually fade away

To observe this diachronic evolution in greater detail, we have analyzed the use of verbs and common nouns in the corpus.

With regard to verbs, whose lemmas[9] we have observed at least ten times in the corpus - in order to avoid hapax[10] that could distort the results - the calculation of specificities[11] shows an opposition between the PARP, the PADOG and the SDAU RP, i.e., the oldest documents on the one hand, and the SD RIF and the SCoT on the other. The 1976 SDAU RIF again finds itself in an in-between position, close to neutrality. Thus, between 1939 and 1965, we see a discourse with several aspects:

- a cognitive dimension, with verbs such as *foresee, understand, interest, envisage, suppose, justify* or *predict*;
- a discursive dimension, with *ask, detail, decline, indicate, tell, propose, accuse, reveal, etc.*;
- a normative dimension, with *prohibit, authorize, grant, impose, admit, submit, execute, must, should, may, order*.

The following extract illustrates the highly prescriptive and normative form of the plans in the first half of the corpus.

> 'These easements prohibit building or exceeding a certain height, and forbid enclosing properties with anything other than hedges or clear fences that do not obstruct views.' (PARP, 1939, Programme général, chapitre 5)[12]

In the plans for the years 1994–2019, three other dimensions predominate:

- a dimension of action, with the overuse of verbs such as *structure, mesh, protect, undertake, house, irrigate, decongest, artificialize, feed, count, produce* or *manage*;

[9] A lemma is the canonical form, or the dictionary form, of a set of word forms. For verbs, the lemma corresponds to the infinitive form. For nouns (and, in French, adjectives), it's the masculine singular form.

[10] A hapax is a word that occurs only once in a corpus.

[11] The calculation of specificities allows us to observe the distribution of the forms studied in the different parts of the corpus. Specificity is positive when these forms are overused (their frequency is higher than the expected theoretical frequency) and negative when they are underused (their frequency is lower than the expected theoretical frequency) (Leblanc, 2005: 66).

[12] Original excerpt : « Ces servitudes interdiront de bâtir ou de dépasser une certaine hauteur de construction et défendront de clore les propriétés autrement que par des haies ou des clôtures à claire voie ne masquant pas la vue. »

- a dimension of support and "working together": *welcome, involve, support, protect, watch over, associate, caution, accompany, participate, link, connect, contribute* or *mobilize*;
- a more political dimension, involving the enhancement of what has already been done and the continuity of what is planned: *improve, enhance, consolidate, pursue, grow, strengthen, perpetuate, renew, maintain, promote, increase, optimize, promote, evolve, adapt, initiate, etc.*

The following extract is typical of this shift towards a more partnership-based, less prescriptive/injunctive approach to formulating future actions.

> 'The undeveloped land located in Tremblay-en-France, to the south of the airport, is naturally destined to host new world-class activities. It is important that they be developed through a selective location policy, involving the State and local authorities and avoiding premature waste of this regionally important land asset.' (SDRIF, 1994, Annexe : Le Schéma Directeur en huit départements) [13]

The chronological opposition between the two "halves" of the corpus thus seems to reside in the way planning is approached: on the one hand, before 1976, planning was approached from the angle of **prescription and rule-setting**; on the other hand, after 1976, it is a question of **valuing action** - and in particular joint action - and what is **achieved** by the institution.

3.4 Fewer references to objects and concrete items, offset by more themes covered

If we take a closer look at the common nouns overrepresented in the various documents, the same chronological pattern emerges. In the first part of the corpus, we find an overrepresentation of numerical or accounting data (*dwelling, a billion, width, height, m³, year, worker, surplus, purchase, kilometer, inhabitant, building, etc*.). , but also very concrete elements linked to the territory and its issues (*area, municipality, road, development, grouping, hygiene, sewer, evacuation, junk, recycling, core, conurbation, location, aerodrome, industry, center, axis, city, leisure, highway, shore, valley, intra-muros, vehicle, poverty, employment, etc.*). Finally, the notion of rule or norm is also over-represented (*article, non aedificandi, property, program, proposal, government, order*).

The second half of the corpus also presents elements that make up the challenges of regional planning, but these are no longer the same: *university, IUT, heatwave, protection, drought, biodiversity, health, energy, crisis, inequality, mobility, cycling, precariousness, school, climate, green, consumption...* The interests and objectives have therefore shifted towards education on the one hand, and the environment on the other.

A number of factors suggest that a major shift in Ile-de-France regional planning discourse took place between 1965 and 1976. This division into two major halves allows us to identify specific lexical and stylistic features (see Table 2).

Overrepresentation of …	First half of the corpus (1939-1976)	Second half of the corpus (1976-2019)

[13] Original excerpt : Les terrains non urbanisés situés sur Tremblay-en-France, au sud de l'aéroport, sont naturellement destinés à accueillir de nouvelles activités de niveau international. Il importe qu'ils soient valorisés par une politique sélective d'implantations, associant l'État et les collectivités territoriales et évitant de gaspiller prématurément ce patrimoine foncier d'enjeu régional.

… types of sentences	Verbal sentences	Nominal sentences
… pronouns	'Je'	'Il'/'elle' + 'nous'
… nouns	Prescriptive and normative assertions Numerical data, norms, concrete elements	Valuation of partnership action and of already achieved results New topics (higher education, environment)

Table 2: summarized results of regional plans discourse analysis

Apart from the addition of new topics, which seems obvious given the evolving legal framework, the rest of the features indicate a discourse that is increasingly approaching the institutional genre, moving away from more injunctive and regulatory forms. These results indicate that, over the long term, regional planning documents, particularly those relating to the Ile-de-France urban region, are gradually losing their normative substance.

4. Discussion

We assumed two specific hypotheses at the beginning of this paper. First, we assumed that (a) the emergence of vagueness in planning prose could be linked with the emergence of a neo-liberal model of urban planning. However, the results do not seem to support this assumption, as the major change in terms of discourse occurred chronologically earlier, at the end of the 1960s. In the case of the Ile-de-France region, this involved a general overhaul of the planning system, giving a new role to regional planning.

4.1 The changing role of regional planning

The evolution of regional planning discourse in region Ile-de-France seems to chronologically follow the establishment, in France, of a 'hierarchy of standards' in spatial planning through the LOF-Act (1967). This law introduced a new national planning system where two main plans played a central role: (1) the POS[14] (a regulatory urban planning plan) at the municipal level which defined the land-use permissions and prohibitions at the plot scale, and (2) the SD[15], strategic plan made up at the built-up area level.

In 1967, this new division of institutional competences therefore define the municipal level as the scale for town planning rules, leaving a more strategic and guiding role for higher order documents, such as the regional planning documents analysed in this paper.

4.2 Writing the rule: from command to recommendation

At the beginning of the paper we also formulated (b) the idea according to which urban planning, being linked to the genre of institutional discourse, would always have been (at least partly) vague. This second hypothesis also seems rather false. Indeed, the first part of our corpus (1939-1976) shows a planning discourse much closer to legal and political genres than to institutional one.

[14] 'Plan d'occupation des Sols'
[15] 'Schéma Directeur'

As we have seen in our analysis, the rule of law in urban planning describes a norm that "consists in modalising actions by means of obligations, authorisations or prohibitions" (Alland and Rials, 2003, p. 1080)[16]. It should be seen as a set of explicit reference models for action. While obligations, permissions or prohibitions are actions that are at the core of urban planning norms, their development has a social purpose (Weber, 2019). The main objective is to use institutional rules to coordinate the decisions of decentralised actors operating at the local level. Development plans and master plans can therefore be seen as texts that act as 'operators mediating regulatory relations' (Smith, 2018, p. 24). The specificity of this regulation is that it is carried out primarily through texts, in which words encode both a reading of the current state of the city and the expectations of the state with regard to its development (Chesneau, 2021). It is through this agentivity of words that the link between institutions and everyday urban planning practices is established and that negotiations can take place in the event of disagreement (Lascoumes, 1990).

Our results seem to show that the prescriptive nature of the rules set out in them gradually fades over time, and today they are little more than flexible or vague guidelines. This observation leads us to a better understanding of the way the norm is constructed in these different texts by focusing on their characteristics that emerge from our analysis. In our case, spatial planning plays the role of a flexible and strategic framework rather than a document that "says what will be" and would be prescriptive for the lower institutional levels.

An analysis of the plans shows that before 1976, norms were commanding, mandatory and directive in nature - in particular by setting out technical and numerical standards - and aimed to standardise behaviour by resorting to prohibition. After this date, norms evolved towards recommendations. Its aim is to reconcile diverse and even divergent interests. It therefore becomes more conciliatory, flexible and permissive. In a spirit of accommodation, its function is less to achieve quantitative objectives than to recognise the possibility of certain hitherto unacquired rights to be asserted or supported. This is expressed, for example, as follows:

> "**Recognise** a certain number of establishments, currently classified as short-stay, for their actual medium-stay activity, particularly geriatric" (SDRIF 94)[17]
>
> "Each area of the Île-de-France region will be **recognised** in the same way as the major centres, as parts of the city that need to be developed. Because real centralities, points of concentration of greater urban intensity, will have been created, the agricultural, wooded or natural areas of the Île-de-France's peri-urban or rural zones can be preserved. This spatial organisation will offer different ways of living in response to the diverse needs of Île-de-France residents" (SDRIF 2013)."[18]

[16] Original quote : « consiste à modaliser des actions par l'obligation, la permission ou l'interdiction »
[17] Original excerpt : « **Reconnaître** à un certain nombre d'établissements, actuellement classés en court séjour, leur activité réelle de moyen séjour, notamment gériatrique »
[18] Original excerpt : « Chaque territoire de l'Île-de-France sera **reconnu** au même titre que les grandes polarités comme des morceaux de ville à aménager. Parce que de véritables centralités, points de concentration de plus grande intensité urbaine, auront été créées, les espaces agricoles, boisés ou naturels des zones périurbaines ou rurales de l'Île-de-France pourront être préservés. Cette organisation spatiale offrira des façons différentes de vivre en réponse aux besoins divers des Franciliens »

> "Forest identified and preserved under the Forestry Code for its ecological, heritage and/or cultural characteristics. This **recognition** is evidenced by a classification and by strong protection that prohibits any change in land use."[19] (SCoT-M 2019)

The shift that takes place over time shows that the norm is not removed from urban planning documents over the decades, but that it is expressed differently, by erasing pronounced linguistic markers, opening the way to another way of constructing the relationship between urban planning and law.

This transformation took place between 1965 and 1976, at a time when the territorial basis of town planning law was completely changed by the “Loi d’orientation foncière” (LOF). From a legal point of view, this transition from plans to master plans corresponded to the establishment of a hierarchy of rules that was strengthened at the top and extended at the bottom. At the top, the master plan must comply with general rules that apply to the whole of the national territory. These rules are imposed by the “Code de l’urbanisme”, which in 1973 got rid of the provisions concerning building and housing contained in the first “Code de l’urbanisme et de l’habitation” of 1954. Downwards, at the municipal level, land use rules were henceforth set by land use plans (POS). This means that each municipality must define the precise rights attached to each plot of land within its territory, in accordance with the urban policy guidelines set out in the master plan. The corollary of this transfer of powers is that there is no longer any need for the master plan to include a detailed description of the organisation of the urban fabric of each municipality in the region, specifying the purpose of the buildings, the density, the location of reserved areas, etc. It is up to the local authorities to define the rights attached to each plot of land. Ultimately, it is up to the building permit officer to interpret the application of the main principles of urban policy in minute detail.

4.3 Injunctive vagueness or worded texts?

As can be seen, the organisation of the principles of planning law follows an easy-to-understand logic: at the top of the hierarchy are the most general rules and at the bottom the most contingent. The consequence of this organisation is that no text is autonomous; it forms part of a linear structure which, according to François Ost and Michel Van de Kerchove, has become circular over time, based on a tangled hierarchy made up of "strange loops" (1987, p. 183–253). The result is that the higher up in the hierarchy of norms the planning rules are, the less detailed they are. What we have called vagueness could be interpreted as a mark of maturity of planning law, where the norm is not systematically expressed in prescriptive terms.

Paradoxically, this essentially qualitative approach to the norm (i.e. vague language) is nevertheless legally prescriptive. The master plans are binding on the schéma de cohérence territoriale (Scot), the plan local d'urbanisme (PLU), the plan de déplacements urbains (PDU) of the Île-de-France region and the plan métropolitain de l'habitat et de l'hébergement (PMHH), while, as we have pointed out, leaving local authorities a margin of interpretation. If this gradual nominalisation of these texts does not contradict their mandatory nature, it might be because of the principle of compatibility, which requires that the lower rule does not contradict the higher rule. In reality, this legality is assessed in the light of the planning principles and objectives defined in a very comprehensive manner, including the "regulatory" and "cartographic" guidelines that make up the prescriptive provisions of the SDRIF. The master plans can

[19] Original excerpt : « Forêt identifiée et préservée au titre du Code forestier pour ses caractéristiques écologiques, patrimoniales et/ou culturelles. Cette **reconnaissance** est actée par un classement et par une protection forte qui interdit notamment tout changement d’affectation du sol. »

therefore be seen as 'outsourcing' the legal content of the planning guidelines to the municipalities (Sulpice, 2023), as shown by the litigation on this issue (JurisClasseur Collectivités territoriales, 2021).

Although planning law has become increasingly complex over the years, it is still based on the need to control land use in order to better control the dynamics of urban growth in a region, the forecast and planning of housing quantity, and (3) the distribution of economic and other activities over the considered area. Since the Grenelle I and II Acts, this framework has also been directly linked to ecological transition policies, such as land-use planning to reduce land consumption (zero net artificialisation by 2050) and transport needs, or to preserve biodiversity. All of these objectives require the use of quantified measures to reduce (CO_2, hectares of built up area, etc.) or increase (biodiversity, energy savings, etc.), just as the PARP or the SDAU 1965 required the most accurate quantification of building needs at the time.

The hierarchy of norms we have described has undoubtedly had the effect of diluting the current imperatives of ecological transition. As Frédéric Rolin points out, 'the legal cascade effect between the different levels of implementation of the national energy transition policy means that it is simply ineffective in imposing precise targets on urban planning documents'. He adds: "We know that for several decades the Conseil d'État has pursued a policy of relaxing [the relationship of compatibility] between two norms" (Rolin, 2021), a principle that no longer guarantees the prescriptive nature of the norm as such.

5. Conclusion

This textometric study of regional planning documents in the Ile-de-France region between 1939 and 2019 reveals a pivotal moment in their evolution. This change, which took place in the 1960s-1970s, corresponds in fact to the implementation of the LOF, enacted in 1967, which established a comprehensive system of planning documents in France, and imposed the strategical coordination at the inter-municipal level.

The corpus shows a shift from verbal to nominal discourse, as evidenced by the distribution of the grammatical categories that make up discourse, and the gradual erasure of the enunciative endorsement in the documents. We move from a discourse that gives pride of place to the pronoun “I” to one that gives more space to pronouns characterizing the use of the passive, description and vagueness concerning the speaker.

Observation of the lexicon overrepresented in the corpus shows that the pre-LOF period presents, (1) a normative dimension, in the sense that the norm is clearly expressed by precise terms (prohibit, authorize, etc.) together with (2) a more concrete aspect, with lexis linked to measurement, quantities and precise locations.
In the later period, both the action carried out and planned are highlighted and valorized, as well as the joint work involved by the diversity of actors.

All of these results invite us to think that the use of vagueness in the planning prose is primarily linked - in the French case - to the reshaping of the planning system which took place at the end of the 1960s. This seems to better explain chronologically, the emergence of such a discourse register, much better than hypotheses of urban neo-liberalism or of a planning discourse that would have always been vague.

In terms of perspectives, these results invite us to analyze the presence and evolution of vague discourses in other urban and national contexts. To do so, our results show the importance of considering (when conducting diachronic analyses) a set of planning documents, covering various scales. This would make it possible to track the shifts of certain parts of the document (in our case, the most normative, concrete and precise aspects towards the lower level). With this in mind, we follow recent developments reclaiming for analyses of "networks of plans" (Hersperger et al., 2024).

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Reconnecting Planning Theory with Urban Design: Public Space as a Social and Architectural Concern

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Reconnecting Planning Theory with Urban Design: Public Space as a Social and Architectural Concern

Abstract

Today's planning theory is largely procedural and remains abstract in urban design terms even when formally content-oriented, as when treating the just city. The theory reflects Anglo-Saxon weak planning conditions. While this explains the felt need to reinvent the role of planning and its theory, it threatens to break planning theory's tie to *town* planning. Especially, it becomes inadequate for comprehending the workings of architect-led, still powerful and proactive planning organisations. Such exist even where academics contribute to mainstream theory, producing a gap in the understanding of real-world planning among students, practitioners and non-practising researchers. My purpose is to help reintroduce an urban design focus into planning theory, integrating the latter's social scientific interests with an understanding of the social significance of urban design traits.

Key words: planning theory, public space, urban design

1 Introduction

Planning theory, despite its all-inclusive designation and its often procedural or abstract nature, usually refers to town planning (urban planning or city planning) or regional planning (Beauregard, 2020, p.3). The field is dominated by Anglo-Saxon academia, non-Anglo-Saxon planning often being neglected (eg, by Fainstein and DeFilippis (2016, pp.5f)). Along with the professionalisation of the theory and the transformations in planning practice since the rise of neoliberalism, the theory has metamorphosised. Yet, the traditional sense of its research object as involving a professional (rather than just a politically-economically defined) physical-functional aspect should be taken seriously, inter alia, for planning theory to be generally relevant for European planning systems (cf. Newman and Thornley, 1996; ARL, 2024). From this viewpoint, it is problematic that planning theorists tend to restrict their treatment to the planning procedure, focusing on communication and participation, and to abstract or radical social thinking. Nonetheless, despite the changes, planning theory does retain a tie to traditional town planning, helping to distinguish the discipline from, for example, political economy, history and philosophy, at whose crossroads Fainstein and DeFilippis (2016, p.4) situate it. They quite reasonably note that planning is not *only* (rather than not at all) about planning places as it also involves communication et cetera. In any case, many de facto difficulties with the theory's idealism, partisanship and vague generality in respect of urban issues relate to its unclear research object and concomitant unclarities regarding its fundamental research interests.

Nonetheless, there is hardly any return to traditional town planning theory, for example of the British post-war kind (Taylor 1998). Its concreteness and straightforward applicability could not compensate for its lacking comprehension of the socio-economic presuppositions and consequences of suggested solutions. Yet, such naïve technocratic theory coupled with a rationalistic understanding of the planning procedure is not the only possible kind of substantial

planning theory. Already in the 19th century, Ildefons Cerdà presented an elaborate alternative to the separation of societal and design thinking (cf Dovey and Pafka, 2016). Jane Jacobs (1961), for her part, advanced a socially based criticism of the technocratic planning of the time, with far-reaching implications for how to design urban environments. She did this without prescribing the architectural realisation of her planning rules in any detailed manner. Presumably, neither kind of thinking needs to be anachronistically categorised as either planning theory or urban design theory. Could the kind of synthesis they represent, instead, be re-effected today?

While there is no reason to oppose a pragmatic division of work between researchers closer to urban design and those more abstractly engaged in urban issues, for planning theory to preserve its tie to town planning – with an emphasis on both *town* and *planning* –, some noteworthy architectural effects should in most cases, as with Jacobs, follow from theorisation. This seems natural, if the task of planning theory is to 'find a leeway within the larger social structure to pursue the good city' (Fainstein and DeFilippis, 2016, p.4). A lack in the theory's applicability has been perceived by observers (Goosen and Cilliers, 2020). Also, the sordid reflections from the inside on the future of planning theory (Beauregard, 2020, pp.115ff), makes a re-evaluation of its focus urgent. Nonetheless, tying social theorising to design is not trivial. As a gap easily appears between urban design practice and academic reflection on urban conditions due to the nature of the tasks and the highly differing education required, it is particularly important to take *this* challenge, internal to the academic project, seriously in theoretical reflection. Planning theory, however, guarding its social scientific credibility, makes few concessions to the practical interests of urban design. On the other hand, urban design theory, although more down-to-earth, contains societal references in line with planning theory, making a reintegration possible.

There are at least two reasons for the need of a rapprochement between abstractly procedural theory and theory studying or guiding urban design. First, in some countries where theoreticians deal with mainstream planning theory, as in Finland, planning still works in the traditional way, planners being experts in physical planning rather than facilitators. This is hidden from view, inter alia, as researchers currently seldom cite studies done by their Scandinavian colleagues if not available in English (this was not the case only a few decades ago). In any case, for this region, to put it starkly, planning theory does not in fact theorise planning. Instead, it treats the occupationally unestablished and rather marginal domain of (non-architect) facilitators ('interaction planners').[1] This easily results in confusion as students, practitioners and, at least, researchers not practising or lacking a background in architecturally focused town planning may get a false understanding of the nature of local real-world town planning.

Second, even where planning conditions have changed to the point of justifying a new professional identity for planners, the question how urban design solutions affect social life remains. As neoliberalism, with its deregulation and larger space for private initiative, has largely shifted responsibility for urban design to consultants, it has become more difficult to

[1] Such officials were hired for the once ambitious participatory endeavour initiated by the powerful architect-led town planning of Helsinki. Its purpose, to be sure, was to increase the communicative competence and responsiveness of the planning organisation, yet doubtless also to let architect-planners concentrate on their key responsibility, namely town planning (in its long-established sense).

steer planning in a democratically desirable direction. Planning theorists have therefore extended their research into domains like governance, and called for even more radical, participatory forms of democracy to regain control. In contrast, the role of urban design and planning expertise in forming a socially well-working environment has been downplayed to a surprising degree, sometimes even being dismissed as 'expert ideology' (Beauregard, 2020, pp.21, 26). After having lost their trust in the omniscient maestro planner, planning theorists today instead seem convinced of the infallibility of laypeople's views (individual strivings apparently being coordinated by an invisible hand). The impression is that urban design knowledge is regarded as irrelevant for grasping complex, perhaps futile, issues such as how legibility affects the urban experience or how physical-functional and symbolical architectural traits condition daily life and social relations. Here planning theory joins hands with libertarianism.

As a response to the problems of planning theory's one-sided attention to the planning procedure, abstractions and the lacking tie to urban design, the intention here is, first, to explore how planning theoretical concerns may be concretised by connecting them to urban design.[2] Second, to suggest how urban design theory might be more closely brought together with planning theoretical reflection. Tying planning theory to urban design with the help of the concept of public space facilitates the clarification of the existence, status and significance of the urban design problems and knowledge that needs to be confronted. The urban design literature used is P. Panerai et al.'s *Urban Forms: The death and life of the urban block* (2004 [1975]), M. Carmona et al.'s *Urban Places, Public Spaces* (2010), J. and C. S. Tarbatt's *The Urban Block* (2020).

2 Back to Basics: What Kind of an Urban Environment do we Want?

Assuming that planning theorists are still, after all, interested in how to achieve a socially well-working and ecologically sustainable urban environment (rather than just in its political-administrative conditions, in popular planning intervention or in planners' action as facilitators), the burden of proof seems to be on those holding urban design to be irrelevant for planning theory. How could the breaking of the tie between procedural and social theorising, on the one hand, and concrete planning goals, on the other, possibly be justified within this practice-oriented domain? The move taken by those denying the importance of urban design

[2] Texts explicitly containing both viewpoints are not quite as readily available as one might think considering general reflections on the tasks of planning theory in standard introductions. These may mention public space as a key goal 'that planners hold dear' (Fainstein and DeFilippis, 2016, p.12). Yet, eg, Philip Allmendinger (2017) touches on public space only abstractly in relation to politics. In Gunder et al. (2018), it is mentioned in a treatment of the public interest; in an article on justice (by Fainstein) in relation to diversity and favouring the poor; as pertaining to ethnic and racial diversity; finally, in the context of complexity, as a task for actors. In Beauregard (2020), it is brought up once, again in relation to justice. In Fainstein and DeFilippis's *Reader*, public space figures in relation to global uncertainties, the planning procedure and justice. In none of these contexts is it more than fleetingly mentioned nor tangibly related to urban design concerns. A Scopus search (09/05/2024) with the keywords 'planning theory' and 'public space' resulted in 29 hits.

focused planning is essentially one from an interest in expertise to an interest in politics, following from changed assumptions about their respective significance for planning and its results. Communicative theorists suppose that optimal planning results can be achieved by considering all relevant needs and viewpoints, which is secured by the involvement of all interested parties in a procedure ideally approaching an unconstrained dialogue. Post-structuralists find such a belief in open exchange of ideas unrealistic, instead presupposing an agonistic constellation, where it should be acknowledged that actors have fundamentally conflicting interests and unequal resources. In both cases, planners become facilitators (or even, in the latter case, political activists), while substantial planning knowledge, especially urban design related knowledge, is devalued.

Instead of criticising these current planning theoretical standpoints, I shall go straight to a positive defence of the possibility of rejoining planning theory with urban design with respect to social goals. The basic question then is: what kind of a built environment do we want? Disregarding, consequently, the currently popular planning theoretical view that the 'we' is misplaced in the context and that common goals cannot exist, except as meaningless empty signifiers, different levels on which consensus and dissensus can be identified may instead be discerned. One should also be clear about what disagreement means. If a deliberatively democratic ideal is accepted, a common understanding should be based on the best available arguments and knowledge. To present a dissenting opinion, it is not enough, then, just simply to say no.

A problem – here planning theorists' worries must be taken seriously – is that this not only concerns resourceful actors, who need to make their strivings transparent and commonly acceptable, partly by making concessions to what (contra a 'post' view) may, at least in clear-cut cases, be described as the public interest, but also by presenting valid arguments. The same goes for weak actors, whose needs, 'fragile knowledge' and viewpoints must be teased out by benevolent but non-patronising planners or mediators and translated into expert language. Real betterments for marginalised people may still basically require the application of valid urban design knowledge in the face of possible resistance by powerful interests, which seems to be conceded by Susan Fainstein (2018, p.139) in her contribution to the *Handbook*, where, in the context, popular initiative and political struggle is otherwise emphasised.

What, then, are the key characteristics of a commonly desired urban environment? The answer must be conventional not to be controversial: at least, it should be ecologically sustainable and socio-economically well-working, as well as of high aesthetic quality. These purposes are non-distributive in the sense of being general and meant for all. This does not mean that justice would not need special attention, only that before pondering on how to distribute urban goods, one should be clear on what they are. Possibly, though, starting out from the above obvious planning purposes might be held only to postpone the real issue, as planning theorists of a post bent will be quick to point out. Nevertheless, as a starting point for planning and urban design, it is not insignificant to identify such goals as basic. It already outlines what may be conceived as a public interest, thereby refuting the view that everything is contestable. What is further needed is a more precise description of the key goals as well as their status in relation to each other and other possible goals.

As to the first task, 'ecologically sustainable' must certainly mean, at least, an environment that helps mitigate climate change and counteract the reduction of *global* biodiversity (eg, by lessening urban sprawl). To be socio-economically well-working, the built environment must, at least, enable users to be and feel safe, offer different kinds of spaces, both commercial and non-commercial, organised in a functionally and symbolically sensible way, satisfying varying needs and enabling the regulation of social relations (implying a hierarchy of privateness–publicness). An aesthetic environment not only carries artistic intrinsic value but also satisfies the needs for beauty and environmental experiential stimulation of users. As to the second task, the fundamental characteristics of the urban environment must not be regarded as just any goals to be considered but, instead, as forming boundary conditions for each other and further objectives. This does not necessarily mean that the key goals should be satisfied completely, only to a reasonable degree. Again, both the specification of the desired environmental characteristics and the exact extent to which they should be realised leaves space for argument. The point is that there in fact is some political-professional agreement on the prioritisation of planning aims.

The omnipresence of politics and agonistic struggle is not necessarily refuted by conceding such a hierarchical view. At each step of the concretisation of ends and means, there is space for reasoning and, in practice, for bargaining. One should note that conflicts may remain on a basic level. Thus, eco-fundamentalists might, coherently in view of their background understanding, hold that urban development should be halted and society reorganised in a work-intensive rather than energy-intensive manner. Radical critics of capitalism may as consistently claim that the unsustainability of urban development, like socio-economic development generally, stems from capitalistic contradictions that need to be solved before other measures can have any effect. In such cases, academic and political discussion is to be solved on a 'more fundamental' or general level, or one must accept that not all involved may be part of an agreement. This should not leave content-oriented professional action by urban designers or planners without any guidelines. True, part of the political struggle takes place in the theoretical sphere. In any case, advances in theory, even of social, planning and urban design theory, more contestable than natural science backing up requirements to act in an ecologically sustainable way, creates an onus of proof for those challenging it.

3 Public Space and Urbanity

While the focus of and the themes treated by urban design theory vary, public space is central to all the sources used. It is a suitable starting point for reconciling planning theoretical concerns with those of urban design and its theorisation since its vulnerable position in current urban development equally worries planning theorists (cf. Fainstein and DeFilippis, 2016, p.4). A discussion of urbanity, which is both tightly interwoven with public space and central to urban designers, then easily follows. To play a mediating role between the two lately separated theoretical realms, public space should be specified in relation to both its design features and its social properties. As there are many kinds of urban space with variable publicness and other features, threatening to make one particular characterisation appear idiosyncratic, it is appropriate to aim at an exemplar. The street (or square) space in (the centre of) the traditional European city is such an instance, defining a standard recognised by all. It may at the same time

be conceived as the paramount example of the urban in the architectural sense and as the archetypal setting of the urban in the social sense.

In fact, public space has simply been conceived as *the* object of urban design (eg, Cuthbert 2007). This, however, is certainly not literally true, as urban design includes various opposites of the definitively public, namely private spaces, suburban environments and other areas, such as parks and even forests, with varying degrees of publicness. More credibly, the design of urban environments may be contrasted with the architectural task of designing individual buildings or situating them in a rural setting, or in the wilderness, as well as planning on an abstract enough level, which may possibly justify a (partial) disregard of urban design features, even if no such delimitations can be sharp.

As to planning theory, which primarily focuses on urban issues in a more general sense and with varying relevance to urban design and architecture,[3] public space is still a central issue, relating to many social issues such as equal access and freedom of use of the city, or to the privatisation and commercialisation of urban space. There is not only a need to concretise planning theorisation and make it more readily applicable, as pointed out above. Urban designers, often working pragmatically in the crossfire of various needs and demands, may in their turn profit from a theory that systematically reflects on questions of equality, justice, sustainability, et cetera, in relation to specific types of solutions.

To elaborate on the cross-fertilisation of urban design and planning theory, with the prototypical public space of the traditional city serving as a mediator, the essential architectural and social traits of the latter should first briefly be outlined. Architecturally, this public space is formed by its strict delimitation by building walls, ground floors communicating with the street, numerous plots making for small building units, and detailed façades that contribute to a rich architectural impression. In social terms, public space makes up a theatre for various social occurrences that play a symbolic, political and socially integrative role. Although in modern society, political and social life is not wholly dependent on common physical locations, places where people can meet in person still form a backbone of it, as testified by the recent anaemic human existence in forced isolation under a pandemia.

4 Planning Theoretical Concerns: Justice, Plurality and Public Space

Several, perhaps most, of the content-oriented planning theoretical concerns thus require urban design measures to be fully met even when town planning is not (tautologically, in the context) understood in its traditional sense as architecturally focused. Sometimes, however, these actions are trivial from a design perspective in being immediately comprehensible and realisable without any genuine architectural effort despite formally containing a design aspect (eg, the demand to secure spaces for businesses and other activities on the ground floor). Yet in other cases, the link between the goals proposed in the abstract and their architectural realisation is not inconsequential. Everything may then depend on exactly how the physical interventions called for are carried out as to their dimensioning, their detailed architectural-symbolic

[3] Fainstein and DeFilippis (2016, 1) mention characterisations according to its object, that is, 'producing and regulating the relations of people and structures in space' and according to its method, namely, 'the process of decision making as it relates to spatial development'.

properties and their functional coordination with other environmental traits. For this link to be theoretically catered for, an urban design theoretical extension of what today is the preserve of planning theory is needed.

Depending on the viewpoint, this vital connection to urban design holds for both justice and pluralism (or difference), which are both prominent themes in planning theory. Undeniably, in the manner justice is treated in planning theory, the urban design aspect may sometimes be justifiably avoided. For example, the issue whether there is enough subsidised housing to provide for poor people's needs seems a political-administrative question, which might not be an issue for the old-style town planning office. This changes once attention is turned to environmental features, for instance relating to needs specific to less resourceful people (or more important to them), to be spatially integrated with other functions. In her treatment of justice, Susan Fainstein (2018) thus, in her practice-oriented conclusions, touches on design-related aspects of a just urban environment, such as provision of basic amenities in the ground floors of subsidised housing.

The currently salient theme of avoiding segregation, also treated by Fainstein, likewise relates to justice and, at the same time, to pluralism. Non-segregation is brought to the fore on several levels of urban development. Flagrant segregation should be avoided not the least on a regional and district level. Segregation may easily arise under conditions of unequal distribution of income and wealth as some urban areas are generally more valued than others, for example due to assets such as a seashore or lakeshore, parks or architecturally interesting historical surroundings. Once such 'natural' segregation occurs, it may easily take on a self-enforcing character since people who can choose, often prefer to live not only at a location with favourable environmental qualities as such but also at addresses with high status. (Hence, homes with a less attractive location within a valued area might be overpriced from the 'objective' point of view.)[4]

On the micro level, on the other hand, a clearcut form of counteracting segregation, which does not necessarily involve urban design measures, is to mix the forms of tenure of a building, an urban block or a district. (Such methods are also relevant on the level of the whole city, as inserting subsidised housing at least somewhere within affluent areas lessens the extreme one-sidedness of supply.) As environmental psychologists have pointed out, however, it matters in what way different socio-economic, age or ethnic groups are mixed on the micro level of the urban block, as differences in lifestyles might cause tensions, whereas possibilities to meet on 'neutral ground' may enrich local life and benefit everybody. Again, sociologically informed building architecture and urban design might be decisive for non-segregating but diversity-generating planning to be realised.

These points are elucidated by Mokarram Abbas and Bas van Heur (2014), whose research is situated in the context of Palestinian urbanity. It emphasises the importance of spatial organisation for both the persistence of and the possibilities to intervene in perceived social and political problems in town planning by urban design means. The theoretical perspective is that

[4] It is important to note, though, that not all people have the same environmental preferences (not even if the notion of preference is not mixed up with the ability to pay). This calls for balancing the planning objective of levelling differences of a segregating kind with that of creating precondition for urban diversity on the meso-level by a differentiation of districts.

of feminism in relation to women and planning, while the object of study are the socio-spatial features of women's urban life in the town of Nablus, where attitudes towards women's presence in society are conservative. A central issue raised by the authors is what line to take to a culture that is discriminating in some sense, when these features will have an even more oppressing effect if not taken into account (whether out of principle or due to naïve generalisation of Western standards) in designing the environment. In the investigated town, where women prefer small semi-public spaces in which they are better tolerated and less exposed to male control and incivilities, the case studies for the research (including both interviews and observation of the sites) indicate that design features of such spaces, such as walls and vegetation limiting the view from the outside, notably complement formal (not strictly enforced) rules restricting the access of men into the area.

Again, the proposed means, as such, are not especially demanding from an urban design viewpoint once comprehended, although sophisticated architectural thinking in the realisation may add to the success of the spaces. A suitable further planning undertaking might be to provide for such small-scale semi-public spaces all over a city, while one may imagine – without knowledge of the cultural conditions – urban design complementing with the use of feminine symbolism and other traits, perhaps in the end even making female, neutral and male dominated spaces meet to secure the female world ever more safe visibility and influence. Here, of course, the danger of architectural naivety lurks as soon as one deceives oneself with an exaggerated belief in the capacity of environmental traits as such to change social behaviour, thus ignoring its structural conditioned nature. Therefore, any efforts of further integrating women into society with design means should certainly be done parallel with non-architectural policy measures and inclusive democratic deliberation.

Another case, where even the nature of the issue depends on urban design related clarification, is that of gated communities or (the possibly less strictly fenced off areas) enclosed residential domains. David Hamers and Joost Tennekes (2015) discuss the effects of the latter on the public realm in the Netherlands in relation to the invigorated debate about gated communities. At the same time as their study, in a most ambitious planning theoretical manner, is based on analysing how alternative positions in social theory and philosophy affect the perception of the empirical case studied, they observe that taking up a stand to the issue requires a detailed analysis of the morphology of the developments making up the research object.

Hence, it seems necessary to clarify what the research object is. The city, its districts and urban blocks consists of a pattern of stepwise or clearly differentiated private and public spaces, which may be so either formally in terms of law or visually-functionally, depending on legibility and factual use. For example, perimeter blocks articulate the difference between public and private space in a rather definite way, while such differentiation is often more difficult in suburban areas, such as in a 'buildings in a park' settlement. There, signs frequently appear to mark out boundaries that urban design has left diffuse. Now, few people would criticise the enclosing of courtyard areas of private houses or reserving perimeter block courtyards for the residents, even when such urban blocks are large and thus lessen the permeability of a district. The situation changes dramatically if a whole network of streets, seemingly forming an integrated part of the city, are suddenly fenced off by cast iron gates across the street, as can be observed in, for instance, the 16th arrondissement in Paris. The reason has to do with the legibility of the city, more precisely with breaches against what we have learnt to expect in an urban environment.

Functionally, it also means that some people are not possible to reach without an appointment, which is certainly part of the plot but somewhat foreign to the traditional functioning of a city.

5 Urban Design Concerns

Most urban design, at least in principle, aims at producing a good urban environment for all, as if architectural town planning were carried out from behind a veil of ignorance, rather than being tailored for some specific social group. Not the least in welfare societies such as the Nordic, more or less the same recipe is applied in all cases, the planners not necessarily knowing what groups will move in. Variation instead stems from the location of the site and environmental values specific to it. When planning for decisive urbanity and well-working public spaces, the purpose is exactly the synergetic integration of different activities, social groups and urban functions (which should not, of course, exclude directing special attention to special needs). Nevertheless, for marginalised or vulnerable groups, an urban environment that is socially well-working in general terms may be particularly important (cf. Fainstein, 2018, p.139) since such groups may not be as self-sufficient as to space and equipment or have the resources to reach services at distant locations.

The urban design literature treated varies as to its concreteness and social or societal references. As the urban design task intrinsically involves the social, the issue is whether broader social goals, preconditions and consequences are discussed and whether the literature accounts for conflicting interests and political views on the preferred design solutions. The need for social engagement varies depending on the specificity of the themes treated. The danger in the urban design context are textbooks and handbooks that neglect the relevance of interests and political awareness, favouring instead a conventional pragmatic approach serving the status quo, even though for example the climate crisis would demand radical action.

Tarbatt and Tarbatt's *The Urban Block*, to a great extent restricts itself to a systematic classification and characterisation of different urban block types, explaining morphology and dimensioning by needs that have produced them (eg, large depths of buildings being tied to, inter alia, the requirements of a parking garage). The book often mentions the pros and cons of different solutions in terms of properties such as legibility (eg, relating to the private or public character of the space). Differing expert views that ultimately might take a political shape may then possibly be overlooked. Still, the comments provided should mostly be taken to reflect the professional ability to see the consequences of specific solutions produced by specific needs or aesthetic preferences for the urban whole. The primary need in the context is not to criticise urban development or to politicise the treatment in other respects. Still, in drawing attention to properties that according to a certain professional consensus make for a good built environment, the authors provide planners with well-grounded arguments as against private interests in profit. At the same time, the explicit formulation of the knowledge behind often pragmatic design may contribute to avoiding haphazard results of democratic decision-making ignoring the best available arguments and knowledge.

Panerai et al.'s *Urban Forms* also treats the theme of the urban block, yet from an even more specific viewpoint. The two foci of the book are, first, the urban block as a building block for the city, forming a critical mediating meso-level structure between the separate buildings and plots, on the one hand, and the district and larger urban structure, on the other. The second is

the traditional morphology of this entity as such: its perimetral character, division into plots, clearcut separation of private and public spaces as well as its multifunctionality. The classical perimeter block is then compared to modern developments of it. For the authors, the social uses and patterns that the traditional urban block enables are as important as its architectural features. They are critical of critics of modernity, including post-modernists, for ignoring the social dimension in instead focusing on formal architectural features. Thus, while architects have tried to reinvent the city after a period of suburban growth, according to the authors, they have often failed as they have not paid enough attention to the classical urban fabric on the level of urban block.

Carmona et al.'s *Urban Places, Public Spaces*, is the most general discussion of city building from the viewpoint of public space. Yet, like *The Urban Block*, its aim is to provide a comprehensive overview of the broad theme treated rather than, as *Urban Forms* does, take a definite stand to a neglected a problem. A background is provided of the meaning of and traditions within urban design (visual-artistic, social usage, place-making) as well as of writing focusing on it since Jane Jacobs. In justifying the endeavour, the authors use examples to illustrate cases where a holistic view on the urban environment is lacking and where an uncoordinated provision for pragmatic needs, not the least of parking spaces, may result in a clearly unattractive urban environment. They discuss urban development both as to its results and to its drivers and situate newly arisen ideals, such as various urbanisms, in this societal context. Also, they account for how governmental organisation and action affects the preconditions of urban design. Here, there are obvious shared interests with present-day planning theory.

In covering dimensions of urban design, first of all urban morphology, including the urban block structure and plot division, Carmona et al. take a critical stand to the development, in line with Panerai et al., without therefore advancing a definite thesis. The critical stance rather follows from what today is commonly regarded as the basic tasks of urban design as well as from contemporary strivings, for example towards decisive urbanity. In this way, again, the importance of the treatment lies, except for the vital task of providing students, practitioners and researchers with a comprehensive understanding of the field, in enabling them to argue for the urban design perspective as such (rather than for specific solutions) in various contexts of urban development.

Whereas the aim of *The Urban Block* is to introduce, in an easily graspable if comprehensive form, the urban block alternatives at the disposal for the urban designer/town planner architect in developing different parts of the city, *Urban Forms* more clearly articulates a consistent critical perspective, favouring one type of urban block structure, largely for social reasons. The approach of *Urban Places, Public Spaces* can be situated in between these as its scope is broad, bringing societal aspects to the fore, but still aims at a balanced viewpoint, acceptable to most actors within the field. (This may have come true for *Urban Forms* as well since the mainstream has moved in the direction recommended by the authors, if not, perhaps, heeding its detailed prescriptions, making all the difference for them.) If the urban design literature treated, and comparable literature, provides a substantial knowledge basis for actors involved in urban development (cf. Moudon 1992), there are several aspects in which the ideas may be developed in a planning theoretically pertinent fashion.

For example, a nuanced discussion is called for about whether the urban block structure favoured by Panerai et al. might be enrich in a way partly accommodating post-modernist and contemporary ideas about semi-private and semi-public space by manipulating rigid divisions effected by classical spatial arrangements within and adjacent to the perimeter block. Such may be the provision of a semi-public courtyard as well as semi-private forecourts, when suitable in view of the urban environment. This does not depend on breaking down the morphological features of the perimeter block. The discussion may be tied to basic interests of planning theory, as regards the integration of various social groups defined by age, gender, class, ethnicity et cetera.

Also, once understanding the critical features of the classical block and its contemporary variants, a main urban design endeavour should be to coordinate the urban development, allowing for morphological and associated social diversity, simultaneously restricting the ecologically disastrous effects of urban sprawl. Could New Urbanist ideas about a Transect logic be employed without necessarily accepting their detailed design principles? A main benefit would be an increased legibility and identity as well as possibilities of enjoying public space and neighbourhood services in suburban environments containing small town qualities.

6 Discussion

In my treatment, I have pointed to ambiguities in the core of planning theory concerning its research object and research interests. As to the first, there is the division into procedural and content-oriented theory, where procedural theory has come to deal with participatory democracy (rather than the technical planning process) and content-oriented theory focuses on relatively abstract social goals, where the connection to specific spatial-architectural traits of the built environment at best remains vague. In addition, the theorising is often partisan, rather than building on consensual starting points. Although radical theory is not reprehensible as such, one might expect the primary question to be why nominally consensual objectives, such as mitigation of climate change or a socially-economically well-working urban environment, are not reached, for example, by means of currently favoured decisive urbanity. If, for some theorists, the answer seems clear (eg, due to capitalist interests), to be able to understand the causal and structural mechanisms, it would be necessary to clarify the goals. What is, for example, a socially well-working city? Switching for a moment to a deeper theoretical level, one may suspect some power/knowledge mechanisms producing conceptual muddle even in cases where the needed action should be relatively easy to grasp, such as in relation to ecological sustainability. Anyhow, specification of goals regarding the built environment is not easy without studying how architectural traits interact with social interaction on different levels, from that of the home to the urban region. Therefore, the missing link between planning theory and urban design theory is problematic.

The treatment is partly based on looking more closely [if definitely not closely enough] at both planning theory and urban design theory. One intersection between their interests is in public space. Although this may be both more or less public and inclusive, depending on its qualities and location, it is clearly one of the main urban qualities for planning theorists, enabling free social interaction, integration, political activism and lingering in the city without necessarily consuming. It is relevant from both a justice and pluralism (difference)

perspective. Yet again, it remains a vague notion without a description in urban design terms. It also admits for interesting discussions from the viewpoint of other cultures and current important theoretical perspectives, such as feminism. It is at centre stage in topical debates, such as that of gated communities. Again, however, one should specify the morphological properties of the urban structure for wholly comprehending what is at stake from a social viewpoint and what is common for contextually varying developments.

It is admitted that there are different levels of urban design relevant treatment of planning issues. In some cases, the issue is abstract enough not to necessitate any architectural dimension. The problem is if one is left with the impression of a missing link to urban design, which might make a highly abstract treatment both comprehensible and implementable. There is therefore no problem with abstract theory as such: the structurationism of both Bourdieu and Giddens, or the architectural thinking of Foucault, to mention a couple of eminent social theorists whose main interest is not town planning, may help comprehend the spatial dimension of social life and applying a fruitful theoretical perspective.

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Adaptive Planning in China: Research Progress, Implementation Effectiveness, and Future Prospects Based on Knowledge Mapping and Meta-Analysis

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Abstract
Adaptive planning aids in addressing nonlinear urban changes through dynamic adjustments. This study employs knowledge mapping and meta-analysis methods to examine the progress and effectiveness of adaptive planning research in China over the past two decades. The results indicate that China has focused on the application of adaptive planning in environmental areas, gradually expanding to territorial spatial planning. Key areas of focus include ecological protection, urban renewal, and transportation development. The overall effectiveness of adaptive planning implementation in China has been positive, though attention is needed on developing multiple alternative plans, enhancing community participation, and increasing long-term investment in adaptive processes. This study identifies adaptive issues and response strategies within the Chinese planning context, aiming to enrich the global research system of adaptive planning.

Keywords
adaptive planning; Chinese practice; research progress; implementation effectiveness

1. Introduction

Global cities are facing profound uncertainties in economic development, environmental climate, public health, infrastructure, and other aspects, posing unprecedented challenges for urban planning. Adaptive planning, as an innovative planning concept, is increasingly receiving attention in academia. Due to its dynamic evolution and the involvement of multiple stakeholders, adaptive planning can assist cities in overcoming short-term uncertainties and create sustainable long-term futures through dynamic adjustments.

In recent years, international research on adaptive planning has been gradually increasing, encompassing diverse disciplines, theoretical foundations, and technological levels. Apart from the typical adaptation to climate change studies(Ahern, 2011; Cai and Wen, 2017), other research focuses on adaptive governance of urban built environments. From the perspective of community participatory planning, discussions revolve around governance strategies concerning sea-level rise(Vella *et al.*, 2016), policy logic(Urwin and Jordan, 2008), ecological resilience in urban design(Ahern, 2013), and the adaptive governance process in comprehensive urban transportation planning(Shin and Lee, 2017).

Other studies aim to innovate theoretical frameworks, emphasizing adaptive capacity in spatial planning(Kruse and Pütz, 2014), survival health(Zhang and Puterman, 2013), and climate change(Fu, 2020), along with discussing adaptive strategies and actions in transportation planning(Chow *et al.*, 2011), community governance(Zandvoort *et al.*, 2019), and disaster impact sectors(Nohrstedt *et al.*, 2022). Additionally, cutting-edge research focuses on adaptive planning application methods such as building adaptive models(Marsal-Llacuna and Fabregat-Gesa, 2016), algorithms(Chen and Yu, 2020), and scenario planning(Lempert *et al.*, 2006; Abou Jaoude, Mumm and Carlow, 2022).

In May 2022, the Chinese government issued the "National Climate Adaptation Strategy 2035," marking adaptive planning as a primary approach for China's climate issues in the new era. In China, adaptive planning is gradually becoming a focal point in academia, potentially offering more Chinese insights to global adaptive governance. Chinese researchers emphasize integrating adaptive processes with local planning characteristics, such as aligning with China's rural revitalization strategy(Yu, Qi and Gong, 2019) or integrating adaptation into unique Chinese planning policies like overall planning(Zhan and Sheng, 2014), and detailed planning(Yao, 2011).

Moreover, Chinese researchers excel in establishing adaptive systems within spatial planning contexts(Wu, 2021; Yue, Wei and Chen, 2021; Wang *et al.*, 2023), expanding to diverse planning scales. At smaller scales, discussions focus on the adaptability of parks(Li, Fan and Ma, 2018) and neighborhoods(Wang and Zang, 2018). At larger scales, exploration extends to area morphology(Chen, Sun and Li, 2021), green space systems(Xiao, Cao and Li, 2020), water space(Du and Tang, 2015), and cultural heritage sites(Song, Zhang and Xu, 2011), aligning with urban spatial adaptation. Additionally, research examines how adaptive methods can better serve population(Neumann *et al.*, 2015), public health(Leng and Li, 2021), and comprehensive transportation planning(Huang and Xu, 2019).

However, there are two shortcomings in the review analysis of adaptive planning: firstly, most reviews focus on climate change, lacking attention to the essence of "adaptation." Secondly, as mentioned subjectively, most reviews are qualitative, making it challenging to effectively reveal domain hotspots, structures, and implementation effects.

Therefore, this study focuses on indigenous Chinese adaptive planning research and practices. The second part defines the conceptual connotations of the study, the third part delineates the research progress of Chinese adaptive planning, the fourth part proposes issues and corresponding action plans, the fifth part studies the effectiveness of action implementation, and the sixth part discusses the practical insights of Chinese experience on global adaptive planning. We hope that through adaptive research on China's multi-element, multi-scale urban-rural complex systems, we can provide relatively objective experiential references for global researchers in adaptive planning (Figure 1).

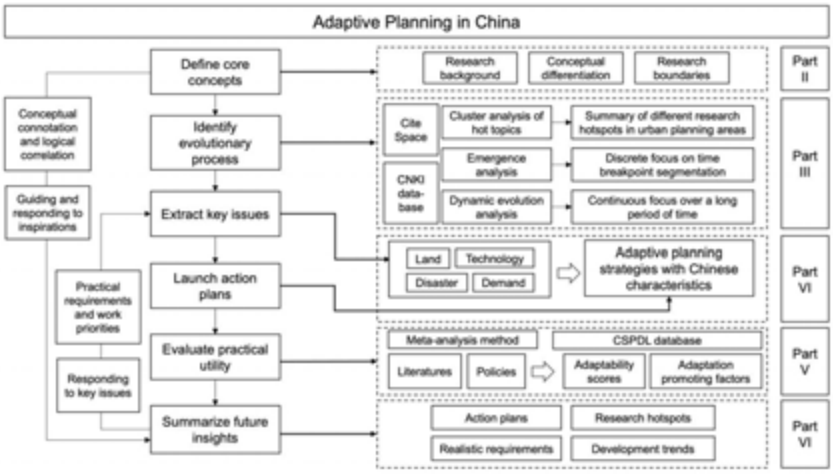


Fig.1 Research Framework

2. Concept: Understanding Adaptive Planning in China

A thorough understanding of the conceptual boundaries of adaptive planning is essential. "Adaptation" generally refers to continuous change and achieving balance with the environment.

This study considers multidimensional urban research and defines adaptive planning as "a proactive and dynamic approach to addressing uncertainties in urban development." Unlike traditional static and long-term planning, adaptive planning emphasizes pre-planning, rehearsal, and simulation for all scenarios, setting planning goals and specifics within shorter timeframes. During implementation, new events are continuously integrated, multi-stakeholder democratic decision-making is employed, and planning content is iteratively adjusted.

In the Chinese planning context, adaptivity has broader theoretical characteristics. First, adaptation is a tool for mitigating uncertainty. Chinese planning agencies conduct comprehensive surveys across transportation, social, and cultural domains, leveraging interdisciplinary perspectives to counter urban uncertainties and maximize planning benefits.

Secondly, adaptation is a dynamic process. Influenced by the Chinese philosophical concepts of "harmony between man and nature" and "non-action," Chinese adaptive planning

sets long-term development goals for each city and continuously monitors progress, aligning with the natural development patterns and effectively meeting the dynamic nature of planning.

Lastly, adaptation results in meeting individual needs. Guided by the "benevolent governance" philosophy of "Ren," Chinese planning emphasizes individual adaptation, addressing a wide range of ecological, cultural, transportation, social, disaster, and health needs. This approach is closely linked to the framework of Chinese planning disciplines.

3. Progress: Summarizing the Research Trajectory of Adaptive Planning in China by Knowledge Graphs

3.1 Methodology and Data Source

This study utilizes CiteSpace, a software developed by Professor Chaomei Chen, for scientometric and visualization analysis of Chinese literature. The software uses nodes, links, and colors to visualize the frequency, connection strength, and time intervals of literature, alongside keyword clustering analysis, burst detection, and dynamic evolution analysis.

Data is sourced from the China National Knowledge Infrastructure (CNKI) database, covering the past 20 years (2004-2024). After filtering the search results, 267 Chinese articles were selected for analysis.

3.2 Results

3.2.1 Analysis of Hotspot Keyword Clustering

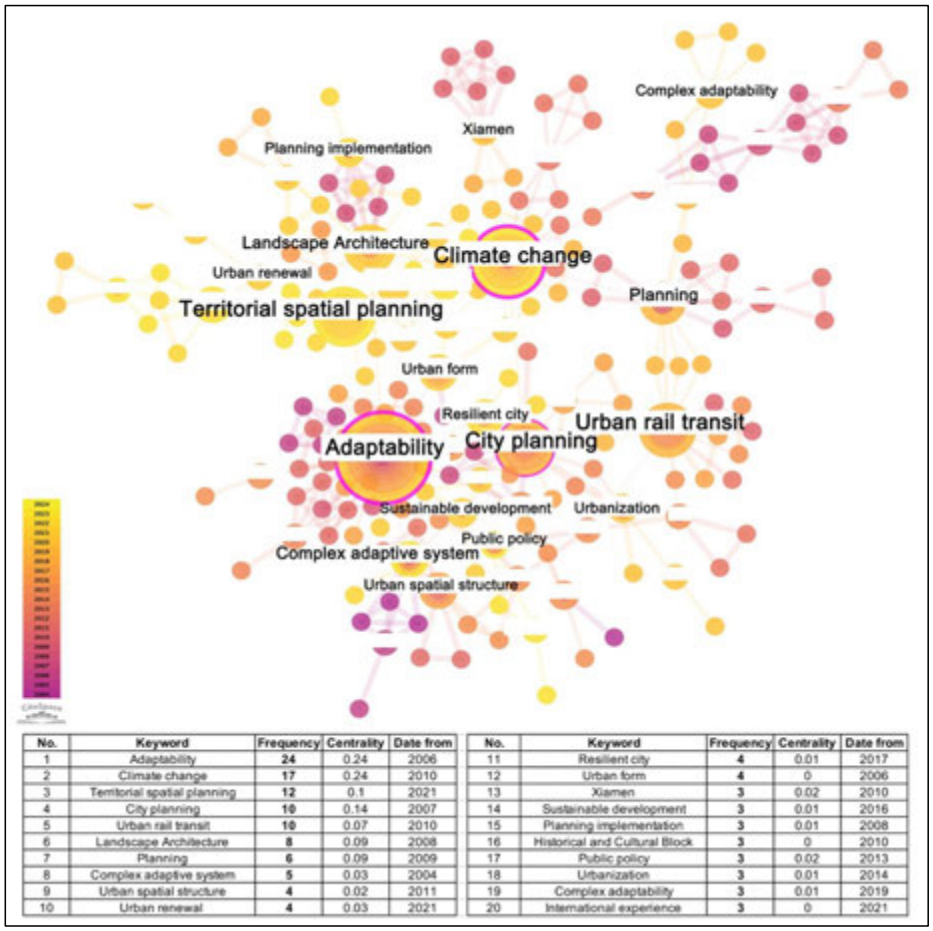
Over the past 20 years, the most frequent keywords in China have formed three major clusters: "adaptation" + "urban planning," "climate change" + "territorial spatial planning" + "landscape architecture," and "urban rail transit" + "planning" (Figure 2). Adaptive methods have increasingly dominated planning theory and practice.

On the theoretical level, research has focused on the origins of complex adaptive planning(Sun *et al.*, 2016) and sustainability(Ahern, 2011), ecological civilization(Du, He and Bao, 2018), resilient cities, and improving living environments(Cai and Wen, 2017; Chen and Li, 2023).

Practically, studies have examined the adaptability of master planning(Zhan and Sheng, 2014), regulatory planning(Yao, 2011), and the evaluation of planning implementation(Tang *et al.*, 2021). Territorial spatial planning(Wu, 2021; Yue, Wei and Chen, 2021; Wang *et al.*, 2023), urban spatial structure and morphology(Chen, Sun and Li, 2021), along with urban renewal(Li and Zhao, 2021) and old neighborhood renovation(Zhang *et al.*, 2023; Zhao and Liu, 2023) have also been explored.

Additionally, research has focused on international experiences in adaptive planning(Jiang, Yuan and Yu, 2021), health risks(Zhou, Wang and Wang, 2021; Chen, Wu and Lai, 2023), public policy and governance models(Qin, 2022), as well as rural and urban landscapes(Li, Fan and Ma, 2018; Ding and Ji, 2020) and transportation systems(Huang and Xu, 2019; Cui and Liu, 2023).

The focus of Chinese adaptive planning over the past 20 years has been closely linked to the development of traditional planning modes, evolving to address subcategories such as "spatial morphology, landscape green spaces, rail transit, and planning implementation" in response to the requirements of territorial spatial planning. However, the extensive knowledge network covered by these research clusters still requires theoretical and methodological innovations driven by "cross-disciplinary integration" keywords.



No.	Keyword	Frequency	Centrality	Date from
1	Adaptability	24	0.24	2006
2	Climate change	17	0.24	2010
3	Territorial spatial planning	12	0.1	2021
4	City planning	10	0.14	2007
5	Urban rail transit	10	0.07	2010
6	Landscape Architecture	8	0.09	2008
7	Planning	6	0.09	2009
8	Complex adaptive system	5	0.03	2004
9	Urban spatial structure	4	0.02	2011
10	Urban renewal	4	0.03	2021

No.	Keyword	Frequency	Centrality	Date from
11	Resilient city	4	0.01	2017
12	Urban form	4	0	2006
13	Xiamen	3	0.02	2010
14	Sustainable development	3	0.01	2016
15	Planning implementation	3	0.01	2008
16	Historical and Cultural Block	3	0	2010
17	Public policy	3	0.02	2013
18	Urbanization	3	0.01	2014
19	Complex adaptability	3	0.01	2019
20	International experience	3	0	2021

Fig.2 Co-occurrence of Hot Keywords and High-Frequency Information

3.2.2 Analysis of Emerging Hot Keywords

The strongest keyword emerging in China over the past 20 years is "territorial spatial planning," which has been emerging since 2021 (Figure 3). In May 2019, the Chinese government specified the establishment of a territorial spatial planning system and supervision implementation, achieving "integrated multiple plans into one." Provinces across the country have successively launched the compilation of 2021-2035 national spatial plans, coinciding with the starting period of related research emergence.

"Territorial spatial planning" also dominates with an emergence intensity coefficient of 5.73, becoming a recent research hotspot alongside topics like transportation development(Huang and Xu, 2019; Cui and Liu, 2023) and spatial renewal(Li and Zhao, 2021). Keywords such as "landscape architecture" and "urban planning" also reflect the characteristic of adaptive planning serving related disciplinary studies.

The emergence of "urban spatial structure" lasted for six years from 2011 to 2017, experiencing extensive, large-scale, and gray construction processes. China's urbanization construction focuses on urban spatial form structure(Wang and Zang, 2018; Yan *et al.*, 2018; Chen, Sun and Li, 2021), making refined adaptive adjustments and becoming a topic of sustained attention in recent years. Keywords like "urban renewal"(Li and Zhao, 2021), "urban governance"(Gu, Wu and Dai, 2021; Qin, 2022), and "rural revitalization"(Yu, Qi and Gong, 2019) had the latest starting time for emergence, reflecting recent research priorities in Chinese adaptive planning.

China's cities are gradually entering an era of stock urban renewal, requiring attention to urban-rural integration, ecological protection, industrial economy, and other diverse planning entities for flexible governance adjustments. It is evident that China's adaptive planning has gradually shifted its focus from climate change and disaster management to specific urban issues and adaptive implementation in recent years, providing a significant inspiration for international planning research.

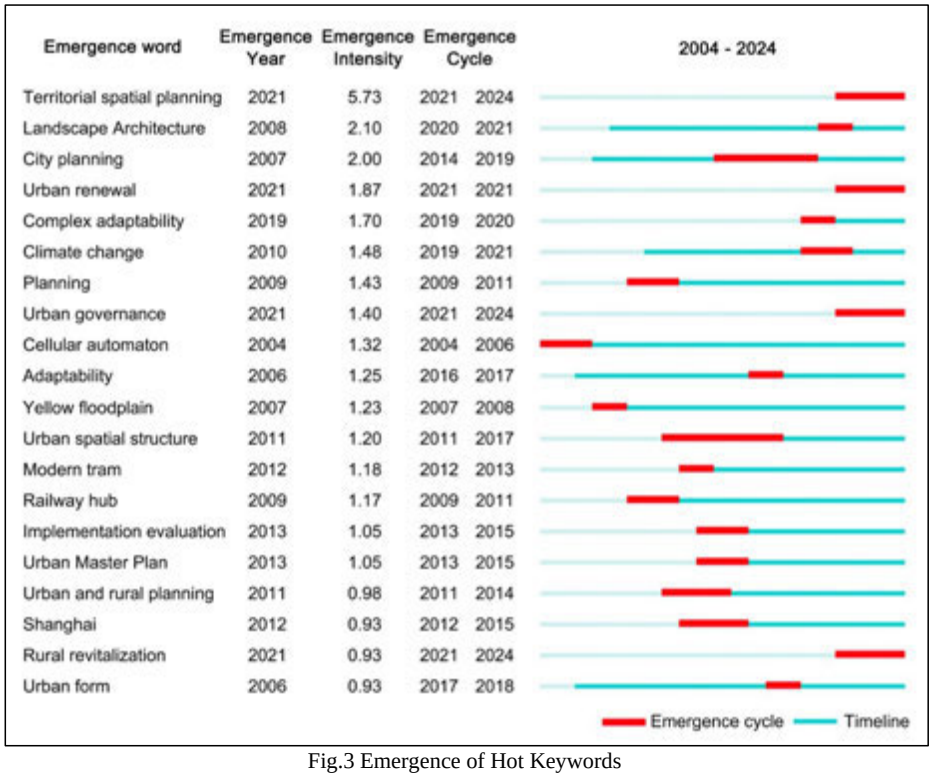


Fig.3 Emergence of Hot Keywords

3.2.3 Dynamic Evolution Analysis of Hot Keywords

Over the past 20 years, the hot keywords in China's adaptive planning have formed multiple generalized clusters such as climate change, urban rail transit, and spatial structure, indicating a dynamic evolution in three stages (Figure 4, Figure 5).

From 2004 to 2010 was the initial exploration period of China's adaptive planning, with relatively dispersed research content focusing on planning simulation, compilation, and multi-element adaptive planning involving urban form, water systems, and hub facilities.

From 2010 to 2020 marked the integration period of China's adaptive planning with climate change response. As global climate change issues unfolded, Chinese researchers actively engaged in climate adaptation as the main theme, exploring multi-element adaptive planning including public transportation, urban form, open space, cultural heritage, and public participation control.

Chinese literature during this period tended to discuss sustainable slowing and adaptation in the urbanization evolution process of the living environment and the dialectical relationship between planning development and protection.

After 2020, China entered a development phase where adaptive planning was incorporated into spatial planning, reflecting the era characteristics of Chinese planning. Based on territorial spatial planning, related research conducted adaptive governance studies on participatory planning, supply-demand optimization, public service facilities and space disaster reduction, urban renewal, etc., implementing spatial planning adaptation requirements of "comprehensive, all-element" and "step-by-step conduction."

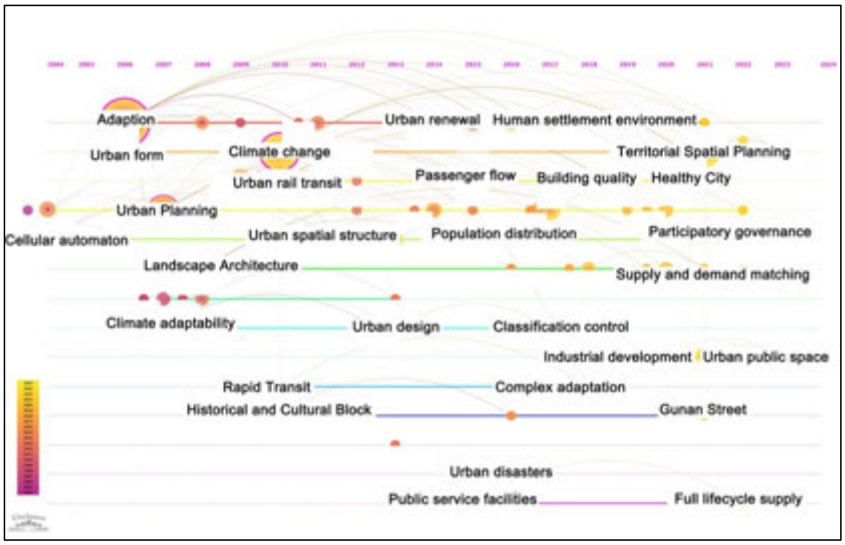


Fig.4 Timeline of Hot Keywords

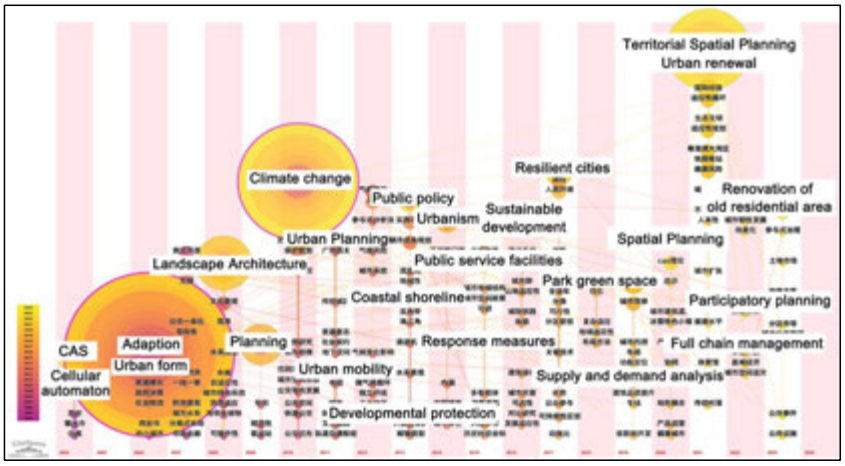


Fig.5 Time Zone of Hot Keywords

4. Issues and Actions: Addressing Adaptive Planning Challenges with Chinese Approaches

4.1 Key Issues in the Transformation of Urban Adaptive Planning in China

The concepts of urban planning in China are undergoing a transformation due to adjustments in national government structures and the introduction of territorial spatial planning policies. Based on a review of the past 20 years of research on adaptive planning in China, several key issues in this transformation have been identified.

On the research front, planning theory lags behind practice. China aims to integrate national strategic policies with theoretical and practical applications to enhance effectiveness. The efficient functioning of state machinery relies on the execution advantages of various administrative levels, necessitating that adaptive planning actions spatially respond to strategic directives.

Spatial planning must adapt to the processes and outcomes of top-level strategies proposed by the Chinese government, such as "ecological civilization," "a community with a shared future for mankind," "carbon peaking and carbon neutrality goals," and "a country with strong transportation network."

In practice, planning has yet to robustly address urban uncertainties. China is designing adaptive toolkits for different scales, adopting spatially adaptive resource management actions to handle urban nonlinear changes. For instance, in the later stages of urbanization, new technologies like autonomous driving and artificial intelligence are leveraged to meet diverse individual needs.

Guided by these key issues, China is exploring an action path for adaptive planning, leveraging its institutional and execution advantages to facilitate a shift in thinking.

4.2 Adaptive Planning Actions Addressing Key Issues

The most prominent feature of China's adaptive planning, and its most effective action plan, is the integration of territorial spatial planning with multi-scale and multi-objective adaptability.

At the national and regional levels, strategic planning is spatially implemented to manage gradual or drastic changes in urban development, ensuring controlled and positive development in the medium to long term. At the city and community levels, multi-objective comprehensive adaptation and the realization of citizen will be emphasized, ensuring iterative adjustments throughout the lifecycle of planning, akin to "moving targets" for stationary objectives.

This process is often driven by specialized administrative bodies, benefiting from top-down administrative execution and long-term construction. An efficient policy implementation system ensures that national intentions are accurately reflected spatially, responding to top-level strategic designs. This facilitates effective linkage and practical implementation of adaptive planning at various scales in China.

Additionally, China's adaptive planning employs cross-disciplinary research methods and legally integrated planning processes, providing multi-domain feasibility and responding to the comprehensive theoretical core of China's adaptability.

Collaboration between experts from academia and industry has yielded various contingency plans for different urban types and emergencies, such as shrinkage planning and refined governance for high-density cities, smart growth and urban-rural integration for developing cities, and the use of emerging technologies for planning autonomous driving lanes, simulating residential patterns, or identifying ecological risks.

Moreover, community participatory governance effectively meets individual needs. China has implemented a legally recognized and protected system where experts with planning backgrounds serve as responsible planners for specific urban communities. This ensures that different urban areas can genuinely adapt to local characteristics during development and that higher-level administrative directives are implemented more normatively and efficiently. Additional examples include adaptive spatial planning strategies that cater to children, the elderly, and people with disabilities, as well as promoting pedestrian and cycling-friendly environments.

5. Effectiveness: Quantifying the Implementation Outcomes of Adaptive Planning in China Using Meta-Analysis

5.1 Methodology and Data Sources

Firstly, we conducted a comprehensive literature review of Chinese adaptive planning, selecting cases through abstract and full-text analyses to finalize our dataset.

Given China's political system, many adaptive planning implementations are enforced through government policies, either mandatorily or non-mandatorily. Consequently, we also collected relevant policies and administrative announcements from the State Council Policy Document Library, the official repository designated by the Central People's Government of the People's Republic of China.

The rigorous nature of official documents resulted in a limited number of relevant records from a single search. Therefore, we broadened our data collection scope to include documents related to adaptive planning in areas such as climate and environmental protection, social equity and inclusion, disaster resilience, transportation and infrastructure, public health, and urban preservation and renewal.

The criteria and process for selecting literature and policies are illustrated in Figure 6.

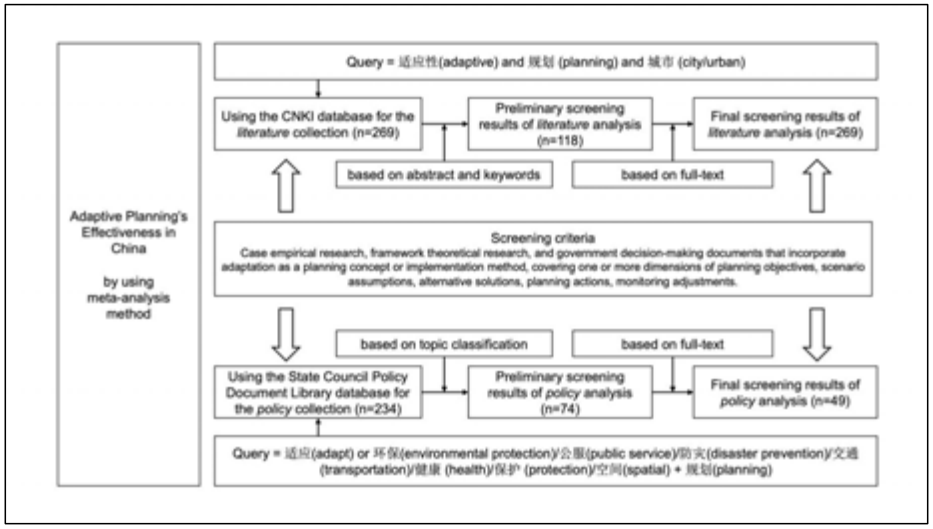


Fig.6 Selection Criteria for Meta-analysis Records

Next, we adapted a methodology from similar studies by Shirin Malekpour and Jens Newig (2020). Drawing from literature reviews by Jeuken et al. (2015), Quay (2010), and Walker et al. (2013), and tailored to China's context, we adopted evaluation dimensions including goals, scenarios, plans, actions, and monitoring. These dimensions were employed in a meta-analysis to assess and statistically evaluate the collected records. The formula used is as follows:

$$U = \sum_{k=1}^{N} S_k$$

$$S_k = \sum_{i=1}^{n} W_i * F_i$$

Where:

U represents the total adaptability score for all records.

N is the number of collected records.

S_k represents the total adaptability score for the k^{th} case, $S_k = \{0,0.5,1,1.5,2,2.5,3,3.5,4,4.5,5\}$.

n is the number of evaluation factors, which in this study is 5.

W_i is the weight of the i^{th} evaluation factor, which is set to 1 based on relevant literature (Shirin Malekpour and Jens Newig).

$F_i$is the adaptability score of the i^{th} evaluation factor, $F_i = \{0,0.5,1\}$.

The specific meanings and scoring standards are detailed in Table 1.

Tab.1 Definition and scoring criteria of evaluation factors

Evaluation factor	**Code**	**Definition**	**Score**		
			0	**0.5**	**1**
Planning objectives	F_1	Expectations for the outcomes of adaptive planning should include both quantifiable and non-quantifiable results.	Not any Planning objectives.	Goals may be vaguely defined or not easily quantifiable.	A list of clear and quantifiable objectives has been established.
Scenario assumptions	F_2	Various future planning scenarios and their potential outcomes should be hypothesized.	Not any Scenario assumptions.	One or two planning scenarios or hypotheses in different application areas have been proposed.	Three or more planning scenarios or hypotheses across different application areas have been proposed.
Alternative solutions	F_3	Multiple flexible planning actions should be proposed, with at least one plan adopted at each planning stage.	Not any Alternative solutions.	One or two alternative plans have been suggested.	Three or more alternative plans or phased implementations have been suggested.
Planning actions	F_4	There should be a conceptual or framework explanation for achieving the goals of adaptive planning, accompanied by concrete actions.	Not any Planning actions.	Conceptual or framework guidance for planning assumptions and alternative plans has been provided, but no concrete actions have been taken yet.	Clear and quantifiable action plans for the planning assumptions and alternatives have been provided, or concrete actions have already been taken based on existing plans.
Monitoring and adjustment	F_5	Continuous monitoring of any critical changes is essential, with proactive measures taken when necessary.	Not any Monitoring and adjustment.	Conceptual or framework methods for future monitoring and adjustments have been proposed, but no monitoring	Clear monitoring and adjustment goals have been established for existing plans, or ongoing monitoring and dynamic adjustments are being conducted.

				actions have been implemented yet.	

Finally, based on the attributes of the Promoting Factors in each record, we calculated the total score for all Promoting Factors from the evaluation results. This analysis identified the most critical driving factors for the implementation of adaptive planning, which can provide valuable governance insights for future research and practice in adaptive planning in China. The formula is as follows:

$$P_j = \sum_{k=1}^{N} S_k * \frac{1}{T_k}$$

Where:

P_j represents the adaptive score of the j^{th} Promoting Factor.

T_k represents the total number of adaptive Promoting Factors summarized from the k^{th} record.

N, k, and S_k have the same meanings as previously defined.

5.2 Results

5.2.1 Overall adaptability

Based on the aforementioned evaluation criteria, the overall status of completed or ongoing adaptive planning cases in China is relatively favorable, with an overall adaptability score of 2.32. Specifically, for individual evaluation factors with a total score of 1 point, these cases performed well in Planning Objectives, Planning Actions, and Scenario Assumptions, with average scores of 0.68, 0.60, and 0.61, respectively. However, there is room for improvement in Monitoring and Adjustment and Alternative Solutions, with average scores of 0.25 and 0.17, respectively (Figure 7).

In the various fields of adaptive planning in China, the highest number of records, 64, is in urban and rural planning and construction. Transportation and climate fields have 13 and 11 records, respectively, while other fields have fewer than 10 records. The average adaptability scores across different fields are relatively high. Notably, the disaster and climate fields achieved impressive average scores of 2.63 and 2.59, respectively (Figure 8).

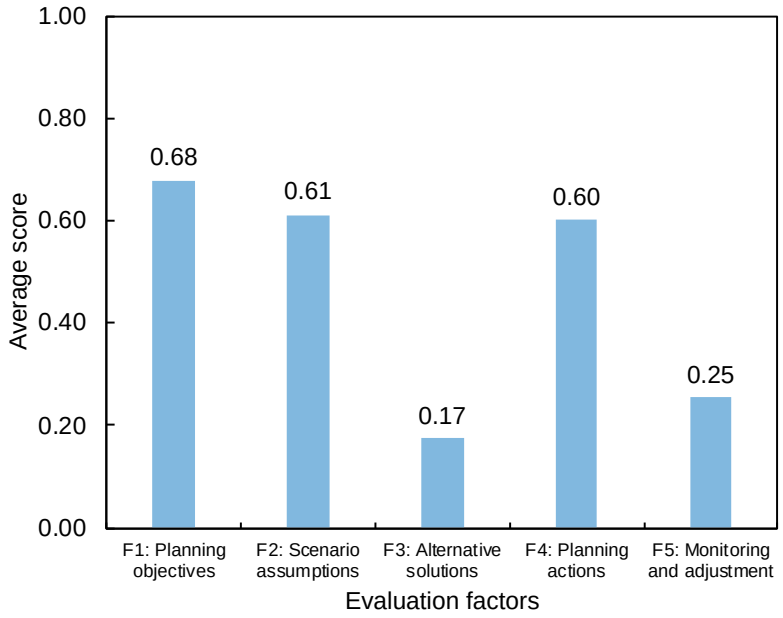


Fig.7 Average Adaptability Scores under Five Evaluation Factors

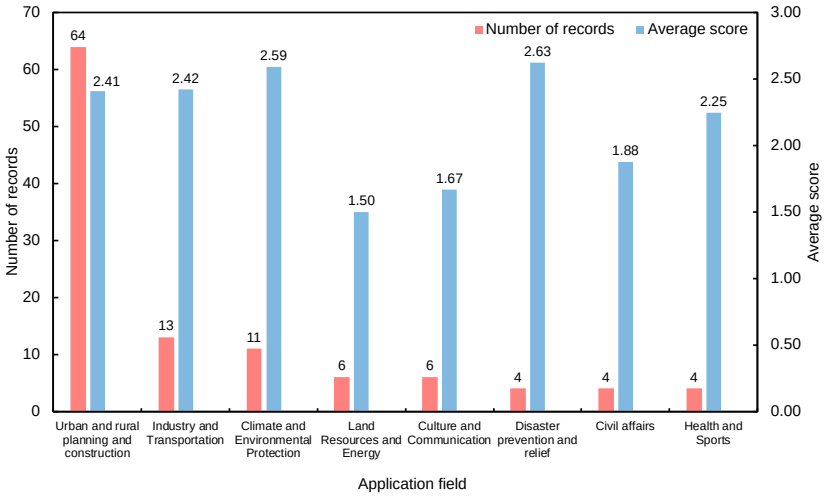


Fig.8 Number and Scores of Adaptive Planning Records in Different Fields

5.2.2 Promoting Factors of Adaptive Planning

We also identified ten key Promoting Factors for the adaptive planning process based on the content of the selected records (Figure 9). It is evident that top-down administrative orders

and interdisciplinary research are the most effective Promoting Factors, with 59 and 49 records respectively, and average scores of 0.41 and 0.36. Continued efforts are needed to promote community participation and public support, as well as investment activities involving related enterprises, as these factors have relatively low numbers of studies and average scores. According to the t-test results, administrative orders and community participation significantly impact the overall adaptability scores.

Regarding the effects of Promoting Factors on different evaluation factors (Figure 10), top-down administrative orders effectively promote the completion of planning objectives, actions, and subsequent monitoring, which is related to the Chinese government's public authority. Interdisciplinary research facilitates the use of scenario assumption methods, while cutting-edge technology supports the development of more alternative solutions, likely due to the academic community's application of theory and methods to practice. Additionally, interdisciplinary research and theoretical expansion play critical roles in meeting planning objectives and achieving overall adaptability results.

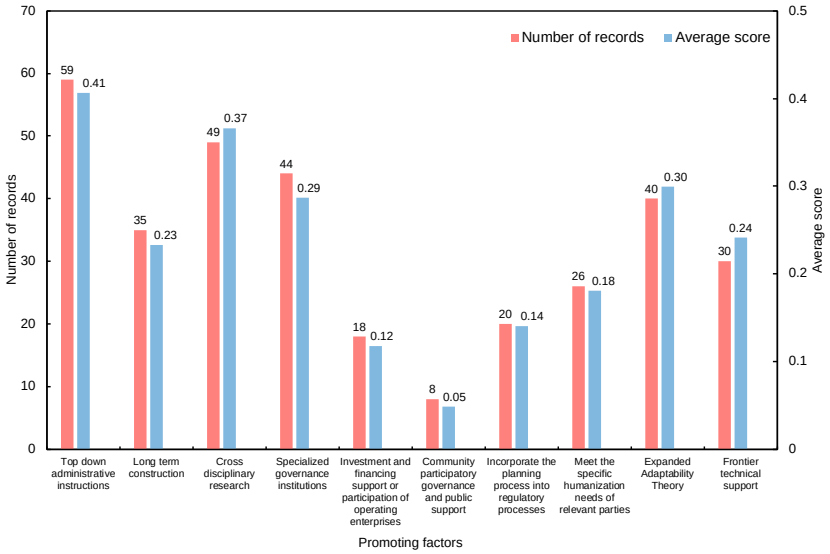


Fig.9 Number and Scores of Promoting Factors in Adaptive Planning Records

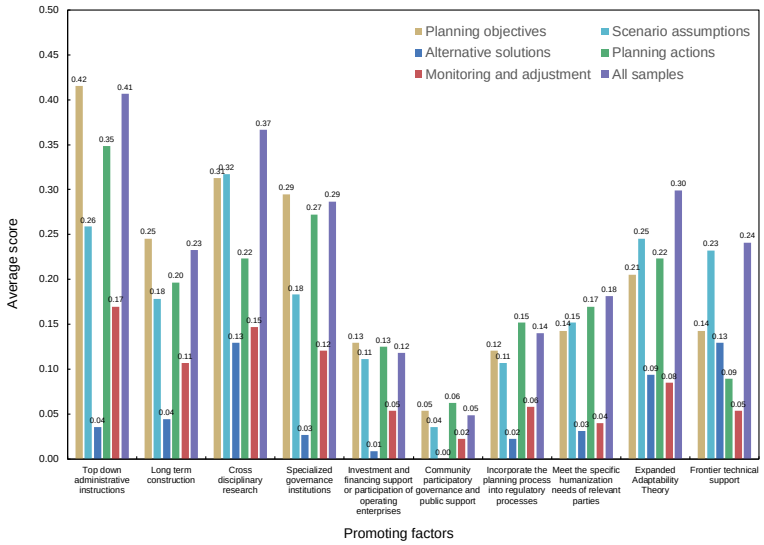


Fig.10 Scores for Each Factor for Promoting Factors in Adaptive Planning Records

6. Reflection: What Can We Learn from China's Adaptive Planning?

6.1 Insights from China's Adaptive Planning Research and Practice

Over the past 20 years, three major research focuses in China's adaptive planning can provide valuable references for the international community.

Firstly, the "timeliness" of adaptation is crucial. Addressing climate change and technological advancements remains a continuous priority for urban adaptability in China. Global climate issues significantly impact international politics and economics, while big data and artificial intelligence can effectively solve complex urban models. Future global adaptive planning should focus on strategies for various types of disasters, regions, and urban computing methods.

Secondly, the "people-centered" nature of adaptation is emphasized. Multi-disciplinary and cross-sectoral approaches that cater to individual needs are particularly important. China's adaptive planning research includes perspectives from culture, communication, industry, transportation, and health, all aiming to meet diverse human needs.

The adaptation of the built environment through spatial layout and policy control effectively integrates rational and emotional decision-making to comprehensively meet these needs. Future global adaptive planning should prioritize individual-centric values, considering citizens' primary needs concerning the environment and health.

Lastly, the "authoritativeness" of adaptation stands out. China's adaptive planning research highlights the characteristics of its political system, effectively utilizing consistent governmental power while considering citizen opinions and community participation. The government rigorously delineates specialized departments for natural resources, housing, and

transportation, which coordinate horizontally under the State Council's unified leadership to issue adaptive planning policies. These policies are directly and efficiently transmitted vertically to subordinate city departments and strictly adhered to. This long-term adaptive planning framework ensures effective future responses.

On one hand, city departments have detailed divisions of labor to collaboratively produce adaptation outcomes in various fields. On the other hand, the procedural basis of this process is legally grounded, ensuring implementation effectiveness. China's adaptive planning leverages these advantages at the macro level, with chief urban planners driving territorial spatial planning, and at the micro level, with community responsibility planners ensuring thorough stakeholder participation and adaptation implementation. These institutional strengths and methods are valuable for international reference.

6.2 Current Requirements, Development Trends, and Adaptive Action Framework for Global Adaptive Planning

Currently, academic attention on adaptive planning is predominantly focused on climate change and disaster risk. The core requirement is to expand research directions and develop localized adaptation strategies with regional characteristics. For instance, China has recently diversified its research content around territorial spatial planning.

The academic community should pay more attention to urban transportation, supply-demand matching, community governance, tourism development, and ecological protection in the context of population mobility, economic development, and technological innovation, forming a comprehensive adaptive planning research network.

Moreover, a clear goal-oriented approach to address pressing national issues is essential for identifying effective adaptive planning pathways. Examples include flood management in the Netherlands, green building initiatives in Singapore, and improved transportation planning in London.

Additionally, supporting adaptive principles with spatial intelligence technology, formalizing participatory planning into legislation, and applying it to decision-making at all levels to meet human-centered needs like social equity and resident health is also crucial.

Therefore, this study attempts to outline future development trends in adaptive planning. There is a systematic integration trend in existing global climate adaptation planning research. Future efforts should establish a reusable response mechanism through cross-disciplinary collaboration.

There is a trend of theoretical expansion in adaptive planning, requiring a clearer definition of its broad and narrow cores according to national strategic needs, specifying its covered fields, and proposing dynamic action plans to meet specific field requirements, which necessitates strong political measures.

Finally, adaptive planning exhibits a trend of multi-dimensional integration, serving the public. Combining foundations from engineering, management, social sciences, and intelligent tools will create more comprehensive and scene-specific adaptive planning methods, focusing adaptation efforts on individual needs.

Based on these trends, we propose a theoretical framework to guide future governance actions in adaptive planning (Figure 11).

Fig.11 Governance Action Framework for Adaptive Planning

7. Conclusion and Discussion

Based on defining the essence of adaptive planning, this study retrospectively reviews the progress and implementation effectiveness of adaptive planning in China using knowledge graph analysis and meta-analysis methods. The research indicates that the theoretical and practical aspects of adaptive planning in China have seen substantial development over the past 20 years, categorized into stages of planning adaptation exploration, climate adaptation dominance, and spatial adaptation development. Research hotspots like "Territorial spatial planning" and "Urban Renewal" with Chinese characteristics have been explored.

Concurrently, administrative orders and interdisciplinary research are the primary driving factors of adaptive planning in China, demonstrating significant implementation effects across multiple sectors and administrative departments. Within China's spatial planning context, studies have gradually moved away from a singular focus on climate change adaptation, instead exploring more localized adaptive pathways, potentially providing insights and ideas for adaptive planning globally.

However, there are shortcomings in this study, such as incomplete literature and policy collection, and subjective dimensions and methods in meta-analysis evaluations. The literature and policies of adaptive planning in China exhibit distinct characteristics, and future research will optimize data and evaluation methods for more detailed discussions.

Through "no-regret" short-term planning and dynamic adjustments involving multiple stakeholders, adaptive planning serves as a methodological guide for planners in China, effectively addressing rapidly evolving urban issues. Spatial planning needs proactive adaptation to promote equitable resource allocation, infrastructure, and public services,

addressing urban population, land, transportation, and environmental issues while fostering urban-rural integration and economic development.

This process requires the participation of planners, government, and the public, as well as supportive policies and regulations concerning land use, environmental protection, and planning standards. It also necessitates promoting optimized resource allocation across administrative regions, harmonious development, and collective adaptation, embracing the future of urban-rural changes with dynamic, flexible, and forward-looking adaptive planning methods.

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Track 14: Policy Mobility

POLICY MOBILITY - Planning models, circulation and learning across boundaries

Chairs:

- Divya Leducq, Université de Lille
- Chandrima Mukhopadhyay, UN-Habitat India
- Marcela Alonso Ferreira, Sciences Po Paris

Keywords: *Mobile urbanism, international exchange, environment, urbanization, green-city models, planning practices, postcolonialism, gender lens, urban strategy, policy transfer, local assemblage, global age, placemaking, traveling theory…*

Within a more interconnected world, urban professionals through their references and practices are contributing to the international circulation of ideas and policies in and around spatial planning, experimenting with solutions to environmental and social challenges. Track 14 “Policy Mobility” aims to critically examine not only the circulating planning ideas, both in theory and practice, but also the transnational circuits of knowledge (how do ideas travel?), international benchmark, local experimentations, urban production that result from them, and urban resistance towards them. The session will focus on the political-economic, institutional, ethical, and methodological issues of international exchange in the planning field (process of diffusion). While the circulation from Norths to Souths - and reverse (even though limited) - of ideas and policies (such as: Olympic urbanism, transition towns, smart cities, Green European Capital, Transit-Oriented Development, 15-minutes city, etc) is not a new topic, new debates have emerged: hybridization of models, entrepreneurial urbanism, adaptive urbanism, decolonization of planning practices, provincialization of policy, etc.

We invite contributions from different intellectual traditions such as the history of planning ideas, international development studies, urban studies, the globalization and postcolonial literatures and the policy transfer and social learning fields. The session will look into North-North, North-South, South-North as well as South-South circulation of ideas and policies. So, we call for studies from various contexts such as Europe, North America, and also Asia, Africa, Middle East.

We welcome studies on roles of international networks, actors and agencies and their expertise and ethics (e.g. ICLEI, UN-Habitat, C40…) in transferring such ideas and policies. While the presentations would discuss land use planning, transportation planning, basic services, and infrastructure planning, we are interested in learning which

policy traveled to what context and by whom, and to what extent it was successfully implemented and why.

Contributions to this track might cover the following urban planning issues (although this list is not exhaustive):

- ??Assemblage and hybridization of planning models; adaptation process
- Provincialisation of planning theories, ideas and policies; situating planning practice
- Planning culture/ Culture of practice
- Institutional changes in sustainability transitions
- Role of epistemic communities
- Role of civil societies in either promoting or resisting international ideas
- Tracing policy mobility and policy networks
- Transnational circuits of knowledge
- Carriers of ideas and Struggle of local experts to adopt; urban resistance
- Outside observer and Insider practitioner; reflective practitioner.
- Local ambitions, policy experimentations
- Sustainableplanning models, new urbanism, European Green Capital, European Capital of Culture, Olympic urbanism, Smart-city, compact city, 15-minutes city, transition towns, TOD, gender mainstreaming strategies...

For all these themes, one might wish to discuss: theoretical perspectives, methodologies and empirical contributions exploring shared urban models, ideas and practices and stakeholder involvement, including activists, across as well as key results/impacts achieved or not achieved such as environmental planning policies, local development, spatial justice or better territorial cohesion.

Exportation of the Parisian's urban knowledge (1976–2005)

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Abstract

From 1976 to nowadays, 'Atelier parisien d'urbanisme' (APUR), which is an urbanism organisation partially financed by the Paris Municipality, was involved in projecs out of Paris, especially in Global South countries. This communication will focus on APUR's networks all over the world to highlight the way of the French way-of-thinking urbanism have been diffused abroad. We will analyse especially the APUR's projects for the reconstruction of the city centre of Beirut (1976–1977), the projets for Phnom Penh (1992–1998) and for Jakarta (1996–1998) and Cairo (2001–2004) in which APUR was involved.

Keywords

Urbanism ; History ; City planning ; Global South

From 1977 to nowadays, 'Atelier parisien d'urbanisme' (APUR), which is an urbanism organisation partially financed by the Paris Municipality, led a programme to disseminate its urbanistic knowledge abroad, especially in Global South countries.

APUR was created in 1967. The architects of this organisation designed many new residential areas in Paris since the mid 1970s and worked on public spaces projects or transportations issues. The urban forms they created was called 'postmodern urbanism' by Nan Ellin (1996), refering to the 'traditional city'. Over the years, these architects acquired skills in urban planning and town-planning design, especially in dense cities with an important heritage, like Paris.

Considering these achievements, APUR was involved in projects worldwide since the end of the 1970s. Thereby several architects from the organisation began to travel in order to work on urban studies in big cities. Therefore, in France, APUR is not the only one urbanism city organisation to lead programmes abroad : Clément Orillard (2017) also highlighted many projects (more or less 150) realised by the 'Institut Paris Region' (previously called 'Institut d'aménagement et d'urbanisme de la région parisienne' (IAURP)) in many cities over the world.

This dissemination of APUR's knowledge began in 1977 when the city of Beirut asked APUR to work on the reconstruction of the downtown of the city after the 'two years war' (1975–1976). Then, after 1986, projects abroad were declined in different ways : urban studies or projects (for cities like Jakarta, Santiago de Chile or Phnom Penh), exhibitions about new Parisians districts or involvement in international conferences about urban planning.

We will analyse how the Parisian architects applied some existing practices in other cities, and what was the process to think these projects abroad, knowing that the 'philosophy' of the APUR was to take into account the specificities of each territory. So we will wonder how the expertise of the Parisian urban planning organization has been applied in various territories ? This analyse will help us to understand how the APUR sometimes places itself in the position of an expert, while at the same time enabling it to enrich its know-how by creating new situations. What is the balance between the parisian way-of-thinking urban planning and each specific site ? Ensentially, if the APUR's methods, approaches and analyses are different for each project, is the final declension is so different ?

We will analyse the APUR's strategical proposals on urbanism, methods and tools using for projects. But we will not focus on how this suggestions were applied, neither the final realisation of projects. This submission will show APUR's networks all over the world to highlight the way of the Parisian way-of-thinking urbanism have been diffused abroad. Also it demonstrates that some countries were asking for an occidental know-how in urbanism. We will first list the cities and the type of events or projects in which the APUR was involved, especially in the 1980s. Then, we will analyse two diffrent types of interventions : the first ones in which APUR's was involved that apply a map strategy based on a precise analyse of the city landscape (throught the case of the reconstruction of Beirut downtown (1976–1977) and Phnom Penh (1992–1998)) ; and in a second part projects developed later with a more *strategical* approach (Jakarta (1996–1998) and Cairo (2001–2004)).

1. APUR and the gradual establishment of an international activity

Created in 1967, APUR organisation was involved first in thinkings of the Parisian new master plan, in the 1970s. Paris approved a masterplan for the city called 'Plan d'occupation des sols' (POS) in 1977. This masterplan is based on a precise analyse of the city landscape, based on

each plot and its relationship with streets (this type of regulatory plan exists in all the French citites but it is particularly precise in Paris). Also, APUR is carrying out projects to enhance some Parisian sites, notably as part of the 'Plan programme de l'est parisien' launched in 1983 : creation of *Coulée verte*, enhancement of the *Halles de la Villette* and *canal de La Villette*, and development of *Bois de Boulogne* and *Bois de Vincennes*.

In 1977, the new mayor of Paris, Jacques Chirac, encouraged APUR to be involved in the design of the new parisians districts (which are called 'Zones d'améagement concerté' (ZAC)). Six APUR's architects were thus involved in designing new residential areas in Paris, and they realised 42 of its between 1977 and 2000. They mostly studied at the Beaux-Arts School in Paris and most of them in the Louis Arretche's workshop in this school. Over the years, these architects acquired skills in urban planning and town-planning thought, especially in dense cities. The best known ZAC are the *Bercy* one (1992–1994), *Reuilly* (1986–2000) and the *Paris Rive Gauche* (1995–2024). Pierre Micheloni was the architect involved in the design of these three districts and also in several projects abroad. In the book *Postmodern urbanism*, Nan Ellin (1996) highlights the importance of the past trails, the heritage and the history of the city, which the new building's forms refered. In these ZAC projects, the public space is very important, as well as parks. The design of the new streets was created in continuity with the neighbourhood's surrounding roads and the buildings are designed to match the scale of the surrounding buildings. Some blocks, whose size, layout and form have evolved over time, are inspired by 'traditional' Parisian blocks, meaning buildings aligned on the street and inner courtyards.

In 1976, the Lebanese government asked APUR to carry out its first international mission for the reconstruction of Beirut city centre. This mission, which included other urban planners and members of the French Ministry of Public Works, was led by APUR, and in particular by its director, Pierre-Yves Ligen, for the first part of the mission. Other APUR's urban planners, such as Philippe Mathieux, were involved in the city's development proposals after the first step of the city analysis.

In the 1980s, APUR gave a lot of presentations about the projects it had recently implemented in Paris, as conferences in Berlin (called 'Politiques d'aménagement à Paris et Berlin', 11-12 december, 1985) and Istanbul ('Conférence des principales villes mondiales', november, 1987). In the 1980s, the mayor of Paris, Jacques Chirac, also suggested to the mayors of several big cities a collaboration or a technical support of APUR's architects. Therefore, it didn't immediately lead to any assignments (for example, the city deputy mayor of Brazzaville, Mr Okabando, asked for a study of the Poto-Poto/Est District, in 1986). This type of project abroad was quite new in the mid-1980s and the APUR's director was wondering about the conditions of this type of mission. Even though no office or urban planner in APUR had ever been assigned to carry out international projects.

At the end of the 1980s, several technicians or civil servants involved in urban planning from cities in the Middle East came to Paris to study the municipality's working methods and achievements. Officials from the city of Amman in Jordan came to Paris in May 1986, as also the president of the Riyadh city development centre. In 1988, a travelling exhibition called 'L'urbanisme parisien' was organised in Middle East (first in Doha and then in eleven cities : Amman, Sanaa, Abu-Dhabi, Aden, Baghdad, Damascus, Doha, Khartoum, Kuwait, Cairo, Manama, Muscat, Riyadh) focusing on Parisian ZAC in the 1980s. It was the *ZAC Reuilly* and *ZAC Bercy* that the APUR's architect Pierre Micheloni presented as references for the project

of the occupation of abandoned railways in Roma during a consultancy assignment he was given in 1966 for the redevelopment of railways in the Appio-Latino-Tuscanola sector.

It was in the 1990s that APUR really began to get involved in several missions out of France, with a first project carried out in Phnom Penh in 1992. In the 1990s and 2000s, APUR has been requested to assist on technical matters. However, no specific office or division was set up in APUR. Therefore, the same APUR's architects worked on the abroad projects : Christiane Blancot in South-East Asia and Pierre Micheloni for a lot of projects in Europe and South America. André-Marie Bourlon, project manager for the transportation team, often accompagnied them. More or less 25 projects have been done abroad by APUR since 1976 (first project in Beirut) and 2010. Except two projects in Roma and Budapest, most of the projects have been carried out in countries in the Global South. These missions are miscellaneous, and have either been the subject of a cooperation agreement with the City of Paris or the French State ; or APUR is acting under contract or in response to calls for tender.

While IAURIP was called upon for the creation of new towns, APUR was mainly asked for its expertise in drawing up or suggesting improvements to master plans or development plans in cities with a major heritage. Other French urban planning agencies were also called upon for missions abroad. Sometimes, APUR and IAURIP may collaborate together on different assignments in the same cities. It happened in Budapest (1994), Buenos Aires (1998), Teheran (2004) and Rabat-Salé (2007). APUR had also been called upon for its expertise in heritage conservation (Santiago de Chile, Phnom Penh, Budapest) and enhancement of public spaces (Hanoï), and for its technical support, particularly in transportation field and GIS matter, and for its methodology, regulatory and administrative know-how. Finally, urban projects on specific sites were also designed, especially by Pierre Micheloni, as in Rio de Janeiro for the Porto Maravilha District (2004), the development of the eastern corridor of Amman (2005), or the development plan for a district of the city centre of Tbilisi (2013).

Dates	City	Country	Mission	APUR's architect(s)
1976-1997	Beyrouth	Lebanon	Reconstruction of the city centre after the "two-year war" (1975-1976).	
1992-2009	Phnom Penh	Cambodia	Study of architectural and urban heritage. Technical assistance to the Municipality of Phnom Penh. Assistance in setting up the sewerage network (with the engineers of the City of Paris). In January 1992, APUR presented the development challenges of Phnom Penh. Technical training for urban planners of the BAU. Proposals for town planning regulations in 1997.	Christiane Blancot
1994	Budapest	Hungary	Expertise of the master plan of the city of Budapest. Development of heritage.	
1994-2000	Santiago de Chile	Chile	Heritage and protection study of the Santiago-Poniente district.	
1996-1998	Jakarta	Indonesia	Expertise in the revitalization of Jakarta's old centre and the renovation of Jakarta's museums. Opinions on projects submitted and recommendations.	Christiane Blancot and Christian Dupavillon
1996-1998	Roma	Italia	Advisory mission on the development of railway rights-of-way in the Appio-Latino-Tuscolano area.	Pierre Micheloni
1997-1998	Hanoi	Vietnam	Assist the AIMF in arranging the premises for hosting the International Francophonie Summit in 1998 around the Hanoi Opera.	Christiane Blancot
1998	Brazzaville	Congo		
1998-2006	Tunis	Tunisia	Establishment of a real estate and land observatory and a geographical reference for Greater Tunis. Urban Development Monitoring Mission, Documentation and Communication.	
1998-1999	Buenos Aires	Argentina	Development of the Retiro-Puerto motorway junction.	André-Marie Bourlon and Pierre Micheloni
2000	Bamako	Mali	Expertise of city planning services.	
2001	Guatemala city	Guatemala	Project management assistance for the development of GIS for transports.	
2001-2004	Cairo	Egypt	Urban renewal of Sayeda Zeinab district.	Christiane Blancot
2002-2005	Téhéran	Iran	Development of GIS. Technical assistance contract on the preparation of the master plan and detailed plans for Tehran, and on the establishment of an urban planning agency.	
2002-2005	Alger	Algeria	Exchange of experience, advice and technical assistance on urban planning, upgrading and organisation of cartographic and thematic databases.	
2002-2004	Vientiane	Laos	Assistance with project management.	
2003-2004	Istanbul	Turqey	Expertise of the city's master plan. Identification of a pilot district for the implementation of an urban regeneration project. Exchange of experience and good practice in urban management.	André-Marie Bourlon and Pierre Micheloni
2003-2004	Bangalore	India	Technical assistance for master plan expertise; technical support for GIS.	
2004-2005	Téhéran	Iran	Revision of the master plan of the city.	André-Marie Bourlon and Pierre Micheloni
2004-2011	Rio de Janeiro	Brazil	Revitalization of the central area, public spaces (Porto Maravilha urban project). Urban plan of Rio Comprido.	André-Marie Bourlon and Pierre Micheloni
2004	Ryad	Saudi Arabia	Technical assistance for an expertise on the Greater Riyadh Master Plan; technical support on GIS.	
2005-2009	Amman	Jordania	Development of Amman East Corridor.	Pierre Micheloni
2007-2012	Rabat-Salé	Marocco	Implementation of the new Unified Land Use Plan (UPA).	Christiane Blancot
2007	Mexico	Mexico	Urban insertion of a tramway.	André-Marie Bourlon
2009	Hanoi	Vietnam	Expert mission on the master plan.	André-Marie Bourlon
2010-2011	Medellin	Colombia	"Medellin 2030" plan, expert mission.	
2011-2013	Tbilissi	Georgia	Reconversion of a derelict railway.	André-Marie Bourlon and Pierre Micheloni

Table 1 : Missions abroad carried out by APUR between 1977 and 2013.

2. First international projects: reconstruction of downtown Beirut (1976–1977) and revitalization of downtown Phnom Penh (1992–1998)

These first two APUR's projects abroad are similar in the urban project method : a precise analysis of the existing city first, and then a city-wide cartographic regulation based on these surveys with the aim of conserving and enhancing city's landscape.

2.1 Reconstruction of downtown Beirut (1976–1977)

APUR was commissioned to carry out its first mission abroad : the reconstruction of Beirut city centre in 1976, accompanied by three french architects (Henry Bernard, Jacques-Henri Labourdette and Charles Delfante). IAURP had already been involved in international projects, starting in 1971 (implementation of Buenos Aires master plan). After the lebanese 'two-year war' (1975–1976), the city centre was partially destroyed and APUR carried out an aerial survey to visualise building heights and the statement of the buildings, in conjunction with a Lebanese team, in order to plan the restoration of the buildings, particularly the remarkable ones. As it was made for Paris urban knowledge, APUR first mapped the city precisely (including for example land-use coefficients) in order to identify areas to be rebuilt or rehabilitated based on these analysis (areas 'to be redeveloped or significantly remodelled', 'likely to be redeveloped in the long term but to be maintained in the immediate future', 'to be improved in their current state'). Far from a *tabula rasa* policy, APUR is thinking in terms of restoring and maintained three quarters of the existing city. A specific attention was paid to public spaces, as in Paris. These analyses led to a 'development plan' and a 'traffic plan'. APUR's expertise in Beirut consisted especially in methodological approach and thinking about urban development as an overall, based on very detailed analysis of what already exists and what can support improvements.

APUR's project, drawn up between 1976 and 1977, proposed the enhancement of the seafront and the creation of a vast public garden in front of it. APUR also suggested the creation of a new thoroughfare from the Grand Serail, the seat of government, to the sea ; the extension and renovation of the existing 'souks' between Place de l'Étoile and Place des Martyrs ; the development of the grand hotel district ; and the creation of a modern port and two new districts in the south and west of the port. There were also regulations, inspired by the Parisian POS, regarding the creation of new roads, public spaces and private spaces (layout, alignment, etc.). Scale models and master plans were drawn up. The report of what they made was published in 1977 and the plan was approved by the municipality on 15th April, 1978 but the resumption of fighting prevented it from being carried out.

The master plan (Fig.1) shows a pre-dimension of blocks to be built in line with each other and a high concentration of pedestrian areas in the north of the town. Wider streets are surrounded by tree lines, and a number of squares have been designed at the crossroads of some streets in several parts of the city. Voluntarily, no major architectural artwork is proposed and the new constructions will have to integrate as well as possible in the city.

Nevertheless, Jad Tabet (1991), a Franco-Lebanese architect highlighted the limits of this APUR's masterplan :

Over and above the architectural and urban qualities of the project, the following are revealed the limits of the "cultural urbanism" that underpins the plan to rebuild the city centre. City

centre: the centre is being reinvested, rehabilitated in delicate pastel tones, and pedestrianised. But these new spaces are not the start of an overall redevelopment of urban space. The most that can be done is to recreate the myth of the bazaar, the primitive souk or that of the Mediterranean cities wrapped around their old port; a certain climate, an atmosphere. Because the fundamental question of town centre development is not asked: what urban organisation should be used? What kind of urban organisation will it be? In the final analysis, this project, which was not carried out in the end because another war interrupted its implementation, was strongly inspired by Parisian principles of enhancing public spaces.

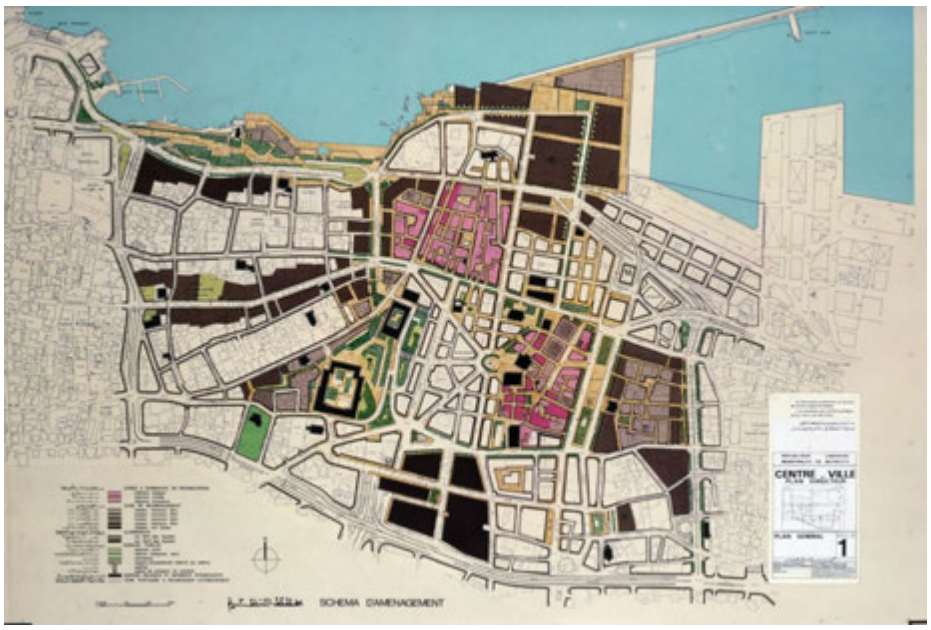

Figure 1 : Masterplan of Beirut, 1977, courtesy : APUR.

2.2 A new masterplan for Phnom Penh (1992–1998)

Phnom Penh is the first abroad project in which APUR has been involved after the project of the downtown Beirut. Since 1990, APUR has been involved in technical cooperation with the cambodian municipal services (that Jacques Chirac, the mayor of Paris, visited in 1994). This

technical cooperation was extended to the field of urban planning in 1991 and 1992 at the initiative of Jacques Chirac. Thus, in January, 1992, APUR presented the challenges of the development of Phnom Penh : to protect and enhance public spaces and their plantations ; to create new planted public esplanades ; to enhance the river and lakes by creating a continuous public promenade on the embankment ; to preserve the airy and sparsely populated nature of the centre ; to enhance the overall landscape of the city along the river ; to enhance the quality of Phnom Penh's public buildings, respecting their architecture and urban integration, and to encourage their rehabilitation.

After the establishment of the Royal Government of Cambodia in May, 1993, the State Minister for Urban Planning suggested the establishment of an Urban Affairs Bureau (BAU), an operational urban planning unit, composed of city's and Cambodian's technicians, assisted by APUR and a 'Transfer of Knowledge Through Expatriate Nationals' (TOKTEN) consultant. During six months, in 1993, the TOKTEN's architect managed a study on squats and formal and informal markets in Phnom Penh. In 1993, technical parisians services were involved in Phnom Penh in setting up the city's sewerage network. In addition, the BAU's urban planners received a technical training. APUR was then associated with this service to ensure the training of city officials and to make a lot of missing documents needed for urban project management (city plans, etc). Christiane Blancot was the main architect of APUR invested in Cambodian projects. As part of the BAU, APUR team in Phnom Penh, led by Ms. Aline Hetreau-Pottier, architect, leaded a study on the city's architectural and urban heritage. These studies are based on surveys of Khmer houses, but also of streets surveys, in section, and also of the templates and location of buildings in relation to the streets, types of islets and their parcel division, with a typo-morphological method (Fig 2). In addition to a survey of typical Khmer houses or complexes, a mapping was carried out to characterize the existing fabric. This first tool, which was primarily geared towards heritage conservation, served as a tool for the development of subsequent regulatory plans.

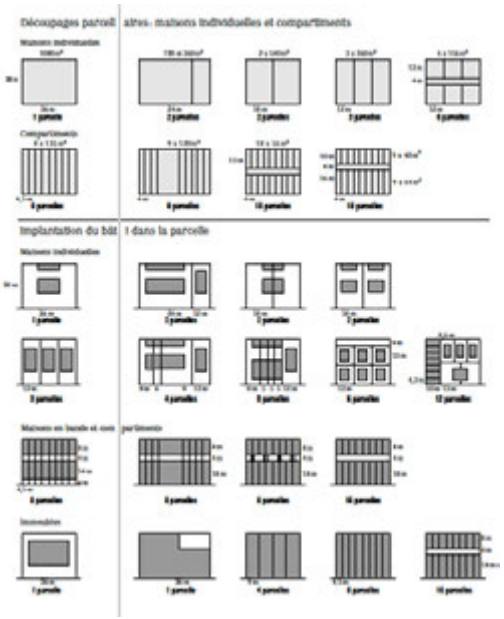

Figure 2 : Subdivision of parcels in Phnom Penh, courtesy : APUR.

In 1995, Phnom Penh issued a law prohibiting the demolition of all old buildings in Phnom Penh, and the preservation of a number of buildings of definite heritage interest was the priority of BAU and APUR. This law was supplemented by an urban regulation by blocks and plots for the Daun Penh area, known as 'servitudes d'urbanisme et de constructions', drawn up in 1996, refering to the Paris POS, but it was simplified. It shew on a plan urban spaces, heights of existing buildings, margins of retreat and the method of siting and the ground clearance of the buildings (Fig. 3). These easements are based on the analytical mapping carried out earlier. These Servitudes were done, discussed and finalized by a Technical Commission which brought together all relevant municipal technical services – cadastre, town planning and construction, environment, culture, public works, industry and the Office of Urban Affairs. These four main areas of development were divided into several sub-sections. In the case of building and non-building land, the first step was to protect the area of public garden streets and to delimit their right of way to prevent private encroachment on them, to protect public facilities and pagodas, and to prohibit construction on plots of less than four metres of façade. With regard to the maximum building heights and the right-of-way of buildings, the aim was to highlight the city's landscape. Around sites of exceptional character, the heights of the facades were erected in order to respect the heights surrounding the site, to take into account the building habits related to the climate, and to preserve the gardens. Considering the architectural aspects of new buildings, they need to maintain the traditional systems of protection against rain and sun and the use of colours and materials in harmony with existing buildings (using of entirely glazed facades, facade tiles, masonry brick or masonry stone coatings was prohibited and the colours white, ochre, yellow and garnet were imposed). Finally, the last priority concerned the importance of regulating the rejuvenisation of public spaces and plantations.

Figure 3 : Map of easements of town planning, 1997, courtesy : APUR.

As with the reconstruction of the city centre of Beirut, an analysis of the city was carried out on a city scale in order to make an overall mapping according to several parameters. In Phnom Penh, however, the heritage and morphological study proved to be even more advanced. While in Beirut these cartographic analyses led to project proposals, in Phnom Penh it led to a proposal for a regulation based on very European principles for the development of public space and respect for the existing landscape, while at the same time establishing architectural easements that value the use of local techniques and materials.

3. The Kota neighbourhood in Jakarta (1996–1998) and the Sayeda Zeinab neighbourhood in Cairo (2001–2004): new strategies

During the 1990s and 2000s, APUR was called upon to work on urban projects in several cities around the world, especially because of its expertise in sites with high heritage value such as in Paris. Most of projects falled within the scope of heritage presentation and multiple, small-scale interventions in cities concerning the development of public spaces. The projects in Jakarta (1996–1997) and Cairo (2001–2004) are interesting to study because APUR and local urban planners needed to thing entirely about how intervene in each city/district, and the proposed solutions were sometimes indenticals and sometimes differents. In Jakarta, projects were made especially on the Kota district and the city's museums, and in Cairo, in the area of Sayeda Zeinab, which are two old districts in these two cities.

3.1 Create the 'image of the city' of Jakarta (1996–1998)

In Jakarta, APUR was involved in urban project by the Ministry of Foreign Affairs in 1996. Christiane Blancot was in charge (she had already been involved in the Phnom Penh project for a long time) of this mission in APUR with Christian Dupavillon, architect and General inspector of Culture at the Ministry of Foreign Affairs. The advisory mission, which was planned at the request of the Governor of the City of Jakarta, consisted of advising on the future projects planned for the city, and especially on expertising Jakarta's old centre projects and the renovation, programming and management of Jakarta's museums.

After the visit of the two French architects in 1996, they formulated guidelines and established a programme and schedule of works. The interventions were interesting because they were not based on city-wide mapping or regulations, but on a series of actions to be carried out in a short term, inspired by Parisian actions to embellish the city.

Regarding the development of the city centre, the district of Kota was especially studied, as the most interesting district in terms of history and heritage, on which attention was focused. The french's architects guidelines decreed that 'Kota has lost its *raison d'être*'. This district was a power one until the 19th century. After it was abandoned in favour of newer district located in the south of the city. The canals would have been a memory of the transport of goods have been covered or blocked, the great street of the district, Kali Besar, has also disappeared and was cut off by railway lines and motorways and in Jajah Mada, ancient islets have been destroyed and replaced by towers and shopping malls. The aim was thus to affirm the history and identity of this district, Kota, at the same time as the memory of khmer people, in order to increase tourism and give an 'image' to the city of Jakarta based on this district linked to the history of Indonesia. The Christian Dupavillon's and Christiane Blancot's report also specified that 'Kota has all the aesthetic and historical elements as in Paris'.

With this in mind, Christian Dupavillon and Christiane Blancot suggested actions to be done quickly, in six months, before embarking on deeper reflections on the Kota district. The quick actions to be implemented in the short term were : the rejuvenisation of public spaces, starting with the building of pavements in all streets and the planting of trees ; the animation of Fatahillah Square by reducing car traffic and setting up open-air cafés ; the installation in some abandoned warehouses of artists or architects ; the organisation of events such as flower markets, fish markets, parades, concerts and the creation of a green space on the site of the old Dutch citadel with the highlighting of archaeological traces. In this district of Kota, they also recommended the enhancement of some of the more 'picturesque' districts such as those of Montmartre or the Marais in Paris, as well as the enhancement of the canal system, which was poorly maintained or no longer maintained. The reference examples are once again European : the *Canal Saint-Martin* in Paris or the canals of Bruges, adding that 'in a few years we will visit the canals of Jakarta as well as those of Venice'. These proposals have been complemented by urban traffic proposals in order to link the different parts of this district.

After these proposals, a working programme was proposed for the implementation of these actions in 1998, with the involvement of several Parisian experts, as well as for the development of canals, which required expertise in the drainage of rainwater and wastewater, or the restoration of buildings, which required the expertise of a specialist architect. Gilles Sensini, architect at APUR, lived in Jakarta for one year. An urban design guideline for a longer-term production was also drawn up in 1997 for Kota district : restoring the physical links between the different parts of the neighbourhood, cut off by transport infrastructure ; highlighting the original Kali Besar axis of Kota and valorise the original district composition affirming and highlighting the significant buildings (maritime museum, lighthouse, fish market, railway

station square) from a very Aldo Rossi's perspective. Other matters were proposed in order to strengthen the links between the centre of Kota and the old suburbs ; thinking about improving pedestrian circulation, especially crossings, and highlighting some monumental hotspots. Also, in order to include the inhabitants of Kota in the urbanization of their neighbourhood, it is suggested to create a house of 'information and exchange' with the inhabitants : the 'Kota House', located in a restored building, to be an example of restoration for the owners and to show to the owners the potential of their cambodian's houses. These projects, carried out in accordance with the guidelines (particularly along the main Kali Besar canal (Fig. 4) where pavements and plantations have been built and the canal has been cleaned) have made it possible to regularize and harmonize this part of the city.

Figure 4 : Kali Besar today in Jakarta, 2024, Google street view.

In Jakarta, it's the rehabilitation of the image of the city that prevails. To aim this goal, Christian Dupavillon and Christiane Blancot proposed faster interventions to revitalize some neighbourhoods. The references were European and Parisian projects and the *touch* of Christian Dupavillon was felt in the proposals. In fact, h has worked on the staging of specific events and has been interested in the rehabilitation of industrial sites into creative sites, proposes quick interventions, not necessarily architectural but more programmatic, allowing to obtain an immediate effect on the uses and image of the city. It seems that in Jakarta, the two architects gave free rein to their imaginations, but proposed projects inspired by European models.

Thus, the ways of city development suggested in 1996 were more precise than those in 1992 for Phnom Penh. The method of intervention was also different. While in Phnom Penh it was

through cartography and regulations that an intervention was primarily linked to the preservation of heritage and the protection of landscapes, a regulation based on the existing one ; in Jakarta, the axes led to the secondment of French personalities attached to neighbourhoods and projects on certain specific aspects (rehabilitation of disused buildings, restoration of canals), in a vein of *tactical urban planning*. It was only later that several districts of Kota were planned with specific urban guidelines.

3.2 *Stategic urbanism* in Cairo (2001–2004)

In 2001, the city centre of Cairo was deteriorated. The governor of the city, who had been bound by a friendship pact with the city of Paris since 1985, called on the city in 2001 for its expertise in the rehabilitation of historic areas and the procedures created to involve the population in the development of neighbourhood projects. The district of Sayeda Zeinab, located in the south of the city, was chosen as a testing ground for methods and tools adapted to its transformation. As a partner of the City of Paris in this decentralized cooperation programme, APUR helps define studies and urban projects on this district. Each proposal had to lead to the definition of a concrete operation, which could be carried out by mobilizing local expertise and resources, under the authority of the governorate services. The approach had to be pragmatic and the result of the work could be transferred to other areas of Cairo.

In December 2002, a mission of experts carried out an initial diagnosis of the neighbourhood. It identified the most critical problems and outlined the actions to be taken. During 2003 summer, young academics managed the research needed to continue the study : surveys and field surveys. At the end of the year, plans were drawn up and the Governor validated the general principles of action to be taken. The first concerned ‘Abdel Meguid al-Labbân Street (Fig. 5), which was selected as a pilot project for the development of public space. The second concerned the rehousing of the mechanics of ‘Abu ad-Dahab Street. The third was focused on the rehabilitation of the built heritage. In 2005, the scope of the study was extended to the neighbourhood of Qal’at al-Kabsh and its connection with the lower city.

As in Jakarta, in Cairo was done strategic interventions, small-scale ad hoc projects, which were supposed to change the image of the city and have a generating action. Two main lines of action were decided : the rehabilitation of existing buildings and the redevelopment of streets. So it is first the streets, squares, dead ends and passages that were renovated. The houses and residential buildings were renovated, the facades first and the structures consolidated, the sanitary and electrical installation network secured. In older districts of Sayeda Zeinab, Qal'at al-Kabsh and Tûlûn, urban development was being proposed through, among other things, the installation of better flooring, quality urban furniture and tree plantations, encouragement of rehabilitation through financial assistance and technical support for the inhabitants, and the reuse of unused plots. More specific projects were planned, such as the rehabilitation of Abu ad-Dahab Street, surrounded by mechanics' workshops that could be optimised in their use, or the creation of a public staircase in the Qal'at al kabsh neighbourhood.

Figure 5 : Plans and sections of the Abdel Meguid Al-Labbân street in Cairo, 2005, courtesy : APUR.

These different projects highlight the way APUR has transposed its tools and methods in the cities in which it has intervened : through a variation of the POS in the oldest cases and through more localized strategies more recently. However, the same conclusions emerge : the enhancement of public spaces, water spaces, and the rehabilitation and enhancement of the existing buildings.

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Post Covid19 topiography: Prospects of the polycentric operational model for a Greek city.

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Abstract
The COVID-19 pandemic prompted a reevaluation of urban dynamics worldwide, impacting economic, social, and daily life aspects. This shift, coupled with the imperative to combat climate change, has led to a reconsideration of modern city functioning. The polycentric city model emerges as a solution, integrating technological advancements to create user-centric, environmentally friendly urban spaces. Research demonstrates the feasibility of this model, emphasizing its economic, environmental, and social benefits. Greek cities, with their manageable scale and existing neighborhood structures, are particularly suited for this transition, offering a favorable cost-benefit ratio. Case studies aim to validate the effectiveness of the polycentric model in Greece, reinforcing its potential for sustainable urban development. This paper evaluates the prospects of the polycentric operational model for the city of Ilioupolis in Athens, Greece

Key words: post-pandemic city, urban environment sustainability, social inclusion

Introduction

Covid pandemic served as a benchmark for the reconsideration of the way users operate in the urban environment. The shifts that happened rapidly not only in the economic sector and the social activities but also in day-to-day life, leading to a global reconsideration of the way developed cities function under these new circumstances. In addition to this, the demands of the strategy towards battling climate change, promote the research for the optimal operational model of the modern city, regarding trivial functions and needs, car use, networking, and communication.

The model of a polycentric city formation is promoted as an answer to these challenges. This contemporary polycentric city theory is enhanced with the technological advancements and oriented towards the city user, aiming to create a greener environment-friendly urban space, that promotes the battle against climate change. Given the turn towards a more viable sustainable environment with a more user-friendly city formation that subjects to the principles of sustainable mobility, as well as the technological means available, the implementation of a structure with multiple centres, a mix of functions and extended networking, can produce a new urban topiography that derives from the environmental principles of the 21st century.

This paper follows previous research where this polycentric city model was evaluated using the economic theory, and specifically a cost-efficiency analysis, to establish a foreseeable outcome and determine and quantify the possible benefits on an environmental, economic, and social level. The analysis applied an ex-ante evaluation and uses simulation techniques and indicators to define the cost-effectiveness ratio, combined with mental mapping activities, in order to promote people inclusion in the decision-making process.

The findings showed that the cost that needs to be allocated to implement a polycentric model of operation in Greece, although dynamic and varied from case to case, is relatively low compared to the benefits that come as a result. In fact, the most of said benefits are linked to the European Sustainable Development Goals, the promotion of which is a strategy all European countries and cities are already committed in following.

The main reason why the cost may appear lower for Greek cities to shift to a polycentric model, is that Greek cities in particular, are characterised by a small scale of the urban fabric and a variety of uses, both equally important when implementing this model of operation. The formation of neighbourhoods is thus favoured and, on a first level, already present, which gives the Greek city an advantageous starting point regarding the possible cost of rearranging the city from scratch.

This paper builds on the previously established evaluation model and employs a case study to validate the evaluation method and furthermore produce a series of observations and results regarding the actual costs and benefits of polycentric city operations in Greece.

The polycentric city establishing the 15minute city

The polycentric city constitutes a development model that has been examined in various variations in urban planning theory since the last century. In contemporary discussions within urban planning, the concept evolved to the 15-minute city that emerged as a compelling vision aimed at fostering more livable, sustainable, and resilient urban environments. Essentially, the 15-minute city model advocates for reconfiguring cities to ensure that residents can conveniently access essential services, amenities, and job opportunities within a 15-minute walk or bike ride from their residences. This vision signifies a reappraisal of conventional urban development patterns, which typically prioritize automobile-centric infrastructure, towards a structure with multiple small scale centralities within the urban fabric.

Among the European cities, the city of Paris has been leading in the implementation of the 15-minute city concept, leveraging its distinctive urban layout and cultural heritage to redefine how urban life is organized spatially. Through strategic interventions and policy measures, Paris seeks to cultivate compact, polycentric neighborhoods where everyday needs can be met within close proximity. This approach aims to decrease reliance on cars, encourage active transportation, and improve overall quality of life.

Nevertheless, the 15-minute city model poses several threats along with its benefits. As pointed out in previous work [1] implementing the 15-minute city model in Paris, or any urban setting, presents both achievements and obstacles. While Paris has demonstrated notable adaptability in capitalizing on opportunities arising from the COVID-19 pandemic to advance its urban agenda, uncertainties persist regarding the applicability and efficacy of certain strategies, particularly in diverse urban contexts characterized by varying scales and socio-economic dynamics.

After drawing insights from Paris' experience, this paper aims to delve into the complexities of implementing the 15-minute city model and assess its implications for urban planning practice in the Greek city. By critically examining both the successes and limitations of Parisian initiatives, valuable lessons can be gleaned for other cities embarking on similar urban transformation endeavors. The chosen case study is the city of Ilioupolis, a municipality in southeast metropolitan Athens, with a characterizing urban plan similar to the 19th century garden city. The city is organized around several roundabouts that have become very closely related to the identity of Ilioupolis. In this paper, these roundabouts become the core of the proposed scenario of the 15minute city model.

The uniqueness of the urban design of the area predisposes and promotes centralities at the points where we encounter the roundabouts. When exploring the case study, the already existing

trend of centralization development at these points is taken into account, a trend that seems to have accelerated after the COVID-19 pandemic. In this way, the proposed centralities of the 15-minute city examined in this research are the product of bottom-up processes and not predetermined top-down locations, as in the case of Paris, for example. Moreover, this paper emphasizes the importance and necessity of flexible, context-sensitive approaches to urban planning that prioritize both equity and sustainability, both of which are significantly boosted via community engagement.

Ultimately, through a comprehensive analysis of the case study of Ilioupolis, this paper aims to contribute to the ongoing discourse surrounding innovative urban planning strategies and their potential to shape more inclusive, resilient, and vibrant Greek cities for the future.

Case study: The Municipality of Ilioupolis - Urban fabric characteristics

Ilioupoli is a municipality that was developed to meet the increased housing demands created by the large refugee influxes to Greece following the Asia Minor Disaster of 1922. It is a suburb of Metropolitan Athens, located in the southeastern part of the basin. It is situated at the foothills of Mount Hymettus and is only a few kilometers away from the center of Athens. It was declared a municipality in 1963 (Government Gazette 45/A/19-4-63). It has always been crossed by several streams, the most significant being 2-3 branches of the Pikrodafnis stream, most of which are now covered. In the area where the municipality of Ilioupoli is now developed, there was a small estate during Ottoman rule, called the "Kara estate." The buyer in the following years was A. Nastos, who later sold the land initially required for the construction of the Municipality of Ilioupoli.

In 1925, the "Greek Company for Urban and Rural Settlements Drandakis - Pagkalos, and CO" was established with the aim of constructing the settlement according to the plan of Aristomenis Valvis, as modified in 1928 after its first approval in 1925. Ilioupoli initially targeted a wide range of residents. It had a rural section, a semi-rural section, and a general population section, which were distinguished from each other based on the size of the available plots of the settlement. In the general population section, the size of the plots reached that of the center of Athens. The smallest acceptable plot size was set at 112.5 sq.m. and remained so until 1940. Along the way, the rural section was abolished as buyers could not afford it financially. According to the "General Guide to Ilioupoli" (1960), anyone "...found a place for a home, the rich and the poor, the scientist and the professionals, the employees and the workers...".

Figure 1. Plan of Ilioupolis (1925) [2]

The original plan by Valvis for the settlement of Ilioupoli was characterized by a clear effort to mimic the principles of a garden city. Strong curves, numerous concentric circles and roundabouts lead to the creation of small building blocks. This initial plan underwent modification with evident signs of improvement in 1928 (Government Gazette 227/1928).

In 1930, the "Anonymous Construction and Industrial Company of Ilioupolis Athens" was founded, a company that, along with the "Greek Company for Urban and Rural Settlements Drandakis, Pagkalos, and CO" and with the "Anonymous Transportation Company of Ilioupolis," undertook the execution of the plan.

However, the image of the city of Ilioupoli in its early years was not very encouraging regarding the completion of the plan and its settlements. Nevertheless, it was widely advertised in newspapers, urging buyers to invest in land purchases, which (according to said advertisements) would not lose their value, and thus the investors would profit from a potential devaluation of the currency (a practice not uncommon in 20th century Greece). The main service networks of the city were ultimately completed after World War II, a period during which the Municipality began to grow systematically.

Locating the city centralities

Existing centralities

In Ilioupoli, the General Urban Plan (GUP) was approved in 1988 (Government Gazette 407/D/1988, reissued Government Gazette 1225/D/1994) and is still in effect, defining the allowed land uses of the city (Fig.2). The GUP includes the entire current area of the Municipality, along with the successive expansions after the initial approval of the city plan. The same GUP separates 14 neighborhoods - Urban Units as they appear on the map below (Fig. 3). The division of neighborhoods seems to have been made based on geometric characteristics of the town plan and with the intention of an equal distribution of the covered area per unit. There does not appear to be an intention to create independent centers per

neighborhood, and the circular nodes are, in most cases, not placed at the center of each unit, but seem to serve as meeting points for two or more neighborhoods. Given that the already defined neighborhoods have a maximum distance range of 1.5 kilometers from each boundary, this distance can work perfectly with the scenario of the 15-minute city and promote accessibility using bicycles, walking, or other non-motorized vehicles.

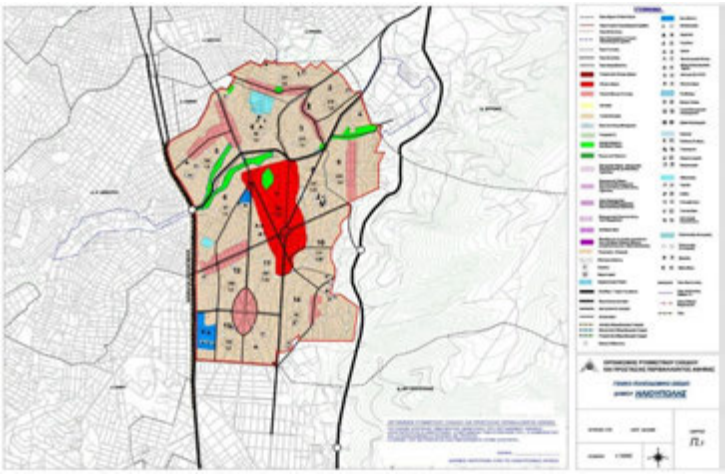

Figure 2. General Urban Plan of Ilioupoli [3].

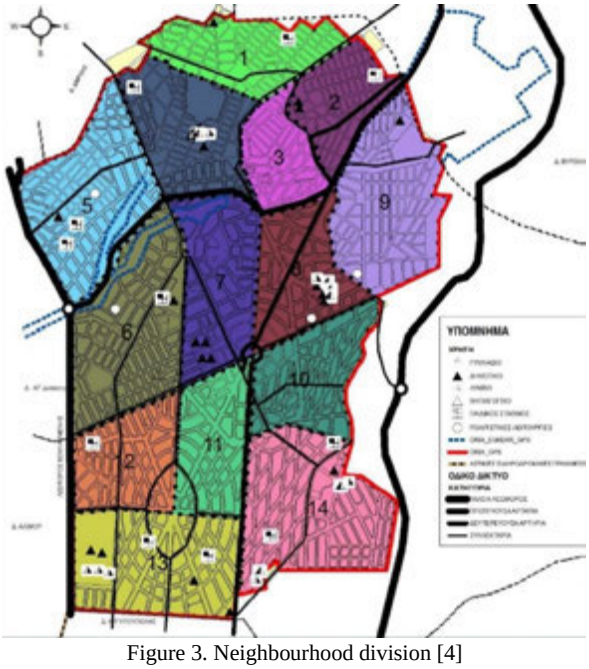

Figure 3. Neighbourhood division [4]

For many years, and up until the end of the 2010s, when the economic crisis changed the density of commercial uses, Ilioupoli developed commercial and recreational activities mainly around

Ethnikis Antistaseos Square, which is the central square of the Municipality and located at the intersection of neighborhoods 7-8-10-11. This development aligns with the General Urban Plan of the city, which designates the square and part of the axes leading to it as the "city center," differentiating it from other adjacent squares in other neighborhoods designated as "neighborhood centers."

Another secondary center of smaller scale was developing at Independence Square in neighborhood 1, just before the intersection of neighborhoods 1-3-4, while with lower intensity and uses related only to commerce, two more centralities were found, located, one at Karaiskaki Square (Kanaria) at the intersection of neighborhoods 4-5-6-7 and one at 28th October Square in the heart of neighborhood 8.

We can observe that, unlike the central square of Ilioupoli, the secondary centers created initially did not follow the current General Urban Plan regarding the determination of the neighborhood centers. The General Urban Plan placed these units mainly along axes and not on circular nodes, not exploiting the centrality they provide due to their layout.

Emerging centralities

After the economic crisis, new centralities began to emerge, mainly around the development of commercial and leisure activity zones in areas that showed less interest until 2010. This trend strengthened towards the end of the economic crisis around 2019, and despite the slowdown experienced during the period 2019-2021 due to the pandemic, it accelerated at a faster pace in the last two years (Table 1).

The newly created centralities also tend to indeed move along axes, as initially predicted by the General Urban Plan (GUP), but still concentrate on those connecting the most developed squares of the Municipality. Thus, we observe a new center at 25th March Square at the intersection of neighborhoods 6-7-11-12, another one at Agia Paraskevi Square at the intersection of neighborhoods 11-12-13, and one more at Agia Mavra Square at the intersection of neighborhoods 8-9-10. The commercial and leisure uses also tend to expand on the axes between squares as shown in the consolidated map below (Fig.4).

CENTRALITIES \NUMBER PER USES	RETAIL			LEISURE			MARKET		
YEAR	2014	2019	2024	2014	2019	2024	2014	2019	2024
25th March Square	12	14	**15**	3	4	**7**	2	2	**2**
Agia Paraskevi Square	2	2	**2**	2	6	**6**	4	4	**4**
Agia Mavra Square	4	2	**2**	3	4	**6**	0	1	**2**

Table 1. Uses per centrality

The above-mentioned businesses are found either on the square or within a radius of less than 100 meters from it. The nearly doubling of leisure establishments along with the increase in retail and food market shops are trends encountered in all three cases. This trend was not -yet- present in other squares of the Municipality.

Proposed centralities

Examining the distribution of existing and emerging centralities in the Municipality, along with a 500meter radius of service for each centrality, we observe that there is a significant overlap across its entire extent of the city, with only two neighborhoods having room for improvement.

The first one is Neighborhood 14. The prominent topography of the neighborhood, located precisely at the foot of Mount Hymettus, as well as the strong boundary formed by Kyprou Avenue, which serves as the main and high-speed axis for vehicular traffic coming from Alimou-Karea Av. towards south Athens, dividing the neighborhood from the rest of the Municipality, result in the relative isolation of the neighborhood. Therefore, it is suggested to explore the creation of a local center in around the Ilioupolis municipal swimming pool, as the pre-existing use already establishes a degree of centrality to the area. The proposal aims to further strengthen this centrality and accommodate the part of the city that is relatively separated from the rest of the municipality.

The second point of low coverage from the existing and emerging centralities is the boundary between Neighborhoods 2 and 3, along which the General Urban Plan (GUP) initially established the use of the neighborhood center. While there is a market operating in the area with some shops, the intense adjacency with Alimou-Karea Av., the increased traffic, and the wide width of the road at this part of the city, have not favored cohesion in operations and the creation of a cohesive centrality up until today.

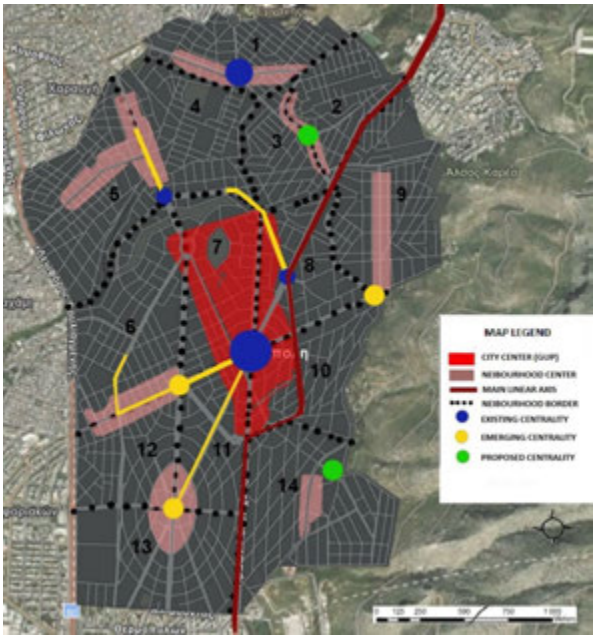

Figure 4. Centralities per type

Model implementation cost and effectiveness assessment

The centralities identified in the study area create a dense network capable of covering the entire Municipality with a service radius ranging from 500 to 700 meters. A total of 7 centralities were identified, and two more were proposed. In proportion to the city's population, which, according to the 2021 census, stands at 76,730residents, this means that approximately 8500 residents are

served per centrality. During the implementation of the 15-minute city model, it is important to protect specific established features defined by urban planning legislation. This means that the new proposed centralities are not intended to compete with the current commercial center of the Municipality. The Ethnikis Antistaseos Square, representing the municipal center, retains its primary central character in any case, as reflected in the intense overlap of service radius of the neighboring centralities under examination. The goal is to strengthen smaller local units that can maintain a degree of differentiation among them in terms of character, functions, and size.

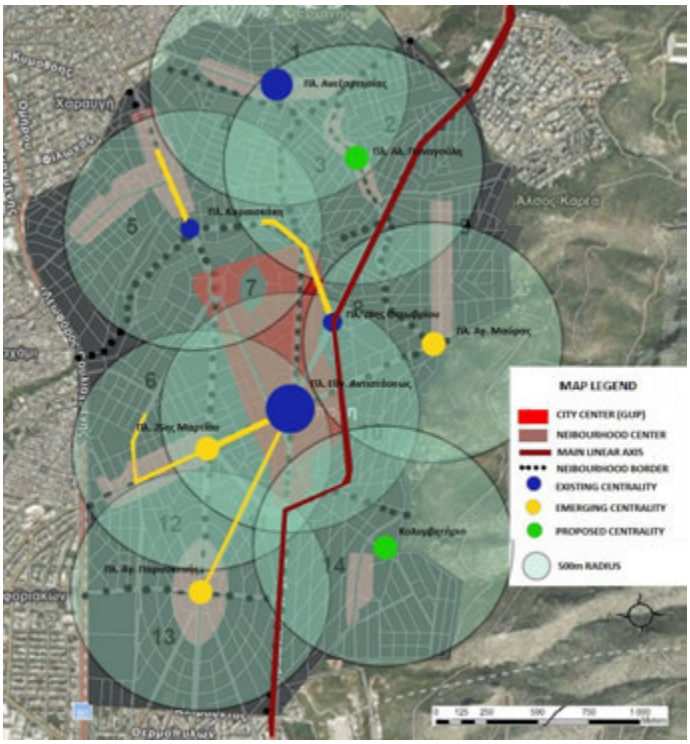

Figure 5. 500m radius per centrality

In this section, we proceed to the parameterization of the centralities according to the desired outcome. This means determining the expected character of each centrality, the desired functions per point, while assessing the degree of satisfaction of the desired condition from the current situation. This comparison will highlight the necessary interventions needed to achieve the predetermined goal for each centrality. These requirements can then be evaluated in terms of cost and effectiveness.
Building upon the functions introduced by the model of K. Moreno for Paris, where the key operating axes were proximity, mixed-use, density, repetition, we observe a high degree of satisfaction of these conditions in the case of the Municipality of Ilioupoli. The city is indeed characterized by a dense fabric with mix of uses and its small scale favors proximity to each center.

In terms of proposed uses, K. Moreno positioned schools at the center of neighborhoods and set the six basic uses that need to be satisfied: residence, work, market, education, health, and

recreation. In the present context, we choose to set open spaces/squares as the center of the unit, which already demonstrate a dynamic concentration of mixed functions. Additionally, while in the case of Paris, where the stronger separation of uses and the size of the city are evident, residence needs to be defined as a default requirement, in the context of the Municipality of Ilioupoli (and the broader Greek cityscape), the function of residence is considered to be satisfied throughout the examined area. Specifically, in the Municipality of Ilioupoli, according to the Operational Program of the Municipality of Ilioupoli [5], which drew data from the 2011 Census, out of a total of 11,885 buildings, only 677 are not used for residential purposes (exclusive or mixed use).

On the contrary, given the inadequate public transportation network in the greater Athens area, which results in increased use of private vehicles mainly for commuting to and from work, it appears that additional public service points and remote working opportunities are much more necessary in the present context.

During the pandemic, three points were highlighted regarding remote work and public service in Greece: a) remote operation without the requirement for physical presence is largely feasible and effective, b) remote work burdens employees with the need to secure a workspace at home, which is not always feasible in terms of living conditions, space, and equipment, and c) there is an inevitable shift of operational costs from businesses to employees.

In this case study, the proposal for municipal remote work operational centers (hubs) ensures a safe environment close to home, allowing employees to have a fully equipped workspace in a common working space open to the public and businesses. The available space can be a public or private building, and private capital can be leveraged with incentives provided to private enterprises. The successful development of such a structure within the Municipality will achieve a reduction in private vehicle usage, decrease commuting time to and from work, create job opportunities for single-parent households and/or young parents, and improve the user's quality of life. All of these are Sustainable Development Goals as adopted by the EU.

However, in the case of examining central Athens or any other city with significant tourist interest, the aspect of residency should revert to the parameters, while the demand for remote work structures would decrease. It should be noted that the exclusion of residency from this specific parameterization does not imply that protective measures for residency should not be considered to the extent that it is estimated that the proposed interventions will affect it (e.g., to avoid the phenomenon of gentrification). These measures should be examined during the stage of establishing the institutional framework for the implementation and execution of the 15minute city model in Greece.
Table2 presents the coverage of functions (YES/NO) per identified centrality in the Municipality of Ilioupoli. The indication "+" is used in case of desired enhancement of the specific use:

CENTRALITIES/USE	RETAIL	LEISURE	MERKET	GREEN SPACES	EDUCATION	HEALTH CARE	REMOTE WOKRING
EXISTING							
Eth. Antistaseos Sq.	N	N	N	N	N	O	O
Aneksartisias Sq	N	N	N	N	N	O	O++
Karaiskaki Sq.	N	N	N	N	N	N	O
28th October Sq	O	N+	N	N	N	O++	O

EMERGING/TO BE ENHANCED							
25th March Square	N+	N	N	N	N	O	O++
Agia Paraskevi Sq	N+	N	N+	N	N	O++	O
Agia Mavra Square	N+	N+	N	N	N	O	O++
NEW PROPOSALS							
Al. Panagouli Sq.	N+	N+	O	N	O	O	O
Swimming complex	O	O	O	N	N	O	O

Table 2. Coverage of functions (YES/NO) per identified centrality

To save resources, specifically concerning public service/healthcare facilities and remote working spaces, a larger radius per central point can be utilized. It is thus proposed a service clustering every three centralities. In this case study, remote working spaces may be established at 25th March square, at Anexartisias square, and at Agias Mavras square, while healthcare/public service facilities may be located at 28th October square and Ag. Paraskevis squre, in addition to Karaïskaki square, which is in close proximity to the existing municipality's healthcare infrastructure. Even with this proposed clustering for these specific functions, the user's commute will not exceed the one-kilometer limit. Data on employment in the municipality of Ilioupolis, sourced from the Operational Program of the Municipality of Ilioupolis. report that out of a total of 30,527 employees in the municipality, 84.79% are employed in the tertiary sector of services [5]. This implies that even if there is a possibility of remote work for 1 out of 3 employees in the service sector, over 8,500 commutes to and from work are prevented per user.

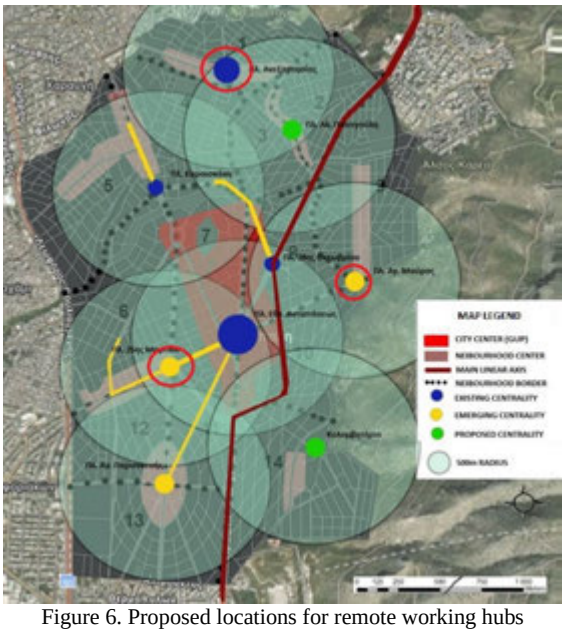

Figure 6. Proposed locations for remote working hubs

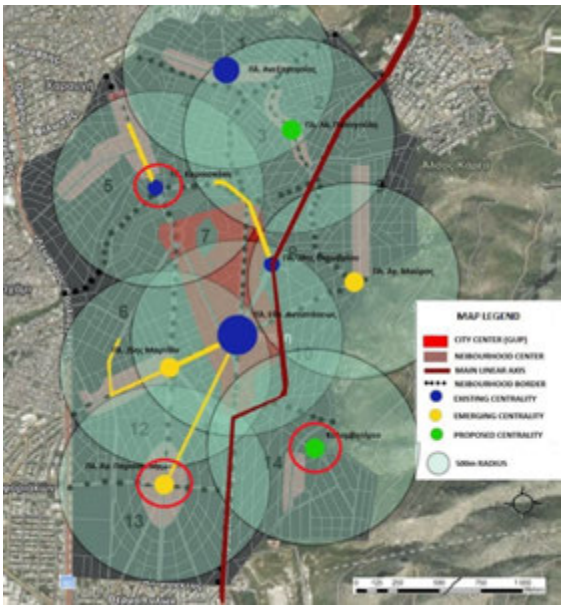

Figure 7. Proposed locations for healthcare facilities

In the previous section, the goals and needs for the operation of centralities in the Municipality of Ilioupolis were outlined. From the table that presented the coverage of functions (YES/NO) per identified centrality in the Municipality of Ilioupolis, we observe that the actual requirements of the local centers mainly involve enhancing existing functions and uses rather

than adding new ones. This ensures that the proposal follows a dynamic already present in the area and guarantees a reduction in potential disruption of balance, as well as an increased likelihood of acceptance by the public.

Specifically, as concluded from the above, the following are required:

Enhancement of existing use:

Retail in 4 centralities
Leisure in 3 centralities
Market in 1 centrality

Installation of new use:

Remote working facilities in 3 centralities
Healthcare/public service in 2 centralities

It should be noted, however, that an exact estimation of the level of enhancement needed is not yet possible, given that both remote work and public service/healthcare facilities are expected to attract daily users to the proposed locations, thus boosting retail and leisure uses to some extent either way. Furthermore, requirements for enhancing uses overlap with the installation of the new uses in all cases except for Panagouli Square, meaning that the city interventions can and will have multiple impact on several sectors.

According to the above analysis, the actions that the Municipality of Ilioupolis should take to support the above scenario are as follows:

Δ1. Enhancement of commercial, leisure and market uses in the designated areas.
Δ2. Establishment of 2 healthcare/public service facilities and 3 remote work facilities.
Δ3. Development of a network between centralities with safe routes that comply with the sustainable mobility principles.
Δ4. Modernization of regulatory framework to facilitate proposed interventions.

In the table below, we have defined the minimum requirements for promoting the scenario of multiple centralities in the case study of Iioupoli Municipality. We observe that, apart from the need for equipping, leasing, and/or adapting municipal buildings to accommodate the new uses of healthcare/public service and remote working facilities, there is a strong overlap of requirements per set Action. This implies increased efficiency of the resources allocated to meet each predetermined requirement.

Actions	Δ1	Δ2	Δ3	Δ4

Costs/Requirements				
Leasing of building infrastructure				
Adapting building infrastructure				
Technical equipment				
Operating costs/Consumables				
Operating costs/Energy				
Incentives for private individuals				
Urban equipment				
Creation/upgrading of pedestrian traffic network				
Upgrade/Enhancement of green network				
Enhancement of public transportation				
Consultation organization				
Person-hours for consultation				
Diffusion of results				

Table 3. Requirements/costs per Action

Furthermore, we observe that overall, the requirements consist of mild-scale interventions that are either explicitly included in existing strategic priorities of the Municipality (e.g., the Operational Program of the Municipality of Iioupolis 2015-2019) or are part of the requirements arising from compliance with European Sustainable Development goals. This fact, on the one hand, makes such interventions a constant target of the municipal authority and, on the other hand, entails the possibility of securing funding from European sources that will not burden the municipal budget.

It is therefore estimated that the substantial burden that the exploration of the 15-minute city model will impose on the Municipality of Ilioupolis will be small and mainly focused on issues of strategic development and management, consultation organization, resource leverage, and incentive development. In terms of efficiency however, this cost, besides being a constant need of Greek local government at all levels, is estimated to be much smaller in comparison to the benefits that the city and the user will derive in terms of daily living, resilience, risk management, as well as in relation to today's requirements for environmental protection.

Concluding observations

In summary, the examination of the polycentric operation implementation within the Municipality of Ilioupoli, advocating for the 15-minute city model, offers valuable insights into the multifaceted implications of this urban development strategy. By meticulously scrutinizing the identified functions and requirements of the centralities, the study reveals a nuanced understanding of how the proposed approach harmonizes with the existing fabric of the community and aligns with strategic priorities. This alignment not only mitigates potential disruptions but also garners widespread public acceptance.

Furthermore, the delineation of requisite measures to bolster this initiative underscores the municipality's steadfast dedication to fostering sustainable urban growth. Leveraging both established strategic frameworks and available European funding avenues, the municipality demonstrates a proactive stance towards realizing its vision. Despite projections of a modest upgrade in administrative and organizational demands, the anticipated benefits for residents—ranging from enhanced quality of life to heightened resilience and ecological preservation—far outweigh any associated costs.

In essence, the pursuit of the polycentric 15-minute city model epitomizes a forward-looking urban planning practices that places paramount importance on safeguarding the well-being and sustainability of the Ilioupoli community. This progressive approach not only sets a precedent for the region but also holds promise for emulation in other Greek cities, signaling a potential paradigm shift in urban development practices nationwide, if evaluated and implemented correctly and according to the needs of every case study.

It's important to note that the findings presented above are part of an ongoing research endeavor, and as such, the results are not final. While the insights gleaned thus far shed valuable light on the potential benefits and challenges associated with the implementation of the polycentric operation in the Municipality of Ilioupoli and the promotion of the 15-minute city model, they represent only a preliminary analysis. Further in-depth examination and data collection are necessary to fully understand the complexities of this urban development approach. In the subsequent stages of this research, more detailed observations will be made, providing a comprehensive understanding of the implications and outcomes of adopting the polycentric model. Thus, these initial findings serve as a foundation for future exploration and refinement of urban planning strategies in Ilioupoli and beyond.

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Optimizing Land Resource Allocation and Functional Configuration in High-Tech Industrial Parks: A Case Study of Chengdu Xinchuan High-tech Innovation Park

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Abstract:
Amid China's ongoing initiatives to enhance industrial land efficiency and promote urban upgrading, high-tech innovation parks emerge as crucial policy zones driving urban economic development. These parks are increasingly integrated into the fabric of urban districts, reflecting their growing role as key components of city functions. This paper specifically examines Chengdu Xinchuan High-tech Innovation Park, exploring strategies for managing land resource allocation and efficient supply to support the park's swift and transformative development. An analysis of the functional configurations from exemplary parks like Shenzhen Nanshan High-Tech Park, Shanghai Zhangjiang Hi-Tech North Park, and Chengdu Tianfu Software Park informs the proposed optimization for Chengdu Xinchuan. The initial planned distribution of 32% residential, 28% industrial, and 40% commercial functions is recalibrated to 32% residential, 43% industrial, and 25% commercial. This adjustment is aimed at creating a more balanced development conducive to both economic vitality and community sustainability. Drawing on the successes of these benchmark parks, the study outlines a tailored functional ratio scheme, providing actionable insights and strategic guidance for similar transformations in other urban high-tech industrial parks.

keywords: Functional optimization, High-tech innovation parks, Benchmark analysis, Land function

1.Introduction

The rapid economic transformation of China over the past few decades has been significantly influenced by the strategic development of high-tech industrial parks (Hu, 2007). These parks are pivotal in fostering innovation, attracting foreign investment, and catalyzing regional development. The Chinese government's emphasis on upgrading industrial structures and enhancing technological innovation capabilities has further propelled the evolution of these parks (Zhang and Wu, 2012). In Chengdu, the push towards establishing a high-tech zone reflects broader national trends aimed at integrating advanced manufacturing and information technology industries. Chengdu's strategic location in southwestern China adds to its potential, positioning it as a gateway for technological and economic interactions between China and South Asia.

Chengdu's commitment to technological advancement is exemplified by the development of Chengdu Xinchuan High-tech Innovation Park. Launched as part of a larger initiative to transform the region into a center for technological innovation, the park is designed to support cutting-edge industries such as IT, biotechnology, and new energy. This development is underpinned by China's national policies advocating for

the intensive use of industrial land, which aims to optimize land use efficiency and support sustainable urban growth (Tu, Yu, and Ruan, 2014).

Since its inception, Chengdu Xinchuan High-tech Innovation Park has made significant strides in attracting high-tech firms and contributing to the region's economic growth. However, the park faces several challenges that hinder its potential to become a leading innovation hub. One of the primary issues is the mismatch between land supply and the specific demands of high-tech industries. This misalignment often leads to inefficient land use and underutilization of available resources, which can stifle the growth of resident companies and reduce the park's overall competitiveness.

Another significant challenge is the functional imbalance in land use, where the proportions of land designated for industrial, residential, and commercial uses do not optimally support the park's goals. This issue is exacerbated by rigid planning policies that fail to adapt to the dynamic needs of high-tech enterprises, which require flexible environments that can rapidly adjust to technological advancements and market changes.

This study aims to address these challenges by:

1. Analyzing the current land allocation and functional configuration at Chengdu Xinchuan High-tech Innovation Park to identify core issues in land management and usage efficiency.

2. Benchmarking against successful high-tech parks nationally to derive actionable insights and best practices that could be adapted for Chengdu Xinchuan.

3. Proposing strategic interventions to optimize land resource allocation and functional configuration, ensuring that the park not only meets the current needs of its tenants but is also poised for future growth and innovation.

The ultimate goal is to redefine the urban space within Chengdu Xinchuan High-tech Innovation Park to better serve its function as a catalyst for technological innovation and economic development, contributing to the broader objectives of Chengdu's urban and economic planning strategies.

2.Literature Review

2.1 Industrial Land Use Policies in China

The transformation of industrial land use policies in China has been profound over the last few decades, reflecting the nation's shift towards a more sustainable and economically productive use of its urban and peri-urban land. The Chinese government has introduced several policies aimed at promoting the efficient use of industrial land, particularly in the context of rapid urbanization and the growing need for innovation-driven economic zones. Notably, the "National Land Use Policy" (2008) and subsequent amendments emphasize the intensive and efficient use of industrial land. These policies support the development of high-tech parks by stipulating that such areas must incorporate sustainable practices and efficient land use to foster innovation while minimizing environmental impacts (Ministry of Natural Resources of the People's

Republic of China, 2008).

Further reforms were introduced with the "Guidelines on Promoting the Economical and Intensive Use of Land" (2015), which set specific targets for the utilization rates and densities of industrial parks. These guidelines are designed to ensure that new developments, like Chengdu Xinchuan, align with national sustainability objectives while supporting high-tech industries (Ministry of Natural Resources of the People's Republic of China, 2015).

2.2 Case Studies on Land Resource Management in High-tech Zones

Several high-tech zones in China and globally offer valuable insights into effective land resource management practices. For instance, the Suzhou Industrial Park and the Shanghai Zhangjiang High-tech Park have been highlighted for their innovative approaches to land use and management. These parks have implemented mixed-use development strategies that integrate residential, commercial, and industrial spaces, allowing for greater functional integration and resource efficiency (Holländer, Wu and Duan, 2009).

Examining high-tech zones within Asia provides valuable insights into the effective management of land resources. Alongside China's Suzhou Industrial Park and Shanghai Zhangjiang High-tech Park, Singapore's One-North is a leading example of a science park that exemplifies best practices in land resource management. One-North has been designed to be a hub for research, innovation, and entrepreneurship, integrating business parks, biomedical sciences, and infocomm technology zones. The park's development strategy has prioritized flexibility in land use and zoning to adapt quickly to the needs of dynamic sectors, enhancing its appeal to international and local companies (Yuen, 2016).

In Japan, the Tsukuba Science City represents another significant case of strategic land use. Tsukuba's planning framework was designed to facilitate close interaction between research institutions and private companies, fostering collaboration and innovation. The city's layout includes dedicated spaces for different scientific fields, residential areas, and commercial services, creating an integrated environment that supports both professional and personal needs of its community.

In Europe and America, examples such as the Research Triangle Park in North Carolina, USA, and the Cambridge Science Park in the UK demonstrate the importance of flexible land use policies that adapt to the evolving needs of high-tech companies. These parks focus on creating environments that foster collaboration and innovation while providing the necessary infrastructure to support high-tech development (Bakouros, Mardas and Varsakelis, 2002).

2.3 Impact of Functional Configuration on Urban Development

The configuration of land use functions within high-tech zones significantly impacts urban development. Properly balanced functional areas can lead to enhanced economic performance, improved environmental sustainability, and increased quality of life for residents and workers within the zone. Research has shown that the integration of green spaces, residential areas, and commercial services within industrial parks not only

supports sustainability but also boosts the attractiveness and competitiveness of these areas (Qu et al, 2015). In Chengdu Xinchuan, the challenge lies in optimizing this functional mix to match the specific needs of high-tech industries while supporting urban development goals. Effective functional configuration can facilitate better traffic management, reduce environmental stress, and create more livable urban spaces, contributing positively to the broader urban fabric of Chengdu (Yang Wu and Dang, 2017).

3.Research subjects and methods

3.1 Background Of Chengdu Xinchuan High-Tech Innovation Park

The Chengdu Xinchuan High-tech Innovation Park, located in the Chengdu High-tech Zone, integrates industrial, residential, and commercial functions (Figure 1). Since its establishment in 2012, the park has attracted numerous industries, primarily focusing on information technology, biotechnology, and new materials. In 2018, the policy document titled "Several Policies for Further Relieving the Non-Core Functions of Central Urban Areas and Enhancing the Quality of Urban Capacity in Chengdu" was issued. This policy mandates further optimization of land use functions in central urban areas, promoting the reform of industrial land supply side, and accelerating the improvement of land use efficiency and management levels.

In the context of this policy framework, the land management strategies of Xinchuan urgently require reevaluation. Currently, under the management of floor area ratio (FAR), Chengdu Xinchuan High-tech Innovation Park still has a potential total buildable volume of 14.687 million square meters. According to statistics, the scale of buildable new-type industrial buildings is estimated to be between 8.75 and 9.5 million square meters, residential buildings between 3.6 and 5.14 million square meters, and commercial buildings between 0.7 and 1.45 million square meters. This data demonstrates significant flexibility in land use adjustment.

Figure 1. Construction Status of Chengdu Xinchuan High-tech Innovation Park

3.2 Research Approach

This study employs a case comparative analysis method to investigate the development trajectories and land management strategies of high-tech industrial parks with successful operational experiences. It aims to summarize and collate the functional configuration combinations and proportions used across different parks, deriving general principles of spatial requirements for high-tech industrial parks. Based on these findings, the study proposes land use configuration strategies for Chengdu Xinchuan High-tech Innovation Park.

3.3 Method of Case Selection

This study selects parks for comparison based on their similarities in function (focusing on high-tech industries), challenges (urban integration and sustainable development), and their successful experiences in overcoming these challenges through innovative land use planning. Chengdu Xinchuan High-tech Innovation Park, with a land area of 10.34 km^2, was ultimately chosen for analysis alongside three other cases: Shenzhen Nanshan High-Tech Park(11.52km^2), Shanghai Zhangjiang Hi-Tech North Park (12.13km^2), and Chengdu Tianfu Software Park (9.55km^2). These comparisons aim to draw actionable insights based on the similarities and distinctive approaches of each park.

4. Case Study Analysis

4.1 Shenzhen Nanshan High-Tech Park

Shenzhen's Nanshan district, home to the renowned Shenzhen High-Tech Industrial Park, represents a model of successful high-tech park development through distinct phases of growth. There are three stages of development as follows.

Firstly, in initial industrialization phase (1985-1996), the Shenzhen Science and Technology Industrial Park, the predecessor of Shenzhen Nanshan High-Tech Park, rapidly achieved industrialization through a strategy known as "three supplies and one compensation". This phase focused on drawing in investment and technology through favorable policies, creating a somewhat isolated development model with designated land separating it from surrounding cities. Secondly, in rapid construction and innovation gathering phase (1996-2006), the High-tech Park shifted its focus towards aggregating innovative resources and fostering leading enterprises. This was a time of intensive land and industrial park development, seamlessly integrating property development with industrial expansion. The approach evolved from solely enhancing physical infrastructure to cultivating a comprehensive environment that supported all aspects of high-tech industry growth. And thirdly, in world-class park development phase (2006-present), the emphasis has been on promoting industrial transformation and upgrading to enhance indigenous innovation capabilities. The park's relationship with surrounding cities has become increasingly centered on human capital needs. This intercity collaboration extends to urban services such as university campuses, commercial centers, high-end residential areas, and the Shenzhen Bay Sports Center, significantly strengthening the integrated urban service framework that supports the

high-tech park.

Today, Nanshan hosts major companies like Tencent and Huawei and has developed a robust ecosystem that supports innovation across various sectors including telecommunications, biotechnology, and digital media. The park's enduring success is attributed to its strategic location, superior infrastructure, and the thoughtful integration of commercial and residential areas which enhance the livability for employees and their families (Cheng et al., 2014). This approach to functional mix and land use optimization provides valuable insights into creating a sustainable and integrated urban environment conducive to high-tech development.

The land use within the Shenzhen Nanshan High-Tech Park has been meticulously categorized to highlight the functionality of different areas as shown in Figure 2. Spanning an extensive site area of 11.52 square kilometers, the park features a total built-up area of 22.36 million square meters. It is predominantly designated as M0 new-type industrial land, accounting for 67% of the total area, which underscores its focus on fostering cutting-edge technological and industrial development. Additionally, commercial and residential lands make up 3% and 30% of the area respectively.

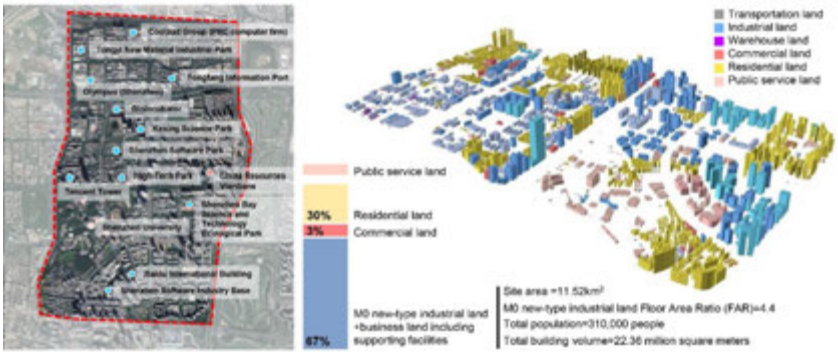

Figure 2. The proportions of different land use functions in Shenzhen Nanshan High-Tech Park

4.2 Shanghai Zhangjiang Hi-Tech North Park

Located in the Pudong district, Shanghai Zhangjiang High-tech Park is often referred to as China's Silicon Valley. Since its inception, the park has undergone several pivotal development phases as follows.

The period from 1992 to 1995 constituted the initial setup phase. The Park was meticulously planned, outlining the functional composition and zoning of the technology area. It established biopharmaceuticals, electronic information technology, and optomechatronics as the three leading industries. The construction of the park's incubators began, and expert and advisory committees were formed to guide development. Then, the period from 1995 to 1999 marked the Consolidation Phase for Zhangjiang. During these years, the area encountered substantial challenges in

attracting investments. In response, the municipal government strategically pivoted to emphasize high-tech development, designating the park as a national biopharmaceutical and technology industry base in Shanghai. This strategic shift included the establishment of national key laboratories, which laid the essential groundwork for the subsequent development of a comprehensive national science center. From 1999 to 2005, during the Aggregation Phase, Zhangjiang witnessed a significant integration of industry, education, and research. The establishment of an industrial base development and operation service company and the completion of a large-scale integrated circuit manufacturing base marked major milestones. Additionally, the groundwork was laid for the burgeoning cultural and creative industries. This phase seamlessly transitioned into the Upgrade Phase from 2005 to 2012, where Zhangjiang was among the first to propose the "Triple Services Strategy" in development zones, which included development and operation, integrated services, and industrial investment. This strategic evolution continued into the current phase, beginning in 2012, where Zhangjiang has been designated as a National Independent Innovation Demonstration Zone. This phase accentuates the dual engines of "function and innovation," rapidly integrating these elements into the park's development agenda, ensuring continual progress and enhancement of its industrial and research capabilities.

Throughout these phases, Zhangjiang High-tech Park has been instrumental in advancing China's pharmaceutical and IT industries. The Park benefits from strong governmental support and boasts a comprehensive service system that promotes research and development activities. Its development has been characterized by a strong emphasis on research and development facilities, which are complemented by residential and commercial spaces designed to foster a balanced work-life environment. The park's planning has been particularly effective in facilitating collaboration between research institutions and businesses, which has been a key factor in its success (Zhang and Wu, 2012).

Similarly, the land use within the Shanghai Zhangjiang Hi-Tech North Park has been carefully analyzed to ascertain the functionality of different areas, as depicted in Figure 3. The Park spans a total site area of 12.13 square kilometers and features a total built-up area of 10.16 million square meters. The distribution of land types includes 74% allocated to M0 new-type industrial land, 5% to commercial land, and 21% to residential land.

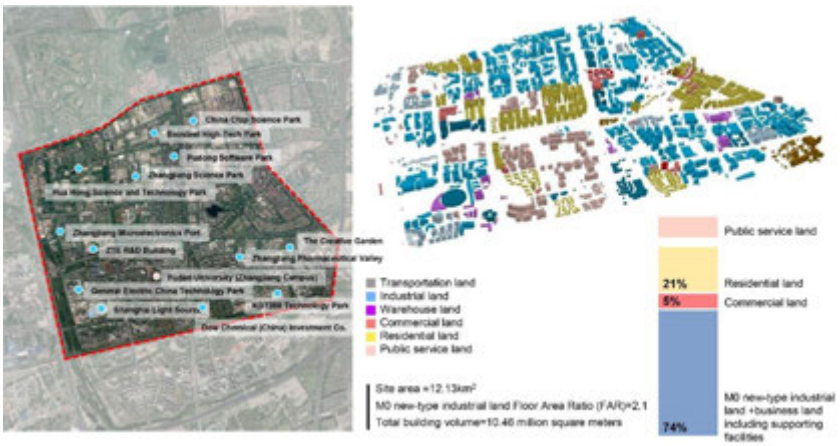

Figure 3. The proportions of different land use functions in Shanghai Zhangjiang Hi-Tech North Park

4.3 Chengdu Tianfu Software Park

Chengdu Tianfu Software Park, located in the heart of the Chengdu Hi-tech Zone, epitomizes a strategic approach to high-tech park development through clearly defined growth phases. Since its official opening in 2005, the park has undergone significant evolution, reflecting the broader ambitions of China's software and service outsourcing industries. Initially, from 2005 to 2007, it focused on establishing a strong foundational structure to rapidly cultivate a professional environment conducive to software development and IT outsourcing. This initial growth phase enabled the park to quickly attract major companies, leveraging Chengdu's burgeoning status as a tech hub. In the next phase, from 2008 to 2011, the park expanded its infrastructure from 800,000 square meters to over 1.3 million square meters, diversifying its industry mix to include business software, digital entertainment, and telecommunications. This expansion facilitated an ecosystem that supports both large corporations and small-medium enterprises. The most recent phase, from 2012 to the present, has centered on sustainability and internationalization. The Park has focused on creating a sustainable and culturally vibrant environment that attracts international investments, enhancing global connectivity and cultural offerings to improve the quality of life for its 30,000 employees and foster a balanced work-life environment.

The land use distribution within Chengdu Tianfu Software Park is detailed in Figure 4. Spanning a site area of 9.55 square kilometers, it is the smallest in size among the three cases discussed. Despite its smaller area, the park boasts a significant total building volume of 17.94 million square meters, ranking just behind Shenzhen Nanshan High-Tech Park. In terms of land allocation, 62% is dedicated to M0 new-type industrial land, underscoring its focus on technological and industrial development. Additionally, commercial land makes up a modest 3%, while residential land comprises 35% of the park. This layout strategically balances industrial growth with residential and commercial spaces, enhancing the overall functionality and livability of the area.

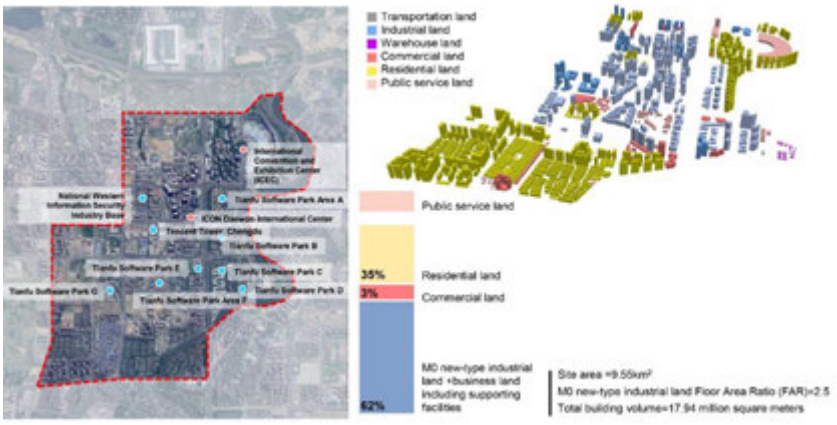

Figure 4. The proportions of different land use functions in Chengdu Tianfu Software Park

4.4 Summary

Although there are clear differences in the total building volumes among the three case study areas, the proportion of industrial, residential, and commercial land use demonstrates a general pattern (Figure 5). M0 new-type industrial land generally accounts for about 60%-75%, residential land comprises 20%-35%, and commercial land falls within the range of 3%-5%. This pattern provides a reference of successful experiences for the functional distribution in Xinchuan.

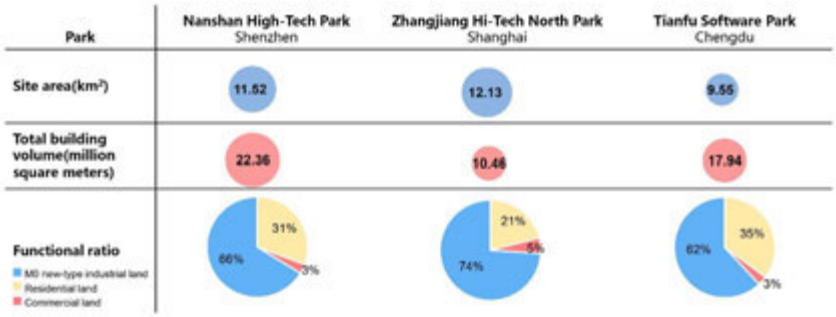

Figure 5. Comparison of land function proportions in the three high-tech industrial parks

5. Strategies and Recommendations

Considering the successful strategies employed by benchmarked parks, it is recommended to strategically reallocate resources within Chengdu Xinchuan High-Tech Innovation Park to foster its development into a leading high-tech hub (Figure 6). To achieve a more optimal functional mix, it is advised to adjust property function allocation to 60-75% for 'Industry + Office', which should include accommodation and small commercial support facilities. Residential areas should then comprise 25-35%, with retail space occupying 3-5% of the total area. Additionally, adjustments in the building ratio are necessary, aligning with the successful innovation parks' experiences

to significantly increase the share of industrial space. This includes accommodating up to 10% of the industry space for service facilities as ancillary rooms, which enhances functionality without overwhelming the industrial character. The proposed changes would maintain the residential space at 470.7 million square meters, increase industrial space from 398.9 million to 631.0 million square meters, and decrease commercial space from 589.5 million to 356.3 million square meters. Finally, the comparison of total building volume by land use type for Xinchuan Park before and after adjustments is shown in Figure 7.

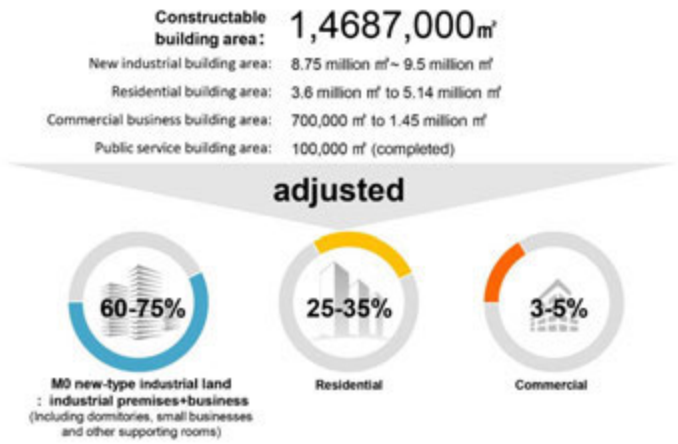

Figure 6. Schematic diagram of land functional ratio adjustment for Chengdu Xinchuan High-tech Innovation Park

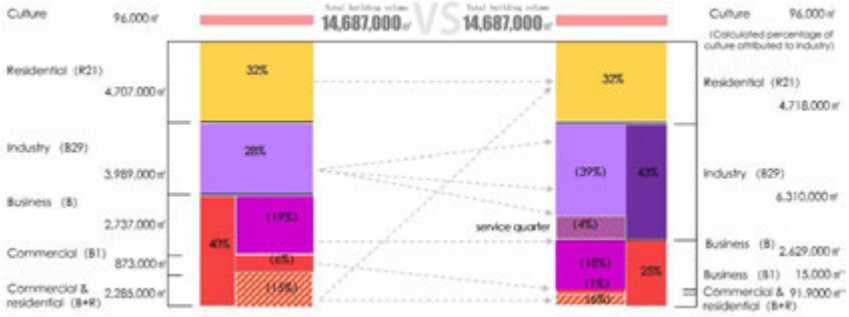

Figure 7. Comparison before and after adjustment of total building volume by land use type

6. Conclusion

This paper analyzes the functional configurations of successful parks such as Shenzhen Nanshan High-Tech Park, Shanghai Zhangjiang Hi-Tech North Park, and Chengdu Tianfu Software Park to derive general principles for land use functional ratios in high-tech industrial parks. It concludes that industrial land typically comprises 60%-75%, residential areas account for 20%-35%, and commercial spaces make up 3%-5% of

these parks. These findings provide empirical guidelines for adjusting the land use layout in Chengdu Xinchuan Innovation Technology Park, aiming to facilitate its transition from a traditional industrial area to an integrated urban district. As a result, this study redefines the urban space of Chengdu Xinchuan High-Tech Innovation Park by adjusting the original planning of 32% residential, 28% industrial, and 40% commercial functions to 32%, 43%, and 25% respectively. This adjustment better positions the urban space to serve as a catalyst for technological innovation and economic development. Although the derived ratios are based on successful parks, the limited number of comparative cases means these guidelines are not yet universally validated and require further substantiation.

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Ligurian transfer: when territorial constraints may hamper mobility policies replicability

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Abstract
Within EU, policy transferability is pivotal. Nevertheless, best-practices' approach has proved ineffective for fragile and peculiar regions. In terms of mobility policies, Sustainable Urban Mobility Plans constitute one of the main EU-led tools larger cities were provided to define context-based actions, later spreading to wider regions, according to the reading of EU system as a polycentric intertwined network, where main hubs connect higher and lower layers. Nevertheless, not all EU regions show this territorial model. Liguria, North-Western Italy, does not: its geo-morphological asset has deeply influenced urban and infrastructural development. The definition of a user-centred perspective, turning from a case-study to a use case approach, contributes shaping inductively tailored solutions. Present perspective may contribute to identify similarities in needs and requirements, thus supporting policies up-scaling.

Key-words: mobility policies, user-centred, use case methodology, place-based

1. Introduction
As the official motto states – *United in diversity* (European Union, 2000) – European Union strategic mission as policy maker is to build shared background, structures and policies able to both respect Member States peculiar cultures and identities as well as define a common approach towards challenges they all need to face.
Best-practices transfer appeared to be, in this direction, the most suitable initiative to meet similar double-layered goal. Descending from private business' world where in the 1960's companies aimed at enhancing performances and consolidating competitive advantage (Jarrar Y. and Zairi M., 2000), similar approach was later extended to support replicability of solutions, policies, actions or procedures within different territorial contexts facing comparable issues, especially whenever planning and mobility initiatives are concerned (Macmillen and Stead, 2014).
Similar choice did not aim only at supporting policy transferability, but played also a significant role in the implementation of evidence-based actions, thus legitimating public decision-making and governance (Ettelt, Mays and Nolte, 2012). Best-practices replication appears indeed to be extremely suitable also in terms of public expenditure rationalisation, thus reducing variability and uncertainties related to experimental steps (Marsden, 2011). This territorial "legacy" supports therefore regions and cities in policy-making processes to capitalize on foreign successes and avoid mistakes repetition (Stead, De Jong and Reinholde, 2008). Exchange network and formats therefore boosted within EU borders, later defined as a "massive transfer platform" (Radaelli, 2000). Increased efficiency and evidence-based approach guided indeed deeply different contexts and regions to reproduce winning experiences implemented elsewhere (Blake *et al.*, 2021), thus providing best-practices a unprecedented pivotal role among policy-making tools (Vettoretto L., 2009).
Nevertheless, their de-contextualizing effect has been also harshly criticized (Vettoretto L., 2009), since actions' effectiveness has been more and more related to context-specific features (Stead D., 2012).

In this direction, progressive EU extension East-ward increased inter-regional differences and variety, so that policy-transfer approach needed to be updated (Hospers, 2005). Regional peculiarities progressively gained relevance in this mechanism, so that innovation and competitiveness started to be promoted and boosted through local features valorisation, following the concept of the so-called *learning regions* (Morgan, 1997). Regional identities gradually acquired indeed larger spots both referring to policies and politics spaces (Salone, 2010), thus increasing structural resources to locate themselves on the map.
After policy transfer and replication showed their weaknesses, networking among cities and regions seemed consequently the most proper way to foster local innovation and development (Stuck, Broekel and Revilla Diez, 2016), thus contrasting isolation risk. Main hubs and secondary nodes were therefore identified to support territorial complementarity in driving regional competitiveness.
As far as transport and mobility policies, similar reasoning may be found at the basis of both infrastructural (TEN-T network) and governance (SUMPs) initiatives.
Large cities are therefore required to drive smart and green transition of their reference region, thus relying on smaller centres supporting progressive spreading of the actions. Nevertheless, not all regions show similar territorial and urban structure, where both vertical and horizontal complementarities contribute in achieve effectiveness performance thresholds.
Ligurian regional asset and structure for instance show not to match present model.
Is it therefore possible to conceptualize different approach towards mobility and transport policies for those contexts where unusual spatial patterns hamper policy up-scaling?
Present contribution aims indeed at highlighting how user-centred approach may help fragile and peculiar regions towards sustainable mobility goals. In details, conceptual shift from a case-study to a use-case methodology will be addressed.
To this aim, mobility policies and EU-led initiatives will be investigated in terms of territorial governance and implementation mechanisms (Section 2), in order to evaluate potential mismatches with Liguria and Genoese asset (Section 3), thus framing potential benefits coming from the shift from a case-study to a use-case approach. In this direction, potential system requirements would be pointed-out (Section 4) to finally evaluate how similar user-centred approach could contribute to overcome existing barriers in terms of mobility policies up-scaling (Section 5).

2. Mobility policies and territorial complementarities

Since the very beginning of common transport and mobility policies, large urban areas have been targeted as key-actors to face EU strategic challenges. Similar responsibilities were mainly due to their weight in terms of socio-economic phenomena, related traffic flows attraction and generation, as well as of energy consumption and emissions production (Harris *et al.*, 2020).
Increasing commitment of EU to mitigate transport-related externalities, supporting sustainable transition of territorial systems, met a significant change in 2013 when both *Guidelines for the development of the Trans-European Transport Network* (European Union, 2013) and *Urban Mobility Packages* (European Commission, 2013) -and consequently *Sustainable Urban Mobility Plans* (SUMPs)-were introduced.
It is therefore evident that on the infrastructural as well as on the governance and planning side, urban hubs were targeted as main drivers of EU-scaled transport and mobility initiatives. Their strategic intertwining was therefore remarked in 2021 when

TEN-T network was revised, and 400 cities constituting the nodal structure of the network were required to design and approve SUMPs in order to ensure transport infrastructures full and effective implementation (European Union, 2021).
As far as sustainable mobility planning is concerned, EU initiative -initially launched in 2009 (European Commission, 2009), supporting progressive consolidation of SUMPs- aimed at collecting experiences descending from voluntary commitment of European cities to foster subsequent best-practices transfer.
Nevertheless, EU monitoring of the databases showed that smaller municipalities (counting less than 100,000 inhabitants) had weakly participated in SUMP programme, due to limited human and material resources to be dedicated (EU Urban Mobility Observatory, 2021). In this direction, White Paper in 2011 (European Commission, 2011) suggested that municipalities over that threshold should be required to draft SUMPs on a mandatory basis, thus conditioning the allocation of regional and cohesion funds (Torrisi *et al.*, 2020).
Specific guidelines for small municipalities were later published, to support widespread transfer of best practices, at the same time topic guide for metropolitan implementation of SUMPs (Chinellato and Morfoulaki, 2019) was introduced, thus stating that similar up-scaling is not feasible through standardized, *one-size-fits-all* solutions. It is therefore evident that present transfer strategy relies on the potential of larger cities to design innovative actions to be later extended to wider metropolitan and regional contexts. Nevertheless, past SUMPs history has shown that not all territorial *milieu* prove to be equally successful (Klausen and Szmigiel-Rawska, 2017).
In this direction, potential explanation could be derived from different territorial networks model. While Christallerian and interconnected networks (Dematteis G., 1994) benefit from both vertical and horizontal complementarities among smaller and larger centres (Figure 1), thus feeding regional hub and spoke system, territorial contexts where strong polarisation is present may face significant challenges (Lang *et al.*, 2022).

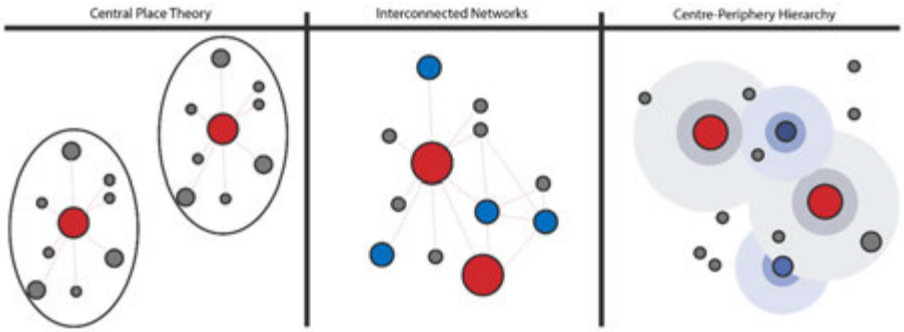

Figure 1. Territorial networks model

In parallel, it is necessary to point-out that SUMPs programme identify several mobility enablers, in order to support multi-modal integration, green and digital transition. Among these several bottom-up mechanisms (such as Mobility Management and Mobility-as-a-Service) are targeted to support bottom-up mechanisms whenever top-down approach fails in the up-scaling of policies (Timms, 2011). User-centred perspective is indeed gaining relevance to overcome planning barriers related to

administrative boundaries, layered and complex urban flows management, conflicting interests and prevision.

3. Genoa: using case-studies or studying use cases?

In this section we introduce the case study: the city of Genoa, Italy, and its role in determining travel in Ligurian Region. Through the experiences gained from the pilot projects and policies implemented in the metropolitan city area, strengths and weaknesses in the scalability on a regional scale will be identified.
To that purpose, through the models of networks and territorial nodes, limitations in the regional development of mobility policies in Liguria are traced.
Finally, a use-case methodology is introduced through which to structure the proposal in the next section.

3.1 Case Study And Regional Mobility

The case study that is the subject of this paper is the municipality of Genoa and by extension of mobility policies the region of Liguria, located in the north-west of Italy. Genoa is the main city of Liguria and with more than 500,000 inhabitants it accounts for more than 35 percent of the regional population.
Liguria is an Italian region consisting of four provinces: Imperia, Savona, the Metropolitan City of Genoa and La Spezia (Figure 2). To the north and south, it is delimited by two physical boundaries: the Ligurian Sea and the Alpine-Apennine arc. This territorial conformation also determines the compressed shape that Liguria possesses and explains its infrastructural systems, with a coastline and three pass lines to the north.
The region's main urban centres are located along the coastline and, in line with the classification provided by the National Strategy for Inner Areas (Agenzia di Coesione Territoriale, 2013), 43% of Ligurian municipalities are unable to reach an urban pole capable of providing the necessary services in less than 20 minutes (Istat, 2021). Moreover, in terms of employment rate they achieve significantly lower percentage values than urban centres - poles, inter-municipal poles and belt poles (Istat, 2021).

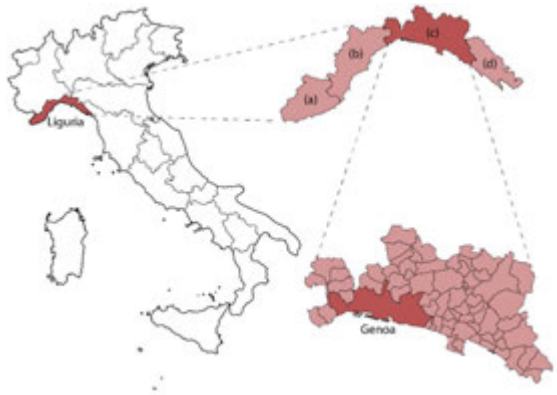

Figure 2. Case study location in relation to Italy. Imperia province (a), Savona province (b), Genoa Metropolitan Area (c) and La Spezia province (d).

Administratively, Liguria borders France to the west, Piedmont and Emilia Romagna to the north and Tuscany to the east. The infrastructure network - motorway and railway - converges on the Genoa node where the presence of the port - freight and cruise - is a determining factor in the Genoese and regional economy (Autorità Portuale di Genova, 2017). In fact, the induced industries activated by the port sector generate over 10 percent of added value and 8 percent of regional employment (Autorità Portuale di Genova, 2017).
All these factors turn out to be decisive in the definitions of the mobility habits of Ligurian citizens, strongly dependent on the need to reach Genoa, a city that plays a barycentric role in the determination of daily travel motives. The Liguria Region itself has published a report analysing regional mobility through data processed by the Vodafone Analytics service(Regione Liguria, 2020). Although the report describes a pre-pandemic situation, it can be considered representative of the current situation, not in numerical terms but in the definition of descriptive trends.
As emerges from the histograms shown in Figure 3, Genoa assumes a centralising role in mobility because it generates and attracts travel numbers hardly comparable to those of other Ligurian destinations, both in the off-season - November - and in the peak-season - August. It is interesting to point out that the city of Genoa exceeds one million trip-days; therefore, relating this number to the number of inhabitants makes the central role more evident than the whole Ligurian population.

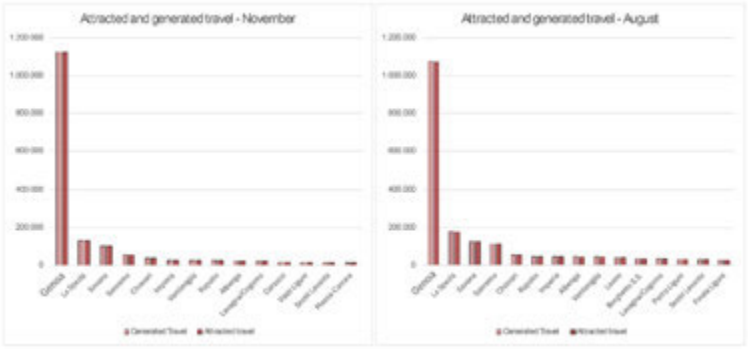

Figure 3. Number of travels generated and attracted in one day by Ligurian municipalities in November and August. Source Regione Liguria (2020), graphic reworking by the authors.

This is most evident when reading the desire lines, the tracks that indicate the movements according to the origin-destination pattern and assess their extent. In Figure 4, the month of November 2019 is taken as a reference and some singularities are highlighted: two areas of disconnection, one between the provinces of Imperia and Savona and one between the Metropolitan City of Genoa and La Spezia; furthermore, the city of Genoa centralises the displacements.
The Metropolitan City of Genoa adopted a SUMP in 2019 (Città Metropolitana di Genova, 2019), through which it determines the strategies and actions to be pursued and monitored in the following years. One part of the proposed actions focuses on the mobility of goods and people within Genoa's urban boundaries. A second part concerns strategic actions to optimise commuting to Genoa. In the latest version of the PUMS the line of strengthening and adapting the urban transport network for people and goods continues, with a strongly focused vision on local public transport (Città Metropolitana di Genova, 2023). In addition, MaaS - Mobility as a Service -

experiments are mentioned for the entire Metropolitan City of Genoa in order to stimulate the development of technologically advanced solutions for travel management and the various mobility services in the area (Città Metropolitana di Genova, 2023).

Figure 4. Map of Liguria's desire lines in November, line size and colour are proportional to the number of travel-days. Source Regione Liguria, (2020), graphic reworking by the authors.

Finally, it is recorded that the city of Savona is beginning the process to adopt its own SUMP (Comune di Savona, no date) and the city of La Spezia has adopted a municipal SUMP (Comune di La Spezia, 2018). In both cases it is emphasised how, despite the non-compulsoriness imposed at national level for the adoption of PUMS, the two municipalities represent two virtuous attempts to adapt to the new sustainable mobility standards. However, it must be emphasised that they are limited to the municipal territory and do not include the entire province in the planning of strategies.
Hence, it can be stated that the mobility policies at stake mainly concern the Metropolitan City of Genoa and describe localised actions on the main urban system and promote its accessibility. Therefore, the successful attempts found at the urban level have not been activated at a larger scale, so the areas surrounding the large urban centres are excluded from the provincial and regional scaling up of mobility actions.

3.2 Regional Limitations

In the previous subsection, actual shortcomings in the transition of mobility policies and winning actions from the urban - Genoese - to the larger - provincial and regional - scale were highlighted.
In line with what has been described by Dematteis (1994), it is demonstrable that Liguria can be ascribed to a polarised model in which Genoa is the centre around which the other municipalities gravitate, for different reasons. Therefore, service levels decline with distance from the centre and actions produced and designed for the centre are hardly redistributed.
Through Figure 5 we describe the territorial limitations in the direct application of the theoretical model of territorial development just specified. In fact, in Liguria, in the first

instance morphological limitations invalidate the regular extensibility of policies; to these are added the borders and administrative subdivisions. The presence of the Ligurian Sea to the south and the mountain arc to the north limit the distribution and incidence of policies and services from a circular model to a west-east linear model.
This theoretical simplification has a representation in reality if the infrastructure structure endowed to the region and described above is visualised.

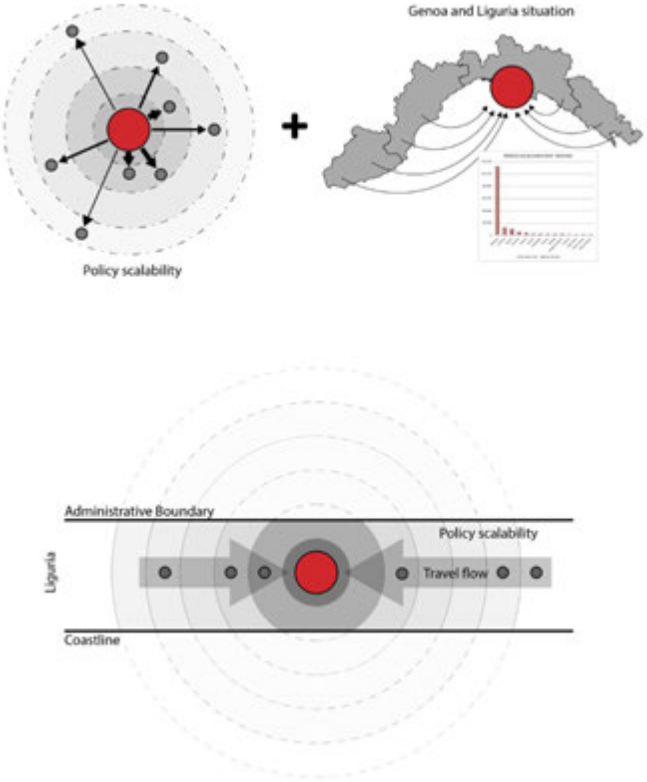

Figure 5. Theoretical application of the polarised model to the Ligurian case. The result is a limited linear distribution against the mobility towards Genoa.

According to the literature, the increased responsibility attributed to metropolitan cities in the exportability on a territorial scale of their policies faces resistance from other levels of governance that attempt to maintain their decision-making autonomy (Chinellato and Morfoulaki, 2019). This is evident from the administrative composition of Liguria, a border region composed of four provinces each dependent on its capital, as a point of convergence of the shifts that emerged from the desire lines (Figure 4). Therefore, it can be said that the greater the distance from Genoa, the more difficulties there will be in the exportability of mobility policies adopted at the local Genoese level. This is more apparent if one adds to the territorial description also the travel trends described in the previous section. In fact, Genoa plays the pivotal role in daily travel motivations from all over Liguria.

Consequently, it emerges how the trend of mobility in Liguria takes place in the opposite direction to the ideal scalability of mobility policies produced by the central pole (Figure 5).

3.3 Use-case Methodology

To motivate the proposed approach for mobility management on a regional scale in the following section, in this section we introduce the Use-case Methodology (UcM).
UcM was developed in 1992 by computer scientist Ivan Jacobson as a language useful for modelling and preliminary design of software and digital tools (Jacobson, 1993).
Use cases are understood to be the description of the individual of a set of interactions between a user and a system that enable the user to achieve a goal or perform a task. In addition, it can be said that through the analysis of the interaction pattern of use cases, the external characteristics of a software system are defined from the user's point of view (Schneider and Winters, 2001).
Hence, UcM can be represented as a whole within which individual use cases are positioned which, if completed, allow the achievement of the objective for which UcM was used.
Although this methodology was born for IT, in this paper we attempt to re-propose it to support regional mobility planning in a territory with particular boundary conditions such as Liguria. So, in our case the object described by UcM is 'Ligurian Transfer', that is the possibility of reaching any destination from any origin in Liguria.
While individual interactions are represented by users who need to make a journey. In conclusion, it will be the individual user who will be the solution to the need to move and the interaction he or she generates with the mobility service will be addressed, in this sense the idea behind UsM in which the user is an element external to the project will be overturned (Figure 6).

4. Proposed approach

As shown by the authors in the previous section, Ligurian urban and infrastructural asset, as well as territorial inequalities and unbalances hamper mobility policies up-scaling. Administrative boundaries, as well as polarised accessibility, act as barriers to best-practices transfer.
At the same time, recent MaaS experiences suggest that both bottom-up and user-centered perspective may contribute to overcome existing limits.
Use-case approach requires the preliminary setting of the operational question. In details, moving across Ligurian Region through sustainable alternatives is therefore main aim of proposed approach. In this direction, origin and destination of the journey deeply affect individual mobility potential. General framing of travel demand implies indeed to further investigate users' mobility patterns, choices and needs to support sectorial policies design independently from territorial boundaries and constraints (Figure 6).
Operational question needs to be detailed then according to travel purposes, being them study/work commuting, personal non-systematic reasons, free time/holiday (Manfredini and Dilda, 2012).
Once travel sub-systems are defined, thus setting travel frequency, purposes and respective elasticity on a general basis, users' individual features require to be identified.

In this direction, it is particularly relevant to define which variable may affect more significantly users' behaviors and attitudes (Lenormand *et al.*, 2015). Similar user-centered perspective is the one leading MaaS offer where transport services combination (and consequent fares) target specifical users' segment.
Starting from demographic and socio-economic profile of regional population, is therefore possible to identify tailored measures to be implemented.
Proposed approach is to profile several "personas" able to orient policy design, not only on a territorial basis, but including also individual features and behaviors.
According to recent studies linked to MaaS experiences (Ye, Zheng and Yi, 2020; Smith, Sochor and Karlsson, 2022), main individual features influencing mobility choices are related to i.age; ii.gender; iii.work conditions; iv.driving licence; v.vehicles ownership.

4.1 Potential Impacts Assessment

4.1.1 Accessibility Improvement

Combinations of similar sets of features may guide policy makers to identify relevant gaps in terms of transport supply as well as in terms of territorial accessibility.
Turning from a strictly sectorial mobility approach to the wider look of activity-based accessibility (Ferreira and Papa, 2020) could represent a turning point for a more integrated and inclusive planning. Defining mobility policies inductively may contribute to meeting widespread needs, more than territorial-scaled top-down initiatives. Similar approach indeed may constitute a win-win solution both for users –provided with tailored services- and policy makers – developing effective and efficient policies supporting sustainable and digital transition.

4.1.2 Planning Prioritization

At the same time, shaping planning and policies following a UcM, may support indeed the analysis of potential synergies among different clusters of users: de-contextualizing mobility needs and data from a standardized territorial-driven basis, may help policymakers to identify different users' segment converging into similar preferences and necessities. In this direction, transport measures replicability and transferability could be further boosted beyond traditional administrative and services boundaries.
In this direction, similar recognition and assessment could prove particularly relevant for public administrations and planners in order to point out priorities among mobility interventions and actions, thus tracing potential economy of scales within a wider context. Instead of consolidated approach where urban-led actions are supported in the name of local competitiveness and efficiency, while non-urban initiatives belong to territorial cohesion field, the potential intersection among the two contexts on a users' needs basis contributes to the clear and effective individuation of mobility patterns, thus making it easier to cluster them and respond them in a targeted way.

4.1.3 Stronger Regional Coordination

Finally, the shift to a user-centered approach –due to the massive requirements in terms of data collection- may lead to an up-scaling of strategic mobility planning, thus providing within the wider framework of regional coordination, significant support to

smaller municipalities, historically unable to cope with EU-initiatives requirements and prescriptions (as SUMPs experience has recently shown).

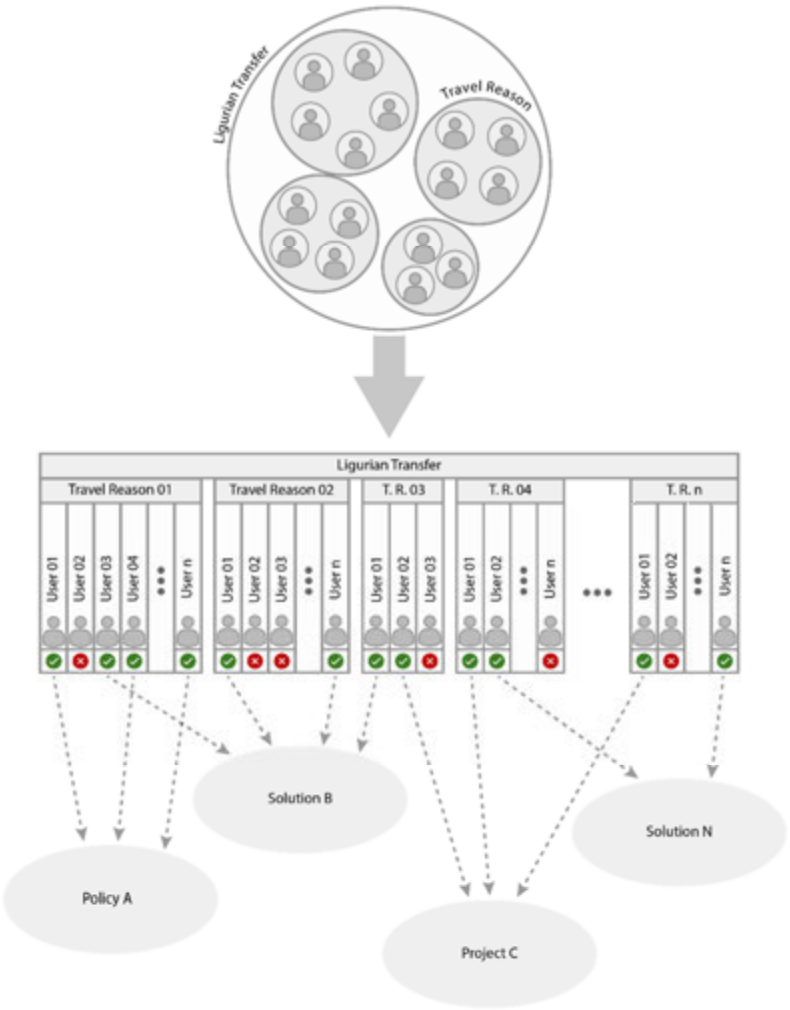

Figure 6. Representative and simplified diagram of the proposed solution based on the UcM and the possible identification of mobility solutions in Liguria.

4.2 Limitations

Nevertheless, some criticalities on the planning level require to be highlighted.

4.2.1 Massive Data Collection

As previously stated –also capitalizing MaaS-related recent experiences- user-centered mobility planning requires massive data-collection, thus constituting relevant

barrier both in terms of users' privacy protection and ICT structures for public administrations. Significant legislative issues are currently under EU investigation to balance tailored mobility experiences and individual privacy guarantee.

4.2.2 Planning Competencies Allocation

Transport and mobility competencies are allocated to different administrative levels. Despite Regional role in strategic transport and mobility planning, mobility basins, as well as public transport networks, are scaled on a provincial/metropolitan basis, transport-related initiatives may be finally defined within municipal borders. In this direction, greater coordination among them is necessary to feed user-centered system, both in terms of data collection and intervention prioritization. Mobility Agencies may for instance constitute key-actors of similar processes, especially in guiding transitional steps.

4.2.3 Strategic Planning Relevance

Policies' fragmentation on a user-centered basis may hamper holistic and integrated mobility planning. Particular attention should be paid to strategic planning in order to orient user-centered initiatives within a wider sustainable mobility framework. Tackling the risk of a vertical planning, thus ignoring interactions among different users' segments and dedicated strategies, general coordination of the entire process should be provided to assure that the sum of individual interests effectively equals the pursue of collective sustainability goals.

5. Conclusions

Best-practices approach towards mobility policies transfer has been for long the prevailing approach within EU boundaries. Increasing variability and complexity of urban flows and dynamics have later required to fine-tune initial approach. After SUMPs were firstly introduced, it was therefore evident that smaller municipalities faced strong criticalities in reproducing mobility initiatives implemented elsewhere. In this direction, plans up-scaling proved particularly difficult whenever territorial assets and network do not develop vertical and horizontal complementarities. Polarised configurations (such as the Ligurian one) are not able to support effective spreading of sustainable mobility planning and experiences.

The definition of a Use-case Methodology may contribute indeed to shift mobility planning inductively, thus tailoring policies through a user-centered approach.

Similar de-contextualized planning and policymaking could represent potential solution to the need of policies mobility and replicability within EU context becoming more and more variegated and changing.

It needs to be pointed out that user-centered perspective, thus potentially driving a more conscious and effective approach towards transport planning, somewhat overlaps best-practices premises in terms of practices replicability and de-contextualization. Nevertheless, decades of EU policies have shown that despite not all regions may develop similar networks, structures and sensibilities, all communities and citizens show comparable needs to join socio-economic opportunities and share similar basic needs.

The shift from a mobility-driven approach towards a more accessibility-centered way to look at passengers-dedicated transport policies and planning could constitute the

turning point to a widespread and effective upscaling of EU initiatives towards a more sustainable mobility.

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From Global North to Global South: Exploring Creative City Policy Mobilities and Their Urban Impacts

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Abstract
An increasing number of cities of the global South are introducing the creative city policy and pledging to adopt creativity as their main developmental focus to improve the living conditions of their population. Although European cities have long used this policy (Scott, 2014), many have been unsuccessful (Rius-Ulldemolins, Hernàndez I Martí and Torres, 2016). Since developing countries of the Global South are participating in such international models, more research is needed to address a gap in the literature on the urban planning effects of creative city policy in the Global South. This study presents a theoretical framework of creative cities focusing on the urban regeneration of cities in developing countries by rehabilitating cultural creativity, diversity, and social inclusion. The research may provide a valuable knowledge base for international exchange of experience in the planning field.

Keywords: creative city policy, policy mobility, global South, urban planning

Introduction

Creative city policy is a well-established approach to urban development (Costa *et al.*, 2007). This article interconnects research on global urban aspects of creative city policy and policy mobilities.

In the past decades, much research has focused on creative cities and policy mobilities of the global North[1] (Bunnell, 2015; Molho *et al.*, 2020). Western cities have long used creative city policies to reposition themselves in the global urban hierarchy and to tackle their problems of rising social inequalities and tensions in the urban context (Scott, 2014). Its roots are in the 1990s, primarily Europe, North America, and Australia (O'Connor, Gu and Kho Lim, 2020). However, some policies have been unsuccessful in creating amenities, requiring massive financial investment and land consumption, like in Barcelona and Valencia (Rius-Ulldemolins, Hernàndez I Martí and Torres, 2016).

Nowadays, an increasing number of cities in the global South (Molho *et al.*, 2020) are introducing the creative city policy and pledging to adopt creativity as their main developmental focus. They rely on Western theoretical frameworks to research the cities and use homogenising scripts of creative cities to interpret the cultural policies (Molho *et al.*, 2020; O'Connor, Gu and Kho Lim, 2020). That calls for further investigation due to different

[1] I use the term 'global North and South'. It refers to the regions of Latin America, Asia, Africa, and Oceania. Most countries maintain low incomes and marginalised cultures and politics, although emerging BRIC countries (Brazil, Russia, India, and China) complicate the division. As (Dados and Connell, 2012) state, 'The term Global South functions as more than a metaphor for underdevelopment. It references an entire history of colonialism, neo-imperialism, and differential economic and social change through which large inequalities in living standards, life expectancy, and access to resources are maintained.'

socioeconomic and cultural backgrounds. Among others, the relationship between culture and urban development (Russo and Van Der Borg, 2010).

My study aims to close the literature gap by creating a theoretical framework within which practitioners and academics can approach these questions: How is creative city policy evaluated globally? Who and what moves the policy? What are the stages of policy mobility from the global North to the South? What are the key features of urban planning effects of creative city policy on recipient cities?

Literature Review

Creative City Policy

Its History and Emergence

The evolution of creative city policies spans the time of the post-industrial crisis, globalisation and the rise of neo-liberal ideologies. In response to these shifts, cities became entrepreneurs in a competitive market striving to attract capital and investors (Pratt, 2011).

This transformation was preceded by the crises of Fordism (Florida 2005, Landry 2008), characterised by mass production technologies predominant in the Western industrialised world until the early 1970s. These changes affected cities such as Detroit, Chicago, the English Midlands, the German Ruhr district, and parts of northern Italy.

The transition from Fordism led to the emergence of more flexible and specialised production models, altering industrial organisation and inter-firm relations. The trend was to liberalise institutional restraints on market competition and weaken the welfare state (Harvey, 1989), (Brenner and Keil, 2014).

These shifts also influenced the spatial patterns of growth (Brenner and Keil, 2014). Industries, like cinema (Storper and Christopherson, 1987), were increasingly clustering in metropolitan areas to improve the efficiency and competitiveness of entrepreneurs and lower production costs. This was possible due to the availability of a specialised and skilled workforce, reduced transaction costs, face-to-face problem-solving, and sharing of skills.

Costa (Costa *et al.*, 2007) suggests five origins for the increasing interest in creativity:

1. 'Creative city' concept developed by, amongst many others Charles Landry (2000), Peter Hall (2000), and Ralph Ebert et al. (1994) in connection with an analysis of 'creative industries' and practical applications via policies
2. Launch of 'Creative Europe' by European research institutions or the project of 'Creative Cities network' by UNESCO in 2004
3. 'Creative class' (Florida, 2002), as a critical driver of competitiveness and urban regeneration processes due to its talent, tolerance and openness
4. 'Creative industries' within the economic analysis originate from the industrial economic tradition, and a similar approach is 'creative economics'. It analyses their organisation in an institutional context, taking their particularities into consideration
5. The importance of creation and artistic creativity, leading to the study of not only the demand side but also the supply (Throsby, 2004)

While the definition of creative cities and creative economies varies (Costa *et al.*, 2007), most authors agree that creative industries include film, music, radio, television, publishing and

advertising along with the support infrastructure (organisational or material) (Pratt, 1997). Despite the substantial economic contributions of creative economies, evaluating their impact can be challenging due to their nature, which has both financial and cultural value (the process of creation is also essential, not only the outcome) (Pratt, 1997; Evans, 2005).

In practice, creative city policies aim to enhance the quality of life for urban inhabitants through targeted interventions in three main areas: (a) economic development, (b) social welfare/inclusion, and (c) urban development (Bianchini and Parkinson, 1995; Rato, Roldão and Mühlhan, 2009). There are benefits in combining all three perspectives (Boddy and Parkinson, 2004; Costa *et al.*, 2007). Figure 1 below gives an overview of the combination of approaches and typical examples of cities.

(a) Economic development is usually the central focus of creative city policies, with the primary objective being the job creation and formulation of industrial and creative strategies.

(b) Social welfare programmes focus on social inclusion or community character.

(c) Urban development plays a central role in shaping the city's physical landscape. It includes renovations and reconstructions to improve the image of the city, even a recreational strategy. These approaches are usually more or less modified and combined (Bianchini and Parkinson, 1995; Rato, Roldão and Mühlhan, 2009).

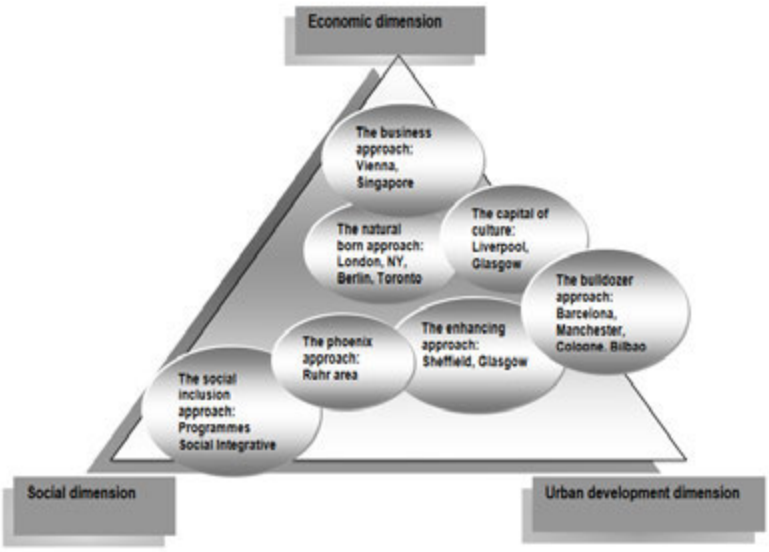

Figure 1 Typology of creative cities (Rato, Roldão and Mühlhan, 2009)

The paradigm shifts from focusing solely on the economic benefits of the arts to sustainability (in terms of physical, social and economic well-being) and distributive equity. From short-term to long-term impacts (Evans, 2005). From building flagship projects to incorporating small-scale public art projects with the stress of everyday use, social inclusion, and design quality (Boddy and Parkinson, 2004) to battle gentrification associated with high art venues and large redevelopment projects. Inclusion of local communities, engagement and consultation. Cultural activity should be incorporated as one key indicator of a city's quality of life (Evans, 2005).

Limitations and Contradictions

There are numerous limitations and contradictions to this neo-liberal urban policy. Much of the critique is centred on the fact that researchers predominantly focus on theoretical and empirical research on the global North and the lack of investigation of a broader range of contexts of different countries (Molho *et al.*, 2020). One example could be the spatial mobility of the creative class[2] (Martin-Brelot *et al.*, 2010).

Planners should focus less on land use and more on incorporating cultural, social, economic and environmental issues (Landry, 2000/2008).

The creative city has often been seen as easily transferable (Kong, 2014), homogenising (Molho *et al.*, 2020) and a 'fast policy' (Peck, 2005). However, the impacts of the policy could be short-lived (Russo and Van Der Borg, 2010; O'Connor, Gu and Kho Lim, 2020), and flagship events cannot do more than divert attention away from the real problems of cities (Mooney, 2004).

The critical critique focuses on gentrification (McGuigan, 1996; Seo, 2002; Evans, 2005). Creative workers and productions depend on specific locations, but at the same time, they are threatened by delocalisation due to the rising valorisation of urban land (Vivant, 2013).

That leads us to another issue: the frequent omittance of the topic of social exclusion in creative cities (Sasaki, 2010). The impacts of the policy could be socially exclusive (Russo and Van Der Borg, 2010). Groups such as the socially excluded, older adults and people experiencing homelessness are not being integrated (Landry and Bianchini, 1995; Landry, 2007; Müller, 2019). We also should not leave out spatial inequalities (Evans, 2005).

Role of International Creative City Networks

Cities are influenced by the increasingly uneven global inter-urban connections (Molho *et al.*, 2020) and seeking a change in their aspirations and identities, however successful in the long term and the extent of their implementation (O'Connor, Gu and Kho Lim, 2020).

[2] Empirical European data show that creatives are less mobile than in the United States due to cultural and institutional barriers. In a search for a location to settle, look for hard factors such as the quality of jobs. Soft factors such as cultural amenities only determine the particular district where to settle (Martin-Brelot *et al.*, 2010).

To meet the challenges of globalisation and ensure cities' success, we must rely on something other than traditional political institutions but on individuals, groups and bottom-up processes. Global public policy networks must include groups from the global South. It is critical in the design and implementation of policies (Reinicke, 1999).

There is a great diversity of institutional frameworks and governance mechanisms in implementing creative city policies. Besides, many public bodies and organisations use these concepts locally and nationally. There are also supranational institutions, such as the UNESCO, European Commission and OECD (Organisation for Economic Co-Operation and Development). Their focus lies in the multidisciplinary approach, management, and governance (Costa *et al.*, 2007).

UNESCO's ''Global Network of Creative Cities," launched in 2004, has quickly spread to developing countries. Now, 350 cities in 7 fields worldwide are registered in the global UNESCO network. There are efforts to strengthen the connections between 'global South' cities (Molho *et al.*, 2020). Ahead of these designations, UNESCO declared the Universal Declaration on Cultural Diversity in 2001. Its purpose is to combat standardisation under globalisation (Sasaki, 2010).

Creative City Policy Travels to the Global South

An increasing number of cities in the global South are introducing the creative city policy (Molho *et al.*, 2020). However, this complex model cannot be re-applied without modification (Bianchini and Parkinson, 1995). All cities are diverse; thus, many formulas address all the city's problems (Molho *et al.*, 2020).

Luckily, not all global South cities accept imported models without changes (for example, Beirut and Istanbul took Dubai as an anti-model) (Centner, 2020). Many cities found alternatives and new approaches to hegemonic models from the West worldwide (Molho *et al.*, 2020).

From a practitioner's or policy outcome-oriented scholar's perspective, 'good' or at least promising solutions must also be transferable from one place to another. And they need to know how this might be done most effectively (Baker and Temenos, 2015).

Guidelines about how global creative policy circulates, vernacularises and is unevenly adopted can offer policy mobility theory. Where and to whom they travel and how they vernacularise depends on the institutions and actors who receive them. It depends on their position and power. Remember that conflicting interests around the globe also influence local policies (Molho *et al.*, 2020).

Policy Mobility Theory

An increasing number of scholars are paying attention to the circulation of urban policies and the concept of 'policy mobilities' (Baker and Temenos, 2015).

There have been numerous attempts to reproduce and implement various entrepreneurial development policies due to intensifying interurban competition (Harvey, 1989; Brenner and

Keil, 2014), increasing globalisation of politics, society and economy (Hall and Hubbard, 1998), and the socio-spatial processes derived from it (Peck and Tickell, 2002; Baker and Temenos, 2015).

Emerging in the early 2010s (Baker and Temenos, 2015; Haupt, 2023), the policy mobility approach was primarily driven by critiques of the previous approaches by human geographers and urban studies scholars (Peck and Theodore, 2010; McCann, 2011; Peck, 2011; Temenos and McCann, 2013). Later, it led to the emergence of urban policy mobilities as a sub-field (McCann, 2011; Baker and Temenos, 2015; Lovell, 2019; Haupt, 2023).

Policy mobility theory emphasises thought patterns and mindsets and the directions of movements that express power relations (Haupt, 2023).

Critical Features of Policy Mobility

Critical features of policy mobility, besides the spread between cities, include international (global) geographical reach (Haupt, 2023), the mobile and changeable character of policies (Peck and Theodore, 2010; McCann, 2011), that are modifiable right from the beginning of the process. Ideas, discourses, or synthesised models can travel in selective and partial forms (Peck and Theodore, 2010; McCann, 2011; Temenos and McCann, 2013).

How ideas/policies might change the places they are spreading to (Stone, 2004; Peck and Theodore, 2010; McCann, 2011; Temenos and McCann, 2013).

Emphasis is more firmly placed on the effects of policy discourse and implementation on social life and practices (Haupt, 2023).

The focus is more on the role of non-state actors, such as NGOs, consultancies, or multinational corporations, and how they influence governmental bodies with their mostly neoliberal policies (Peck and Theodore, 2010; Prince, 2010; McCann, 2011).

Another key feature is the significance of failed policy spread – policy immobility (McLean and Borén, 2015; Lovell, 2019) no longer studied from a positive point of view but to research the power relations and inequalities and drawing attention to failed or harmful policies that can also travel to different places (Lovell, 2019).

Policy mobilities literature has a critical perspective (critical of policy spread and society) (Haupt, 2023).

Urban policy mobilities research has no defined paradigm or definitive approach. Instead, they draw from various epistemological perspectives spanning planning, sociology, geography and political science (Baker and Temenos, 2015).

Critique of Policy Mobilities and Recommendations for Future Research

Early critiques focused on neoliberal policies, orientation toward the global North (Bunnell, 2015), and presentist outlook are being answered (Temenos, Baker and Cook, 2019).

Further critique of policy mobilities scholars addresses the work of scholars who rarely reach out to policymakers and politicians with suggestions on how to improve current practices (Haupt, 2023).

Söderström and Geertman (2013) and Cohen (2015) argue that focusing on Southeast Asian cities has led to the conclusion that we should further focus on understanding ad hoc networks and nonliberal urban practices.

For future studies (Temenos, Baker and Cook, 2019) recommend foregrounding the integration of policy mobility within the socio-spatial fabric of cities and urban life and (a) engaging with other conceptual questions in the field of urban studies, (b) enlarging the collection of studies outside of the Anglo-American area. That would be beneficial in policy mobility studies for differentiating what is general and specific, and (c) conceptualising policies on dualities: local/global, fixed/mobile, territorial/relational—also adding mobilities of knowledge, people, materials and politics.

Shaping a Framework for Creative City Policy Mobility and Its Urban Planning Impacts Across Global Regions

Stevenson (2004) highlights the necessity for new methodologies that combine approaches of anthropology, sociology, and cultural and urban studies that can be applied to evaluation models to measure physical, social and economic changes. Responding to the need for more conceptual and integrative groundwork, this paper proposes a framework for urban planning effects of creative city policy mobility from the global North to the South.

I build my framework on the work of Evans (2005), Temenos, Baker and Cook (2019), and Müller (2015).

The proposed framework involves types of evaluation, who and what moves policy, the three stages of policy mobility, and key features of urban effects of creative city policy.

Types of evaluation

The following types of reporting can evaluate culture's contribution to regeneration (Evans, 2005): (a) project evaluation and (b) programme evaluation.

(a) Project evaluation focuses on the project's process and results. It can use quantitative or qualitative evidence. Data are collected via unstructured interviews, focus groups, questionnaires and participant observations. It is ideal to start evaluating from the beginning of the project, during and after post-completion. The assessment area is not limited (it can be a local regeneration area or national programme). The evaluation may include one or multiple projects (see Programme evaluation below).

(b) Programme evaluation includes multiple projects in one local, national or transnational initiative. It uses Project evaluation techniques and can be measured by standard output criteria, including performance indicators (comparing actual and targeted performance).

Academic discourses often counter overly optimistic official narratives on urban development. Usually, it is not possible to access the necessary data. The studies include more technical quantitative impact assessments (economic/econometric) and area and sectoral case studies of a particular cultural activity like theatre quarter and fashion industry. „In some respects, the lack of 'hard evidence', of access to detailed data, decision-making processes and the basis to measure impacts over time, have limited more 'scientific' analysis, leaving little scope, outside political and policy discussions and micro-level case studies" (Graeme Evans, 2005, 965).

Area of intervention	quarter(s) city region	(Rato, Roldão and Mühlhan, 2009)
Timeframe	short middle long term	(Evans, 2005)
Amount of funding		(Evans, 2005)

Figure 2

Who and What Moves Policy

Mobility of urban planning effects of creative city policy is possible because of the mobility of (a) knowledge, (b) people, (c) materials and (d) politics (Temenos, Baker and Cook, 2019).

(a) Knowledge is transferred when there is a need for detailed policy or a global approach is desired. It can be local or outside expertise.

(b) Diversity among the team of people is beneficial; it includes all types of policy actors and their mobilities, as there remains a need for shared experiences and face-to-face meetings at conferences and study tours. It can be bureaucrats, politicians, activists, lobbyists, service managers, consultants, architects, etc.

(c) Materials are needed to circulate between people. They can travel in physical and virtual spaces through reports, PowerPoints, spreadsheets, maps, and visualisations. They are crucial for the actors to visualise the proposals and make connections to them.

(d) Politics is central to the mobility of policy. It reflects the current political conditions, ideologies and functions of the state. These conditions are globally different, and various policy advocacy and activism levels exist.

Primary recipients of the intervention	the state the region	(Rato, Roldão and Mühlhan, 2009)

	the city the community a particular group of actors the private sector	
The level of participation of the population in the process	bottom-up top-down	(Rato, Roldão and Mühlhan, 2009)
Inclusion of multiple stakeholders	arts and cultural groups heritage associations and communities	(Evans, 2005)
Accessibility of culture and physical infrastructure	for locals for visitors	(Evans, 2005)
Schemes structured to facilitate collaboration between those responsible for regeneration and those responsible for cultural activity	local authorities partnership bodies responsible for regeneration	(Evans, 2005)
Integration into legal documents	strategic plan master plan	(Evans, 2005)

Figure 3

Three Stages of Policy Mobility

Questions accompanying Figure 4 below help us systematically trace North-South policy mobility and help in orientation and approach to urban planning questions in three time frames: (a) transportation, (b) transformation and (c) translation (Müller, 2015).

(a) Transportation happens when the policy is moved from place A to place B (Healey, 2012; McCann and Ward, 2012). It is transported and impacted by diverse people via various materials to different political systems. It does not come packaged but rather as selected elements brought to one place and assembled. It might be of interest to study what parts of policies are immobile.

(b) Transformation is embedding policy into the local socio-material environment. It is usually changed, seldom not at all. Policy changes are due to interaction with existing policies, translations, interpretations, institutional settings and legislation. The carriers also modify elements of policies.

(c) Translation can be similar to policies' original intentions or have different impacts. Responses to its implementation can be studied from the perspectives of the public, private, and state sectors. Translation is not the end of the cycle; the policy can travel to a new place again.

Transportation	Transformation	Translation
Who and what moves and is moved?	What aspects of a policy change?	What actions does the policy create?

When?	For what reasons and through what channels does change happen?	How well is the policy able to align intentions and actions?
Where to and from?	To what extent is change intentional or unintentional?	Through what mechanisms is the policy applied?
How?	What is the role of already existing policies in affecting change?	What is the response to the policy?
Through what channels or events?	What other elements does a policy enrol?	Does the policy itself serve as a model for others?
Who and what does not move?		

Figure 4 Transportation, transformation and translation (Müller, 2015)

Key Features of Urban Effects of Creative City Policy

Urban regeneration is usually directed towards transforming physically, socially and economically declining areas. The paramount principles lie in the sustainability of the place, aiming toward long-term improvement. Responding to the call for a more integrative approach, the evaluation also touches on social and economic domains.

People's needs across the globe are met differently. Guidelines can offer Maslow's hierarchy of needs, including physiological and safety, as the base (Maslow, 1943). The sustainable principles should, therefore, include the liveability of the place, people's quality of life, safety, inclusion and heritage conservation. Inclusion of all groups irrespective of income, ethnic profile, religion, skills, gender, disabilities, age, caste, or political orientation. Quality of life depends on mobility and access to public amenities and open spaces, as well as on the living environment, densities, pollution, and health.

Monitoring should also include social and land use diversity and the multifunctionality of places.

We should remember the authenticity and identity of the place and design quality, which does not rely on homogenising principles.

To attract creative individuals and companies, agglomerations should offer spaces for production (both enabling work from home, small-scale businesses and open coworking places for sharing information, knowledge and skills), consumption, commercialisation (shops, markets), socialisation and residence (Vivant, 2013). Government bodies at local and national levels can support innovative clusters (cooperation of private companies and research centres; networking of local producers) and industrial planning (rezoning large areas for cultural consumption and production) through urban policies (Vivant, 2013).

Graeme Evans (2005) noted that no universally applicable set of indicators for a particular intervention exists. Due to its context-specific nature, a pick-and-mix approach is required. Standardised performance indicators and quantitative benchmarks are also not valuable in this context.

Extent of the physical intervention	heavy intervention in forms of renovations, construction of an emblematic building, transport networks renewal of buildings and requalification of quarters	(Rato, Roldão and Mühlhan, 2009)
Reuse of redundant buildings	studios galleries museums venues	(Evans, 2005)
City's creative historical assets	renewal of buildings	(Rato, Roldão and Mühlhan, 2009)
Reuse of land	brownfields	(Evans, 2005)
Places for production	enabling work-from-home small-scale businesses open coworking places for sharing information, knowledge and skills	(Evans, 2005)
Places for consumption	construction of a new emblematic building	(Vivant, 2013)
Places for commercialisation	shops markets	(Vivant, 2013)
Places for socialisation	public spaces festivals, events and public art schemes	(Evans, 2005), (Vivant, 2013)
Places for residence	houses apartments	(Vivant, 2013)
Innovative clusters	for cooperation of private companies and research centres for networking of local producers	(Vivant, 2013)
Clustering	of producers	(Evans, 2005)
Industrial planning	rezoning large areas for cultural consumption and production	(Vivant, 2013)
Complementary infrastructure (investment in land preparation and transport infrastructure)	air, road, rail/ light rail, metro housing hotels upgrading of existing cultural facilities	(Evans, 2005)

Figure 5

Discussion and Conclusion

This research links creative city and urban development studies with policy mobilities. A theoretical framework has been created on the policy mobility of creative cities in urban development. The proposed framework involves types of evaluation, who and what moves policy, the three stages of policy mobility, and key features of urban effects of creative city policy.

A policy can only be packaged and implemented with changes on its way to a new destination. Moving policy loses or gains different directions depending on who moves it, what moves it, and where it is moved.

There is also no universally applicable set of indicators for a particular intervention. Due to its context-specific nature, a pick-and-mix approach when researching a city is required. Standardised performance indicators and quantitative benchmarks are also not valuable in this context.

Academic discourses often counter overly optimistic official narratives on urban development.

Urban policy mobilities research has no defined paradigm or definitive approach. Instead, they draw from various epistemological perspectives spanning planning, sociology, geography and political science (Baker and Temenos, 2015).

The paradigm shifts from focusing solely on the economic benefits of the arts to sustainability (in terms of physical, social and economic well-being) and distributive equity. From short-term to long-term impacts (Evans, 2005). From building flagship projects to incorporating small-scale public art projects with the stress of everyday use, social inclusion, and design quality (Boddy and Parkinson, 2004) to battle gentrification associated with high art venues and large redevelopment projects. Inclusion of local communities, engagement and consultation. Cultural activity should be incorporated as one key indicator of a city’s quality of life (Evans, 2005).

Limitations include restricted access to data. Frequent omittance of the topic of social exclusion in creative cities (Russo and Van Der Borg, 2010; Sasaki, 2010).

Recommendations for future research are further investigating what influences liveability and quality of life. One of the challenges is the threat of an unfavourable environment that needs to respond to current climate challenges or conserve nature. The following recommendation regards the digital revolution's effects on culture and urban planning.

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Transit-Oriented Development Approach to Social Sustainability, Doha city as a Case Study

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Abstract
Transit-oriented developments (TODs) are widely used to promote sustainable mobility by encouraging residents to use public transportation and to reduce car dependence (Calthorpe, 1993). Doha, the capital of Qatar, has faced numerous challenges including excessive reliance on private vehicles and lack of integrated last-mile connections. This study points to better integrating TOD models with sustainability indicators, to achieve more sustainable urban development. Quantitative and qualitative methodologies were used, including literature review concentrating on TOD and sustainable urban mobility, SWOT assessment, site analysis, data collection from the Qatar Ministry of Municipality and Environment (MME), consultant companies, and Qatar Railways Company. The study demonstrates the adaptation of TOD approach to non-western country through promoting socio-cultural spaces, heat mitigation strategy, integrated transport system, and more community engagements.

Keywords: Transit-Oriented Development, Sustainable Development, travel behaviour, Doha, Qatar

1. Introduction

An increasing number of communities have adopted the concept of transit-oriented developments (TODs) as a tool to enhance the city's urban fabric and increase the usage of public transport. The aim of TOD is to promote urban development near the transit nodes, integrate the land use and transport system, and improve compact urban development. Consequently, promoting sustainable urban mobility and a livable urban pedestrian area. The assessment of TOD is crucial for reaching the society's needs. It reflects the pedestrian catchment area (PCA) known for the adequate walking distance. TOD concentrates on 10 - 15 minutes walking distance (400 m - 800m) as a strategic area (Al Saeed and Furlan, 2019, Song et al., 2021).
Doha, Qatar capital city, experienced a rapid development and economic growth over the past two eras. It turned out to be an international leading city due to the host of distinctive worldwide events like the forthcoming FIFA 2022 World Cup (Boussaa et al., 2021). Broad infrastructure developments were developed including the operation of the Doha metro network, as part of the Qatar integrated railway scheme. However, the city lacks the integration of land use and transportation system and suffers from heavy cars dependency causing high traffic congestion. The State of Qatar launched the Qatar National Development Framework (QNDF) 2032 as a long and short-term strategy, at the national level for achieving sustainable development. The

QNDF emphasizes the significance of connecting the Doha Metro within the city's urban development by applying the TODs principles (Nafi et al., 2021).

The TOD design strategy is valuable for improving the air quality, creating compact and sustainable urban form, fostering a pedestrian-friendly environment, promoting attractive and livable spaces, and locating the city development form around transit nodes (Renaissance, 2016, Dong, 2021, Ann et al., 2019).

Consequently, this research aims to evaluates the TOD towards sustainable urban mobility in Doha. The paper investigates the land use and transportation system of Al Waab neighbourhood, mainly the area nearby the Sport City metro station. For the study, the analysis area focuses on 5-10 minutes walking distance (400m) a Quarter mile. Al Waab neighbourhood is located between the municipalities of Al Rayyan and Doha in the state of Qatar in zones (54 and 55), approximately 10 km far from the city centre of Doha. The Sports city metro station operates through the Doha Metro Historic line (Gold line) and is located adjacent to Al Waab primary road and Sports City minor road. Al Waab Road is marked by its distinctive curving streetlights and includes a path to Al Shamal Highway, while Sports City Road includes the path to the Aspire Zone (250-hectare sporting complex).

The research also examines the social travel behavioral change toward Doha metro as a sustainable public transport system; and formulate integrated land use and multi-use transportation system strategies for policymakers to attract the usage of sustainable public transport.
Quantitative and qualitative methodologies were used, including interviews and other qualitative data collection from the Qatar Ministry of Municipality and Environment (MME), International consultant corporations in Doha, and Qatar Railways Company. Moreover, and SWOT assessment. The paper proposed a guideline for the policymakers to develop TOD through sustainable urbanism principle and TOD design strategy.

2. Methodology

In this study, a diverse-method was involved including a mixture of quantitative and qualitative analysis as follow (a) a literature review of recent theories about the relevant topic of sustainable urban mobility, transit-oriented development model and assessments; (b) data collection analysis, containing interview and graphic data from the Qatar Ministry of Municipality and Environment (MME), International consultant companies in Doha, and Qatar Railways Company; and (c) Site observation and SWOT analysis. The mentioned research methodology is represented in Figure 1**.**

2.1. Literature Review

The review was done through examining the findings of the selected literature and evaluating these findings by using a non-statistical procedure. This helped in building interpretations and conceptualizations based on the previous studies. In addition to identifying the key elements for TOD in the research area, such as (a) enhancing pedestrian spaces and mixed-use areas; (b) promoting walkability and connectivity; and (c) integrating land use and public transportation system.

2.2. Data collection analysis tools

The study used a qualitative data collection tool, including a visual analysis and SWOT (strengths, weaknesses, opportunities, and threats) assessment to establish a framework to analyze the study area current conditions. Additionally, interviews were obtained with transport planning specialist working in the governmental agencies and international consulting companies. The data were analyzed and managed through Geographical Information System (GIS) software. This tool helped in gathering information on the study area existing situation and collecting the land use data. This contributes to deeply understand the spatial and geographical data of the study area.

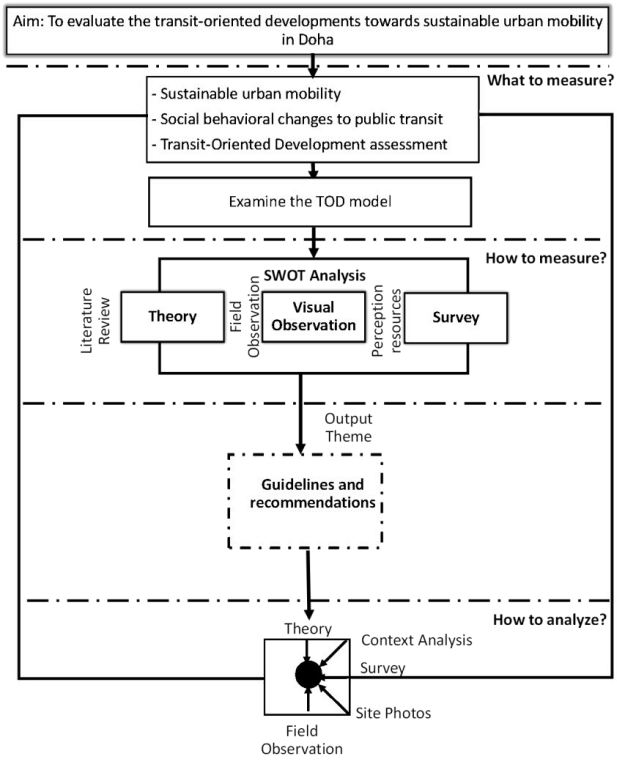

Figure 1: illustration of the research methodology.

3. TODs assessment approaches

TOD usually focuses on an area of 10 minutes walking time (400 m-800 m) as a strategic area when planning the pedestrian catchment area (PCA). (Alawadi et al., 2021, Al-Harami and Furlan, 2020, Dong, 2021). The standard thresholds are 400 m (quarter mile), 500 m (third mile), 600 m (2000 feet), and 800 m (half mile) (Tong et al., 2018).

Using the node-place model, Bertolini (1999) analyzes and examines the interface between the transport and land use systems within station zones. Even though the node-place model does not specify potential development, it is useful for better understanding growth dynamics. (Caset

et al., 2020). Essentially, this model consists of two dimensions: "place" (quality and quantity of land use) and "node" (proportional accessibility of traffic). As a result, if a site is a node for a range of traffic forms, it needs to operate as a diverse land-use pattern. Similarly, intensive use cannot occur in areas where access is inaccessible (Figure 2) (Schulman et al., 2015).

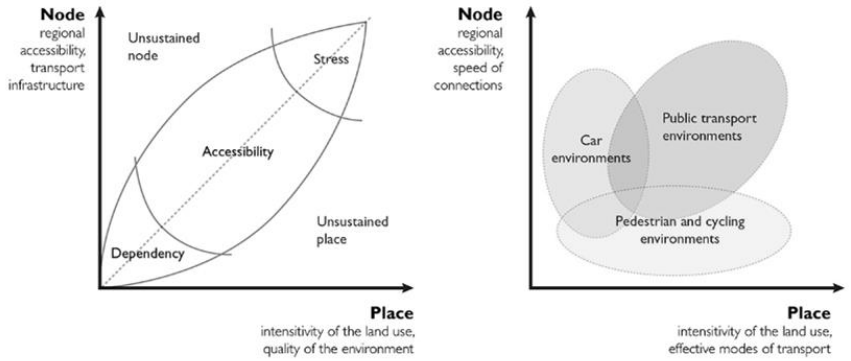

Figure 2: illustration of Bertolini's node-place model (Schulman et al., 2015)

The gap of the TOD features was carried over the outcomes of the political impact of TODs through integrating the essential character like density, compact development, connectivity, integrated land use and public transportation, and amenities (Su et al., 2021, Yildirim and Arefi, 2021). The study process brings several measures to conduct the study and analysis by enforcing various requirements to test the method relating to the TOD (Al Saeed and Furlan, 2019).

4. TODs as a Sustainable urban mobility

Sustainable urban development mainly relates to urban design from the built environment perspective. Urban design can be defined as an "act of designing and forming cities". It is also known as the "art of placemaking" which involves people, space, nature, and activity setting (Alawadi, 2017). Lynch (1981) refer to urban design as "a field handling the built environments form and the link among the physical city and human values.

Various articles have outlined the perception of sustainability, highlighting the social pillar of sustainability. Literature about social sustainability illustrates some assessments and themes. However, due to its complexity, it did not include a specific definition (Bouzguenda et al., 2019). Four main aspects were developed to enhance the social sustainability concerning urban renewal developments including open spaces availability, resources conservation, and enhancing liveability (Figure 3) (Canitez, 2019).

In summary, the sustainable and vibrant cities involve the following: (a) diverse and wealthy urban life and well-designed community spaces; (b) offers a sense of safety and low levels of pollution; (c) generating a positive impact living conditions quality in cities, and (d) facilitating a various social activity (Al-Thawadi and Al-Ghamdi, 2019, Baobeid et al., 2021).Inhabitants feel unsatisfied to live in cities where they are obliged to live in congestion, spend lots of their time at traffic congestion, far to the nature access, and hardly communicates with their neighbours (Al-Thawadi et al., 2020). Interpretation of the literature emphasized that a city to be liveable, it shall offer jobs access that enables a platform for interaction between each other;

and allow self-fulfilment along with providing access to recreation and green open spaces (Al-Thani et al., 2019).

Figure 3: Sustainability in planning and urban renewal.

Generally, TOD for a particular city's requires an integrated transport system encompassing the entire city (Nafi et al., 2021). Consequently, the catchment areas are measured at the urban level instead of the individual level of the transport station, which involves a broad awareness of land use design and the aspects to deliver it. The land-uses shift should be carefully considered as they are mainly affected by the local environmental aspects (Mai et al., 2021, Revoltós Fort et al., 2017).
Nowadays, TOD is known as a well-recognized urban planning model; intended to promote affordability, enhance accommodation quality, promote compact development, and diversify public open spaces (Zhou and Yang, 2021). Once TOD is applied effectively, it could assist in progressing toward the world of vital and sustainable cities (Al Saeed and Furlan, 2019). In addition, TOD improves the creation of wealth for residents, facilitates economic opportunities, and enables societies to react flexibly to possible disruptive incidents like pandemics (Patnala et al., 2020) Figure 4 illustrates the theoretical approach.

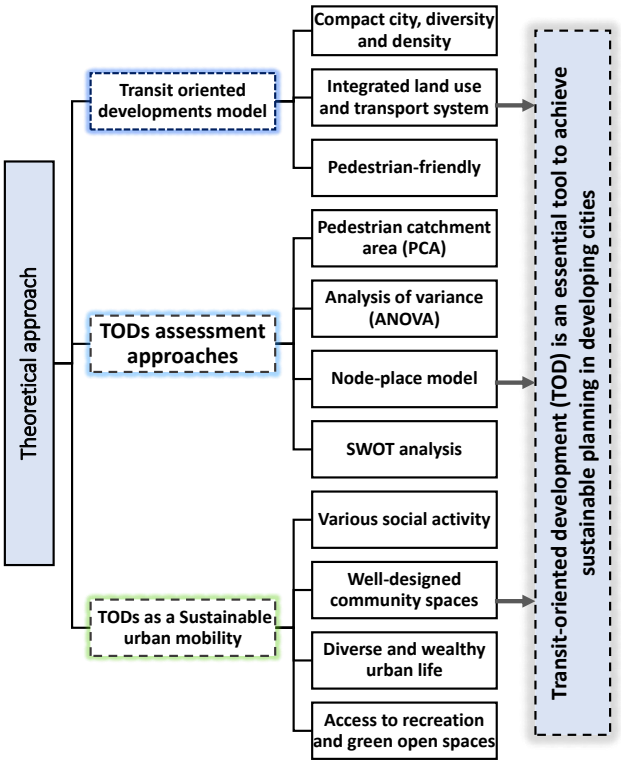

Figure 4: Theoretical approach

Finally, the TOD model is beneficial in promoting sustainable development through (a) lessening the costs and usage of driving; which leads to lowering the air pollution and the usage of energy; (b) raising revenue and economic development; (c) preserving land and green areas; (d) enhancing the neighbourhood diversity and compactness near to transit nodes; and (e) promote accessibility for pedestrian and cyclist which lowering the usage of private car (Furlan et al., 2021, Knowles et al., 2020, Furlan et al., 2019).

5. Qatar's Transport System and Vison

A detailed analysis Qatar has rapidly transformed from a fishing and pearling economy to a powerhouse driven by energy resources over the past two decades. Due to extensive oil and natural gas exploitation since the late 1930s, this shift has shaped the economic landscape but also led to remarkable urbanization. Consequently, Qatar has created a modern cityscape with distinctive architecture that reflects its strategic ambitions for economic diversification, sustainable urban development, and global influence (Burt et al., 2017). Doha, the capital of the country, has gained international prominence by hosting distinctive global events, such as the FIFA 2022 World Cup (Wiedmann et al., 2013, Zaidan and Abulibdeh, 2018). Globalization has resulted in extensive infrastructure development, leading to modern buildings replacing traditional residential structures. The Central Business District of Doha has emerged

as a result of this evolution (Nafi, 2015). Qatar National Development Framework (QNDF) has been developed as a national action plan for managing sustainable urban development.

Emphasizing the importance of transit-oriented developments (TODs), the QNDF aims to integrate the Doha Metro system with city growth (Furlan et al., 2020, Mannan et al., 2019). 'Light Rail Trains' (LRTs) and 'Bus Rapid Transit's (BRTs)' serve the main cores of the city through the Doha Metro network. With this comprehensive plan, users will be able to travel efficiently from origin to destination, promoting public transportation and aligning with Qatar National Vision 2030's sustainable development goals (Rizzo, 2014).

Several major stadium sites are accessible via Doha's metro network, including the Doha Port, Hamad International Airport, and Doha's urban core. In total, there are four metro lines in the city: the Red, Green, Gold, and Blue. The metro line network consists of underground, ground-level, and above-ground railways with a total length of 300 kilometers. Al Wakra in the south and Lusail in the north are served by the Red Line, also called the Coastline. The city center and Hamad International Airport are connected by this line. The network consists of 18 active stations, including West Bay, Katara, and Qatar University. Stations on this line include Lusail QNB and Legtaifiya interchange stations for trams and metros (Al-Janahi et al., 2020). In the direction of Al Mansoura, the Green Line runs for 22 kilometers from west to east. Notable stops on the line include Qatar National Library, Msheireb, Hamad Hospital, and Education City (Revoltós Fort et al., 2017). From Al Aziziya to Ras Bu Aboud, the Gold Line stops at 11 stations including Sports City, Souq Waqif, Qatar National Museum, and Al Aziziya. A 7.5 km semicircular route will connect West Bay and Airport City North along the blue line ("City Line") (Figure 5) (Amerio, 2020).

Figure 5: Scheme of Doha Metro Network (Rail, 2022)

According to Qatar's National Development Framework (QNDF), a well-integrated public transit services will make transportation safer, more efficient, and more convenient. This will reduce the number of cars on the road, helping to reduce traffic congestion and air pollution (The Ministry of Municipality, 2016). Figure 6 illustrates Qatar road hierarchy.

Figure 6: Qatar road hierarchy *(The Ministry of Municipality, 2016)*

6. Results and discussions

A detailed analysis of the site was made to examine the land use and transportation system of the study area. Survey questioner was also conducted to gain a wide idea about the inhabitants' perceptions of their neighborhood. In addition, the existing situation of the site and challenges were examined through SWOT assessment tool.

6.1. Site context

During the site visit, it was observed that the research zone contains diverse land-uses such as residential, commercial, recreation, and educational. The Sports city metro station is located near several popular sites in Qatar, such as the Aspire Zone, Villaggio Mall, Khalifa International Stadium, and Aspire Torch tower (the tallest building in Qatar). Furthermore, the Al Waab neighborhood contains various residential compounds, attached, and detached private villas, and medical developments. The land use data was validated by the Qatar Ministry of Municipality and Environment.

In addition, the study area includes numerous Western schools such as the American School of Doha, Newton International School, and Doha College. Gated communities are common in the Al Waab neighborhood, which generates isolated areas within the city urban fabric, and creates

social segregation which lessens the degree of interaction. Moreover, generating an economic disparity through altering the land values (Figure 7).

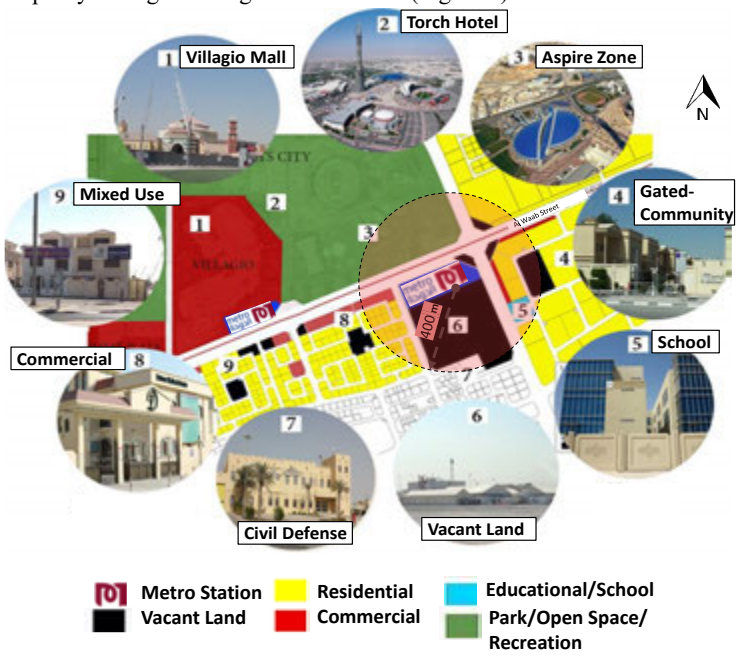

Figure 7: Current land-use map in Al Waab area showing a diverse use.

6.2. Transportation system

The study area consists of various modes of transportation, such as private vehicles, buses, taxis, and the Doha metro. Private vehicles are the frequent mode of transportation in the study area along with buses. An intersecting usage of various transportation systems is not present. Nevertheless, the operation of the Doha Metro has introduced the feeder buses flow at several stations to make it easier to commute. The Sports city metro runs across the Doha Metro Gold line from Doha East-West directions connecting the Airport City North with Salwa Road, Al Waab Street, and Al Rayyan South. The Sports city station includes a key destination for sporting and recreational activities such as the Aspire Zone and Villaggio shopping mall (Figure 9).

The Doha Metro seeks to establish a transport zone through the main city centers and guarantee an effective user's experience. It includes an interchange station between the metro and the tram through Legtaifiya and the Lusail QNB stations. The Green Line (Education Line) passes for 22 km connecting the Al Riffa area from the east to the Al Mansoura area from the west. Finally, the gold line (Historic Line) passes for 14 km connecting the Ras Abu Aboud area to the Al Aziziya area (Al-Harami & Furlan, 2020; Al Saeed & Furlan, 2019).

Figure 8: Current transportation system in the Al Waab area (a) Aspire zone (b) Villaggio mall parking (c) Hayatt plaza sculpture (d) Sport city metro station (e) Al Aziziya metro station.

6.3. SWOT Assessment

SWOT Assessment represents a framework to assess the strengths, weaknesses, opportunities, and threats of the site. It was obtained to get a rich idea of the existing situation of the site and consider the site strengths and opportunities. The assessment examined the weakness and threats of the study area. The weaknesses contain the physical aspects that create the disadvantages of the study area, which reflect as the following: the shortage of mixed uses within a walking distance; traffic congestion due to high traffic flow; lack of integration between the sports city, malls, and residential area; and high noise level. While the threats are the absence of pedestrian and cyclist safety; rents prices for residential and commercial properties have increased due to the existence of the metro; not addressing the transit connectivity and parking management which will attract personal driving.
Furthermore, the results show that the strengths of the study area are the availability of attraction points such as Aspire zone, Villaggio Mall, and Khalifa international stadium; and the accessibility to the sports city and malls attract people to live in the area. Finally, the opportunities are the presence of the metro, which fosters a multimodal transport system leading to less traffic congestion and sustainable solutions. The SWOT assessments summary is shown in Figure 9.

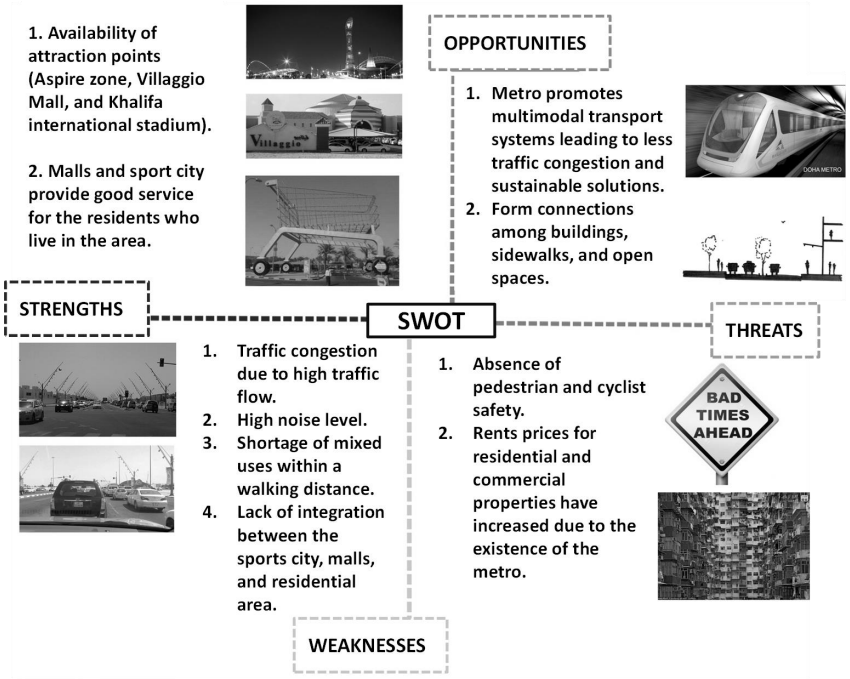

Figure 9: SWOT assessment.

7. TOD Design guidelines and recommendations

A series of TOD design guidelines and recommendations were made to support the stakeholders and policymakers in developing a comprehensive approach of TOD. These guidelines were developed based on the study findings and in relation to the survey outcomes. Mainly through sustainable urbanism and TOD design strategy taking into consideration the Qatar cultural heritage.

7.1. Integrated land uses and social heritage

Literature pointed out that, the TOD model is beneficial in fostering sustainable development through improving the neighbourhood diversity and compactness near transit nodes; and promoting the accessibility for pedestrian and cyclist which lowering the usage of private car (Canitez, 2019). The study area shall include a diverse use along with a social-cultural heritage places that promote the Qatar unique identity and enhance the social interaction in the study are, the proposed spaces are (a) the Barahat which is an open area around the houses that can held some traditional performance and attract public gathering; (b) the Sikka which is a narrow shaded walkable path that create a pedestrian-friendly environments; and (c) the Majlis which considered as a social engagement place where neighbours sit together, socialize, and debate about local events and issues. The neighbourhood will be more liveable when ensuring a balances and mixed distribution of uses where people live, work, learn and leisure. This reduces the travel distance which leading to lessening the private travel demand supporting the public transport, cycling, and walking.

7.2. Public realm and open space scheme

Public realms which contain plazas, souks, parks, squares, and leisure area promotes social cohesion. It also offers a sense of safety and low levels of pollution which generate a positive impact on the living conditions (Al Saeed and Furlan, 2019). As a result, the following has been proposed in the study area to promote TOD and enhance sustainability: (a) create a green corridor in Al Waab Road to connect the Sports City with Aspire Zone; (b) develop a green public realm around the metro station; (c) enhance the street furniture, plaza, and landscaping; and (d) locate the schools near the edge of the commercial zone and the recreational area in a highly visible points around the transit stop. Furthermore, to promote TOD in the study area, public open paces shall contain areas for inhabitants to contribute to community public activities and celebrate their socio-cultural identities. The research area additionally proposes incorporating a public realm with a secure car-free movement adjacent to the metro station.

7.3. Cohesive transport system and pedestrian-friendly design

As reviewed in the literature, the preferred walking distance in the case of TOD is 5 to 10 minutes' walk for 300-800m diameter (Dong, 2021). The neighbourhood within 400m radius shall contain a cohesive transport system with a connected walking and biking networks along with metro and bus stations on the borders. Furthermore, the street system shall be planned in a way that ensure the pedestrian safety, and intersection shall be designed to reduce the distance crossed by the pedestrians. Also, shaded walkways shall be created near the metro station to encourage the individuals to use the public transport.
Through adopting these guidelines, several enhancements will take place in the study area, for example (a) increasing the public transport usage and mobility choices, like the bus, metro, and rail; (b) lessening the traffic congestion which will reduce the pollution and promote sustainable developments; (c) improving access to open spaces, parks, and squares; and (d) promoting the accessibility to retails, recreational area, services, and cultural spaces. Figure 10 illustrates a summary of the reviewed literature.

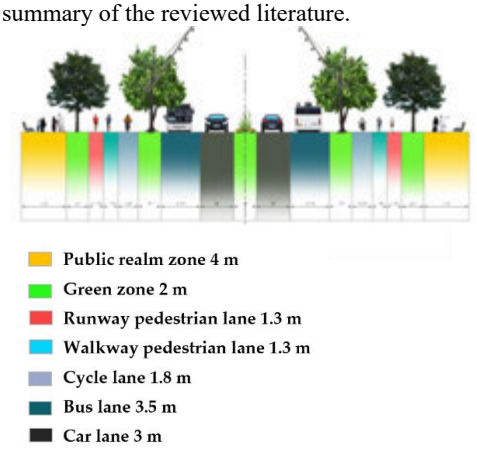

Figure 10: proposed street network for a cohesive transport system and pedestrian-friendly design

8. Conclusion

This paper examined the TOD model implementation for the Al Waab neighborhood in Doha, covering a 400 m radius centered around the Sport City metro station. The social travel behavioral change was explored toward Doha metro as a sustainable system. The study attempts to formulate integrated land use and multi-use transportation system strategies for policymakers to attract people to travel by a green public transport. The findings of this research study also demonstrate the significance of applying the TOD model to promote sustainable urban development and socio-cultural spaces leading to more community engagements. This is achieved through establishing the following guidelines: (1) creating a diverse land-use approach including attractive public areas; (2) promoting the identity of the space surrounding the study area; (3) designing a shaded walkway with cool shading techniques; (4) creating a cohesive transport system and pedestrian-friendly design; and (5) developing a green public realm around the metro station.

The Qatar Rail Development Framework, which includes the Doha Metro and Lusail Tram, serves as a prime example of TOD on a national scale. This framework strategically combines transportation networks with urban development to foster sustainable growth and enhance the quality of life for people. To foster lively and inclusive neighborhoods, it is necessary to strategically design many development and revitalization initiatives centered on metro and tram stations.

Implementing TOD in Qatar presents both obstacles and opportunities. For instance, the region's elevated temperatures and predominant focus on automobiles make it difficult to create pedestrian-friendly environments and efficient public transportation. However, the implementation of strategic planning, creative design, and the acceptance of technology have the potential to revolutionize urban transportation and sustainability.

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From Global North to Global South: Exploring Creative City Policy Mobilities and Their Urban Impacts

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Abstract
An increasing number of cities of the global South are introducing the creative city policy and pledging to adopt creativity as their main developmental focus to improve the living conditions of their population. Although European cities have long used this policy (Scott, 2014), many have been unsuccessful (Rius-Ulldemolins, Hernàndez I Martí and Torres, 2016). Since developing countries of the Global South are participating in such international models, more research is needed to address a gap in the knowledge on the North-South policy mobility and the urban planning effects of creative city policy in the Global South. This study presents a theoretical framework of creative cities focusing on the urban development of cities in developing countries by rehabilitating cultural creativity, diversity, and social inclusion. The research may provide a valuable knowledge base for international exchange of experience in the planning field.

Keywords: creative city policy, policy mobility, global South, urban planning

Introduction

Creative city policy is a well-established approach to urban development (Costa *et al.*, 2007). This article interconnects research on global urban aspects of creative city policy and policy mobilities. In the past decades, considerable amount of research has focused on creative cities and policy mobilities of the global North[1] (Bunnell, 2015; Molho *et al.*, 2020).

Western cities have long used creative city policies to reposition themselves in the global urban hierarchy and to tackle their problems of rising social inequalities and tensions in the urban context (Scott, 2014). Its roots are in the 1990s, primarily Europe, North America, and Australia (O'Connor, Gu and Kho Lim, 2020).

Nowadays, an increasing number of cities in the global South (Molho *et al.*, 2020) are introducing the creative city policy and pledging to adopt creativity as their main developmental focus. They rely on Western theoretical frameworks to research the cities and use homogenising scripts of creative cities to interpret the cultural policies (Molho *et al.*, 2020; O'Connor, Gu and Kho Lim, 2020). That calls for further investigation due to different socioeconomic and cultural backgrounds. Among others, the relationship between culture and urban development (Russo and Van Der Borg, 2010).

[1] I use the term 'global North and South'. It refers to the regions of Latin America, Asia, Africa, and Oceania. Most countries maintain low incomes and marginalised cultures and politics, although emerging BRIC countries (Brazil, Russia, India, and China) complicate the division. As (Dados and Connell, 2012) state, 'The term Global South functions as more than a metaphor for underdevelopment. It references an entire history of colonialism, neo-imperialism, and differential economic and social change through which large inequalities in living standards, life expectancy, and access to resources are maintained.'

My study aims to prepare a ground for filling a knowledge gap by creating a theoretical framework within which practitioners and academics can approach these questions: How to approach creative city policy mobility from the global North to the South? What are the key features of urban planning effects of creative city policy on recipient cities?

Literature Review

Creative City Policy

Its History and Emergence

The evolution of creative city policies spans the time of the post-industrial crisis, globalisation and the rise of neo-liberal ideologies. In response to these shifts, cities became entrepreneurs in a competitive market striving to attract capital and investors (Pratt, 2011).

This transformation was preceded by the crises of Fordism (Florida 2005, Landry 2008), characterised by mass production technologies predominant in the Western industrialised world until the early 1970s. These changes affected cities such as Detroit, Chicago, the English Midlands, the German Ruhr district, and parts of northern Italy.

The transition from Fordism led to the emergence of more flexible and specialised production models, altering industrial organisation and inter-firm relations. The trend was to liberalise institutional restraints on market competition and weaken the welfare state (Harvey, 1989), (Brenner and Keil, 2014).

These shifts also influenced the spatial patterns of growth (Brenner and Keil, 2014). Industries, like cinema (Storper and Christopherson, 1987), were increasingly clustering in metropolitan areas to improve the efficiency and competitiveness of entrepreneurs and lower production costs. This was possible due to the availability of a specialised and skilled workforce, reduced transaction costs, face-to-face problem-solving, and sharing of skills.

Costa (Costa *et al.*, 2007) suggests five origins for the increasing interest in creativity:

1. 'Creative city' concept developed by, amongst many others Charles Landry (2000), Peter Hall (2000), and Ralph Ebert et al. (1994) in connection with an analysis of 'creative industries' and practical applications via policies
2. Launch of 'Creative Europe' by European research institutions or the project of 'Creative Cities network' by UNESCO in 2004
3. 'Creative class' (Florida, 2002), as a critical driver of competitiveness and urban regeneration processes due to its talent, tolerance and openness
4. 'Creative industries' within the economic analysis originate from the industrial economic tradition, and a similar approach is 'creative economics'. It analyses their organisation in an institutional context, taking their particularities into consideration
5. The importance of creation and artistic creativity, leading to the study of not only the demand side but also the supply (Throsby, 2004)

While the definition of creative cities and creative economies varies (Costa *et al.*, 2007), most authors agree that creative industries include film, music, radio, television, publishing and advertising along with the support infrastructure (organisational or material) (Pratt, 1997). Despite the substantial economic contributions of creative economies, evaluating their impact

can be challenging due to their nature, which has both financial and cultural value (the process of creation is also essential, not only the outcome) (Pratt, 1997; Evans, 2005).

In practice, creative city policies aim to enhance the quality of life for urban inhabitants through targeted interventions in three main areas: (a) economic development, (b) social welfare/inclusion, and (c) urban development (Bianchini and Parkinson, 1995; Rato, Roldão and Mühlhan, 2009). There are benefits in combining all three perspectives (Boddy and Parkinson, 2004; Costa *et al.*, 2007). Figure 1 below gives an overview of the combination of approaches and typical examples of cities.

(a) Economic development is usually the central focus of creative city policies, with the primary objective being the job creation and formulation of industrial and creative strategies.

(b) Social welfare programmes focus on social inclusion or community character.

(c) Urban development plays a central role in shaping the city's physical landscape. It includes renovations and reconstructions to improve the image of the city, even a recreational strategy. These approaches are usually more or less modified and combined (Bianchini and Parkinson, 1995; Rato, Roldão and Mühlhan, 2009).

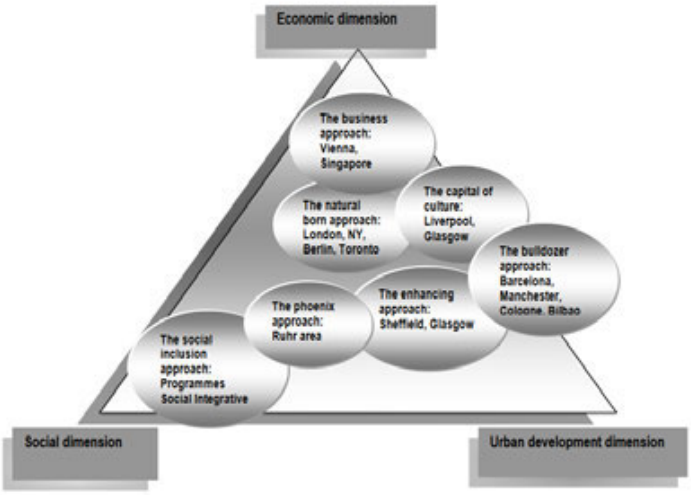

Figure 1 Typology of creative cities (Rato, Roldão and Mühlhan, 2009)

The paradigm shifts to focusing more on sustainability and distributive equity. From short-term to long-term impacts (Evans, 2005). From building flagship projects to incorporating small-scale public art projects with the stress of everyday use, social inclusion, and design quality (Boddy and Parkinson, 2004) to battle gentrification associated with high art venues and large redevelopment projects. Inclusion of local communities, engagement and consultation. Cultural activity should be incorporated as one key indicator of a city's quality of life (Evans, 2005).

Limitations and Contradictions

There are numerous limitations and contradictions to this neo-liberal urban policy. Much of the critique is centred on the fact that researchers predominantly focus on theoretical and empirical research on the global North and the lack of investigation of a broader range of contexts of different countries (Molho *et al.*, 2020). One example could be the spatial mobility of the creative class[2] (Martin-Brelot *et al.*, 2010).

Planners should focus less on land use and more on incorporating cultural, social, economic and environmental issues (Landry, 2000/2008).

The creative city has often been seen as easily transferable (Kong, 2014), homogenising (Molho *et al.*, 2020) and a 'fast policy' (Peck, 2005). However, the impacts of the policy could be short-lived (Russo and Van Der Borg, 2010; O'Connor, Gu and Kho Lim, 2020), and flagship events cannot do more than divert attention away from the real problems of cities (Mooney, 2004).

The central critique focuses on gentrification (McGuigan, 1996; Seo, 2002; Evans, 2005). Creative workers and productions depend on specific locations, but at the same time, they are threatened by delocalisation due to the rising valorisation of urban land (Vivant, 2013).

That leads us to another issue: the frequent omittance of the topic of social exclusion in creative cities (Sasaki, 2010). The impacts of the policy could be socially exclusive (Russo and Van Der Borg, 2010). Groups such as the socially excluded, older adults and people experiencing homelessness are not being integrated (Landry and Bianchini, 1995; Landry, 2007; Müller, 2019). We also should not leave out spatial inequalities (Evans, 2005). Some cities have been unsuccessful in tackling local inequality problems and primary infrastructure access (case of Rio de Janeiro (Claudia Seldin and Gavinho, 2020)) or even enhanced the problems (case of Cape town (Malte Steinbrink and Ley, 2011)).

Role of International Creative City Networks

Cities are influenced by the increasingly uneven global inter-urban connections (Molho *et al.*, 2020) and seeking a change in their aspirations and identities, however successful in the long term and the extent of their implementation (O'Connor, Gu and Kho Lim, 2020).

To meet the challenges of globalisation and ensure cities' success, we must not rely on traditional political institutions but on individuals, groups and bottom-up processes. Global public policy networks must include groups from the global South. It is critical in the design and implementation of policies (Reinicke, 1999).

There is a great diversity of institutional frameworks and governance mechanisms in implementing creative city policies. Besides, many public bodies and organisations use these concepts locally and nationally. There are also supranational institutions, such as the

[2] Empirical European data show that creatives are less mobile than in the United States due to cultural and institutional barriers. In a search for a location to settle, look for hard factors such as the quality of jobs. Soft factors such as cultural amenities only determine the particular district where to settle (Martin-Brelot *et al.*, 2010).

UNESCO, European Commission and OECD (Organisation for Economic Co-Operation and Development). Their focus lies in the multidisciplinary approach, management, and governance (Costa *et al.*, 2007).

UNESCO's ''Global Network of Creative Cities," launched in 2004, has quickly spread to developing countries. Now, 350 cities in 7 fields worldwide are registered in the global UNESCO network. There are efforts to strengthen the connections between 'global South' cities (Molho *et al.*, 2020). Ahead of these designations, UNESCO declared the Universal Declaration on Cultural Diversity in 2001. Its purpose is to combat standardisation under globalisation (Sasaki, 2010).

Creative City Policy Travels to the Global South

An increasing number of cities in the global South are introducing the creative city policy in order to rescale and reinvent themselves (Molho *et al.*, 2020). However, this complex model cannot be re-applied without modification (Bianchini and Parkinson, 1995). All cities are diverse; thus, many formulas address all the city's problems (Molho *et al.*, 2020).

Luckily, not all global South cities accept imported models without changes (for example, Beirut and Istanbul took Dubai as an anti-model) (Centner, 2020). Many cities found alternatives and new approaches to hegemonic models from the West worldwide (Molho *et al.*, 2020).

From a practitioner's or policy outcome-oriented scholar's perspective, 'good' or at least promising solutions must also be transferable from one place to another. And they need to know how this might be done most effectively (Baker and Temenos, 2015).

Guidelines about how global creative policy circulates, vernacularises and is unevenly adopted can offer policy mobility theory. Where and to whom they travel and how they vernacularise depends on the institutions and actors who receive them. It depends on their position and power. Remember that conflicting interests around the globe also influence local policies (Molho *et al.*, 2020).

Policy Mobility Theory

An increasing number of scholars are paying attention to the circulation of urban policies (Baker and Temenos, 2015).

There have been numerous attempts to reproduce and implement various entrepreneurial development policies due to intensifying interurban competition (Harvey, 1989; Brenner and Keil, 2014), increasing globalisation of politics, society and economy (Hall and Hubbard, 1998), and the socio-spatial processes derived from it (Peck and Tickell, 2002; Baker and Temenos, 2015).

Emerging in the early 2010s (Baker and Temenos, 2015; Haupt, 2023), the policy mobility approach was primarily driven by critiques of the previous approaches by human geographers and urban studies scholars (Peck and Theodore, 2010; McCann, 2011; Peck, 2011; Temenos

and McCann, 2013). Later, it led to the emergence of urban policy mobilities as a sub-field (McCann, 2011; Baker and Temenos, 2015; Lovell, 2019; Haupt, 2023).

Policy mobility theory emphasises thought patterns and mindsets and the directions of movements that express power relations (Haupt, 2023).

Key Features of Policy Mobility

Critical features of policy mobility, besides the spread of policy between cities, include international (global) geographical reach (Haupt, 2023), the mobile and changeable character of policies (Peck and Theodore, 2010; McCann, 2011), that are modifiable right from the beginning of the process. Ideas, discourses, or synthesised models can travel in selective and partial forms (Peck and Theodore, 2010; McCann, 2011; Temenos and McCann, 2013).

How ideas/policies might change the places they are spreading to (Stone, 2004; Peck and Theodore, 2010; McCann, 2011; Temenos and McCann, 2013). Emphasis is more firmly placed on the effects of policy discourse and implementation on social life and practices (Haupt, 2023). The focus is more on the role of non-state actors, such as NGOs, consultancies, or multinational corporations, and how they influence governmental bodies with their mostly neoliberal policies (Peck and Theodore, 2010; Prince, 2010; McCann, 2011).

Another key feature is the significance of failed policy spread – policy immobility (McLean and Borén, 2015; Lovell, 2019) no longer studied from a positive point of view but to research the power relations and inequalities and drawing attention to failed or harmful policies that can also travel to different places (Lovell, 2019).

Policy mobilities literature has a critical perspective (critical of policy spread and society) (Haupt, 2023). Urban policy mobilities research has no defined paradigm or definitive approach. Instead, they draw from various epistemological perspectives spanning planning, sociology, geography and political science (Baker and Temenos, 2015).

Critique of Policy Mobilities

Early critiques focused on neoliberal policies, orientation toward the global North (Bunnell, 2015), and presentist outlook are being answered (Temenos, Baker and Cook, 2019).

Further critique of policy mobilities scholars addresses the work of scholars who rarely reach out to policymakers and politicians with suggestions on how to improve current practices (Haupt, 2023).

Söderström and Geertman (2013) and Cohen (2015) argue that focusing on Southeast Asian cities has led to the conclusion that we should further focus on understanding ad hoc networks and nonliberal urban practices.

For future studies Temenos, Baker and Cook (2019) recommend foregrounding the integration of policy mobility within the socio-spatial fabric of cities and urban life and (a) engaging with other conceptual questions in the field of urban studies, (b) enlarging the collection of studies outside of the Anglo-American area. That would be beneficial in policy mobility studies for

differentiating what is general and specific, and (c) conceptualising policies on dualities: local/global, fixed/mobile, territorial/relational—also adding mobilities of knowledge, people, materials and politics.

Shaping a Framework for Creative City Policy Mobility and Its Urban Planning Impacts Across Global Regions

Stevenson (2004) highlights the necessity for new methodologies that combine approaches of anthropology, sociology, and cultural and urban studies that can be applied to evaluation models to measure physical, social and economic changes. Responding to the need for more conceptual and integrative groundwork, this paper creates ground for a novel framework for urban planning effects of creative city policy mobility from the global North to the South.

I ground my framework on the work of Evans (2005), Temenos, Baker and Cook (2019), and Müller (2015). The proposed framework involves types of evaluation, the three stages of policy mobility in detail, and key features of urban effects of creative city policy.

Types of evaluation

The following types of reporting can evaluate culture's contribution to development (Evans, 2005): (a) project evaluation and (b) programme evaluation.

(a) Project evaluation focuses on the project's process and results. It can use quantitative or qualitative evidence. Data are collected via unstructured interviews, focus groups, questionnaires and participant observations. It is ideal to start evaluating from the beginning of the project, during and after post-completion. The assessment area is not limited (it can be a local development area or national programme). The evaluation may include one or multiple projects (see Programme evaluation below).

(b) Programme evaluation includes multiple projects in one local, national or transnational initiative. It uses Project evaluation techniques and can be measured by standard output criteria, including performance indicators (comparing actual and targeted performance).

Academic discourses often counter overly optimistic official narratives on urban development. Unfortunately, it is not possible to access the necessary data. The studies include more technical quantitative impact assessments (economic/econometric) and area and sectoral case studies of a particular cultural activity like theatre quarter and fashion industry. „In some respects, the lack of 'hard evidence', of access to detailed data, decision-making processes and the basis to measure impacts over time, have limited more 'scientific' analysis, leaving little scope, outside political and policy discussions and micro-level case studies" (Graeme Evans, 2005, 965).

Stages of Policy Mobility

Questions accompanying Table 1 below help us systematically trace North-South policy mobility and help in orientation and approach to urban planning questions in three time frames: (a) transportation, (b) transformation and (c) translation (Müller, 2015).

(a) Transportation happens when the policy is moved from place A to place B (Healey, 2012; McCann and Ward, 2012). It is transported and impacted by diverse people via various materials to different political systems. It does not come packaged but rather as selected elements brought to one place and assembled. It is of interest to study what parts of policies are immobile.

(b) Transformation is embedding policy into the local socio-material environment. It is usually changed, seldom not at all. Policy changes are due to interaction with existing policies, translations, interpretations, institutional settings and legislation. The carriers also modify elements of policies.

(c) Translation can be similar to policies' original intentions or have different impacts. Responses to its implementation can be studied from the perspectives of the public, private, and state sectors. Translation is not the end of the cycle; the policy can travel to a new place again.

Transportation	Transformation	Translation
1.1 Who and what moves and is moved?	2.1 What aspects of a policy change?	3.1 What actions does the policy create?
1.2 When?	2.2 For what reasons and through what channels does change happen?	3.2 How well is the policy able to align intentions and actions?
1.3 Where to and from?	2.3 To what extent is change intentional or unintentional?	3.3 Through what mechanisms is the policy applied?
1.4 How?	2.4 What is the role of already existing policies in affecting change?	3.4 What is the response to the policy?
1.5 Through what channels or events?	2.5 What other elements does a policy enrol?	3.5 Does the policy itself serve as a model for others?
1.6 Who and what does not move?		

Table 1 Transportation, transformation and translation of policy (Müller, 2015)

Mobility of urban planning effects of creative city policy is possible because of the mobility of (a) knowledge, (b) people, (c) materials and (d) politics (Temenos, Baker and Cook, 2019).

(a) Knowledge is transferred when there is a need for detailed policy or a global approach is desired. It can be local or outside expertise.

(b) Diversity among the team of people is beneficial; it includes all types of policy actors and their mobilities, as there remains a need for shared experiences and face-to-face meetings at conferences and study tours. It can be bureaucrats, politicians, activists, lobbyists, service managers, consultants, architects, etc.

(c) Materials are needed to circulate between people. They can travel in physical and virtual spaces through reports, PowerPoints, spreadsheets, maps, and visualisations. They are crucial for the actors to visualise the proposals and make connections to them.

(d) Politics is central to the mobility of policy. It reflects the current political conditions, ideologies and functions of the state. These conditions are globally different, and various policy advocacy and activism levels exist.

Where to and how is policy transported is seen in Table 2.

Transportation		
1.3 Where to and from?		
Primary recipients of the intervention	the state the region the city the community a particular group of actors the private sector	(Rato, Roldão and Mühlhan, 2009)
Transportation		
1.4 How?		
The level of participation of the population in the process	bottom-up top-down	(Rato, Roldão and Mühlhan, 2009)
Inclusion of multiple stakeholders	arts and cultural groups heritage associations and communities	(Evans, 2005)
Schemes structured to facilitate collaboration between those responsible for regeneration and those responsible for cultural activity	local authorities partnership bodies responsible for regeneration	(Evans, 2005)
Intended duration of policy	short middle long term	(Evans, 2005)
Integration into legal documents	strategic plan master plan budget	(Evans, 2005)

Table 2 Where to and how is policy transported

Key Features of Urban Development Effects of Creative City Policy

Urban development is usually directed towards transforming physically, socially and economically declining areas. The paramount principles lie in the sustainability of the place, aiming toward long-term improvement. Responding to the call for a more integrative approach, the evaluation also touches on social and economic domains.

People's needs across the globe are met differently. Guidelines can offer Maslow's hierarchy of needs, including physiological and safety, as the base (Maslow, 1943). The sustainable principles should, therefore, include the liveability of the place, people's quality of life, safety, inclusion and heritage conservation. Inclusion of all groups irrespective of income, ethnic profile, religion, skills, gender, disabilities, age, caste, or political orientation. Quality of life

depends on mobility and access to public amenities and open spaces, as well as on the living environment, densities, pollution, and health.

Monitoring should also include social and land use diversity and the multifunctionality of places. We should remember the authenticity and identity of the place and design quality, which does not rely on homogenising principles.

To attract creative individuals and companies, agglomerations should offer spaces for production (both enabling work from home, small-scale businesses and open coworking places for sharing information, knowledge and skills), consumption, commercialisation (shops, markets), socialisation and residence (Vivant, 2013). Government bodies at local and national levels can support innovative clusters (cooperation of private companies and research centres; networking of local producers) and industrial planning (rezoning large areas for cultural consumption and production) through urban policies (Vivant, 2013).

Graeme Evans (2005) noted that no universally applicable set of indicators for a particular intervention exists. Due to its context-specific nature, a pick-and-mix approach is required from Table 3. Standardised performance indicators and quantitative benchmarks are also not valuable in this context.

Area of intervention	quarter(s) city region	(Rato, Roldão and Mühlhan, 2009)
Extent of the physical intervention	reuse of land, brownfields	(Evans, 2005)
	rezoning large areas for cultural consumption and production, Industrial planning	(Vivant, 2013)
	requalification of quarters	(Rato, Roldão and Mühlhan, 2009)
	construction of an emblematic building	(Vivant, 2013)
	renewal/reuse of (historical) buildings	(Evans, 2005)
	upgrading of existing cultural facilities	
Places for consumption + production + commercialization + socialization	art galleries and visual art venues concert and music venues theaters, dance and drama venues cinemas multi-use venues museums libraries	(Duxbury, Garrett-Petts and MacLennan, 2015)

	archives historic buildings and structures historic monuments historic parks and gardens historic landscapes protected natural landscapes archeological sites world/national heritage sites landmarks shops markets public spaces studios festivals, events and public art schemes enabling work-from-home small-scale businesses open coworking places for sharing information, knowledge and skills	(Vivant, 2013) (Montalto *et al.*, 2019) (Evans, 2005), (Vivant, 2013) (Evans, 2005)
Spatial distribution	clusters of producers innovative clusters for cooperation of private companies and research centres innovative clusters for networking of local producers	(Evans, 2005) (Vivant, 2013)
Complementary infrastructure (investment in land preparation and transport infrastructure)	air road rail/ light rail metro hotels housing – houses, apartments	(Evans, 2005) (Evans, 2005), (Vivant, 2013)
Spatial accessibility of places for consumption, production, commercialization, socialization and complementary infrastructure	for locals for visitors disabled minorities older adults people experiencing homelessness indigenous communities	(Evans, 2005) (Landry and Bianchini, 1995; Landry, 2007; Müller, 2019) (Duxbury, Garrett-Petts and MacLennan, 2015)

Table 3 Key Features of Urban Development Effects of Creative City Policy

Discussion and Conclusion

This research links creative city and urban development studies with policy mobilities. A theoretical framework has been created on the policy mobility of creative cities in urban development. The proposed framework involves types of evaluation, the three stages of policy mobility, and key features of urban effects of creative city policy.

The paradigm of the creative city shifts from focusing solely on the economic benefits of the arts to sustainability (in terms of physical, social and economic well-being) and distributive equity. From short-term to long-term impacts (Evans, 2005). From building flagship projects to incorporating small-scale public art projects with the stress of everyday use, social inclusion, and design quality (Boddy and Parkinson, 2004) to battle gentrification associated with high art venues and large redevelopment projects. Inclusion of local communities, engagement and consultation. Cultural activity should be incorporated as one key indicator of a city's quality of life (Evans, 2005).

A policy can only be packaged and implemented with changes on its way to a new destination. Moving policy loses or gains different directions depending on who moves it, what moves it, and where it is moved (Healey, 2012; McCann and Ward, 2012).

There is also no universally applicable set of indicators for a particular intervention. Due to its context-specific nature, a pick-and-mix approach when researching a city is required. Standardised performance indicators and quantitative benchmarks are also not valuable in this context. Academic discourses often counter overly optimistic official narratives on urban development (Evans, 2005).

Urban policy mobilities research has no defined paradigm or definitive approach. Instead, they draw from various epistemological perspectives spanning planning, sociology, geography and political science (Baker and Temenos, 2015).

Limitations include restricted access to both qualitative and quantitative data. Qualitative data is dependent on subjective opinions of individual actors. Quantitative data can also be difficult to obtain as developing countries are often limiting access or there is absence of data. Countries also use different categories and granularity in the datasets which makes it almost impossible to compare.

Recommendations for future research are further investigating what influences liveability and quality of life of the city, respecting needs of different cultures. Secondly, there is a need to respond to current climate challenges that create an unfavourable living environment. Next recommendation regards the digital revolution's effects on culture and urban planning.

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Track 15: Histories

HISTORIES - Knowledge exchanges in urban developments from a historical perspective

Chairs:

- Clément Orillard, Ecole d'Urbanisme de Paris
- Olivier Sykes, University of Liverpool
- Yi Xin, Southeast University of Nanjing
- Asli Ulubas Hamurcu, Istanbul Teknik Üniversitesi

Keywords: *Transnational planning histories, knowledge exchanges, planning models, cross-national fertilisation, technical aid*

This thematic track is dedicated to exploring the intricate history of knowledge exchange among urban experts from various countries along the last waves of globalization. Starting with WWII and continuing to the present day, the landscape of urban development worldwide has been profoundly shaped by the transfer of knowledge, ideas, and urban models. This track focuses mainly on the impact of the third wave of globalization, during the 1980s, 1990s and 2000s, which witnessed a particularly rich and influential cross-pollination of concepts, strategies, and experiences that has left a lasting and transformative impact on urban development practices in numerous nations.

One of the central focal points of this track is the detailed examination and comparison of knowledge exchange processes themselves and their impacts on urban development. The types of exchange include technical aid missions, transnational academic and scientific exchanges, foreign commissions of architectural/planning firms or consultants, etc. This track considers exchanges between countries in Europe, between European countries and other countries in the Global North, and European countries and the Global South and East. Through this exploration, we seek to unravel the multifaceted interplay of ideas, strategies, and shared experiences that continue to shape our ever-evolving urban world.

A special session will focus on exchanges between China and Europe. Within this session, there will be an particular emphasis on urban regeneration practices, a vital facet of urban development that plays a pivotal role in revitalizing and rejuvenating urban areas. By studying the experiences and approaches of these exchanges between Europe and China, we aim to draw valuable insights that can inform and enrich urban regeneration practices on a global scale.

RETAINING INDUSTRIAL HERITAGE PUBLICNESS

The interrelationship of industrial heritage and public space

Abstract

This research aims to explore how to use interrelationship of industrial heritage and public space for making a city with public industrial heritage. In the UK and especially in London, the industrial heritage is gradually becoming a private profitable property rather than being used as historical knowledge for the public. To retain the publicness of industrial heritage, this research uses public spaces as a platform for industrial heritage presentations, examines how the industrial heritage shapes and influences the public space, and in what way the public space reflects and responds to the public value of industrial heritage in the transformation process. The research finds that the interrelationship of industrial heritage and public space can be enhanced and created by intervening on the public space visually, socially and physically. Therefore, three specific strategies of different aspects are proposed to enhance the interrelationship and further to present the publicness of industrial heritage.

Key words: industrial heritage; publicness; public value; public space

0.Introduction

With the pressure of housing and profit rises in the last twenty years and the booming of post-industrial transformation, the abandoned industrial heritage is re-used for stylised high-end housing for urban development. In the UK and especially in London, the industrial heritage is gradually becoming a private profitable property which is purchased by investors and developers because of the location, distinct physical fabric and the high price of land, further transformed into high-level residential and commercial buildings for specific groups. However, as the private value of industrial heritage is continuously magnified, its public values are overlooked. When transformed into residences, the industrial heritage is privately owned and increasingly emphasising its use-value for specific groups, rather than being used as historical knowledge for the public. This makes the industrial heritage lack publicness, private values are over-presented, and public values are under-presented.

This research argues that the industrial heritage needs to retain the publicness in the city rather than utilised as private property. To present public values, the interrelationship of industrial heritage and public space are studied to explore the way of presentation. Thus, two research questions are investigated: how the industrial heritage shapes and influences the public space, and in what way the public space reflects and responds to the public value of industrial heritage in the transformation process (Figure 1).

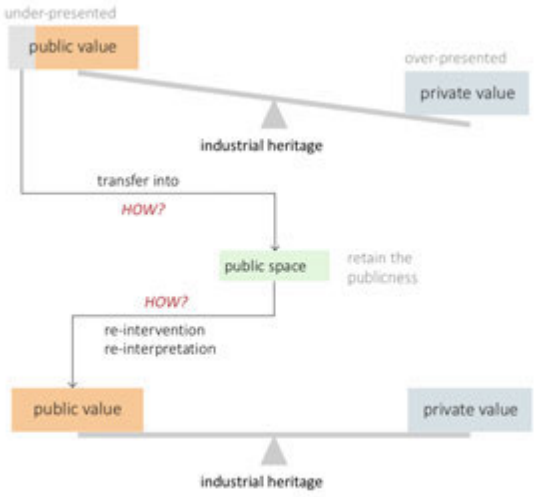


Figure 1. Diagram of research questions

1.Industrial heritage and its public values

1.1 Definition of industrial heritage

In the London context, industrial heritage is usually used as an effective and significant resource for economic growth. With the rapidly increasing of land price, there is a tendency that the industrial heritage is purchased and invested by private developers, the transformation focuses on high-end residences and offices to get maximum profits.

However, the transformation ignores the socio-cultural value of industrial heritage, resulting in the values that should be expressed for the public are under-presented, only reach to specific groups, the true socio-cultural value of industrial heritage may be concealed or even forgotten. For the public, especially the minority with the experience and memory of industrial heritage and the next generation, the value of heritage cannot be felt and loses its inheritance from the past to the future.

From these perspectives, the transformation of industrial heritage indeed should consider the part of definition related to “social activities”, for highlighting its public values and social life and memory related to industrial eras.

1.2 The publicness of industrial heritage

This research argues that the publicness of industrial heritage should be retained and presented for the public. Thus, four elements are selected to figure out what are the “publicness” of industrial heritage and the meanings in the contemporary context.

1.2.1 Physical fabric

The "physical fabric" in this research refers to the "formal appearance" of industrial heritage and its morphological reflection in the urban landscape. ICOMOS（1987）and Historic England (2008) state that the scale and massing, style and form, materials, colours and decoration constitute the appearance of industrial heritage, are "the product of formal design" and the "succession of responses within a particular cultural framework" (Historic England 2008, p. 31). In the larger scale, the physical fabric of industrial heritage treats as an "organic form" (Historic England 2008, p. 31).

It believes that in the “physical fabric”, the industrial heritage shapes the traditional aesthetic value. The architectural design visually reflects the specific architectural and technical significance of the industrial era, the interpretation and preservation of the design over time are overlapped, formed the current industrial heritage landscape, which is the self-development process of industrial heritage. But when it is placed on a city perspective, it is also necessary to consider how to combine with other urban spaces to build a harmonious urban landscape. Specific industrial heritage is mapped as a landmark and it’s meaning is reflected through reinterpretation. This is one of the ways in which industrial heritage can keep up with the times after losing its original function.

1.2.2 History

Lowenthal (1998) made the distinction between “heritage” and “history”, he argues that “history explores and explains pasts grown ever more opaque over time; heritage clarifies pasts so as to infuse them with present purposes” (p. xv). The history itself is what happened in the past, it is the study of the past, did not need to engage with specific groups of people; while heritage is “the celebration of the past” (Lowenthal 1998, p. x).

The theory holds that the history of heritage can be selected and changed according to current purposes. However, heritage is a manifestation of the historical process, as regards the phenomena of heritage development, some of history is interpreted and presented by the authorities, valued and manipulated to benefit them. Therefore, the authorities control history in heritage, the selected parts are in a profitable way to serve some groups. Authorities ignore the history of heritage as it relates to the public because this part of history and its owners cannot contribute to the current development. This makes the historical display of industrial heritage neglect its original value to the public, makes the public gradually forget the original history and heritage. Heritage can cater to the development of the times, inject new functions and serve new groups, but are no longer the public, the heritages is gradually losing the publicness.

1.2.3 Personal memory, collective memory

Memory is related to past experiences. Locke (1971) argues that personal memory is the memory of “particular items [that] personally experienced”, which is physical experience and life, while Benton and Cecil (2010) further treat it as unique “personal mental act”, which is the individuals selective interpretations, related to the people themselves. The minds “encode” the experience as a memory, while the interpretation or intervention in the present is the process of decoding. In common circumstance, it decodes visually through images, objects and sculptures, shows the culturally specific or personal experiences.

Different from personal memory, collective memory refers to groups and their experience as “lived experiences” or “moments from the past”. It is always social and only exists when shared with others. The special nature of group experience creates shared memories and identities; it creates a powerful bond with each other. In the present, the public use collective memory to get identity and sense of themselves, it can occur more powerful resonance than personal memory. The “communal value” of heritage reflects the importance of collective memory. The collective memory of industrial heritage is influenced by the specific physical and social environment of the industrial era, it is reflected in the contemporary resonance of certain people for certain experiences in the past. The resonance is very important for the specific groups, it represents the imprint of experiences and memories. In the social context, these memories further form the every-day urban life and cannot be ignored by the public.

1.3 The presentation of industrial heritage

In the transformation of industrial heritage, how to explain and apply these concepts to the project is very important. In terms of publicness, industrial heritage needs to find a way to show these values to the public to retain the publicness within the privatisation development. This research uses public space as a display platform for industrial heritage, examines the presentation of the values by analysing the relationship between these two aspects.

2. Public space: definitions, dimensions and elements

2.1 The definitions of public space

In the definition of “public space”, “public” refers to the people in general, it points out the nature of “public space”, which can be accessible to or shared by all members of the public; it also provides a place for the use of human contact and interactions related to social. However, the dictionary definitions are not sufficient to systematically describe the public qualities of urban place, in this regard, this section focuses on the publicness in public space.

2.2 Dimensions of publicness

Existing literature agree with the core dimension of publicness and have a high degree of commonality, Varna and Tiesdell (2010) further concludes them into five mega dimensions – “ownership”, “control”, “civility”, “physical configuration” and “animation”. The terms “ownership”, “control” and “civility” refer to whether the space owned and used for the public and how to balance the management of public space for different groups. The “physical configuration” and “animation” are two design-oriented dimensions, the distinction is whether considering the site as a whole to discuss the relationship between other areas (“physical configuration”) or the potential uses and activities inside the site (“animation”).

In the process of industrial heritage, it can be predicted that when the industrial heritage and its public space is privately owned and managed, it is becoming more and more important to discuss the publicness in terms of "physical configuration" and "animation". Therefore, this research focuses on four elements from these two aspects to explore the specific meanings of publicness in the industrial heritage transformation.

2.3 Elements

2.3.1 Morphology

Physical configuration refers to the connection system environment and settings provided by the public space, highlight the “accessibility” and “visual permeability”. The “accessibility” contains the layout and configuration of public space shapes and forms, which can be shown by the morphological changes in the public space. The morphological structure of the public space network defines "streets" and "spaces" through the arrangement of buildings, which can reflect the local development patterns and processes of change. It also constitutes the basic movement patterns of different scales for different groups of people, further determines how easy people can enter and welled-use the public space and the publicness of public space”.

Based on these interpretations, the research defines the morphology of public space in industrial heritage project by two scales, the regional scale and the project itself. In the regional context, industrial heritage is defined for establishing as an important node in the public space system. Its morphology caters to a larger scale public space system, highlight accessibility of different social groups and important social and political position. In contrast, inside the project, the morphology of public space related more to the new building forms and concentrations. The form of public space caters to the new functions of industrial heritage and specific consumers, highlighting the accessibility of specific groups, regardless of the vulnerable groups in the city, contrary to the definition of “public”.

2.3.2 Visual perception

Another concept of physical configuration is “visual perception”. This research argues that visual perception could be used as a tool for visual permeability experiencing and measuring the visual connection to the built environment. The patterns and rhythms of building and its relationship to space help to understand the characteristics of visual perception. The English Heritage (2012) clarifies the important role of views in shaping knowledge and understanding of heritage. For industrial heritage, the view is the historical industrial composite; it represents the specific eras and experiences. The direct visualisation of industrial heritage displays through the official viewing point, which provides the potential restrictions for the proposed developments in surrounding areas to protect the heritage assets and values visually. The document sets up an evaluation viewpoint for heritage but ignores that some groups have no emotion when observed at this point, namely, this has no value for them. Therefore, how to make visual assessment of heritage through public space to meet the needs of specific groups has become a problem that needs to be studied.

Cullen (1971) and Bosselmann (1998) deepen state that scale, massing and building materials interact as relatively static elements with public spaces, this is more largely dependent on the continuous movements, visual and social experiences that occur in the public. From this, the viewpoints cannot be fixed but need to design a series of continuous observation areas in public space to examine the building and pay attention to the feelings in the experience.

Thus, “visual perception” can be explained in two ways: the direct visualisation of the buildings and the visual interaction in the changing environment of movement. Additionally, when observing industrial heritage, perspective recognition should also include the lived experiences that industrial heritage attempts to convey to the public. These experiences are different according to the observers, the history and memory conveyed by the industrial heritage overlap with the social life

in public space, shaped a new visual perception. This perception should not and cannot be assessed by viewing points; they are formed by real social life and exist in the memories and experiences.

2.3.3 Diverse users, activities and events

The animation of the public space refers to supporting a wide range of potential uses and activities, it can be understood in terms of the interpret and use for different social groups, activities and events that the public space can provide to meet the needs of people.

In present, however, some industrial heritage does not show that it should be public. These industrial estates transfer ownership to privately stronger management or business departments for greater benefits, the more powerful departments use industrial heritage for private purposes and serve to the high-end group, the more profiting from it. Each department has the right to use public space according to the benefits it can provide, while some powerless sectors will lose their right to use. From these perspectives, it is important to intervene and negotiate with powerful sectors to make them aware of the needs of public groups for providing more public purposes of industrial heritage.

When it can be used for public purposes, the activities and events could be further considered as a way of engaging with public sectors and presenting the industrial heritage. The activities are particularly relevant to the history of industrial heritage and the memories and experiences of specific groups, through which the public can be made the socio-cultural significance of industrial heritage for the present era, and can present the values of industrial heritage into social interaction in public spaces, thereby keeps it meaningful to every-day urban life.

3. Interrelationship of industrial heritage and public space

Based on these concepts of industrial heritage and public space, this section summarises and proposes theoretical frameworks to explore their interrelationships in the presentation of publicness (Figure 2, 3).

3.1 Interrelationship of elements

From the conceptual discussion in the literature review, the relationship can be summarised as a framework that abstractly shows the relationship of each category. For example, the theory proposes the importance of public life for “visual perception”, for industrial heritage, it is the experiences of history and memory, thus the connection between “visual perception” and “history” and “memory” can be linked. The establishment of this connection is two-direction, and it can be created from two aspects.

Moreover, different elements in the same category can also interact. In the process of transformation, the interpretation of the "history" may affect the "memory" and experience that it conveys to the public, so the presentation of "physical fabric" may be indirectly affected by these factors. This effect varies according to time and space, and external interventions and explanations are considered in the long-term process.

3.2 Add the temporal dimension

Furthermore, the understanding of heritage is not stable and unchanged, the way of use changes through time and space as well. The concepts of temporality in industrial heritage transformation are vital to understanding the changeable process. In this sense, heritage can be interpreted, presented and conserved within any age. In the circumstance, the "process" shows the interpretation in temporal dimension rather than fixed and static intervention. Figure 3 explores the interrelation from the past to present, proposes a reasonable assumption for the future. The appearance of this influence in the process of urban development is subject to time constraints, such as the current intervention in industrial heritage may affect the public space in the future with development and configuration.

Based on this, the empirical analysis will focus on the literature review and Figure 2 to evaluate the relationship between industrial heritage and public space. Figure 3 is used to analyse the specific performance of the interrelationship in the development at different time periods. When there is a contradiction between the practical development process and the theoretical, it will open up the design intervention.

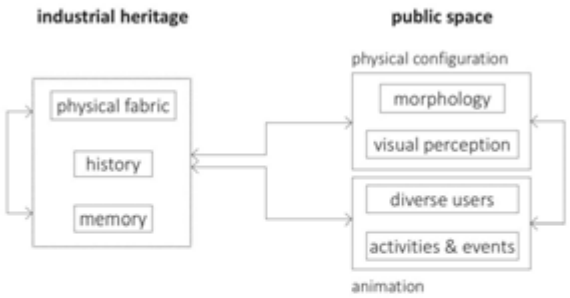


Figure 2. The interrelationship of industrial heritage and public space

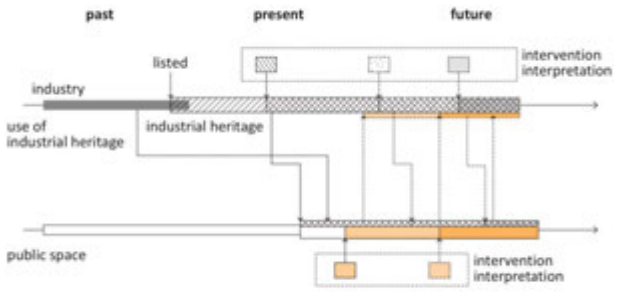
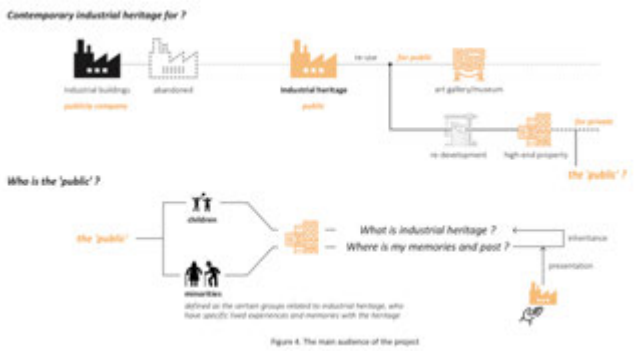


Figure 3. The interrelationship in a temporal dimension

4. Empirical analysis – site intervention and case study

The empirical analysis is divided into four parts. The main audiences of the research will be first addressed. Then the overview of the site (Battersea Power Station) and the case study (Tate Modern) will be introduced to compare the change and use of industrial heritage. Based on the theoretical framework, analysing and comparing the selected elements of public space related to the industrial heritage in two projects. Finally, to conclude the findings from the analysis, two concrete empirical frameworks will be formed and analysed based on the theoretical outcomes, evaluate the condition and degrees of the interrelationship between each element for the design process.

This research focuses on two groups of people – the minority and children – as the representation of the past and the future related to the public industrial heritage. Targeting the high-end property transformation project, the research will further explore how to present the values for these groups to retain the publicness of industrial heritage in the contemporary transformation (Figure 4).



4.1 Overview and relation

Different types of industrial heritage transformation affect the degree of public value presentation. In order to amplify the difference and explore the relationship between transformation project and public space, this research selects Battersea Power Station as the site intervention and the Tate Modern as a case study for analysis and comparison.

These two projects are both in the development Opportunity Area in the central of London, which have the same status in the urban narrative. In terms of difference, the chosen projects show two extremes: a private profitable project and a public welfare project. Therefore, the difference is used as the context and purpose of the analysis to explore the presentation of the industrial heritage public values in the public space (Figure 5).

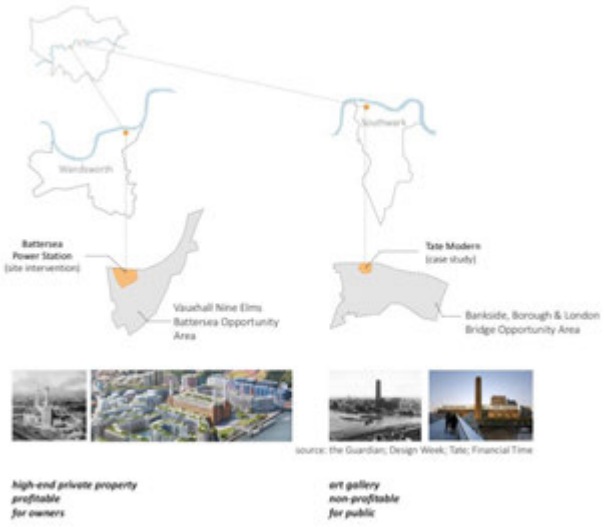


Figure 5. The basic information of site intervention and case study

The Battersea Power Station (BPS) is a regeneration unfinished project located in the centre of London. As a listed British industrial heritage and iconic building in London, BPS is purchased by three overseas investment companies and transforming into the high-end residential and commercial private property from 2011 to 2022. Its private ownership shows that the values of industrial heritage can only be used for a specific type of groups. Differently, as a former power station transformed into a new functional building in 2000, the Tate Modern (TM) is a well-known gallery and the most-visited tourist attraction in London, focusing more on the public sector. With the extension project finished in 2016, TM provides more opportunities and places engaging with the public groups as well as balancing the functions for different users (Figure 6).

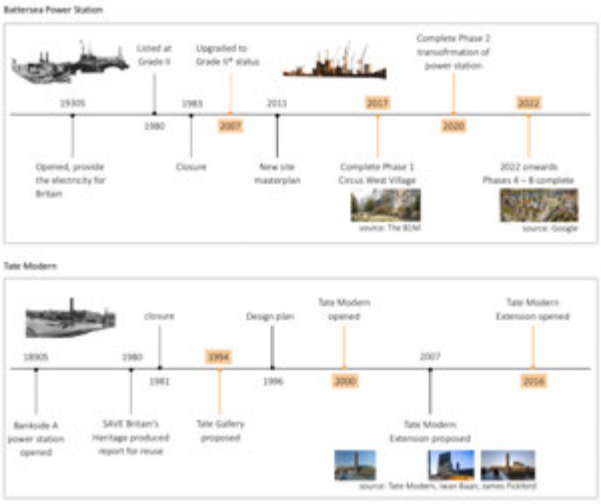


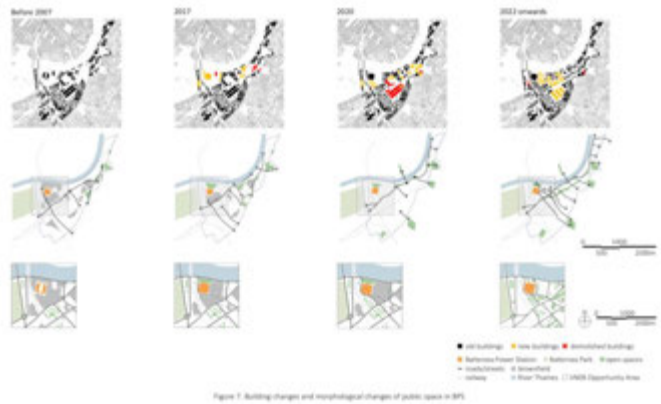
Figure 6. The process of development in Battersea Power Station and Tate Modern

Key time points are selected in different development projects as a context for each project to further detailed analysing the relationship between elements in public space and the intervention of industrial heritage.

4.2 Focused analysis

4.2.1 Morphology

With the development of the VNEB Opportunity Area and the vital position of BPS in the development, the morphology of public space around BPS changed significantly. The brownfields form a systematic public space network, including the linear park and the riverfront trail, cater to the surrounding open spaces. However, the open spaces in BPS are separate from the linear park, shown as the morphology of public space determined by the forms of new buildings (Figure 7).



In contrast, the public spaces in the BBLB Opportunity Area are dispersed. With the development of new projects including the extension, the number of public spaces in TM surrounding areas has increased while no obvious morphological changes (Figure 8).

4.2.2 Visual perception

In terms of view perception, the document Seeing the History in the View provide guidance of heritage view assessment.

It can be seen through the official Viewing Point that the BPS in 2022 will change the skyline of the River Thames. Lower than the four chimneys, the new development buildings will form the backdrop of its urban environment and serve as a foil for the industrial heritage, visually enhance the unique architectural skyline. Meanwhile, the industrial heritage is the new architectural background, is consumed by the new building with its uniqueness and legibility.

Conversely, from the temporal dimension, the view perception of BPS itself is gradually decreasing. With the development of the site, the changing skyline only highlights its chimneys, the heritage building is hidden in the new buildings, the contrast between old and new buildings can only be distinguished through the materials of the buildings (Figure 9). However, the official viewing point is often the optimum locations for heritage observations but is rarely visited by minorities, it cannot be used to obtain visual memory from this location.

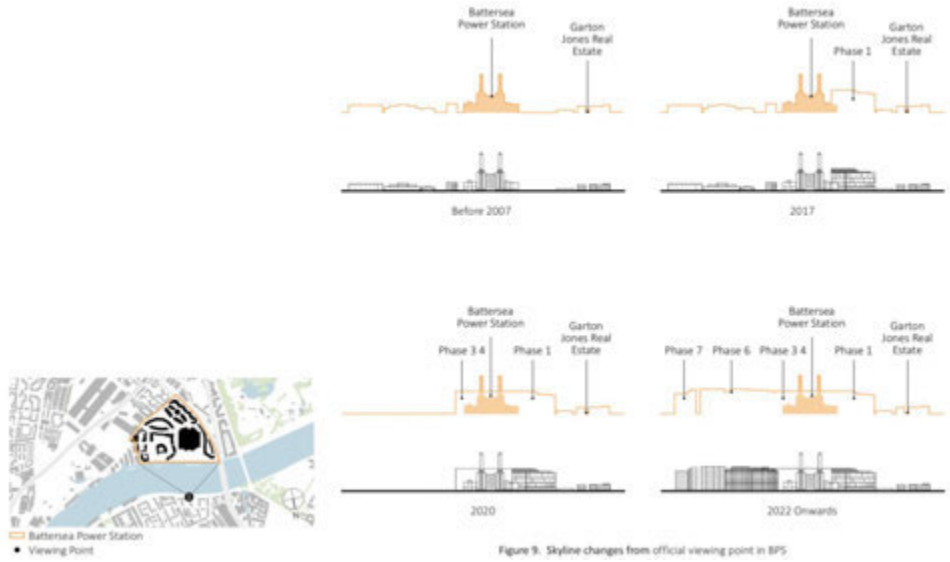


Figure 9. Skyline changes from official viewing point in BPS

Therefore, two political viewing points are also selected in public spaces for minorities, which are in Battersea Park and Chelsea Bridge. It can be clearly seen that the visual perception of the heritage buildings in these two public spaces has reduced obviously. The half or even all the main heritage building are obscured by the new buildings, only use four chimneys as symbols for highlighting the industrial heritage (Figure 10).

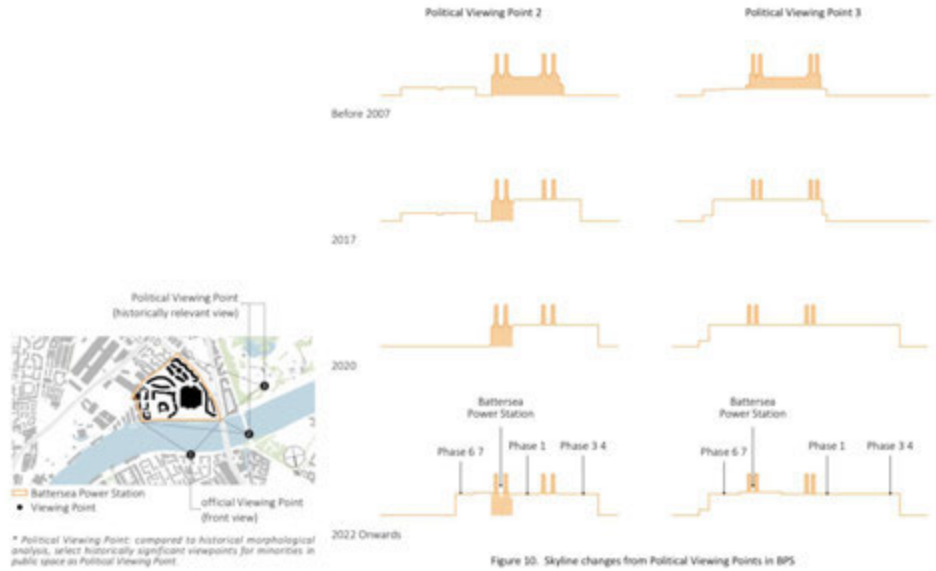


Figure 10. Skyline changes from Political Viewing Points in BPS

The skyline changes in TM are mainly reflected in the extension project and Neo Bankside development after 2016. The new building enhances the public's visual perception both from official Viewing Point and the Political, it contrasted with the main building in volume and height, stands out from the background skyline. For the visual perception from the Political Viewing Point, the new building destroys the original visual perception but to a certain extent, it enhances the recognition of TM in the skyline change (Figure 11).

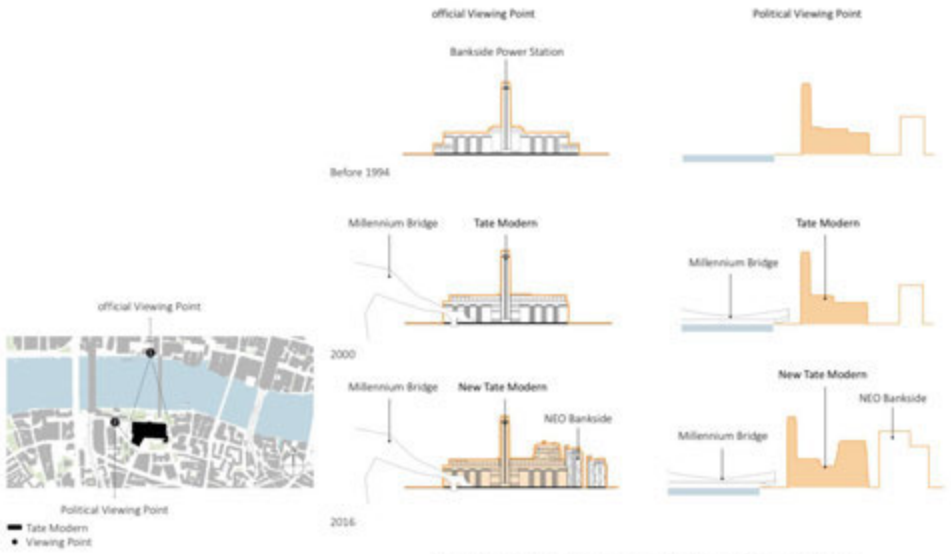


Figure 11. Skyline changes from official Viewing Point and Political Viewing Point in TM

4.2.3 Diverse users

For BPS, the VNEB Opportunity Area development indirectly affects the type of transformation. As a landmark, BPS is positioned as high-end residential and office areas, which will be supported by policies and economically. Meanwhile, such transformation will attract investors and developers with private economic benefits, at this stage, the authority and developers have a common interest. The impact of public groups' economic value is very weak, which leading to these public groups that can use industrial heritage are ignored by the common interests (Figure 12).

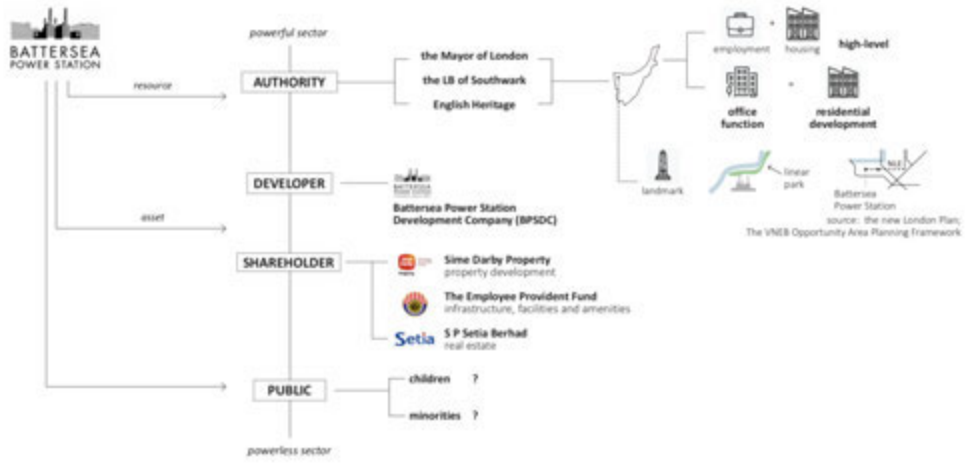


Figure 12. Diverse users in BPS

In comparison, the positioning of TM in the Opportunity Area determines the degree of publicness. As a local attraction, TM is used for the public while serving the tourists. As an NGO, Tate has received policy and economic support developing culture and activities that have made children benefit from it. While for minorities, TM pays more attention to the use of new features rather than provide services for them (Figure 13).

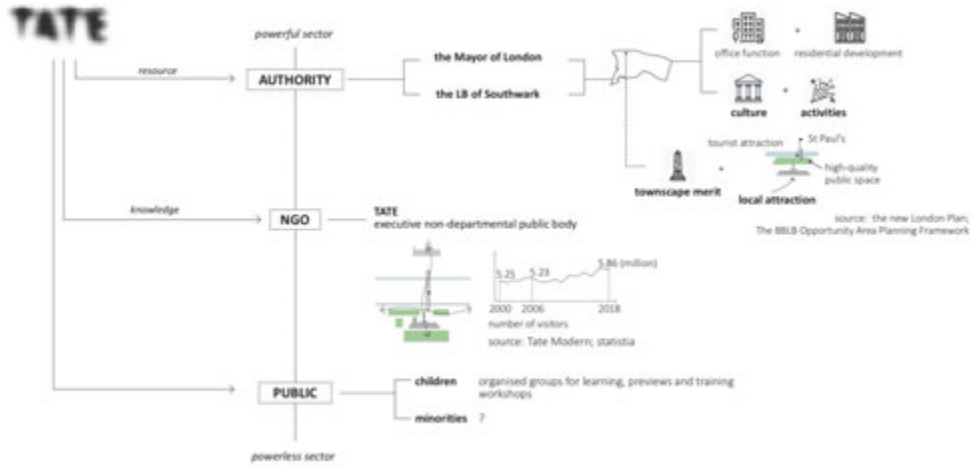


Figure 13. Diverse users in TM

4.2.4 Activities and events

Based on different users, this section further analysed the activities and events of children in the TM public space. Different activities in the north square attract more visitors that come from St Paul's through the Millennium Bridge without any visual obstruction. The riverside also links residential areas in west and east, which provides a linear space for exercising.

In contrast, the southern public space is much quieter. Although it provides places for the public do activities, it is hard to link with TM, the interrelationship between industrial heritage and public space is weak (Figure 14 15).

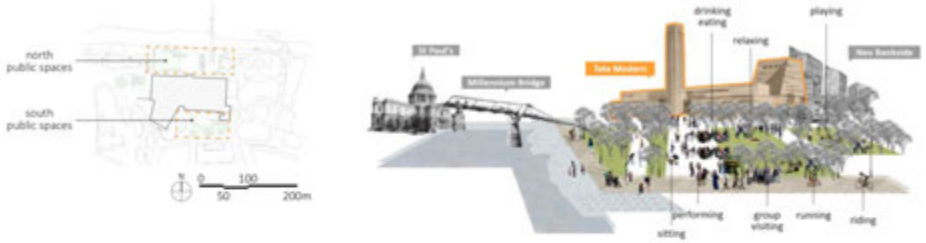


Figure 14. Activities and events of children in TM north public spaces

Figure 15. Activities and events of children in TM south public spaces

Specifically, in the north public space, the bench and chairs provide a place for children relaxing and playing at different times, trees are used as borders separated different spaces for different users. However, due to the visitors, it does not explicitly consider the space dedicated to children.

While in the south public space, the usage is distributed at noon and afternoons. Activities change according to time, basically are resting, chatting and picnics (Figure 16).

Figure 16. Activities and events of children in different times in TM

4.3 Findings of analysis

Through the analysis of industrial heritage and public space, two concrete interrelationship frameworks are summarised for BPS and TM.

As Figure 17 shown, the degree of interrelationship between BPS and its public space is concluded based on the theoretical analysis. However, by analysing the process of development, somehow reality shows conflicts and contradictions between each element.

4.3.1 Memory & history – activities & events – diverse users

The relation between “history” “memory” and “activities and events” should be strong enough to use different activities engaging the public and presenting BPS and industrial revolution and the memory form the public. Represented as an industrial icon in London, the history of BPS constitutes evidence of cultural, social and economic evolution, it documents and interprets public life that contained in urban changes. However, history is not presented in public space through the process of transformation, and the analysis of “diverse users” of BPS also shows the lack of “activities and events” in public life for children and minorities, which can be interpreted through the cut off the connection between these two (line 1 in Figure 17).

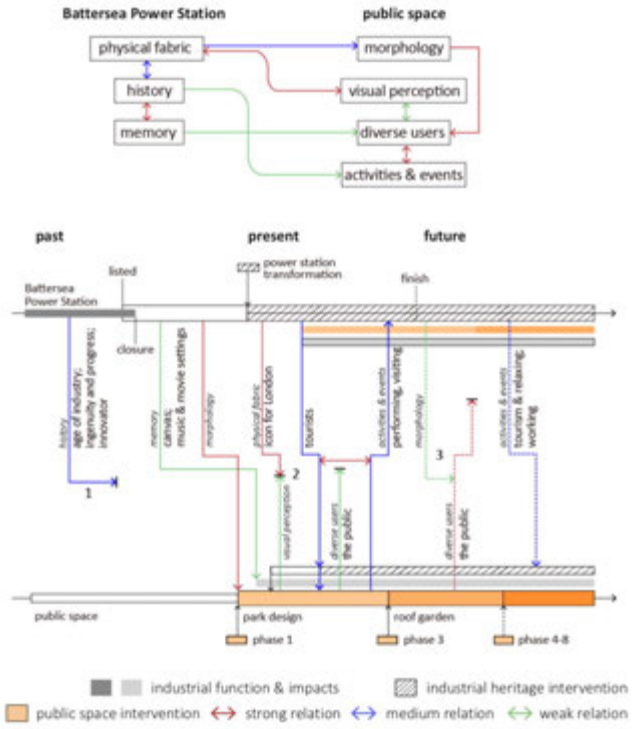


Figure 17. Interrelationship framework of BPS and public space

4.3.2 Physical fabric – visual perception

Similarly, the interrelation of "physical fabric" and "visual perception" is not interrelated with each other through different phases (line 2 in Figure 17). The transformation preserved four chimneys of BPS, which is an iconic symbol in London cityscape, the open space in front of the building indeed reduced obstructions for the visualisation of heritage. Though, in the green space and buildings that developed at different phases, with the regard to the analysis of "visual perception", the visual line obstacles caused by the higher floors, make it impossible for the minorities to obtain visual interaction with the power station from the political viewpoints in public space.

4.3.3 Morphology – diverse users

Based on the morphological analysis and existing information, the "morphology" of the public space after BPS completed will further influence the public's use of BPS (line 3 in Figure 17). It can be seen from the masterplan that the new building will affect the morphological expression of the public space. It cuts off the spatial and visual connection between BPS and the surrounding

area, including the buildings obstacle BPS from the public space, and the public space inside the project does not cater to the public space network and the linear park in the Opportunity Area, makes it difficult for the children and minorities to visually enter and physically use BPS through continuous public space.

In contrast, the interrelationships in TM are more solid and specific. Based on the analysis of "diverse users" and "activities and events", the relationship between industrial heritage and public space can be established through these two aspects. The simultaneous provision of external and internal public spaces increases the maximum use of industrial buildings in public spaces and increases the interaction of the public, especially the children. Meanwhile, the linkage can also be built in the same category (line 1 in Figure 18) by providing "activities and events" that focus on children.

However, for the minorities, the new features of TM did not present the history or memory of Bankside Power Station. The history and memory that TM displays are related to its new function and transformation status without discussing the relationship with minorities, cut off the linkage between TM and minorities in the public space (line 2 Figure 18).

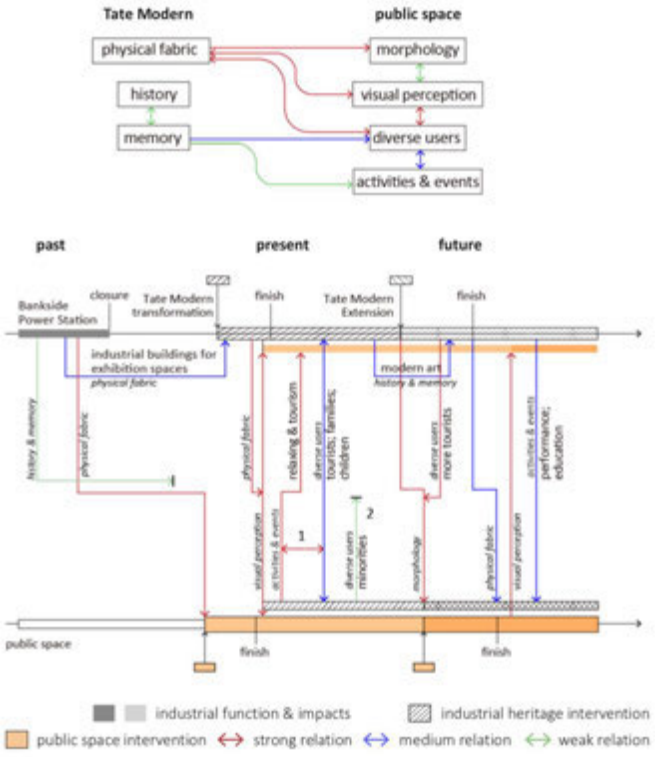


Figure 18. Interrelationship framework of TM and public space

5 Design process

5.1 Types of creating relationship

5.1.1Industrial heritage interventions

The industrial heritage interventions provide physical spaces and indirectly affect the morphology of public space, which can link to the use of the public. The extension project in TM and the other two projects provide more opportunities and options for the children to get involved with the culture and history of industrial heritage indirectly. TM use new building provide more space for events and workshop, while Mining History Centre and the Green Building focus on culture and art, use the building preserve and promote the mining culture and local arts for the next generation (Figure 19).

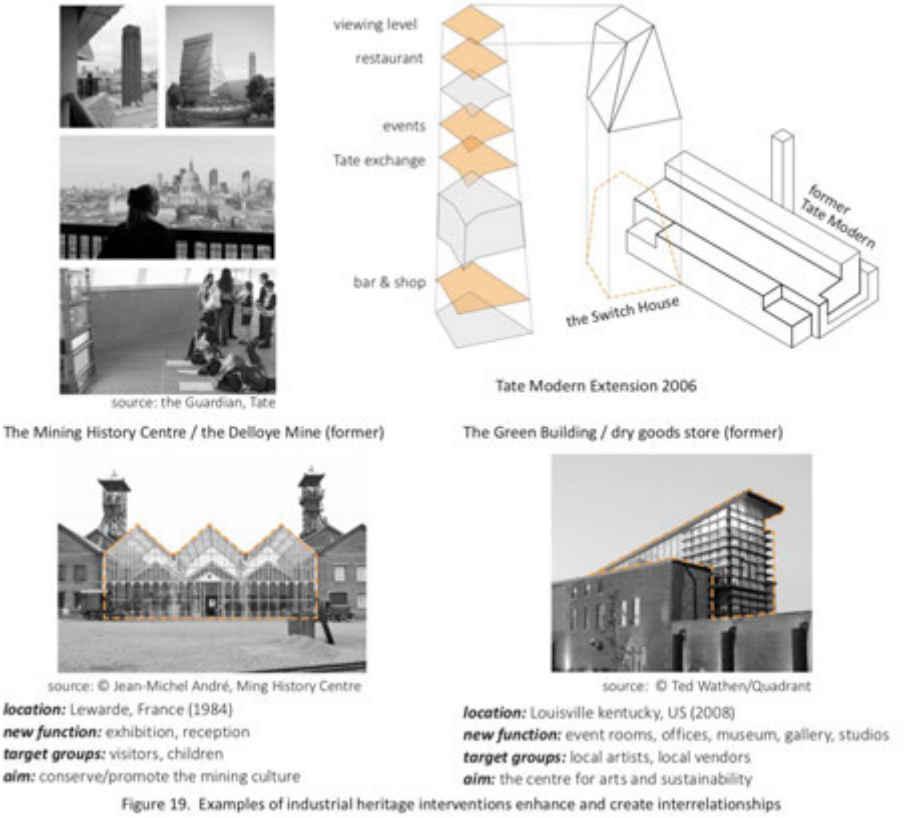


Figure 19. Examples of industrial heritage interventions enhance and create interrelationships

However, it is important to consider the conditions of the surrounding areas. The height and volume of new buildings need to reduce the effects to residential buildings to protect the view corridors of residents.

5.1.2 Public space interventions

Different kinds of detail design make public space play different roles. The publicity display in contrast with the colour of the industrial heritage itself can attract people who are observed in the distance. Temporary exhibitions and events guarantee the public's, it also enables the heritage to integrate with the development, meet the art culture related to its own nature. Furniture is the most direct link between industrial heritage and pedestrians, which should have some practicality and not relevant to its own attributes. The benches and cafes, to a certain extent, can attract pedestrians who do not understand the heritage. It is also a chance to convey information to the public and introduce themselves to people.

These details design and activities in the public space are the most direct display and contact between the industrial heritage and the public. It needs to introduce the past and present to the public with the simplest design methods, which is closely related to its own history and culture. It should serve the public who have a special feeling for it and become the purest historical and cultural space within the entire industrial heritage. (Figure 20).

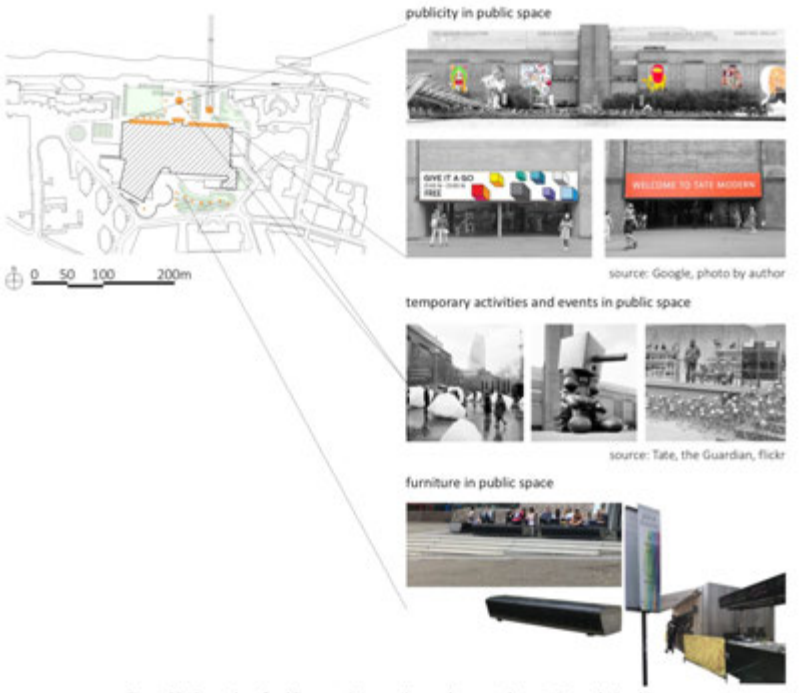


Figure 20. Examples of public space interventions enhance and create interrelationships

5.1.3 External condition influences

In addition, external conditions such as transportation and policies indirectly affect the interrelationships.

The Millennium Bridge and the Thames connect TM to other directions, the Thames cruise routes also link TM to the main tourist attractions on both sides of the river. The status of TM in the Central Activities Zone potentially affects the control of morphological public space and the services of heritage buildings to tourists.

The London View Management Framework emphasizes and protects the important historic buildings through viewings. However, the “assessment point” in this document ignores that some groups have no feelings for the heritage observed at this so-called point, they do not pass through

this point in their daily life, nor do they examine the heritage at this point, this is of no value to some groups. From this and based on the empirical analysis of "view perception", this research believes that the assessment point in the document is detrimental to the evaluation of industrial heritage to a certain extent, it is necessary to explore a new viewpoint that targets specific groups and could reflect public life related to industrial heritage (Figure 21).

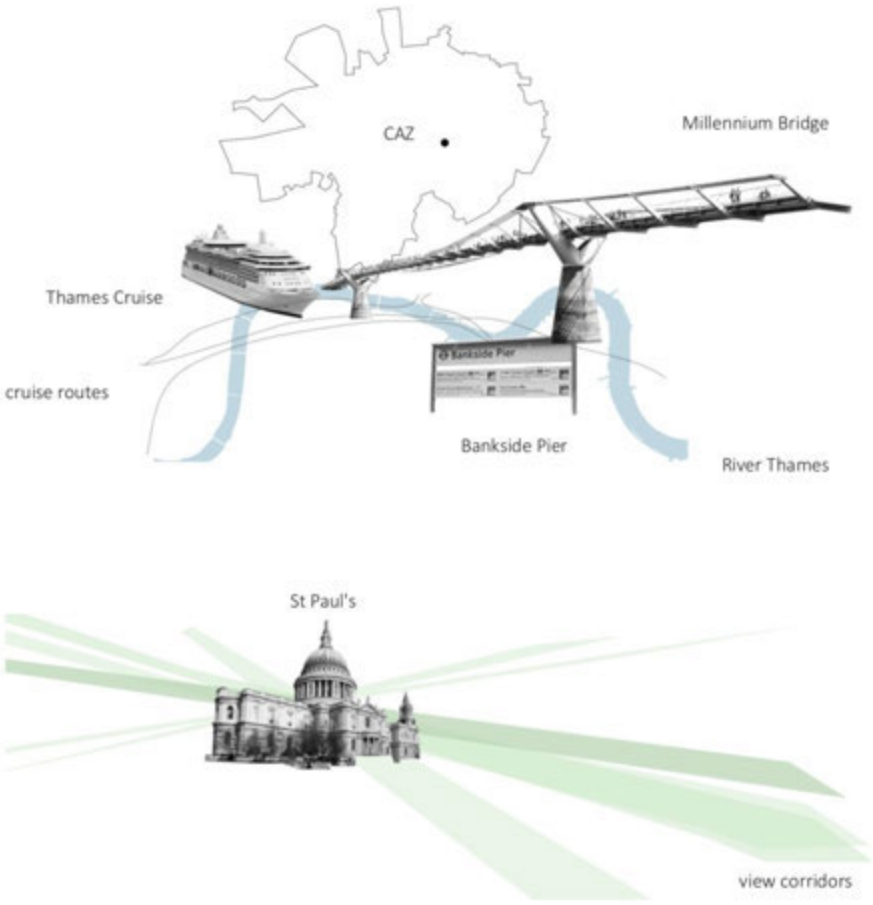


Figure 21. Examples of external condition influences enhance and create interrelationships

5.2 Design brief

Based on the conclusions of BPS analysis, the design begins with a summary of the three interventions in the TM and precedent. The industrial heritage intervention is characterised by

physical morphological changes, including buildings and open spaces, which can enhance the connection related to "morphology" and "physical fabric". Public space interventions enhance the use of public life and different groups by increasing activities and events, it can be summed up to the social dimension. The external condition influence comes from restrictions such as policies and regulations, mainly manifested by the influence of viewing. To conclude, based on the different type of interventions, three directions of strategy are proposed and explored how they enhance and create a relationship between BPS and public space (Figure 22).

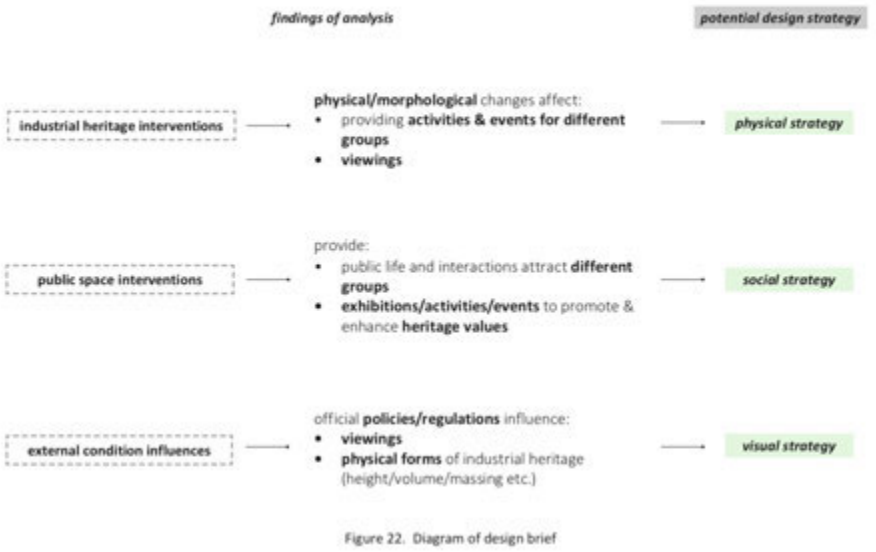


Figure 22. Diagram of design brief

5.3 Visual strategy – defining political viewing system

5.3.1 Process of finding political viewing system

Based on the empirical analysis of "visual perception" and the official document guided in viewing assessment, the strategy tries to apply the conceptual Political Viewing Point in the existing assessment methodology, as an assessment point for evaluating the viewing of industrial heritage for minorities.

For minorities, viewing is not only an intuitive observation but also a reflection of the meaningful public life in public space. Political viewing points are the combination of viewing and public life that it needs to discuss and propose (Figure 23).

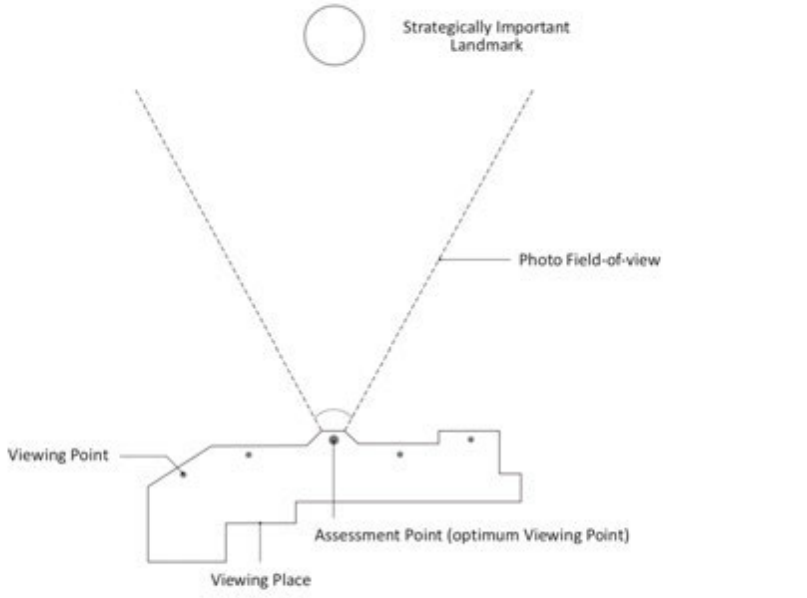


Figure 23. Viewing methodology defined in official document

According to official explanation and empirical analysis, this strategy revises the methodology specifically for an industrial heritage site and the minorities. Compared to the public space historical morphological analysis, the historically significant viewpoints are selected for minorities in public space as "Political Viewing Point". It contains the meaningful public life of minorities related to industrial heritage during viewing, this public space is defined as "Political Viewing Place" (Figure 24).

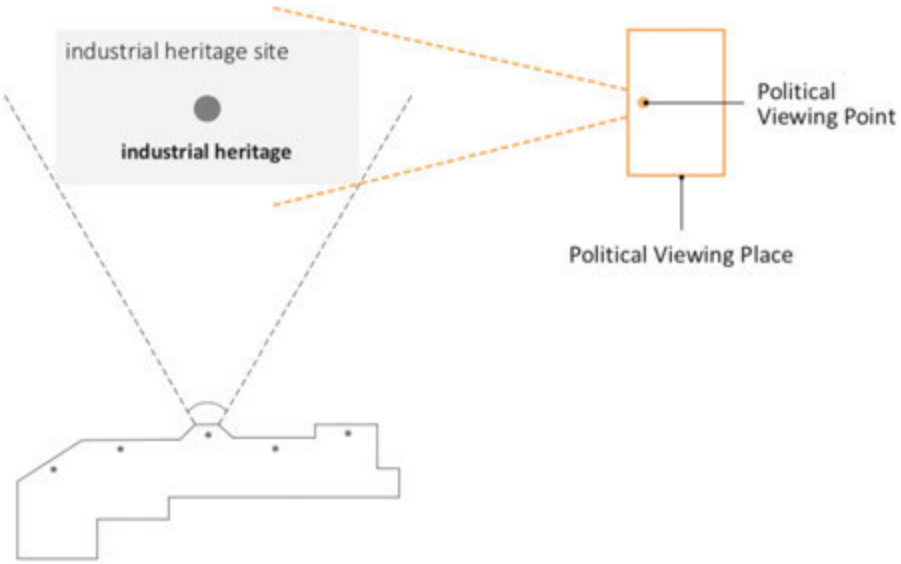


Figure 24. Viewing methodology defined in political viewing system

However, based on the previous page analysis, the political viewpoints cannot treat as the static points such as Assessment Point to express complete social life and vivid memories of minorities, their locations cannot be accurately expressed in the diagram. From this point, the strategy further discusses in another way (Figure 25).

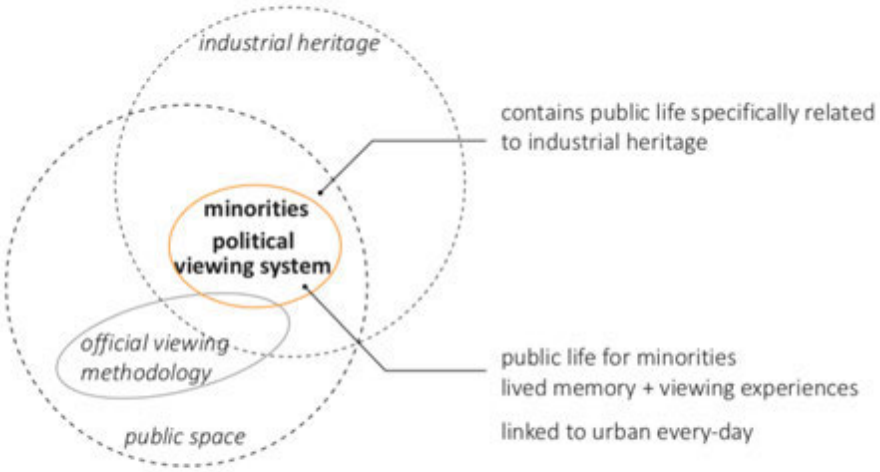


Figure 25. Relationship of official viewing methodology and political viewing system

Figure 26 presents the steps for selecting a political viewing system. It goal is to establish a combination of visual and social experiences for minorities. The Political Viewing Routes replace the previous viewing point, which is represented as a series of points related to life and experience rather than fixed individual viewpoints. The routes at this stage require engaging with minorities to figure out their living experiences in every-day life to achieve accurate and targeted.

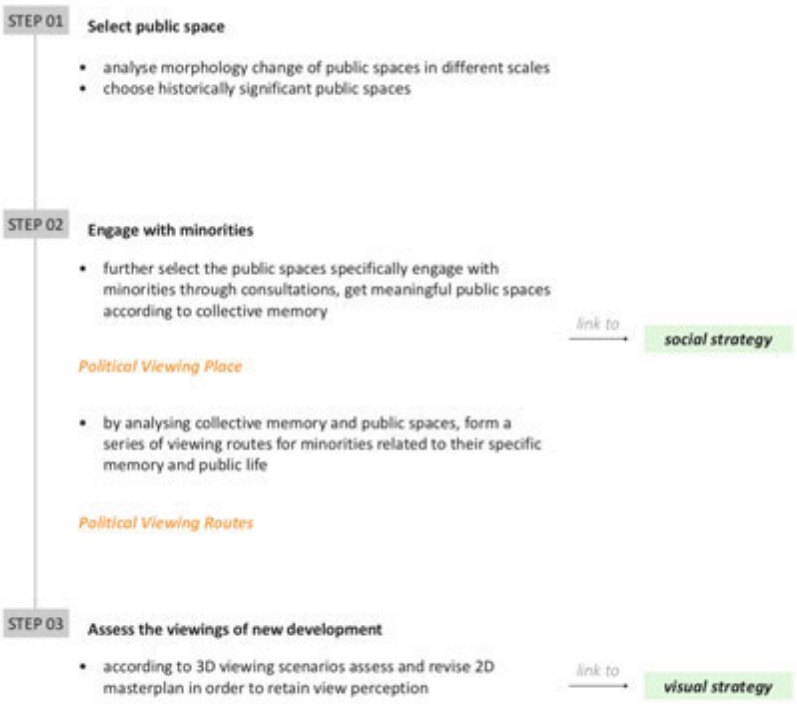


Figure 26. Flowchart of define political viewing system

Regarding with BPS, step 2 can be related to the social strategy that impact on public spaces for minorities, while step 3 is more focusing on the morphology of new development project.

5.4 Social strategy – Battersea Miraculous Journey

The social strategy proposes an event contains three specific events engage with minorities and children, to get the definition of political viewing system in BPS and enhancing the relationship related to activities and events (Figure 27).

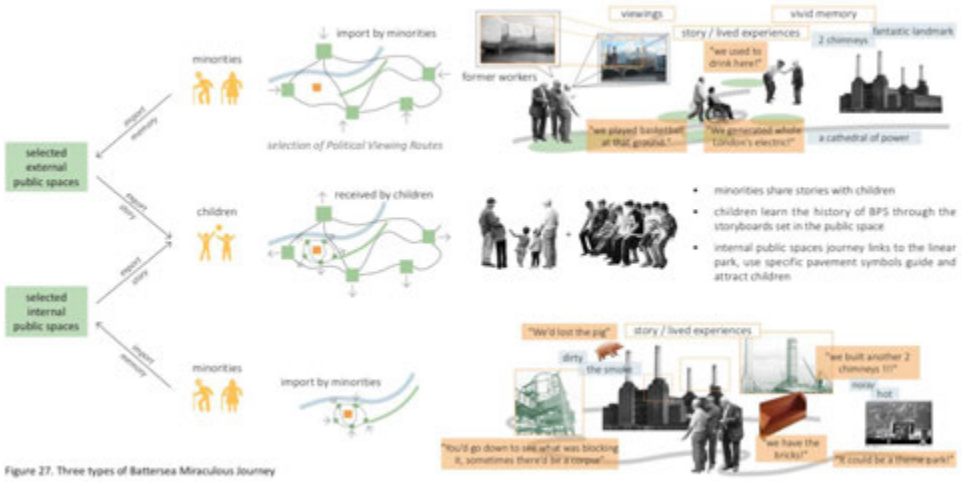


Figure 27. Three types of Battersea Miraculous Journey

The promotion contains three steps. Firstly, finds four potential sectors for supporting and organising the activity. The roles and reasons are as below:

Regarding developers, the event can be a promotional approach that shows how they realise the importance of participating in and promoting public sector activities in the context of private development, expanding their visibility and influence to get more projects and funding, thereby get maximised profits.

Secondly, divided into physical publicity and apps and websites, the event makes posters and booklets at the beginning for propaganda, and posts them on the websites, such as BPS Community Forum and development official website.

Figure 28 shows the timetable of the events for different groups. The experiences and stories that they share during walking tours can be used as data for defining political viewing system. The annual event takes place based on the schools and children, it engages with both minorities and children to share the stories and memories from one generation to another.

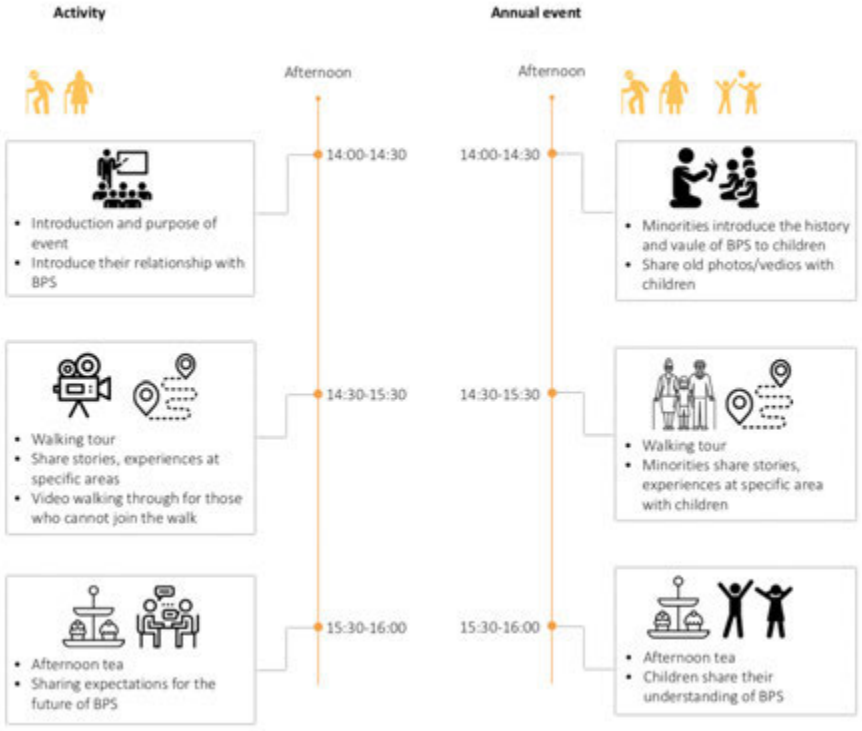


Figure 28. The timetable of Battersea Miraculous Journey Event

5.5 Physical/spatial strategy – testing masterplan

Based on the empirical analysis, the physical strategy proposes new masterplan for BPS, as a way of retaining the viewings in external public space, and the use of children with the public space, which links to the linear park and BPS in the Opportunity Area.

The strategy uses 3D viewing scenarios to assess and revise the 2D masterplan. In the context of the VNEB Opportunity Area Planning Framework, the linear park will provide activities and open space for entertainment and other public life for the children, it is vital that the open space link to BPS get evolve and attract more children (Figure 29. 30. 31).

The second scenario retains the same amount of massing as the existing plan, placing the commercial space underground, and vertically increasing the public life for minority groups and children through the morphological and topographical change of the square and green space. Similar to activities analysis in literature review (see p. 10) and in TM open space (p. 23), the public sector, which is children and minorities can play and rest in this space. At the same time, this space

can also be used as part of the walking tour space in social strategy. Through the display and promotion of billboards, minority groups can communicate with children, including one-way communication in publicity and two-way interaction in activities.

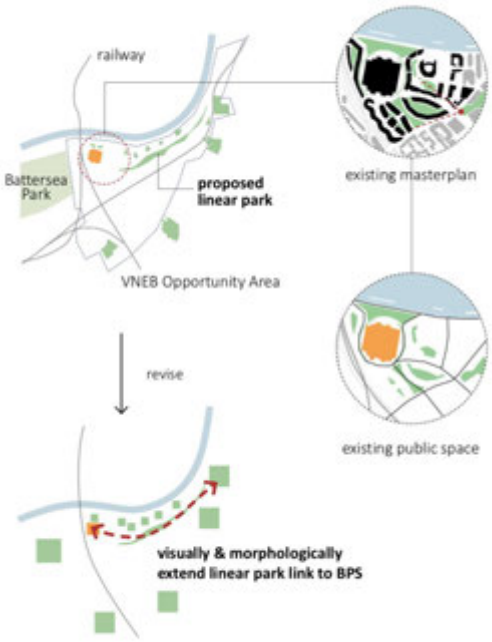


Figure 29. Initial concept of changing masterplan

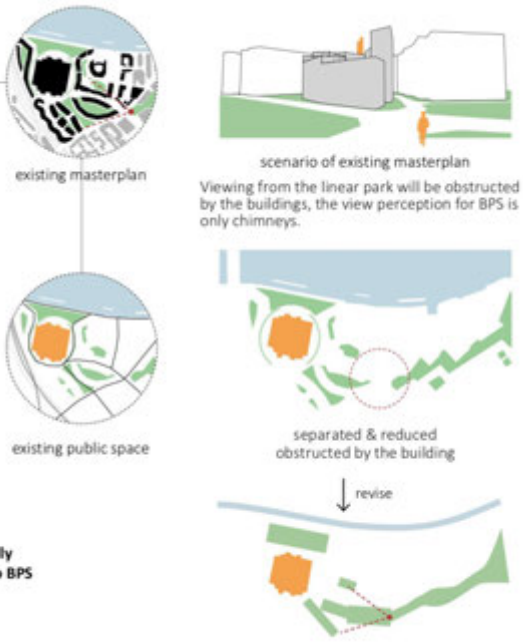


Figure 30. Existing masterplan analysis for changing public space

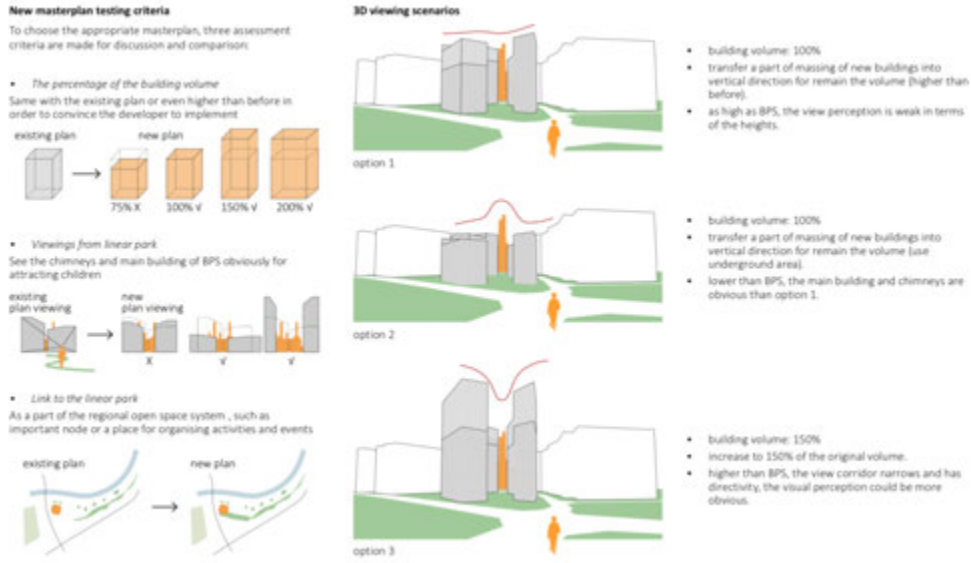


Figure 31. Testing of different viewing scenarios

The evaluation of each plan can be summarised as follows:

Strengths:

The underground commercial can increase continuity and space, it can also increase the types of businesses.

Vertical changes in the public space provide opportunities for interaction between different public groups and stimulate activities.

The sinking square can visually enhance the connection between BPS and public space.

Weakness:

The construction of underground space is inconvenient, and the cost is high.

Strengths:

The underground commercial area is bigger.

Similar to the roof garden, the public space provides the public with activities and green space, the hill can attract people visually to come from the linear park.

The hill can visually enhance the connection between BPS and public space, form a viewing axis.

The cost is lower than the first one.

Weakness:

Large events such as performances or exhibitions will be restricted due to the topography.

The third scenario continues to increase the height of the building, regard case studies as a reference, the increased space is used for residential area and the activities for minorities and children. Activity area includes exhibitions, art gallery and historical pavilions to present the culture of the Industrial Revolution and the history of BPS by photography and paintings.

The evaluation of this plan can be summarised as follows:

Strengths:

Expanding amount of residential areas and indoor activity areas.

Increased space can be used as the platform for industrial heritage presentation for the public.

The viewing level also increases the visual perception of BPS for minorities and children.

Weaknesses:

The plan needs to consider local regulations and policies which control the height of new buildings

In the process of using, it should further explore the tension between residents and minority groups and children.

6. Conclusion

This research focuses on the interrelationship of industrial heritage and public space in order to retain the publicness of industrial heritage specifically for minorities and children, namely, how the industrial heritage shapes and influences the public space, and in what way the public space reflects and responds to the public value of industrial heritage in the transformation process.

Regard to the research aim, the project reviews relevant literature to discuss and analyse the concept "physical fabric", "history" and "memory" of industrial heritage as public values, and further related these concepts to the "morphology", "visual perception" and "activities and events" of public space to study and explore how the concepts of industrial heritage shape and influence in public space, which is concluded into establishing the interrelationship framework of these two aspects. The conclusion can be used as a basis for further specifically evaluated by a case study in order to further understand in what ways that public space demonstration the interrelationships in the practical cases.

The project selects Tate Modern as a case study and Battersea Power Station as the site intervention. Based on the literature review and particularly focuses on the minorities and children in the public, the project focuses on the concrete analysis of elements in public space in the cases and combined with secondary data related to the development of industrial heritage transformation, thus formed the empirical interrelationship framework, including the specific relations and degrees of each element. By analysing the case and precedent studies, the results show that the interrelationship can be enhanced and created by intervening public space in three ways: the visual intervention related to polities and regulations, social intervention including activities and events, and the physical and morphological intervention. These findings answer the research questions to a certain degree.

Based on the findings of the literature review and case study analysis, the design proposal focuses on dealing with the interrelationship framework of BPS, in which shows conflicts and obstructs regard to the development process, and needs to enhance and create the interrelationship visually, socially and physically, the findings help as a reference to come up with three specific strategies for BPS. The visual strategy engages with minorities for a way to enhance and make awareness of the visual perception of industrial heritage on public space. The social strategy gives an opportunity for minorities to introduce history and memory, by interacting with children it also promotes the attractions of industrial heritage to the next generation. The physical strategy is related to regional development planning, the morphological changes of new buildings and public spaces in BPS can enhance and provide more opportunity for industrial heritage presentation for both minorities and children visually and socially.

This research provides a reference for the ways of industrial heritage presentation in private profitable transformation projects. In the context of London, the projects have the same urban narrative, but each project itself also different from BPS, including the local policies and regulations, economic status and development direction of transformation, and the unique socio-cultural values of industrial heritage. Further in the global context, there will be differences in the performance of the elements in this research in different political and development context, but in terms of methodology, the project and research could be the same. As a framework, this research provides a conceptual way to think and examine the relationship between industrial heritage and public space, which meanwhile opens up new research ideas for different projects to explore specific ways in the different context.

For a wider context, such as capitalist cities and developer-driven planning systems, industrial heritage development represents the interests and powers that are controlled by the powerful sector, limit the use and expression. This research and the design strategy redefine industrial heritage from a critical perspective as publicness, representing the equal rights of the public to use it visually, socially and physically. Industrial heritage in capitalist cities needs to highlight its public status, and it needs to explore the publicness expressions of different cultural, social and political contexts, including its targeting groups, the relationship with the urban spaces in different cities in order to maximise its values.

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Research on the Protection and Development of Industrial Heritage in China and Europe under the Background of Urban Renewal—The Case of Hanyeping Company

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Abstract
As the first steel and coal joint venture in modern China to use advanced machinery and equipment for large-scale production, Hanyeping Company is an important practical case for scientific and technological exchanges between China and Europe. Based on the research on the construction of industrial heritage systems in China and Europe, the paper sorts out the historical development background and actual protection situation of the Company, and analyzes the intrinsic connections and shared values of industrial heritage in time, space, function and cultural dimensions. It is of fundamental guiding significance for the renewal and development of China's industrial cities, and has important reference value for promoting the construction of a systematic and holistic protection and utilization system for world industrial heritage.

Keywords
Self-Strengthening Movement, Technical Import, Linear Industrial Cultural Heritage, Urban Regeneration and Development

Introduction

The 19th century was the period of the emergence of the first industrial revolution, when European countries represented by the United Kingdom began to replace the traditional handicrafts with mechanisation and large-scale production methods, which greatly improved production efficiency. The development of industry led to the migration of a large number of people from the rural districts to the cities, promoting the process of urbanisation in Europe, and realising the country's economic development and social progress. However, at the same time, China was suffering from the failure of the two Opium Wars[1] and the Taiping Rebellion[2], which opened up a number of trading ports, leading to the disintegration of China's natural economy as well as the emergence of the bud of capitalism. In order to cope with these internal and external challenges, the bureaucrats represented by the landlord class, realised that capitalism could be used as a means of developing industry and commerce to maintain the feudal rule of the Qing government, and initiated the Self-Strengthening Movement[3] under the slogan of "learn from the foreigners in order to gain command of them", introducing advanced Western science and technology on a large scale, and setting up a series of modern military

[1] The Opium Wars in the mid-19th century were a critical juncture in modern Chinese history. The first Opium War was fought between China and Great Britain from 1839 to 1842. In the second Opium War, from 1856 to 1860, a weakened China fought both Great Britain and France. China lost both wars.

[2] During the years from the first year of the Xianfeng reign to the third year of the Tongzhi reign of the Qing Dynasty (1851-1864), a peasant uprising war against the feudal rule of the Qing Dynasty and foreign capitalist aggression was initiated by a leading group composed of Hong Xiuquan, Yang Xiuqing, Xiao Chaogui, Wei Changhui, Shi Dakai, and others, starting from Jintian Village in Guangxi.

[3] It was a self-strengthening movement of the late Qing Dynasty from the 1860s to the 1890s, led by the Westernization faction, which utilized Western military equipment, mechanized production, and scientific technology under the slogans of "self-strengthening" and "wealth-seeking" in an attempt to salvage Qing rule.

industries and civilian enterprises, thus promoting the process of China's modernisation. With the construction of the railway, China's demand for iron was increasing day by day, the development of the iron industry has become a pressing task. In 1890, Zhang Zhidong[4] supervised the Lu-han Railway[5] and transferred to the Governor-General of Hubei and Guangdong Province, in Hanyang at the foot of Guishan to establish the Hanyang Iron Works. In 1893, Daye Iron Ore Mine was built as a large-scale open-pit iron ore mine, and began to be mined on a large scale, to provide raw materials for the Hanyang Iron Works. Due to the high phosphorus content of Daye iron ore, the steel produced was easy to be brittle and cracked. In 1896, Sheng Xuanhuai[6] took over the ironworks, and began to mine and refine a large amount of high-quality coal and coke in Pingxiang, Jiangxi Province, to produce compliant rails, which solved the problem of the shortage of raw materials. In 1908, in order to solve the problem of insufficient operating funds, he applied to the Qing government for a merger of the Hanyang Ironworks, Daye Iron Mines, and Pingxiang Coal Mines, to form Hanyeping Coal and Iron Works Co.

As the earliest iron and steel joint venture in China, Hanyeping Company spatially distributed across a number of cities including Wuhan, Daye, Pingxiang, Shanghai and Chongqing, the process involves important production steps such as coal and iron ore mining and iron and steel smelting, and the dissemination of technology involves the introduction of Western science and technology and machine production, and the promotion of advanced industrial production management systems. As a representative of large-scale linear industrial heritage, it has promoted the development of a transport system linking raw materials and products to multiple locations, driven regional economic ties in the central region, and had a profound impact on urban spatial landscapes, production and living patterns. The paper describes the historical development of Hanyeping Company using the methods of metallurgical development history and urban planning history, and analyses the current situation of Hanyeping industrial heritage. Combined with the current experience of industrial heritage protection system in China and Europe, it explores its historical and cultural value, lays the research foundation for the establishment of Hanyeping industrial cultural routes, and provides important reference value for the overall protection research of regional industrial heritage.

1. Historical Development of Hanyeping Company

As an important iron and steel joint venture in China, Hanyeping Company went through three periods of institutional changes: government-run, government-supervised and merchant-managed, merchant-run. With sufficient capital investment and government support, it introduced technological innovations and adjusted its institutional structure to adapt to changes in the global market and promote the development of national capitalism. By analysing the overall historical development of the company, we could better understand the development history and characteristics of modern Chinese industry in the context of the socio-economic environment of the late Qing Dynasty.

[4] A Chinese politician of the late Qing Dynasty and a prominent figure of the Westernization movement. He held various positions including tutor, reader, lecturer, cabinet scholar, governor of Shanxi, governor-general of Guangdong and Guangxi, governor-general of Hubei and Hunan, governor-general of Jiangsu and Zhejiang (acting on multiple occasions but never confirmed), and Grand Secretary of the State Council. He vigorously advocated for the integration of traditional Chinese studies with practical Western knowledge, emphasizing "Chinese learning as the foundation and Western learning for practical application." He placed great emphasis on education and law enforcement, spearheading the modernization of China's police system, which had a significant impact on education and social development in late Qing China. Additionally, he established the Hanyang Ironworks, Daye Iron Mine, Hubei Arsenal, and other enterprises.

[5] The Lugou Bridge and the railway from Zhengzhou to Hankou were the first railways planned for construction by the Qing government of China after the First Sino-Japanese War. They were supervised by the Minister of Beiyang, Shen Xuanhuai, who oversaw the construction of the Luhan Railway. Construction began in 1897, with work starting simultaneously from the north and south ends by the end of 1898. The Yellow River Bridge in Zhengzhou was completed on November 15, 1905. The entire line was completed and opened to traffic on April 1, 1906, with a total length of 1214 kilometers, and it was renamed as the Jinghan Railway.

[6] A representative figure of the Self-Strengthening Movement, he was a renowned politician, entrepreneur, and philanthropist who founded the Beiyang College and Nanyang Public School.

1.1 Government-run Period (1890-1895)

In 1889, Zhang Zhidong planned to set up a factory in Fenghuanggang, Guangzhou under the support of the Qing government's grant, and purchased 2 blast furnaces with a daily output of 200 tonnes as well as machines and equipments for making clinker iron, steel, pressing plate, drawing bar from the Tee Sides Company in Middlesbrough, England[7]. After that, he transferred to Hubei to be the governor of Hubei and Guangdong province to supervise the southern section of Luhan Railway. and to facilitate the regional management, he asked the court to move the ironworks to Hubei. In order to facilitate the regional management, he asked the imperial court to move the ironworks to Hubei, decided to set up a factory in Hanyang area of Wuhan, and shipped the equipment ordered by Guangzhou Ironworks to Hubei instead. To facilitate regional management, he petitioned the court to move the ironworks to Hubei, decided to set up a factory in the Hanyang district of Wuhan and to ship the equipment ordered by the Guangzhou Ironworks to Hubei instead. In 1890, Hubei Iron Bureau was established, which undertook the three major tasks of iron development, coal mining and plant construction, and successively organised 15 batches of 30 people to explore coal and iron in Hubei, Hunan, Sichuan and other places, and hired some foreign mining engineers to explore the iron ore mine in Daye repeatedly, confirmed that Daye iron ore has abundant reserves and can be used as raw materials for smelting.

In 1891, the infrastructure project of Hanyang Iron Works was designed by British engineer Johnson[8] and supervised by Henery Hobson[9]. All materials were imported from Britain and Belgium, building construction and equipment installation were carried out alternately, which took two years and ten months to complete all the construction tasks. Walls were built around the factory, and four main gates were set up, namely, the main gate (facing the Han River), the Xingren Gate (facing the Yangtze River side), the Neode Gate (right side of the main gate), and the Dachang Gate (left side of the main gate). In order to facilitate the entry and exit of materials after construction and production, a pier was first built along the Yangtze River, all of which were made of red sandstone. A large gap was reserved in the middle of the pier, which can be made into a 300-foot-long ramp by steel and timber, and its inclination can be changed according to the rise and fall of the Yangtze River water level. There were large winches, cranes and other equipment on the shore, and a 6-kilometre-long light railway was laid from the bank of the Han River to the factory so that materials could be transported directly to the construction site, and facilities such as an unloading ramp bridge were established. The factory was divided into two types of industrial buildings and civil buildings, with six large factories, four small factories and residential buildings. The six large factories included pig iron plant, clinker plant, Bessemer steel plant (converter steel factory), Martin steelworks (flat furnace steelworks), rail manufacturing works, iron goods manufacturing works, and the four small factories included machine factory, iron foundry, blacksmith factory, fish fillet hook and nail factory. Civilian residences were mainly occupied by technical personnel and were divided into buildings or rooms. The general layout of the ironworks was designed according to the process, means of transport and the actual situation in Hanyang, and the work production lines were designed to avoid crossings and to be short. The building was always planned and comprehensively arranged in terms of energy supply, water supply and drainage, warehousing and transportation, equipment maintenance and administrative management.

[7] A large steelworks stretched from the town of Middlesbrough in North Yorkshire, England, to the town of Redcar along the southern bank of the River Tees. At its peak, there were 91 blast furnaces within a 10-mile radius of the area.

[8] The designer and draftsman of the Hanyang Ironworks.

[9] The Chief Engineer of the Hanyang Ironworks before 1892.

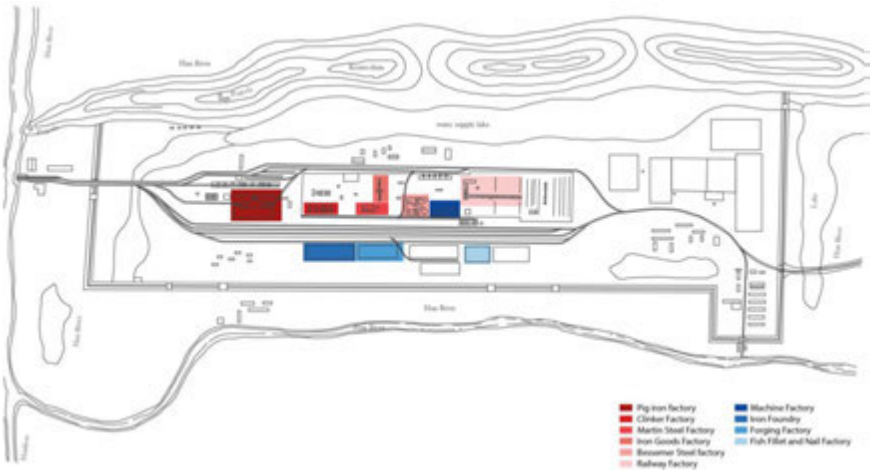

Fig.1: Layout of Hanyang Ironworks

At the same time, with the technical assistance of Belgian and German mining engineers such as Max[10], Gustavus Leinung[11] and Parkinson[12], the exploration and exploitation of the Daye coal and iron ore mines was carried out, while the mining works and the construction of the railway to transport the ore from the Daye mine were actively promoted. The project took one year and four months to complete, with the construction of a large open-pit iron ore mine and the establishment of an iron smelting plant, a depot and accommodation for technicians. A 35-kilometre-long railway from Tieshan to Shihuiyao was equipped with four stations, namely Tieshan, Shenghongqing, Xialu and Shibao, and transport infrastructure such as Shihuiyao Ore Transportation and Loading Terminal was constructed to facilitate the supply of raw materials for the Hanyang Iron Works, such as iron ores.

[10] German, Chief Mining Engineer of the Ma'anshan Coal Mine.
[11] German, Engineer of the Daye Iron Mine, Chief Engineer of the Pingxiang Coal Mine.
[12] Mine engineer

Fig.2: Location Map of Daye Iron Ore Mine Site

In 1894, Hanyang Iron Works was officially put into operation. No.1 blast furnace, churning and clinker furnaces, steel making and steel rolling were operated at the same time, and soon there were problems such as high phosphorus content in pig iron smelted and insufficient supply of coke, which led to several stoppages of the ironworks, and the operation of the factory under the constraints of the government-run management system resulted in a relatively serious loss.

1.2 Government-supervised and Merchant-managed Period (1896-1907)

In 1896, in order to maintain the production of the ironworks, Zhang Zhidong recommended Sheng Xuanhuai take over the Hanyang Ironworks, adopted investment promotion and undertaking to solve the problem of ironworks losses. Therefore, it entered the period of government-supervised and merchant-managed.

In the same year, Sheng Xuanhuai sent Max and Leinung to Anhui, Henan, Jiangxi and other places to explore coal resources. Two years later chose to open Pingxiang Coal Mine in Pingxiang, Jiangxi Province, and set up the "General Administration of Mines in Pingxiang", to refine a large number of high-quality coal and coke, and to produce compliant steel rails, which solved the shortage of raw materials for the ironworks. Pingxiang coal mine to Anyuan coal mine as the main mine, at the same time in Tianzishan, Zijiakeng, Xiaokeng, Longjiakeng, Wangjiayuan, Tielukeng, Shanzhuling, Zhanggongtang, Gaokeng, Xikeng, Nanmukeng, Bashanchong, Wupixia, Taipingshan and other mines, the construction of 14 earth shafts. The mine is divided into two parts: ground constructions and underground constructions. The ground constructions were divided into three parts: the mining production area, the living service area and the product transhipment and distribution area. The mining production area consisted of modern infrastructure facilities such as power equipment, machine repair equipment, large and small coal washers, coke ovens, machinery plants, power plants, etc., while the living service area consisted of the surveying and mapping office, the construction office, the telegraph and telephone room, the hospital, the mining school, the employees' primary school, the printing press and other living service support facilities. Hanyang Transportation and Marketing Bureau, Changsha Distribution Bureau, and Yuezhou, Zhuzhou and Xiangtan Transfer Bureau were added to the mine to adapt to the multi-channel transport

of iron and steel products, to improve the quality of transport and to drive the economic development along the routes of Hanyang, Daye and Pingxiang. The underground constructions consisted of the large coal chutes, the straight shafts and the flat alleys.

Fig.3: Ground Constructions Map of Pingxiang Coal Mine

Under the management idea of government-supervised and merchant-managed, Sheng Xuanhuai began to raise commercial shares to expand the production scale of the ironworks and reduce production costs, while appointing European engineers such as Gustavus Leinung and Eugène Ruppert[13] to assist the iron and steel industry in realising technological innovation, installing and applying a variety of production equipment for the iron and steel industry, and promoting the systematic innovation of coal and iron enterprises, which helped to establish China's modern company system in China. In 1905, the expansion and renovation project of Hanyang Iron Works was carried out. Due to the problem of matching the Martin furnace with the ore and coal coke, the quality of some of the iron and steel products of the ironworks was not up to the standard, therefore, new machines and equipments were investigated and purchased, and the alkaline Martin furnace was renovated and introduced. Newly built and replaced the equipment and facilities of the steel mill and rolling mill[14], and constructed the wheel plants, cargo completion plants, expanded the machine repair plants, and

[13] Luxembourger, served as the Blast Furnace Engineer at Hanyang Ironworks from 1894 to 1898, and as the Chief Engineer of Hanyang Ironworks from 1905 to 1912.

[14] The ironworks will construct a new No. 3 blast furnace with a daily output of 250 tons of pig iron, dismantle two Bessemer acid converters, and initially replace them with four 30-ton basic Martin furnaces and ten 10-ton small Martin furnaces until seven Martin furnaces are built. Additionally, a new 150-ton mixed iron furnace, two 35-ton electric steel ladle cranes, one 10-ton electric overhead crane, two 50-ton electric traveling cranes, and one vertical steel ingot stripping machine will be installed. The steel rolling mill will include a new 80-ton reheating furnace, one 4-ton electric overhead crane, one fully steam reversible primary rolling mill with a roll diameter of 1016 millimeters and its auxiliary facilities, and one fully steam reversible steel plate rolling mill with a roll diameter of 760 millimeters and its auxiliary facilities.

motor plants. Renovation of the loading and unloading wharf on the river bank, installation of electric loading and unloading devices and a railway line. The railway in the factory area was increased from 6 kilometres to 34 kilometres. The entire expansion and renovation project lasted three years.

During this period, Daye Iron Mine opened up the Shizishan Mining Area in Dedaowan, further expanding the scale of production and increasing the output of iron ore year by year. At the same time, Japan Yawata Iron Works and Sheng Xuanhuai signed the "Coal and Iron Mutual Sale Contract", through the sale of Daye iron ore to the Japanese Iron Works, to raise funds for the Hanyang Iron Works. Although the contract was not in the nature of borrowing, it laid down the mode of capital export from Japan to Hanye Ping Company thereafter.

1.3 Merchant-run Period (1908-1937)

In order to solve the problem of insufficient funds, in 1908, Sheng Xuanhuai petitioned the court to form the Hanyang Iron Works, Daye Iron Mine and Pingxiang Coal Mine into the "Hanyeping Coal and Iron Works Co., Ltd". The company formally entered merchant-run period, with "mining, ironmaking, coal mining" as the main business. According to the joint-stock commercial operation model, it has gained more corporate vitality and gradually improved its economic benefits. Compared with the period of government-supervised and merchant-managed, The company has integrated various factories and mining enterprises, the jurisdiction of the enterprise throughout Hubei, Hunan, Jiangxi, Anhui, Jiangsu, Hebei, Liaoning provinces, to further expand the scale of production, increase the installation of machinery and equipment, and enhance the strength of industrial technology. The rapid development of the company's European engineers into the enterprise's technological innovation and production operations, the company's steel production reached 170,000 tonnes in 1910, the quality of steel broke through the previous technical deficiencies, gained the affirmation of the purchasers and assisted the company in improving the management system and production norms, formulated the Technical Standards and Acceptance Criteria for the production and manufacture of rails, and assisted China in realising the short-lived glory of the coal and iron industry.

With the outbreak of the First World War in 1914, the price of international iron and steel raw materials skyrocketed, and there was a brief boom in Hanyeping, with the production of pig iron, steel, iron ore and coal and coke increasing dramatically, and the company began to purchase some subsidiary enterprises, invested in some joint ventures, and opened a special line of water transport to ensure the company's energy supply and product output.

After the post-war world economic depression, the price of steel plummeted. Due to the severe constraints of Japanese debt contracts, Hanyeping declined rapidly. In 1921, the Republic of China (Beijing) government changed the standard of rails, which caused the company nearly 50,000 tonnes of rails with no sales, and a large number of rails were backlogged, which led to the complete shutdown of Hanyang Iron Works in 1924, and the company couldn't maintain the operation of Pingxiang Coal Mining in 1928, and it was taken over by the Jiangxi Provincial Government. Only one iron ore mine in Daye was left to continue production, and it was reduced to a supply unit of Yawata Iron Works of Japan[15]. This large-scale iron and steel joint venture was basically disintegrated at this point.

[15] Established in 1901, the steelworks located in Kitakyushu City, Fukuoka Prefecture, began operations during the Meiji era in 1903. It was Japan's second steelworks after the Tanaka Factory of the Kamaishi Mining and Smelting Company, which commenced operations in 1887 (Meiji 20) in Kamaishi City, Iwate Prefecture. Prior to World War II, it was Japan's largest steelworks, producing over half of Japan's steel output. In 2015, four assets including the former head office, repair factory, former blacksmith factory (Kitakyushu City, Fukuoka Prefecture), and the Mogagawa water source pump house (Nakama City, Fukuoka Prefecture) were designated as Japan's Meiji Industrial Revolution heritage sites. As part of the "Iron and Steel, Shipbuilding, and Coal Mining Industries" (totaling 23 sites), it was selected as a UNESCO World Heritage Site.

Fig.4: Traffic map between Hanyang, Daye and Pingxiang

2. Status of Hanyeping Industrial Heritage

The development of Hanyeping Company spanned across important industries such as coal mining, iron ore extraction, and steel smelting, exerting profound influence on multiple cities along its route, including Wuhan, Daye, and Pingxiang, from spatial landscapes to production and lifestyle patterns. As a typical representative reflecting the modern industrialization process in China, an analysis of the company's retained industrial heritage and its current status of preservation and utilization is conducted. Furthermore, the relationship between urban development and the conservation and utilization of industrial heritage is explored, delving deeper into its historical significance and cultural connotations, thereby promoting the development of urban clusters in the central region.

2.1 Hanyang Iron Works

From 1927 to 1937, the factory remained abandoned. During the period of the War of Resistance against Japan, all machinery and equipment of the ironworks were relocated to Chongqing, and the factory buildings were entirely destroyed by explosives. It wasn't until 1958, as a continuation of the history of the Hanyang Ironworks, that the Hanyang Steel Works was established on the site of the former Hanyang Gunpowder Factory. Later, the Hanyang Rolling Mill and the Hanyang Steel Works were merged into the Hanyang Steel Works.

The factory is located in the central urban area of Wuhan, bordered to the north by the Han River and to the south by the Beijing-Guangzhou Railway. The division of Qintai Avenue

creates a spatial layout of one factory and two zones[16] within the factory area. In 2000, due to the operation of Wuhan's land reserve system, the northern zone was included in the demolition scope by the government and auctioned off to the real estate developer China Resources. It was swiftly demolished and the land was reorganized.

In 2011, the Hanyang Steel Works was designated as a key construction project in the "12th Five-Year Plan" of Wuhan City. At the same time, the Wuhan Municipal Bureau of Culture established clear protection levels for the cultural relics and buildings within the factory area. With active promotion from the Wuhan municipal government, Wuhan Iron and Steel Group, in conjunction with Vanke Group, initiated the "One Museum, Two Parks" development project[17] for the factory area. During the construction of the Zhang Zhidong and Wuhan Museums by American architect Daniel Libeskind[18], Vanke[19] hoped to acquire further development rights for the factory area by purchasing land. However, the owner of the land use rights, Wuhan Iron and Steel Company[20], firmly opposed this proposal. Due to the lack of capacity and funding to develop the factory area and the government's lack of sustained updates to policies regarding the protection and reuse of the Hanyang Steel Works area, the factory area could only be utilized in an inefficient manner under the game-playing of various stakeholders. Historic buildings with cultural value could only be used as warehouses.

Currently the Zhang Zhidong and Wuhan Museum has been established around the factory, which narrates the life and achievements of Zhang Zhidong as well as his activities and influence in the Wuhan region through narrative design. They utilize a combination of physical artifacts and historical photographs related to the history of the Hanyang Ironworks and Hanyang Manufacturing for exhibition. As a result, an increasing number of people are beginning to pay attention to the significant historical importance of the Hanyang Ironworks in China's modernisation process.

The industrial buildings within the factory area are in relatively good preservation condition and generally follow the layout of the Hanyang Iron Works. The buildings are categorized based on their functions, including production facilities, storage warehouses, office buildings, and dormitories. Most of the buildings were constructed between the 1980s and 1990s. The most distinctive and well-preserved industrial heritage within the factory area is the electric furnace sub-plant converter workshop[21]. It features a red brick facade, reinforced concrete frame structure, single-story layout, with a span of 30 meters, a depth of 90 meters, and a height of 23 meters. The roof is made of prestressed large roof panels supported by truss steel structures. Additionally, there are five historical buildings with modern industrial characteristics, including the electric furnace sub-plant maintenance spare parts room, electric furnace sub-plant smelting workshop, electric furnace sub-plant production workshop, sewage treatment workshop, and industrial oxygen plant workshop. Other remnants such as water towers, chimneys, railways,

[16] The northern section of the plant is dedicated to the rolling mill area, comprising the billet mill workshop, wire mill workshop, universal section mill workshop, special-shaped section mill workshop, and transportation workshop. The southern section of the plant is dedicated to the steelmaking area, including the converter workshop, electric furnace workshop, oxygen-making workshop, and lime workshop, among others.

[17] Zhang Zhidong Museum, Creative Cultural Industry Park, Headquarters Economic Park

[18] A Polish-American architect, artist, professor and set designer. Libeskind founded Studio Daniel Libeskind in 1989 with his wife, Nina, and is its principal design architect.

[19] Vanke Corporation Limited was founded in 1984 and is a leading urban and rural construction and life services provider in China. Its business focuses on the three most dynamic economic circles and key cities in the central and western regions of the country.

[20] Established in 1955, it is the first super-large-scale steel joint venture constructed after the founding of the People's Republic of China. Completed and put into operation on September 13, 1958, it is a centrally administered state-owned key enterprise under the supervision of the State-owned Assets Supervision and Administration Commission of the State Council.

[21] Established in 1965, it was designated as a key project of Wuhan City from 1976 to 1984 and underwent two expansions during this period. Utilizing the three-phase electric arc furnace steelmaking method, it primarily produces high-quality steel. In 2011, including oxygen supply and dust removal pipeline facilities, it was listed in the first batch of industrial heritage sites in Wuhan. In 2017, it was included in the first batch of national industrial heritage sites.

industrial pipelines, and gateways collectively form the historical spatial environment of the Hanyang Steel Works.

Fig.5: Zhang Zhidong and Wuhan Museum
Fig.6: Electric Furnace Sub-plant Converter Workshop

2.2 Daye Iron Mine

During the period of Japanese occupation from 1938 to 1945, the mining area was under Japanese control, and extensive construction was undertaken, resulting in the formation of production and residential zones. It wasn't until after the liberation war that the Daye Iron Mine gradually resumed production and completed infrastructure projects such as water and electricity supply, transportation, industrial plant areas, and worker living quarters for the mine. Roads were constructed from the city to Tieshan, forming the initial grid pattern of roads within Tieshan district.

In the early 21st century, the mineral reserves in the mining area gradually decreased, prompting the government to propose the development of mining culture and tourism industries. In 2006, the Daye Iron Mine Museum was established, featuring multiple exhibitions including mineral displays, ancient mining practices, and modern mining methods, reflecting the entrepreneurial and developmental history of modern mines. In 2007, the Daye Iron Mine Park and the Tonglushan Ancient Copper Mine Site were combined to form the Huangshi National Mine Park. The park's landscape design integrated the reuse of industrial heritage from the Daye Iron Mine, greatly enhancing the public nature of the mining area. In 2012, it was selected "Huangshi Mining and Metallurgical Industrial Heritage" on the UNESCO World Heritage tentative list for China.

Currently, the main industrial relics of the Daye Iron Mine include mining remnants, constructed structures, and mining equipment. The mining remnants constitute the core landscape resources of the Daye Iron Mine, consisting of a 440-meter open-pit mine and underground mines. Constructed structures encompass factory dormitories located in urban areas and buildings in the mining area, such as fortification ruins and ore dressing workshops built by the Japanese. Mining equipment imported from Europe showcases the production process from mining to ore dressing and transportation. Due to the unique production methods in the mining area, the production and residential areas are closely linked, but the lack of spatial boundaries leads to a dispersed spatial layout of industrial heritage, preventing the formation of a systematic and complete spatial form, which is difficult to meet the current needs of urban development.

Fig. 7: Ancient Mining Scene

Fig. 8: Open-pit Mine

2.3 Pingxiang Coal Mine

In 1939, due to wartime reasons, the Pingxiang coal mine was relocated and damaged by the Nationalist Government. It wasn't until 1954 that the Anyuan coal mine resumed operations at the original site and, through renovation and expansion projects, became the largest coal mine among the seven mines under the Pingxiang Mining Bureau. Although the Pingxiang coal mine is still in operation, coal resources are showing a trend of gradual depletion.

During the construction and development of the Pingxiang coal mine, various distinctive architectural heritages were left behind, including production facilities of the coal mine and buildings from the red revolutionary era[22]. Presently, the production facility buildings mainly include mineral offices, dormitories, coal mine passages, coal mining and washing facilities, etc. The buildings from the Red Revolutionary era mainly consist of revolutionary remnants such as the Workers' Club established to lead workers, night schools for guiding workers' learning, consumer cooperatives serving workers' lives, and revolutionary sites like the Autumn Harvest Uprising[23]. In recent years, the Pingxiang coal mine and relevant government departments have been continuously engaged in the conservation of architectural heritage and have collaborated on the development of Anyuan Red Tourism, constructing a scenic area integrating industrial heritage, urban tourism, and the inheritance of the Anyuan spirit. Due to the government's emphasis on the cultural significance of the Red Revolutionary spirit, the investment and effectiveness in the construction of buildings from the Red Revolutionary era have been significantly higher than those of the coal mine production facility buildings, leading to an imbalance between the development of scenic area infrastructure and regional development.

[22] These are buildings primarily used by leaders of the Communist Party of China (such as Mao Zedong, Liu Shaoqi, Li Lisan, etc.) during the period of 1920-1921 to lead workers' production and movements at the Pingxiang Coal Mine, as well as during the guidance of the Red Revolution era.

[23] During the Land Revolution War, the Chinese Communist Party led armed uprisings by peasant self-defense forces, worker patrols, and revolutionary soldiers in the border regions of Hunan and Jiangxi provinces.

Fig. 9: Anyuan Coal Mine Shaft Entrance - Zongping Tunnel
Fig. 10: Anyuan Historical and Cultural District

3. Protection and Reflection on Hanyeping Industrial Cultural Route

Based on theoretical literature on the conservation of world industrial heritage and the experiences of the European Industrial Heritage Route, combined with the practical situation of industrial heritage conservation in China, comprehensive protection of Chinese industrial heritage holds significant guiding significance. It has important foundational research value for the establishment of cultural routes for the Hanyeping industrial heritage and the corresponding development of tourism routes.

3.1 World Level

The attention to industrial heritage conservation originated from industrial archaeology in Britain in the 1950s. With the gradual rise of industrial heritage conservation and research in countries such as Germany, France, the United States, and Japan, it has increasingly become a trend in cultural heritage protection. In 1973, the first International Symposium on Industrial Monuments was held at the Ironbridge Gorge Museum in Britain. At the third International Symposium on Industrial Monuments held in Sweden in 1978, the International Committee for the Conservation of Industrial Heritage (TICCIH) was established. Entering the 1990s, with the acceleration of the post-industrial era, the position of industrial heritage in the world cultural heritage became more important. The World Heritage Committee of UNESCO entrusted the International Council on Monuments and Sites (ICOMOS) to conduct studies on various types of industrial heritage, such as "World Heritage Bridges" (1996), "Railways as World Heritage Sites" (1999), and "International Coal Mining Studies" (2002). Of particular note in international activities was the 12th International Conference on the Conservation of Industrial Heritage held in Nizhny Tagil, Russia, from July 10th to 17th, 2003. The conference formulated the "Nizhny Tagil Charter" for the conservation of industrial heritage, which became the most authoritative document on industrial heritage conservation theory and a guide for conservation activities in various countries. In October 2005, at the 15th ICOMOS General Assembly held in Xi'an, China, the theme of "International Day for Monuments and Sites" on April 18, 2006, was designated as "Protecting Industrial Heritage," marking a new stage in international industrial heritage conservation. As of 2024, there are 50 industrial heritage sites listed on the World Heritage List, distributed across 28 countries.

The concept of cultural routes in the field of cultural heritage originated from the "European Heritage Plan" in 1987. In 2005, the "Operational Guidelines for the Implementation of the World Heritage Convention" introduced the concept of cultural routes for the first time, proposing to rediscover shared heritage through tourism, promote cultural interaction, interreligious dialogue, and landscape conservation and development, thereby enhancing cultural cooperation. The emergence of cultural routes reflects the innovation and

breakthroughs in the concept of cultural heritage conservation, where cultural heritage is no longer considered as isolated "heritage points" separate from historical and natural environments. Among them, the European Route of Industrial Heritage, as the only thematic route showcasing industrial and scientific heritage, currently includes over 1,850 industrial heritage sites from 26 countries such as Germany, Belgium, the United Kingdom, France, Poland, Spain, and Italy. It has established a cultural route system composed mainly of 100 important industrial heritage anchor points, 20 regional industrial routes, and 13 European thematic routes, linking industrial heritage sites through natural and artificial geographic factors such as rivers, railways, mines, and industrial areas. With the promotion of international industrial heritage conservation organizations, more countries have formulated policies for the protection and utilization of industrial heritage, clarifying protection objectives, measures, and responsible entities, providing a solid foundation for cooperation and exchange among countries.

3.2 National Level

In 2006, the "China Industrial Heritage Protection Forum" convened by the State Administration of Cultural Heritage, along with the resulting "Wuxi Proposal," marked the formal inclusion of industrial heritage conservation and development into the national policy protection framework. In the same year, in response to the industrial heritage protection work plan, the State Administration of Cultural Heritage issued the "Notice on Strengthening the Protection of Industrial Heritage." From 2017 to 2021, the Ministry of Industry and Information Technology successively announced five batches of national industrial heritage lists, with 11 industrial heritage projects from 13 units selected. In 2018, the "Interim Measures for the Management of National Industrial Heritage" were introduced. In 2022, the "Implementation Plan for Promoting the Development of Industrial Culture" was launched. In 2023, the Ministry of Industry and Information Technology issued the "Management Measures for National Industrial Heritage," implementing General Secretary Xi Jinping's important instructions on the protection and inheritance of historical and cultural heritage, strengthening national industrial heritage management, promoting industrial spirit, developing industrial culture, and enhancing China's industrial soft power and cultural influence.

In recent years, the country has continuously strengthened its emphasis on the protection of industrial heritage, issuing corresponding protection documents and management systems. However, a complete industrial heritage management system has yet to be established, which makes it difficult to provide clear guidance for the planning, construction, and implementation of industrial heritage development and utilization projects. This situation needs to be improved to address the practical contradictions between the cultural value of industrial buildings and the scarcity of land resources.

3.3 Regional Level

In 2007, Huangshi City collaborated with Daye Iron Mine to organize the Mining and Metallurgy Cultural Festival. In 2008, the Zhang Zhidong Memorial and Hanyang Ironworks Museum initiated the commemorative seminar for the 100th anniversary of the founding of "Hanyeping Company" and the protection and utilization of "Hanyang-made" modern industrial heritage. In April 2010, the Chinese Urban Planning Society organized the "Symposium on Urban Industrial Heritage Conservation and Utilization" in Wuhan, resulting in the "Wuhan Proposal on the Conservation and Utilization of Urban Industrial Heritage during the Transition Period." The "Wuhan Master Plan (2010-2020)" explicitly proposed the need to further investigate and excavate industrial factories and blocks reflecting the modern industrial development history of Wuhan, incorporating them into the scope of historical and cultural protection as modern industrial heritage. In 2017, the Pingxiang Municipal Bureau of Culture and Tourism held a conference on the protection and utilization of Pingxiang coal mine

industrial heritage, emphasizing the significant role of industrial heritage in promoting urban transformation and tourism economic development.

In recent years, Wuhan, Daye, and Pingxiang have each introduced corresponding industrial heritage protection policies and management systems. However, due to the dispersed locations and lack of unified protection, utilization, and development policies among the three places, it has not been possible to promote regional connectivity and development. This has resulted in the collaborative form of reshaping the Hanyeping industrial heritage cultural route not yet being realized.

Conclusion

Industrial heritage, as an important component of human cultural heritage, records the trajectory and achievements of past industrial development and serves as a witness to urban history and culture. The Hanyeping cultural route, representing modern industrial heritage in China, introduced advanced Western science, technology, and machine production, spanning multiple cities and involving various smelting processes, thus exerting a significant influence on the economic and urban development of the central region. In the process of its protection and utilization, it is necessary to draw on the rich experience of European cultural routes, combined with the actual situation of industrial heritage conservation in China, to protect and preserve industrial buildings and their historical landscapes through policy guidance, planning recommendations, and design practices based on conservation principles. This transformation of industrial resources into cultural resources enhances cultural cooperation between cities, drives urban regional transformation and development, and provides theoretical references for the protection of industrial heritage in China.

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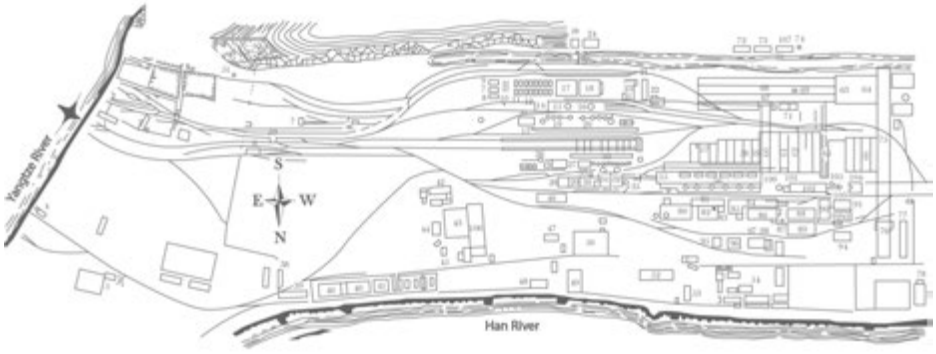
Appendices

Map of the Location of Hanyang Ironworks



1. Briefing room
2. Horsepower Stables
3. pound house
4. stack house
5. Wholesale hall
6. Repair room
7. stack house
8. Pumping house
9. backstops
10. Coal storage area
11. heating furnace
12. steam furnace
13. Blower's room
14. Blower's room
15. iron furnace
16. Iron-carburising furnace
17. Iron dump
18. Iron leaving yard
19. Lift
20. Lift
21. stack house
22. Repair shop
23. Repair room
24. Pumping Station
25. Iron Carbide Unit
26. steam furnace
27. Blower's room
28. Cleaning room
29. Lighting house
30. Blower's room
31. ironmongery
32. Ironing house
33. lift
34. ash-cleaning furnace
35. Ash Cleaning Furnace
36. Iron Outhouse
37. Iron leaving yard
38. stacks
39. stacks
40. Stores
41. Material Unit
42. Police Patrol Office
43. Pharmacy
44. Supervisory Service
45. Pumping Station
46. Carriageways Division
47. coal office
48. telegraph office
49. Hospitality Centre
50. Head Office
51. Scrap Iron Machine
52. Iron foundry
53. Mould House
54. Civil Engineering Service
55. Blending Furnace
56. Steelworks
57. Laboratory Unit
58. Iron stores
59. Weighbridge
60. 3 tonne crane
61. 3 tonne crane
62. 20 tonne crane
63. Steel-drying furnace
64. Steel drying furnace
65. 30 tonne crane truck
66. Finishing plants
67. Teppan Stacks
68. 5-tonne crane
69. Pumping house
70. Completion plant
71. official's office
72. stacks
73. stack house
74. Pumping plant
75. 20-tonne crane
76. Steel rail plant
77. 30 tonne crane year
78. Pumping house
79. Pools
80. Sand tilling plants
81. boiler plant
82. Iron foundry
83. steam furnace
84. repair works
85. Copper works
86. Hook and nail factory
87. Asphalt wok
88. Brick factory
89. Brick-making factory
90. waterworks
91. electric light house
92. Electricity works
93. Repair house
94. motor stack
95. steel test house
96. stack house
97. Machine Hunt Unit
98. Plotting room
99. Bricklayers
100. Lifting stacks
101. Tubes
102. Stoves
103. Taps
104. Furnace
105. Furnace
106. Money Unit
107. Laboratory Unit

Site Plan of the Expanded Hanyang Ironworks

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Research on Sustainable Protection and Inheritance of Overseas Chinese Hometown Cultural Heritage: A Case Study of Xiangshan Ancient City

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Abstract
Due to its unique nature, the protection and utilization of overseas Chinese hometown cultural heritage face many practical challenges and ongoing debates. In the past, the protection of overseas Chinese hometown cultural heritage primarily focused on the material aspect and achieved significant short-term results, but it was not sustainable in the long run. Building upon the shortcomings of three previous approaches, a transformation is proposed towards a sustainable mode. Using Xiangshan Ancient City as a case study, this research analyses the sustainable potential and impact of overseas Chinese hometown cultural heritage from both the supply and demand sides. It considers both material and social aspects, covering three dimensions: people, objects, and events. Subsequently, sustainable protection and inheritance strategies are proposed, including 5 aspects.

Keywords: sustainability; overseas Chinese hometown cultural heritage; protection and inheritance; Xiangshan Ancient City

1. Introduction

Overseas Chinese hometown cultural heritage is a special category of Chinese regional cultural heritage, mainly located in the southeast coastal areas (including Guangdong, Fujian, Hainan and Zhejiang). Overseas Chinese hometown cultural heritage not only has unique value at the material space level, but also carries special cultural connotations, endowed with profound humanistic spirit and national sentiment. The overall protection of Chinese historical and cultural heritage began in the early 1980s when the first batch of national historical and cultural cities were recognized, and after four generations, the protection and restriction of the material space level have gradually matured to a certain extent, and a relatively complete system for the protection and utilization of historical cities, towns, villages, and other areas has been formed. Therefore, when heritage protection enters the 4.0 stage in China, the regeneration and sustainable utilization of historical and cultural heritage have to be considered. Focusing on the dimension of overseas Chinese hometown cultural heritage, based on years of research on the protection and utilization of historical and cultural cities in overseas Chinese hometowns, this research takes Xiangshan Ancient City in Zhongshan, Guangdong Province as an example to summarize new ideas for the sustainable protection and inheritance of cultural heritage in overseas Chinese hometowns, with a view to solving practical problems such as unclear property rights, resource mismatch, and inefficient utilization caused by neglecting sustainability in the past practices in overseas Chinese hometowns.

2. The specificity of overseas Chinese hometown cultural heritage and the typicality of Xiangshan Ancient City

2.1. Overseas Chinese culture and overseas Chinese hometown cultural heritage

Overseas Chinese culture is formed in the life process of overseas Chinese in overseas and returned countries, and it is a comprehensive culture that integrates the culture of both their ancestral homeland and their host country [1]. This cultural phenomenon can be regarded as a cultural transformation process [2]. The elements of traditional culture are redefined and shaped

in the new geographical and cultural background, forming a cross-cultural and cross-border cultural construction. Overseas Chinese culture is one of the most important components of the cultural landscape in the southeast coast of China. Protecting and inheriting overseas Chinese culture is of far-reaching significance to maintain cultural diversity, strengthen cultural identity, preserve historical memory, and promote cultural exchanges and social cohesion in overseas Chinese hometowns.

Overseas Chinese hometown cultural heritage carries the connotation of overseas Chinese culture and reflects the social activities, social relations and ideology of overseas Chinese, and is a branch of regional cultural heritage [3]. The immovable overseas Chinese hometown cultural heritage is mainly formed when the overseas Chinese promote the construction of cities and towns, such as overseas Chinese houses, factories, schools, hospitals, parks, etc. The movable overseas Chinese hometown cultural heritage is mainly formed when the overseas Chinese participate in political, economic and cultural activities, as well as in their daily lives, such as the genealogy of the overseas Chinese and the related documents, manuscripts and canonical works, etc. The intangible overseas Chinese hometown cultural heritage includes the lifestyles, religious beliefs, folk customs, and values of overseas Chinese.

From the urban and rural spatial dimension, the overseas Chinese hometown cultural heritage hometown is mainly distributed in historical cities and traditional villages. In recent years, the overseas Chinese hometown areas have paid more attention to rural revitalization, so previous research has focused more on traditional villages in overseas Chinese hometowns, with insufficient attention paid to the study of ancient cities in these areas. As the spatial pattern, industrial structure, land use and population differentiation of the ancient cities are quite different from those of traditional villages, whether the research conclusions can be applied still needs further exploration. In addition, the traditional protection and utilization model limited to material space in the past has shown remarkable results in a certain space and time range, but this effect is limited and unsustainable. This mode relies heavily on government finance and ignores the subjectivity of private forces [4], thus losing the long-term sustainable power of cultural heritage protection and inheritance in overseas Chinese hometowns. In conclusion, this research takes the ancient city in overseas Chinese hometowns as the main research object, and analyses its dynamic protection and inheritance based on the sustainable perspective.

2.2. The Great Xiangshan Cultural Circle and Xiangshan Ancient City

2.2.1. Xiangshan Culture and the Great Xiangshan Cultural Circle

From a geographic perspective, the Xiangshan culture refers to a special regional culture formed in Zhuhai, Zhongshan and Macao, where the history and culture of these three areas have the same roots, forming the Great Xiangshan Cultural Circle. The conceptual connotation of Xiangshan culture is intertwined with but different from "Lingnan culture" and "Pearl River culture", etc. The core and soul of Xiangshan culture is the fusion saltwater and freshwater civilizations. On one hand, centrally reflects the cultural characteristics of the three major ethnic groups in Lingnan culture, namely, Guangdong, Fujian and Hakka. On the other hand, as a typical immigrant society constantly absorbing foreign cultural inputs, multiple cultures collided and exchanged, transformed and upgraded, and demonstrated the cultural spirit of openness and communion. The social and cultural network of the Xiangshan region is intricate but strong and powerful, laying down the tone of the highly open and inclusive Great Xiangshan Cultural Circle.

2.2.2. Typical significance of Xiangshan Ancient City

Xiangshan Ancient City is located in Zhongshan, Guangdong Province, which is the hometown of the great man Dr. Sun Yat-sen and was approved as a National Historical and Cultural City in 2011. In the 22nd year of Shaoxing in the Southern Song Dynasty (1152 AD),

Xiangshan was established as a county, and its original territory included the present-day Zhongshan, Zhuhai, Macao, as well as parts of Panyu District in Guangzhou and Shunde District in Foshan. The scope of Xiangshan Ancient City is from Yixian Lake in the north to Baishi Creek in the south, from Lianfeng Mountain in the east to Shiqi River in the west, a total of 2.42 square kilometers (Fig. 1).

Since ancient times, the Xiangshan region has been one of the most active areas in China in terms of foreign trade and immigration, and it is also one of the most concentrated areas in China in terms of the distribution of overseas Chinese. Since the establishment of Xiangshan County, Xiangshan Ancient City as the birthplace of Xiangshan culture, has always been the political and economic center of Xiangshan region, and also retains a large number of overseas Chinese hometown cultural heritage. Therefore, this research takes Xiangshan Ancient City as a typical case, and analyses the protection and inheritance paths and strategies of overseas Chinese hometown cultural heritage for sustainability.

Fig.1. The scope of Xiangshan Ancient City

3. Realistic dilemmas and sustainable transformation in the protection of overseas Chinese hometown cultural heritage

3.1. Previous coping models

In the actual protection practice, the interests of all parties are often intertwined and complicated, which makes the implementation effect and theoretical research diverge from each other [4], causing a wave of reflection on the heritage protection in recent years. According to the protection route of the overseas Chinese hometown cultural heritage hometown for more than 40 years since China's reform and opening-up, three modes could be summarized (Tab. 1). One is the traditional mode (Mode T), which takes the sample type and static protection as the guide to fix the overseas Chinese hometown cultural heritage in a certain historical period and cultural form; The second is the destruction mode (Mode D), which tends to follow economic interests and carry out low-quality renovation, demolition and construction; The third is the passive mode (Mode P), which maintains the original state but allows its overall decline and the people to live in poverty. There are certain practical problems in the actual implementation of the above three coping modes, which leads to the difficulty in reconciling the contradictions

between the "reformers" and the "fixers" involved in the protection and utilization of the overseas Chinese hometown cultural heritage [5].

Tab.1. Previous three coping modes

Mode	Characteristics	Advantages	Problems
Mode T	specimen-based, static protection	Apply to a small number of original buildings with specimen value, so that they become the original material carriers of cultural memory.	Extreme dependence on local government finances has resulted in a degree of resource mismatch.
Mode D	Low-quality renovation, major demolition	In the short term, it will stimulate local economic development, increase local financial income and slightly improve the quality of the human environment.	Irreversible damage will be caused to heritage resources; a large amount of "antique garbage" may be produced, leading to excessive commercialization.
Mode P	General decline, a mass impoverishment	In the short term, heritage resources can be preserved without burdening local revenues.	Allowing precious heritage resources to decline will result in the disappearance of historical values, the loss of traditional craftsmanship and local cultural memories.

3.2. Realistic dilemmas and sustainable transformation

After more than 40 years of practical exploration on the protection and utilization of overseas Chinese hometown cultural heritage, it is obviously unrealistic to adopt the T model to completely protect and repair, which also imposes a burden on government finance and regional development [6]. In the process of improving the system construction, supervision and control of historical and cultural heritage in China, in recent years, Mode D has also been alerted by all regions, gradually rectified and banned. Therefore, in the current context, the hometown of overseas Chinese is forced to adopt Mode P to passively cope with the large amount of overseas Chinese housing resources. Based on the above background, the author proposes that the sustainable protection and inheritance of overseas Chinese hometown cultural heritage hometown should be considered in the protection 4.0 stage. With the help of the application of new technology and institutional construction, changes should be realistically controlled rather than prevented from evolution, so as to achieve a dynamic balance between cultural inheritance and social needs in the process of protection and utilization, and form a sustainable mode (Mode S), Finally, an innovative model led by the Mode S and driven by Mode T will be formed, and this change in the concept of sustainable heritage protection will also become the key to breaking through the bottleneck and creating value in the future of overseas Chinese hometown cultural heritage protection and inheritance.

4. Exploration of sustainable protection and inheritance practices of overseas Chinese hometown cultural heritage: taking Xiangshan Ancient City as an example

4.1. Paths of sustainable protection and inheritance

According to the above analysis, it can be seen that the effectiveness of the static specimen-type heritage protection mode is extremely limited, while the sustainability-oriented heritage protection and inheritance is continuous, stable and broadly inclusive. In order to solve the practical dilemma, this research takes Xiangshan Ancient City as an example to conduct an empirical study, and analyses the sustainable potentials and sustainable impacts of overseas Chinese hometown cultural heritage from both the supply side and the demand side, respectively, and puts forward the corresponding strategies of sustainable protection and inheritance (Fig. 2).

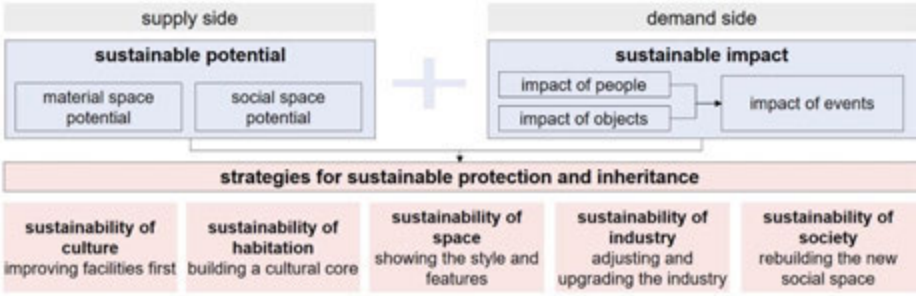

Fig.2. Path of sustainable protection and inheritance of overseas Chinese hometown cultural heritage

4.2. Analysis of sustainable potential

Based on the comprehensive consideration of both material space and human needs, this research analyses the sustainable potential of overseas Chinese hometown cultural heritage from two levels. The potential of material space is "tangible", while the potential of social space is "intangible", which are closely intertwined and intuitively oriented to the sustainable preservation and inheritance strategy of overseas Chinese hometown cultural heritage.

4.2.1. Material space potential

1. The integrity of the city pattern

"Xiangshan County Local Gazetteer" records the construction of rammed earth city walls during the Song Dynasty, which is also the earliest record of the city construction in Xiangshan Ancient City. Based on the street and alley names listed in the *"Zhongshan Gazetteer"* during the Song Dynasty, combined with the length of the city wall recorded in the *"Xiangshan County Local Gazetteer"* (approximately 1425 meters), it is estimated that the location of the Song Dynasty city wall was around the vicinity of today's Renhouli, Shoushanli, and Qixing-Chudi. (Fig. 3).

In the 26th year of the Ming Dynasty (1393 AD), Chen Yu, the defender of Xiangshan County, expanded the city on the basis of the old county seat and built a new brick castle, while the earthen castle built in the Song Dynasty was changed into a military camp. Since then, it had been repaired several times. Compared with the Song Dynasty, the perimeter of the wall during the Ming Dynasty expanded from about 1425 meters to about 2117 meters; west half of the wall location can be calibrated according to the 1933, 1959 Xiangshan County map, the east half of the wall can be identified according to the 1911 Xiangshan County map, presumably the location of the Ming wall in today's Pasha Street, Xiaojiaochang street, Gongjian Alley, Zhian Street, Changtai Street, Fangta Street, and Shanghebo (Fig. 3). There were four gates in total. The south gate was called Fumin Gate, which was located approximately between the intersections of Zhian Street and Changtai Street; the west gate was Dengying Gate, situated roughly between the foot of the Xishan Mountain and the intersection of Minzu Road; the east gate was Qixiu Gate, situated near the post office on Sun Wen Middle Road; and the north gate was Gongchen Gate, located approximately at the Banyan Tree intersection of Taiping Road and Gongchen Road.

Fig.3. Speculation of the location of the city wall

2. The uniqueness of the ancient cityscape

Due to the integration of functions such as trade and education, four closely connected areas (Guanxiang) - east, west, south, and north - gradually formed outside the ancient city, maintaining close ties with the main city. These four Guanxiang areas are vast, covering a much larger area than the main city, thus forming the unique city layout of "small city and large Guanxiang" in Xiangshan Ancient City (Fig. 4).

During the continuous development of Xiangshan Ancient City, the four Guanxiang areas gradually evolved into urban spaces with different functions and characteristics. The West Guanxiang embodies the characteristics of commercial culture, the South Guanxiang represents the clan culture, the East Guanxiang showcases the educational culture, and the North Guanxiang manifests the folk culture. The division of labor and functions among these four Guanxiang areas complements the main city.

Fig.4. The layout of "one main city and four Guanxiang areas"

3. The wisdom of urban planning that harmonizes with nature

The site of the ancient city is located in the north of Wugui Mountain, near the river, which is a natural harbor and can avoid the wind and waves. It is located to the east of Qi River but not close to it, with Yandun Mountain and Lianfeng Mountain to the north, reflecting the practical principles in *"Guanzi"*. The terrain slopes from north to south, with the Jiuqu River

winding past the southern outskirts, creating an overall pattern of "facing the sun and backed by shade.".

In addition to the "Jiuqu River Surrounding the City", the "Seven-Star Peaks Guarding Renshan Mountain" is an even more unique landscape pattern that existed since the inception of the city's construction. According to the "Xiangshan County Gazetteer," the selection of the city's location was based on the formation of the Big Dipper from ancient Chinese astronomical systems, embodying the simple planning ideology of imitating the heavens and following the laws of nature. There were originally 8 mountains within areas, and the landscape pattern was basically intact. Yingshan Mountain, Fushan Mountain, and Phoenix Mountain have been flattened, while Shoushan Mountain and Yingshan Mountain are now the locations of the Radio and Television University. Renshan Mountain is the site of the Sun Yat-sen Memorial Hall, and Yueshan Mountain and Xishan Mountain still serve as mountain parks (Fig. 5).

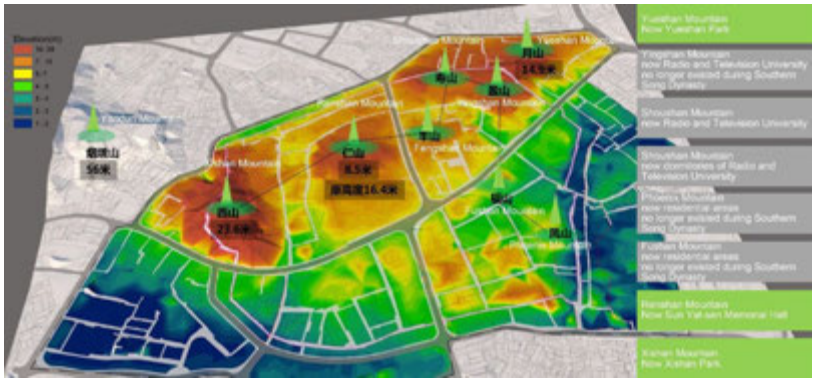

Fig.5. The location of "Seven-Star Peaks Guarding Renshan Mountain"

4. The exemplary nature of modern construction

On April 15, 1925, Xiangshan was renamed Zhongshan in honor of Dr. Sun Yat-sen. Under the convergence of Chinese and Western cultures, Zhongshan has developed a relatively complete urban planning concept, especially during the period when Zhongshan was recognized as a national "model county" in 1929, which supported its large-scale construction and renovation campaign, both economically and politically. Zhongshan's campaign was spearheaded by the plan of "building new roads and constructing the county town", which built the urban skeleton of modern Zhongshan city. As the county town of Zhongshan city, Xiangshan Ancient City has preserved the complete arcade streets and public facilities built during the Republic of China period (Fig. 6), which centrally reflects the construction achievements of the "model county" during the Republic of China era.

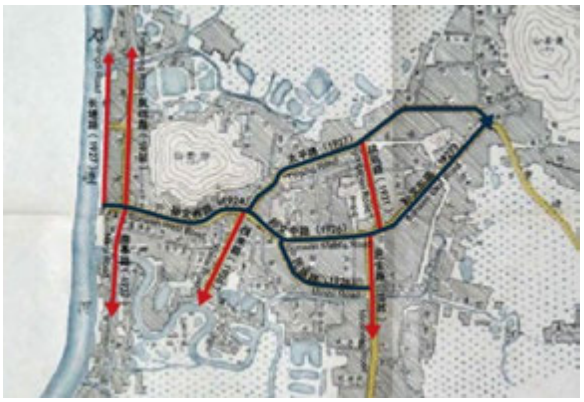

Fig.6. Construction time and location of 10 roads during the Republic of China

5. The exemplary character of the overseas Chinese hometown architecture

Under the combined influence of the traditional culture of the ancestral homeland and the overseas culture of the expatriate countries, the architecture in Xiangshan Ancient City also exhibits a unique fusion of traditional Chinese style and Western and South Asian styles. The proportion of architectures from the Republic of China and before is about 26%, including towers, temples, pawnshops, traditional dwellings (Lingnan houses, bamboo tube houses) from the Qing Dynasty and before, as well as schools, churches, theaters, hospitals, factories, libraries, arcade shops, merchant houses and western-style dwellings from the Republic of China period (Fig. 7).

The architectural styles in overseas Chinese hometowns are diverse, and the most representative architectural styles are Western-style mansions, arcades, etc. The Western-style mansions often appear in the form of multi-story overseas Chinese residences or cottages, with two stories being the most common, and some extending to three or four stories. The arcade buildings are narrow and deep inside, resembling bamboo tubes, and are commonly known as "bamboo tube houses." They often appear in a single plane form, or in combinations of two or more. The facade along the street usually includes Manchu windows, colored glass windows, balcony railings with elaborate patterns, elaborate pediments, etc. The roof often combines a flat roof with a pitched roof.

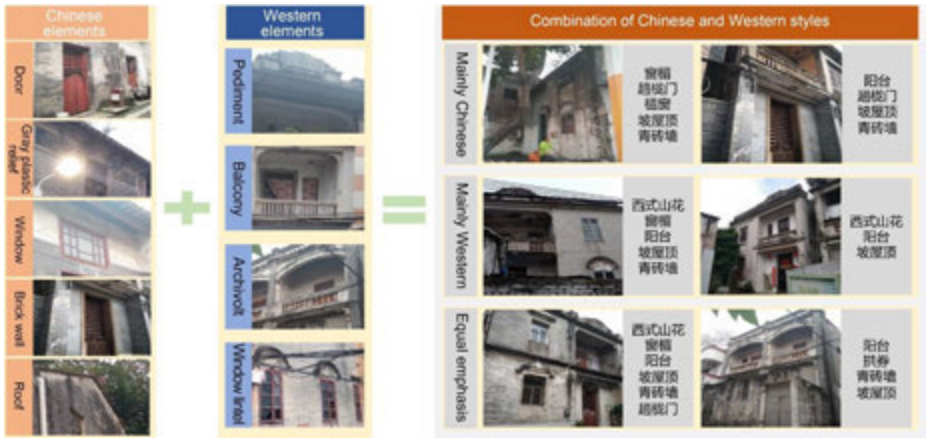

Fig.7. Style and elements of overseas Chinese hometown architecture

4.2.2. Social space potential

1. The leadership of celebrity culture

Since the Ming and Qing dynasties, Xiangshan Ancient City has nurtured many talents due to its special geographical location and cultural and historical environment. A group of modern celebrities in Zhongshan, represented by Dr. Sun Yat-sen, had changed the course of Chinese history and promoted the modernization of China. For example, Zheng Guanying, the earliest theorist, enlightenment thinker, and industrialist with a complete reformist ideology in modern China; Zheng Zaoru, the first Chinese ambassador to a foreign country; Rong Hong, the "father of modern overseas students" in China and the pioneer of Chinese compradors, all of them had a significant impact on Dr. Sun Yat-sen's revolutionary thoughts.

2. The richness of Xiangshan culture

Under the evolution of the vicissitudes of life, the local Lingnan culture has fused with the Central Plains culture from immigrants, the Western culture and the Southeast Asian culture from overseas, developing in harmony and coexistence, thus forming the unique Xiangshan culture. The diverse folk culture, the hybrid overseas Chinese culture integrating Chinese and Western elements, the commercial culture that connects the world, the philanthropic culture of universal love and mutual assistance, and the illustrious celebrity culture are all important components of Xiangshan culture. The modern openness and enlightenment of thoughts have made Xiangshan culture a trendsetter, with characteristics of diversity, inclusiveness, openness, and leadership, and profound modern value.

4.3. Analysis of sustainable impact

The sustainable impact of overseas Chinese hometown cultural heritage is intuitively reflected in the "material" aspect of material space and the "people" aspect of social space. Meanwhile, the spatial composition of "material" and the complex and diverse factors of "people" directly affect the implementation of "events" [7]. Therefore, based on comprehensive consideration of material elements and human needs, this research analyses the most urgent and direct influencing factors for the sustainable protection and inheritance of overseas Chinese cultural heritage from the three perspectives of people, objects, and events.

4.3.1. The impact of people

As more and more attention is being paid to historical and cultural heritage, the overseas Chinese hometowns, especially the majority of areas within and around ancient cities, have gradually become "regularized" and focused on the material space level [8]. Some historical buildings that have been officially recognized have been restored, a large number of old buildings and illegal structures that do not conform to the traditional style have been demolished, and many alleys and lanes have been gradually renovated. This has achieved a certain degree of environmental improvement and enhancement of the overall style of the ancient cities.

In the past, the protection and utilization of overseas Chinese hometown cultural heritage generally focused on the transformation of the material space level, but neglected the governance of the social space level, which also directly led to the gradual loss of the "social autonomy" of the civil power in the process of participating in the protection of overseas Chinese hometown cultural heritage [9]. In the 1980s and 1990s, for example, many overseas Xiangshan groups set up their own social organizations, returned to the ancient city to visit their roots, financed the renovation of their ancestral houses, built public services, and assisted those with the same surname who had difficulties in their lives, but such positive initiatives are now

diminishing. This also indicates that in the past, the bottom-up, self-organized private forces of the overseas Chinese townships in the process of formalizing the protection have been exhausted, the platform for private forces to shine is shrinking dramatically. Due to the lack of capital or formal authority, private forces can only be eliminated in the game with government entities.

4.3.2. The impact of objects

architectural heritage in overseas Chinese hometowns is a very important part of the overseas Chinese hometown cultural heritage. Among them, the protection of Overseas Chinese houses is currently the most tangled in the protection practice. Overseas Chinese houses refer to buildings whose property owners are overseas Chinese, foreign nationals of Chinese origin, returned overseas Chinese, or relatives of overseas Chinese. Although a large number of overseas Chinese houses are privately owned, the property owners, due to their long-term residence overseas, are unable to fully enjoy the right to possess and use these houses [10]. And with the passage of time, it is even impossible to get in touch with the property owner and his or her descendants. Overseas Chinese houses exhibit characteristics such as the separation of property owners from their properties in different countries due to the dispersal of property rights, as well as complex property inheritance. The unclear property rights can also lead to uncertainty in rights, responsibilities, and interests, triggering a series of property issues [11]. Due to the complexity of property rights, the government's efforts in protection work are often hampered. Although these overseas Chinese houses possess distinctive value and characteristics, they often face issues such as long-term vacancy, disrepair over the years, dilapidation, potential collapse hazards, and poor surrounding environments.

According to existing data, the total floor area of overseas Chinese houses within Xiangshan Ancient City reaches 134000 square meters, accounting for approximately 7.7% (Fig. 8). Most of these overseas Chinese houses were built during the Republic of China era and are an important part of the traditional architecture within the ancient city. Approximately 7% of these overseas Chinese houses are classified as protected buildings, about 31% are recommended for protection, and the remaining approximately 62% are traditional-styled architecture. However, due to disrepair over the years, many of these overseas Chinese houses have sustained varying degrees of damage and collapse, posing significant safety hazards. About 38% of them fall into the third and fourth quality categories. The ancient city is rich in overseas Chinese housing resources, but currently, most of the personnel responsible for their protection are elderly and officials, who can only conduct routine maintenance and cleaning of a small number of key houses. The protection and revitalization of overseas Chinese houses is urgent and requires immediate investment in funds, manpower, and intellectual resources.

Fig.8. Distribution of overseas Chinese housing

4.3.3. The impact of events

During the period of China's reform and opening-up, Zhongshan was at the forefront of institutional reform, opening up to the outside world, and attracting investment, etc. Relying on the "three to one complementary" industry, Zhongshan has become a representative of the development of cities in Guangdong and even in the whole country, and has become one of the "Four Little Tigers of Guangdong". As the political, economic and cultural center of Zhongshan, Xiangshan Ancient City has produced famous brands and has a good industrial foundation.

However, at present, the distribution of industries within the ancient city is relatively chaotic, and cannot effectively combine with the historical and cultural space, and the development of industrial integration is insufficient. The development and utilization of overseas Chinese cultural resources failed to form a whole industry chain, branding production and management, such as overseas Chinese architectural resources, overseas Chinese specialties and food, failed to be transformed into differentiated and competitive quality cultural and tourism resources. At the same time, Xiangshan Ancient City also has some common problems faced by other ancient cities, which further lead to the obstruction of industrial development, such as the quality of the human environment needs to be upgraded, the lack of display of core cultural characteristics, the aging population and the lack of vitality in the development of the area.

4.4. Strategies for sustainable protection and inheritance

The above research analyses the sustainable potential and impact of Xiangshan Ancient City from the supply and demand sides. Based on this, this research focuses on sustainability with "people" as the core, considering both material space and social space, and develops a strategy for the sustainable protection and inheritance of overseas Chinese hometown cultural heritage from five dimensions: culture, habitation, space, industry, and society.

4.4.1. Sustainability of culture

With the change of history, Macao has become a special administrative region and Zhuhai has become a special economic zone, therefore, under the new situation, Xiangshan Ancient City should adhere to and inherit the traditional elements of the Xiangshan culture and make it more colorful [12], and to make the Great Xiangshan Cultural Circle more vibrant and powerful.

At the regional level, to build a regional cultural framework of "one core, three centers, one belt, one road and many points" (Fig. 9), and to shape a regionally competitive and unique cultural image. At the ancient city level, the first priority is to maintain the traditional spatial layout (Fig. 9); the second is to clarify the cultural heritage resources of the ancient cities and form a relatively complete system for cultural heritage exhibition and utilization (Fig. 10); and the third is to focus on promoting the protection and utilization of the architectural heritage in overseas Chinese hometowns and continue to promote the protection and restoration of overseas Chinese houses.

Fig.9. Spatial pattern of Xiangshan Ancient City

Fig.10. Display system of cultural symbols throughout the city

4.4.2. Sustainability of habitation

According to the past practice of visiting and researching, the residents in the ancient cities in overseas Chinese hometowns often do not comment on the heritage protection work, and even have a certain degree of resistance, the most critical factor is that the heritage protection and utilization work has not been carried out with the consideration of solving the pain points of people's livelihoods, especially the simultaneous promotion of the infrastructure and the enhancement of the living environment. Take Xiangshan Ancient City as an example, it needs to be upgraded in terms of land structure, population development, facility supply, public space, municipal transportation and living environment.

Therefore, in order to realize the sustainability of Xiangshan Ancient City, the protection work should also take into account the improvement of the living environment, which generally includes six aspects: infrastructure upgrading, improvement of public service facilities, decongestion of non-ancient city functions, governance of backstreets and alleys, classified renovation of buildings, and restoration of landscape environment. Guided by the principle of "comprehensive improvement" and centered on "people" [13], priority should be given to facilities, leaving no weaknesses behind.

4.4.3. Sustainability of space

By locally restoring the ecological and cultural space of the historical Xiangshan Ancient City [14], we aim to promote functional transformation and build an integral system of highlighting the mountains, brightening the water, constructing the city, expanding the lake, and rejuvenating the streets (Fig. 11).

Highlighting the mountains means to protect the circular texture pattern of the Yandun Mountain, restore historical memories, transform the three entrance spaces of Yandun Mountain, restore the park by combining with the Kanggong Temple site, and construct a cultural and creative arts block along the bank of Qijiang River and at the foot of Yandun Mountain.

Brightening the water refers to the restoration of the Jiuqu River, the improvement of the landscape on both sides, and the revitalization of Zhongshan's first electric plant (Diguang Electric Light Plant). We will renovate Yonganfang to form a refined and lively block characterized by water town style.

Constructing the city means to take the ring road of the Ming Dynasty city wall of the Xiangshan Ancient City as the starting point to renovate the seven historical areas along the route.

Expanding the lake means to relocate Guangming Market and move wholesale and logistics functions to other areas. The Yixian Lake will be expanded, and the Hougang Stream will be restored to connect with the Qijiang River and the Yixian Lake, forming a diversified space of water dock.

Revitalizing the streets means proposing plans for facade renovation and business updates, taking the arcade-style streets such as Sunwen West Road and Taiping Road as examples. The goal is to create an external showcase for the historical urban area and foster an open-air living district with the charm of urban life.

Fig.11. Overall style and feature system of Xiangshan Ancient City

4.4.4. Sustainability of industry

There are a large number of vacant public houses and overseas Chinese houses in Xiangshan Ancient City, so on the basis of resource mapping, repair and remediation, further consideration should be given to the revitalization and utilization of these architectural heritage. The promotion of rent through the upgrading of the industry can not only improve the reality of insufficient funds for the protection of heritage, but also help to promote the localization of employment, so that manpower, intelligence and capital will flow back to the local area [15], thus restoring the vitality and attractiveness of the ancient city.

Firstly, promote the reuse of public housing. First of all, for vacant public housing, such as the former municipal party committee building, workers' cultural palace, Sihao Hotel, Hongqi Cinema, Zhongshan Department Store, etc., we will conduct unified planning and introduce new industry forms. In addition, we will promote the construction of demonstration areas for the utilization of public housing, select public housing clusters to collect and store sandwich houses, adjacent houses, etc., and promote the overall renovation and reuse of contiguous public housing. Finally, we will implement the relocation of government-subsidized housing in a distributed manner.

Secondly, improve the current industry type. At present, the overall industry type in Xiangshan Ancient City is relatively low-end, especially the Sunwen West Road, which is the most concentrated historical resources and the most prominent historical value characteristics in the ancient city. At the same time, the vacancy rate of the second and third floors and the rooftop is very high, and the business activity is not enough for most of the arcade streets in the ancient city. In view of the above analysis, the promotion of the industry type of Xiangshan Ancient City should give priority to the development of cultural industry types and time-honored brands, so as to form the complex industry model.

4.4.5. Sustainability of society

The protection and inheritance of overseas Chinese hometown cultural heritage for sustainability emphasizes the construction of overseas Chinese social space, pays attention to the intricate but powerful social network relations in overseas Chinese society, strengthens the emotional connection of overseas Chinese, their descendants and residents to the overseas Chinese region and overseas Chinese hometown cultural heritage, and reconstructs the "new social space".

One of the most prominent cultural features of Xiangshan region is its large number of overseas Chinese and returned overseas Chinese, numerous overseas Chinese-funded enterprises, numerous overseas Chinese donation projects, many pioneers of modern and contemporary overseas Chinese, and a wealth of cultural heritage related to overseas Chinese [16]. From the perspective of social space, to achieve sustainable protection and inheritance of overseas Chinese hometown cultural heritage within Xiangshan Ancient City, there are three core strategies.

Firstly, "gathering overseas Chinese through history" means fully understanding the uniqueness of overseas Chinese culture and deeply grasping its special spiritual connotations and characteristics of the times. Secondly, "using overseas Chinese as a bridge" involves promoting the construction of a network of building owners in overseas Chinese hometowns, leveraging new technologies, methods, and platforms to establish a relatively complete network system for building owners in overseas Chinese hometowns, and resolving the conflict of scattered property rights of architectural heritage. Thirdly, "nurturing overseas Chinese with overseas Chinese" involves organizing activities, strengthening propaganda and exchanges, and consolidating the hearts and strengths of overseas Chinese to attract their investments. This enhances the local identity of overseas Chinese and their descendants towards their hometowns. Meanwhile, it provides residents of overseas Chinese hometowns with a "stage" for social activities to make a contribution [17], bridging the trust gap between residents, between residents and the government, and strengthening their sense of belonging, identity, and cultural confidence towards the ancient city.

5. Conclusions

This research explores the protection and inheritance of overseas Chinese hometown cultural heritage from the perspective of sustainability, considering both material and social dimensions. This shift in approach is a reflection on the practical difficulties faced by the

protection of cultural heritage in the past. It not only enhances and improves the protection system for overseas Chinese hometown cultural heritage, but also represents a historic leap and transformation from traditional protection methods in China. Focusing on practical research in the protection of cultural heritage, although this research cannot be directly translated into relevant theoretical methods, it still provides a certain reference and basis for overseas Chinese hometowns that are currently facing difficulties in practical protection and utilization.

Appendices

Supplementary information to this article can be found online at http://www.zs.gov.cn/zswgxj/gkmlpt/content/2/2339/mpost_2339685.html#964

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Study on Refining Historical and Cultural Values of Urban and Rural Areas in Qinghai Province

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Abstract: Highly condensing the value and characteristics of urban and rural historical and cultural resources in Qinghai is crucial for building a preservation system. This study, focusing on Qinghai, excavates its value themes and summarizes its historical development's core values. Leveraging geography, history, and GIS, it analyzes cultural origins, lineages, and theme condensation. Integrating planning, heritage, and spatiotemporal development, 27 value features are extracted from politics, economy, society, science, culture, and geography. Ultimately, Qinghai's "Four Area" core value is condensed. This study aims to offer insights for recognizing the province's urban and rural cultural value and utilizing cultural heritage.
Keywords: Historical Culture, Historical Culture Protection and Inheritance System, Qinghai Province, Value Condensation

1. Introduction

Excellent traditional Chinese culture is the crystallisation of the wisdom and essence of Chinese civilisation, and is the root and soul of the Chinese nation. The urban and rural historical and cultural heritage of China carries the genes and bloodline of the Chinese nation, contains the great creativity, outstanding wisdom and common memory of the Chinese people, and is a powerful testimony to the continuity, innovation, unity, inclusiveness and peacefulness of Chinese civilisation. In the context of the new era and new journey, the cause of China's urban and rural history and culture protection and inheritance is currently experiencing its most favourable period of development in history, which is also the most critical period.

The systematic protection, utilisation and inheritance of historical and cultural heritage in urban and rural construction is of great significance to the continuation of the historical lineage, the promotion of high-quality development of urban and rural construction, the firming up of cultural self-confidence, the building of a strong socialist cultural country, and the realisation of the great rejuvenation of the Chinese nation in a comprehensive manner by means of Chinese-style modernisation. It is of great importance for Qinghai to explore and construct an urban and rural historical and cultural protection and inheritance system that can fully reflect the characteristics and lineage of Chinese civilisation development. Furthermore, it is vital for the province to research the value system with the province as a unit. This is because it is essential for Qinghai to be able to tell a good Chinese story on the cultural lineage of the whole country.

As a province with a diverse ethnic population, Qinghai has amassed a wealth of historical and cultural legacies, encompassing a multitude of styles and hues, over the centuries. These invaluable resources serve as a vital foundation for the formation of a unified Chinese identity and the safeguarding of the country's ecological integrity. The cultural value of the Qinghai region should be viewed in the context of the complete picture of China, which will be more magnificent and profound. This will have positive value and significance to the understanding of the development pattern of the region, and to the perception of the laws and trends of regional exchanges nowadays and even in the future.[1]

Currently, China's large-scale regional historical and cultural protection is in its nascent stages of development. Currently, the framework for a national urban and rural history and culture protection and inheritance system is being developed, with all provinces and municipalities taking the initiative in this regard. Cities and counties have implemented local responsibility for protection and inheritance work, and a three-level management system for urban and rural history and culture protection and inheritance is gradually being established. Nevertheless, it is necessary to reinforce the integrity of the national-provincial-municipal protection and inheritance system. The province's urban and rural historical and cultural protection and inheritance work lacks sufficient overall coordination and upward and downward linkage. A significant number of urban and rural heritages continue to exist that have not yet been included in the protection list.[2] Furthermore, heritage resources that reflect the historical memories and important cultural values associated with the 100th year of the founding of the Communist Party of China (CPC), the 70th year of the founding of New China, and the 40th year of the Reform and Opening-up period have yet to be fully explored and protected.

This study focuses on Qinghai Province in the context of China's national historical and cultural protection and inheritance system. It employs the principle of "value-based", emphasises multi-level, multi-faceted and continuity, and focuses on the main research line of vein sorting, heritage excavation, value condensation and system construction. The objective is to systematically sort out and excavate the historical stories, cultural values and spiritual connotations of Qinghai. The study analyses the natural and social contexts and the overall dynamic change process of Qinghai's historical and cultural space. It also conducts deeper interpretation and excavation of the historical and cultural connotations and values. Based on the value carrier, a future-oriented, large-scale historical and cultural value system is constructed for the purpose of historical and cultural protection and inheritance in urban and rural areas of Qinghai Province. This system provides ideas for the current cognition of the value of provincial urban and rural historical and cultural characteristics and cultural inheritance and utilisation.

2. Foundations and strategies for building a provincial historical and cultural value system

2.1 Core tasks of provincial historical and cultural preservation and inheritance in the new era

In the context of the new era, the protection and inheritance of historical and cultural resources is of particular importance. The core task is to clarify the three major issues of "what to protect, who to protect, and how to protect", and to focus on the construction of a perfect system of protection objects and a system of management systems.

Firstly, all kinds of historical and cultural heritage should be protected in a systematic and complete manner. A comprehensive census and sorting out will establish a map of the current status of historical and cultural resources in urban and rural areas of the province, as well as the implementation of protection measures. This will result in the formation of a unified database of the province's protection list, ensuring that historical and cultural resources are protected in a comprehensive and effective manner.[3]

Secondly, the revitalisation and utilisation of historical and cultural resources will be strengthened. It is of the utmost importance to conduct in-depth research and analysis of the

historical and cultural values and spiritual connotations inherent in all forms of historical and cultural heritage. This knowledge must be integrated into urban and rural construction, with the objective of promoting the preservation by use of historical and cultural resources. [4]Furthermore, the integration of preservation with use is essential to ensure that historical cultures continue to flourish in the modern
era.

The third and final step is the establishment of a comprehensive management system for the protection and transmission of historical and cultural resources. It is necessary to implement a hierarchical management system, to clarify the responsibilities of governments and authorities at all levels, and to strengthen the coordination capacity at the provincial level and the implementation capacity of cities and counties.[6] This will ensure that the protection work is carried out in an orderly manner.

In addition, five key tasks must be completed in the context of provincial historical and cultural protection and inheritance planning, as shown in Figure 1. These include determining values, types, patterns, themes and standards. By determining the value and characteristics of cultural resources, the foundation for protection and inheritance is established. The types of historical and cultural resources are identified, thereby ensuring the comprehensive coverage of the entire region and its constituent elements. The spatial pattern of protection and inheritance is determined, and The structural requirements for protection are proposed, the theme of display and interpretation is determined in relation to the historical and cultural values and characteristics of the province, and the standards for the work of cities and counties are established in order to ensure that protection and inheritance work is implemented in an appropriate manner.

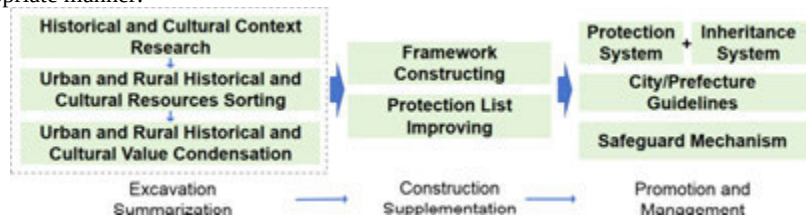

Figure 1 General Framework of Qinghai Urban and Rural Historical and Cultural Protection and Inheritance System

2.2 Provincial Historical and Cultural Value Refinement and System Construction Strategy

The implementation of the requirements set forth by General Secretary Xi Jinping in his "three favourable aspects" directive. In order to fulfil the requirements of "being conducive to highlighting the historical and cultural values of Chinese civilisation, reflecting the spiritual pursuits of the Chinese nation, and presenting a comprehensive and authentic picture of ancient and modern China to the world", it is necessary to distil the value elements and key messages, and condense the core values.

The value system is derived from the overall development of Chinese civilisation, taking into account the historical, cultural, spiritual and contemporary aspects of Chinese civilisation. The research framework of the National System of the Ministry of Housing and Construction was employed, with the five historical stages of 5,000 years of ancient civilisation, 180 years of modern history, 100 years of the founding of the Communist Party of China (CPC), 70 years of

the founding of the New China, and 40 years of reform and opening up serving as the basis for the comprehensive sorting out of the historical and cultural development lineage and the condensation of the core values.

Systematically study the historical and cultural values of urban and rural areas from a multi-dimensional perspective. In the process of constructing the historical and cultural value system, Fernand Braudel's holistic view of history was introduced. This was subsequently deployed by General Secretary Xi Jinping in the report of the 19th CPC National Congress, in which he outlined the overall pattern of "comprehensively advancing the construction of economy, governance, culture, society and ecological civilisation". Similarly, historian Huang Renyu introduced the overall pattern of "promoting economic construction, governance, culture, society and ecological civilisation" in the aforementioned report. The overall pattern can be described as follows. Historian Huang Renyu proposed that history is the need to analyse the whole long period of time. He argued that history is not an isolated event, but rather that there are intrinsic laws and connections. In order to grasp the micro-objects, it is necessary to focus on historical structural changes and long-term development trends. This approach allows one to reveal the laws of history and the concept of big history. Furthermore, the Ministry of Housing and Construction's "national system" research, which established the "five categories" (political, economic, social, scientific, technological and cultural, geographic), and the "fifteen themes" (state power, Institutional civilisation, national rituals, agricultural economy, handicrafts and industrial development, The framework encompasses trade and commercial exchanges, social organisation, ethnic integration, ideology and culture, religious beliefs, literature and art, science and technology, cities and architecture, natural geography and humanities geography. It is designed to facilitate the systematic.

3 Tracing the Historical and Cultural Threads of Qinghai Province

3.1 Overview of Qinghai Province

The province of Qinghai, abbreviated as "Qing", is named after Qinghai Lake, the largest inland saltwater lake in China. The spatial scope of the study is the administrative area of Qinghai Province, which has a total area of 722,300 square kilometres, accounting for one-thirteenth of the country's total area and ranking fourth in the country. Furthermore, the province is endowed with a wealth of natural resources, including petroleum, potash, and lithium, as well as substantial hydroelectric and solar energy reserves. These resources provide a robust foundation for the development of a world-class salt lake industrial zone and a national clean energy industrial hub. Additionally, Qinghai is situated in the northeastern region of the Qinghai-Tibetan Plateau, with a topography that is elevated in the west and low in the east. It is renowned as the "source of rivers" and "Chinese water tower," which has fostered the growth of world-class tourism resources, including the source of the Three Rivers and Qinghai Lake. The natural and humanistic geographic pattern of Qinghai Province is defined by the presence of Qinghai Lake, the Yellow River, Yangtze River, Lancang River, Kunlun Mountain Range, Qilian Mountain Range, Tanggula Mountain Range, a lake, three rivers and three veins. Furthermore, Qinghai is home to a diverse array of ethnic minorities, who live in a region characterised by cultural diversity, unique customs, and the presence of numerous religious traditions.[5] These distinctive geographic and cultural traits serve as a vital link between Tibet, Xinjiang, and the mainland, as shown in Figure 2.

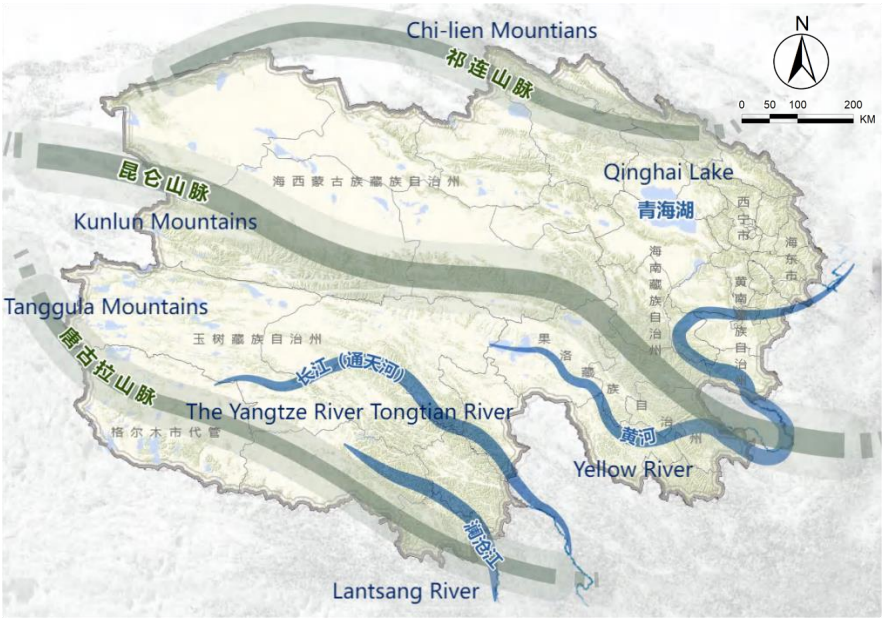

Figure 2 Natural and human geography of Qinghai Province

3.2 Composition and Spatial Distribution Characteristics of Urban and Rural Historical and Cultural Heritage in Qinghai Province

As a province inhabited by a multitude of ethnic groups, Qinghai has amassed a historical and cultural legacy of diverse styles, rich in colour and invaluable in its contribution to the formation of the Chinese nation and the safeguarding of the country's ecological security.[5]

3.2.1 General Situation of Heritage Composition

As of October 2023, Qinghai has one national historical and cultural city, four provincial historical and cultural cities, one Chinese historical and cultural town, nine provincial historical and cultural towns, five Chinese historical and cultural villages, thirty-three provincial historical and cultural villages, eighteen Chinese traditional villages, four historical and cultural districts, and one national scenic spot. Additionally, there are fifty-one national key cultural relics protection units. A total of 466 provincial cultural relics protection units and 6,411 immovable cultural relics have been identified. Additionally, there are 51 national key cultural relics protection units, 466 provincial cultural relics protection units, 6,411 immovable cultural relics, one world natural heritage site, two national industrial heritage sites, and 88 national intangible cultural heritages. These have been the subject of initial protection systems comprising a variety of elements and cultural values, which have effectively safeguarded a significant number of precious urban and rural historical and cultural heritages. The Qinghai region has been at the forefront of exploring and innovating the concept and method of protection and inheritance, particularly in the context of Chinese civilisation exploration, Huangshi culture heritage, the promotion of the "two bombs and one star" spirit, the construction of the plateau beautiful town, and other related fields. This has resulted in the

formation of numerous exemplary cases of protection and inheritance, which have collectively accumulated a wealth of experience.

3.2.2 Spatial Distribution Characteristics of Resources

The distribution of historical and cultural cities, historical and cultural towns, historical and cultural villages, and traditional villages is largely concentrated in the basin and valley areas, particularly in the Huangshui River Basin, where they are particularly dense. The Tongtian River (Yangtze River), the Yellow River, and the Zhaqu (Lancang River) are also located in the river valley basin.

Cultural relics protection units are distributed in the basin and valley area, with a concentration in the Huangshui River Basin, which is particularly rich in such sites, as well as in the Tongtian River (Yangtze River), the Yellow River, and the Zhaqu (Lancang River) along the river valley basin.

The majority of scenic spots are situated in mountain ranges and along rivers, particularly in the vicinity of the Yellow River, which is particularly dense. Other notable locations include the Qilian Mountains and the Kunlun Mountains.

The Silk Road (Qinghai) cultural belt is predominantly located in the river valley and basin areas, with the Huangshuang Basin representing a particularly dense concentration. The Qinghai-Tibet Railway Culture Belt is primarily concentrated in the basin and along the railway line, with the Huangshui Basin exhibiting the highest density. The Tangfan ancient road culture belt is distributed in the basin and valley area, with a particularly dense concentration in the Huangshui Basin. It also extends along the Tongtian River (Yangtze River), the Yellow River, and the Zachu (Lancang River) in the valley area.

Other remains are distributed in the basin, valley and along the belt, with a particular concentration in the Huangshuo Basin. Additionally, the Tongtian River (Yangtze River), the Yellow River, and the Zachu (Lancang River) are located along the valley, along the Qinghai-Tibet Railway, and in other zones, as shown in Figure 3.

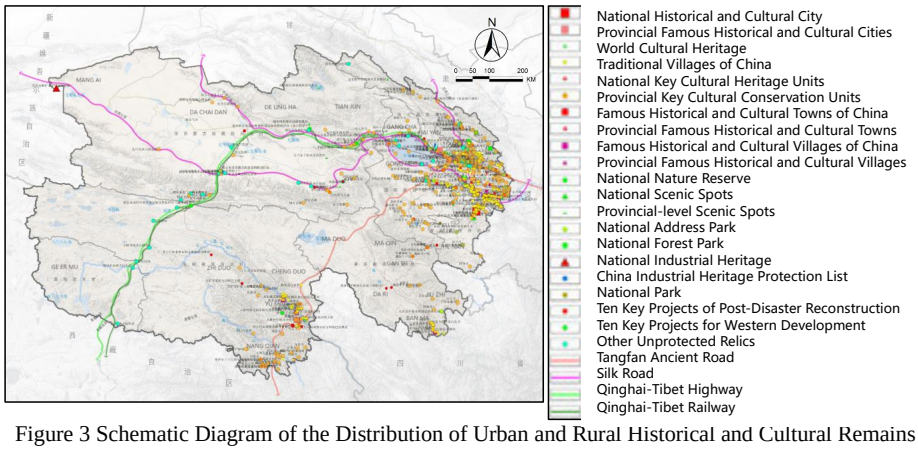

Figure 3 Schematic Diagram of the Distribution of Urban and Rural Historical and Cultural Remains

3.3 The Historical and Cultural Lineage and Phased Characteristics of Qinghai Province

Based on literature and historical materials, the latest archaeological data, historical relics and existing research results, it carries out thematic studies on politics, economy, society, science and technology, culture, geography and other aspects, and systematically sorts out the historical and cultural lineage of Qinghai, as shown in Figure 4 and 5.

3.3.1 From Prehistory to the Han Dynasty: The Emergence of Agriculture and Animal Husbandry in Qiang Region, and the Penetration of Central Plains Culture

From Xia to Shang to Zhou, Qinghai was the "Qiang land of the Xirong clan", and the Qiang people lived by hunting and herding, then turned to agriculture under the influence of Central Plain culture. During the Qin and Han dynasties, the Xiongnu expanded their power and the Qiang people of Qinghai became a force in their attacks on the Han dynasty. When Emperor Wu of the Han Dynasty successfully counterattacked the Xiongnu, the Western Han began to build cities with tunnels in the Huanghe Valley and established Pavilion County, gradually bringing the Huanghe area under the rule of the Central Plains. After the Eastern Han Dynasty, Jincheng and Xiping County (now Xining) were established, and Xining became a major military city, consolidating the western frontier.[5]

At the same time, the Qiang people in the nomadic life, opened to all parts of the traffic road, such as "Huanghuanzhong Road", "Henan Road" and "Qiangzhong Road", these roads to the centre of Qinghai Lake, connecting the four sides, forming a net-like structure. These roads, centred on Qinghai Lake, connected the four directions and formed a net-like structure, providing convenient transportation for Qinghai and the northwestern region. The Qiangzhong Road was particularly unique, as it not only connected the north, west and south, but also led to Zhangye through the Dadubai Valley, making it an important transport route in ancient times.

3.3.2 From the Wei-Jin Period to the Late Tang Dynasty: Frequent Political Changes and Remarkable Cultural Integration

From Wei Jin to the end of the Tang dynasty, Qinghai experienced regime change and cultural fusion. The Xianbei tribes moved in and established the southern Liang state, which was controlled by the northern Wei dynasty, and then established the Shanshan state. The rise of the Tugukhun, a vast territory and close interaction with the central dynasties, had far-reaching effects. After the unification of the Sui Dynasty, Shanshan Prefecture was transformed into Xiping County, and Emperor Yang's personal conquest led to the decline of the Tugukhun. At the beginning of the Tang Dynasty, Li Jing surrendered to the Tugukhun, and the Tang-Fan Road was opened, promoting exchanges between China and foreign countries. The rise of Tubo, the destruction of the Tugukhun, Qinghai has become an important source of horses, tea and horse market prosperity. After the Anshi Rebellion, the Tubo occupied Qinghai, and various ethnic groups integrated into the Tubo, forming a new cultural landscape. The tombs are rich in excavated artefacts, showing the unique charm of Qinghai culture under Tubo rule. At the end of the Tang Dynasty, the internal turmoil of the Tubo brought Qinghai into a new stage of history.

3.3.3 From the Song to Yuan Dynasties: The Process of Political Unification and Deepening Ethnic Integration

During the Northern Song Dynasty, Guosiluo established the Qingtang regime in Qinghai with Tibetans as the main body, integrating Han, Huihe, Dangxiang and other ethnic groups, thus ending a long period of chaos. The rulers attached great importance to the lines of communication between China and the West, and maintained exchanges between the western regions and the central plains. During the reign of Emperor Huizong of Song, the Guosiluo regime was destroyed and the name Xining was adopted. The Song Dynasty followed the Tang system, and the Old Tea Horse Road was further developed, increasing economic and cultural exchanges. In the Yuan Dynasty, the unified situation encouraged ethnic migration and integration. Western Muslims moved to Qinghai, and Islam was introduced and spread there. During this period, the Qinghai region underwent historical changes from local regime to national unity, from ethnic dispersal to integration and development.

3.3.4 From the Ming and Qing dynasties to the Republic of China period, Establishment of the Great Wall Defense and the Transformation of Qinghai Province

During the Ming Dynasty, to ensure the security of the Huangshui area, the Ming army built the Great Wall, which is over 330 kilometres long, and formed a complete defence system with castles, beacon flints and other facilities. At the end of the Ming dynasty, the Heshuit Mongol Ministry entered and ruled Qinghai, promoting the Gelugpa school of Tibetan Buddhism. In the Qing Dynasty, the government introduced the Alliance Flag System, which further strengthened the administration of Qinghai and promoted the economic and cultural development of all ethnic groups. At the same time, the Tea Horse Road flourished during this period, becoming an important trade route between the Chinese and Tibetan regions. During the Republic of China period, Qinghai experienced nearly 40 years of rule by the Ma family warlords, during which time Qinghai was officially established as a province. In 1936, the West Road Army fought hard in Qinghai, and although some of the soldiers were captured and persecuted, their revolutionary spirit lives on, engraving their beliefs on the flower bricks and leaving a deep revolutionary imprint. Rescued by the Party Central Committee and all parties, many of the soldiers eventually survived, and the heroic deeds of the West Road Army soldiers have written a most heroic and tragic chapter in the history of the Chinese revolution.

3.3.5 From the Founding of the People's Republic of China to the Present: Ethnic Unity, Social Harmony, and the Increasing Prominence of Strategic Status

Xining was liberated in 1949 and the Qinghai Provincial People's Government was established in 1950. The Qinghai Provincial Party Committee actively implemented the Party's ethnic policy and promoted comprehensive economic and social development under the guidance of "prudence and steady progress". Under the supervision of the Party Central Committee, Qinghai explored resources, promoted national defence science and technology, and carried out construction, which not only transformed Qinghai's backwardness, but also cultivated the spirit of "Two Roads", "Two Bombs and One Star", "Qaidam" and "Xiaogaoling", which inspired people of all ethnic groups. It is a vivid interpretation of the Party's glorious history in Qinghai during the period of socialist revolution and construction, which inspires and encourages generations of builders and achievers from all walks of life to root themselves in Qinghai and devote themselves to Qinghai.[1]

Qinghai's vast territory and complex climate and geography are the bottlenecks limiting economic development. Reform and opening-up have brought new opportunities to Qinghai. Qinghai's transportation network has been greatly expanded, with highways, railways and aviation facilities becoming more and more perfect, and the Qinghai-Tibet Railway has become

a world-renowned plateau railway. Qinghai has become the transport hub of the Qinghai-Tibet Plateau, laying a solid foundation for economic development.

In recent years, based on the strategic position of "three more important", Qinghai Province has made clear the goal of building "four places" with clean energy industry highland to promote high-quality development. Qinghai has made remarkable achievements in clean energy, big data, agriculture and tourism, and has become a nationally recognised economic highland. These achievements have not only enhanced Qinghai's comprehensive strength, but also contributed to the comprehensive construction of a modern socialist country.

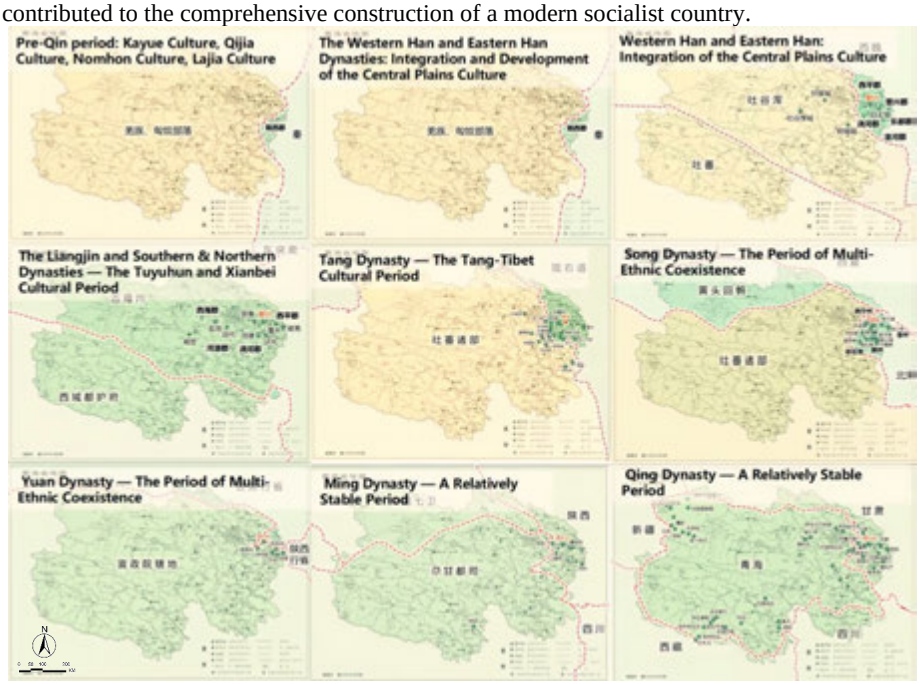

Figure 4 Historical Evolution from Pre-Qin to Qing Dynasties

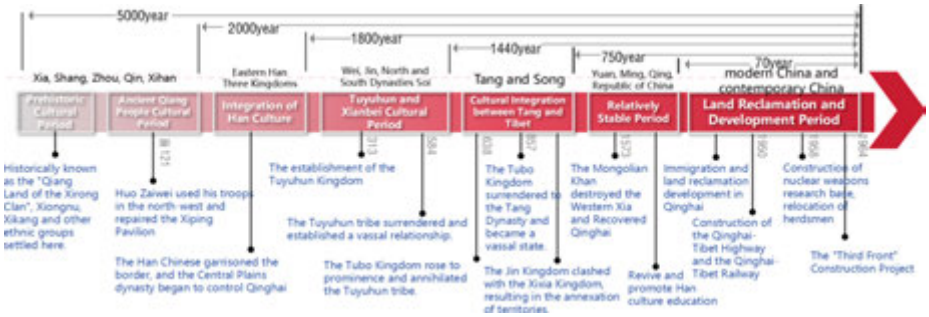

Figure 5 Schematic Diagram of the Distribution of Urban and Rural Historical and Cultural Remains

3.4 The Formation Mechanism of the Historical and Cultural Values in Qinghai

Located at the crossroads of agricultural and nomadic cultures, Qinghai played an important role in the formation and development of the unified multi-ethnic state of ancient China. A number of traditional settlements in Qinghai are important testimonies to the social patterns of multi-ethnic, multi-religious and multi-cultural mixing in Qinghai.

4. Condensation and Framework Construction of Urban and Rural Historical and Cultural Values in Qinghai Province

4.1 Identification and Organisation of the Characteristics of Historical and Cultural Values

From the birth of human civilisation to the new era of scientific and technological innovation selected 24 representative historical events and other five historical veins and spatial and temporal evolution combing, clear Qinghai in the national urban and rural historical and cultural protection and inheritance system, the Yellow River Cultural Corridor, the Silk Road Cultural Corridor, and other national and regional cultural protection system in the positioning, and based on the national and provincial relevant policies and documents, condensed on behalf of the historical and cultural values of Qinghai Province, as shown in Figure 6.

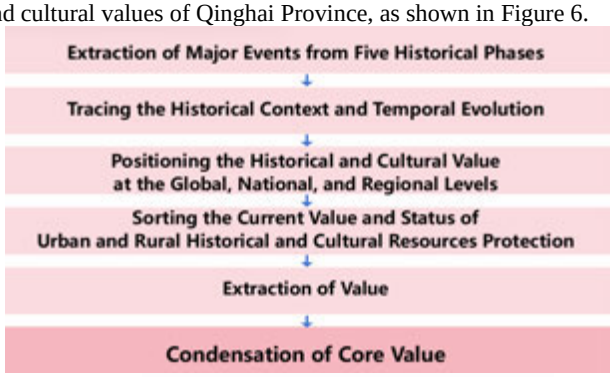

Figure 6 Pathway to Condensing the Values of Qinghai

4.2 Condensing Historical and Cultural Values

The study systematically combed through the five stages of historical development of Anhui Province: 5000 years of ancient civilisation, 180 years of modern times, 100 years of the founding of the Party, 70 years of the founding of New China, and 40 years of reform and opening up, and identified the typical value characteristics of urban and rural history and culture in Anhui Province in terms of five categories: politics, geography, society, economy, science and technology, and five aspects of state power, institutional civilisation, national rituals, agricultural economy, handicrafts, trade and commercial exchanges, social organisations and strata, Chinese nation, ideology and culture. Religious beliefs, literature and art, science and technology, urban architecture, natural geography, human landscape and other fifteen aspects[8][9][10], condensing the typical value characteristics of urban and rural historical and cultural features of Qinghai, and constructing the "5 categories-15 themes-27 characteristics" of Qinghai's historical and cultural value system, as shown in Table 1. The value system of Qinghai's history and culture is constructed with "5 categories-15 themes-27 characteristics", as shown in Table 1.

Table 1 The Historical and Cultural Value System of Qinghai Province

Number	Value categories (5)	Value themes (15)	Value characteristics (27)
1	Political Category	National Governance	1 Prehistoric cultural sites, represented by Lajia Site and Liuwan Site, are significant historical witnesses to the origin of Chinese civilisation in Qinghai. The Hehuang culture in eastern Qinghai is an important symbol of the human civilisation process at the source of the Yellow River and a crucial part of the Yellow River civilisation system.
			2 Qinghai, located at the junction of farming and nomadic cultures, served as an important strategic fulcrum for the Central Plains dynasties to govern the Qinghai-Tibet Plateau, playing a vital role in the formation and development of the unified multi-ethnic country in ancient China.
			3 The Red Army's Second and Fourth Front Armies and the Western Route Army left an epic chapter of battle in Qinghai. The liberation of Qinghai had a profound impact on the liberation of Ningxia, Gansu, and even the peaceful liberation of Xinjiang, Tibet, and other regions.
2		Institutional Civilisation	4 Qinghai is a typical region where the ancient unified country adopted a variety of governance systems such as prefectures and counties, native chieftaincies, chieftaincy households, and alliance banners in multi-ethnic areas.
			5 Qinghai is a typical region where the Central Plains dynasties implemented systems such as garrison farming and garrison institutions in the western region.
3		National Etiquette	6 "Sea Worship" at Qinghai Lake was a national sacrificial system implemented by the Qing Dynasty to enhance national identity and promote ethnic integration among multi-ethnic regions in Qinghai.
4	Economic Category	Agricultural Economy	7 The Hehuang region in eastern Qinghai was an important garrison area of the Central Plains dynasties on the Qinghai-Tibet Plateau and a typical representative of plateau agricultural development in China.
			8 Qinghai's unique geographical environment possesses tremendous advantages for developing animal husbandry. It was one of the main sources of military horses for ancient China's Central Plains and remains one of the four major pastoral areas in China.
5		Development of Handicrafts and Industrial & Information Industries	9 “Qing Embroidery” represented by Tu Nationality Pan Embroidery, Tibetan Embroidery, Danggar Leather Embroidery, Salar Embroidery, Hui Embroidery, and Hehuang Embroidery, along with traditional crafts such as Jiaya Tibetan Carpet Weaving, Tibetan Black Pottery Firing, and

			Traditional Barley Wine Brewing, showcase Qinghai's ethnic-specific, profound, and diversified handicraft system.
			10 Qinghai is the most resource-rich region of salt lakes in the world, with comprehensive development conditions for hydropower, solar energy, and wind energy ranking among the best in the country. It is a crucial salt chemical and clean energy industrial hub for China's modern industrial development.
6		Trade and Commerce Exchange	11 The "Qinghai Route" of the Silk Road and the Tang-Tibet Ancient Road are important passageways connecting the hinterland of the Central Plains to Xinjiang and Tibet. The Riyueshan Market Exchange in the Tang Dynasty and the tea-horse trade during the Song and Ming Dynasties were significant commercial exchange methods between the agricultural areas of the Central Plains and the nomadic areas of the Qinghai-Tibet Plateau.
7	Social Category	Social Organisations and Classes	12 Traditional villages represented by Tibetan Dianda Village, Tu Nationality Guomari Village, Salar Dazhuang Village, and Hui Nationality Hongshuiquan Village are crucial witnesses to Qinghai's multi-ethnic gathering, coexistence of multiple religions, and cultural integration.
			13 After the founding of New China, the Tibetan regions of Qinghai were the first to transition from feudal serfdom to socialism, serving as an important witness to the leapfrog social and economic development of ethnic regions in China.
8		Ethnic Integration	14 Qinghai has been an important region for the integration and development of multiple ethnic groups since ancient times. Modern Qinghai features the harmonious coexistence of Han, Tibetan, Mongolian, Hui, Tu, and Salar ethnic groups, and it has the largest proportion of nationally autonomous areas and the highest percentage of ethnic minority populations in the country.
			15 The Princess Wencheng's route to Tibet and related cultural relics, represented by the Tang-Tibet Ancient Road, Riyueshan, and Beidari Tathagata Grottoes, are crucial witnesses to the long history of exchanges and integration between the Han and Tibetan ethnic groups.
9	Science, Technology, and Culture Category	Ideology and Culture	16 Qinghai is an important place for inheriting and promoting the red genes of the Long March Spirit, the West Road Army Spirit, the "Two Roads" Spirit, and the "Two Bombs and One Satellite" Spirit.
10		Religious Beliefs	17 Qinghai is a significant region for the dissemination and development of Tibetan Buddhism and Islam. Ta'er Monastery, Qutan

			Monastery, Longwu Monastery, and Dongguan Grand Mosque are important witnesses to the harmonious coexistence of multiple religions.
11		Literature and Art	18 Qinghai boasts a rich and diverse multi-ethnic culture, represented by literary works such as "Gesar" and "Camel Spring Legend", performing arts like Flower Songs, Tibetan Opera, and Jianzha Folk Songs, and painting and plastic arts exemplified by Regong Art, Beidari Tathagata Grottoes, and Lebago Cliff Carvings. These are outstanding representatives of ethnic literary and artistic achievements.
12		Science and Technology	19 Qinghai Jinyin Beach is China's first nuclear weapon research and development base, and the cradle of China's atomic energy industry.
			20 The Qinghai-Tibet Railway is the highest and longest plateau railway in the world, achieving numerous "firsts" both domestically and internationally. It is one of the four major projects of China's new era.
			21 Astronomical and medical achievements represented by "Ma Yang Temple Han Calendar Essentials," "Essentials of the Kalachakra Calendar," and Tibetan medical bath therapy are typical representatives of the technological development of ethnic minorities in history.
13		Cities and Architecture	22 Traditional settlements like Tongren Longwu Ancient City, Xunhua Jiezi Town, and Tongren Guomari Village, as well as traditional dwellings like Jianzha Nangla Qianhu Compound and Xunhua Mengda Salar Ancient Residential Groups, are typical representatives of natural adaptive human settlements in China's cold and arid plateau regions, serving as practical examples of traditional wisdom in landscape and cultural construction.
			23 The reconstruction of Yushu is the largest and most effective disaster relief operation and reconstruction project ever undertaken by humans in cold and high-altitude areas, serving as a model for urban construction in the ecologically fragile regions of the Qinghai-Tibet Plateau.
14	Geographic Category	Physical Geography	24 Qinghai is a strategic region for safeguarding national ecological security, undertaking the significant mission of protecting ecological security, the source regions of the Three Rivers, and the "Water Tower of China."
			25 Qinghai is the region with the most concentrated biodiversity in the world's high-altitude areas, serving as the primary habitat for endangered and rare wild animals such as Tibetan antelopes, snow leopards, and Przewalski's gazelles.

15		Human Geography	26 The Kunlun Mountains are considered the "ancestor of all mountains" and the "source of culture" in the collective memory of the Chinese nation. The Qilian Mountains, Bayan Har Mountains, Animaqing Mountains, and Tanggula Mountains are important regional cultural and geographical landmarks.
			27 Qinghai Lake, anciently known as "Xihai," is the largest inland saltwater lake in China, renowned as "the most beautiful lake in China."

5. Core Values and Conclusion

5.1 Core Values of the 'Four Area'

Consolidate the five categories of values of Qinghai Province, condense the core values of Qinghai from the main line of "Four Area", interpret Qinghai based on the special geographical pattern of "one lake, three rivers and three veins", and take on a special mission in the development of Chinese civilisation and the long history of national integration, which is of outstanding significance. It is of outstanding significance to clarify the value and support of Qinghai in the national urban and rural historical and cultural protection and inheritance system.

National ecological safety strategy: "Protecting the ecological environment of Qinghai is 'the most important thing of the country'", and Qinghai has the important task of maintaining ecological security, protecting the source of the Sanjiang River and protecting the "Chinese Water Tower". The mission.

Qinghai is the province with the highest proportion of ethnic minorities, and has a deep history of interaction and exchange among various ethnic groups in western China, which has played an important role in strengthening the sense of community among the Chinese nation.

Where the Red Spirit genealogy is carried forward: Qinghai is an important area for the inheritance and promotion of the Red Spirit, such as the Spirit of the Long March, the Spirit of the Western Road Army, the Spirit of Two Bullets and One Star, the Spirit of the Two Roads, and the Spirit of Yushu Earthquake Rescue and Disaster Relief.

Plateau Habitat Wisdom Inheritance: Qinghai people of all ethnic groups have created regional habitat wisdom adapted to the cold and arid environment of the Qinghai-Tibet Plateau and coexisting harmoniously with nature through long-term production and living practices, forming a rich and varied urban and rural heritage.

5.2 Conclusion

China's original hierarchical classification of historical and cultural heritage protection system has certain limitations, through the provincial level of historical and cultural protection and inheritance planning, can achieve regional coordination, the whole area of the whole elements of the protection of the work of the foundation, has an important practical value. Provincial-level protection and inheritance planning can not achieve the depth of complete excavation and specific positioning of the protection content, the key is to do a good job in coordinating the role of the top and the bottom. This paper combines the methods of geography, history and GIS, analyses the origin of culture, cultural lineage and theme content condensation, and combines

the relevant planning and historical and cultural heritage of time and space evolution characteristics, from the political, economic, social, scientific and technological culture, geography, five aspects of the summary distillation of 27 value characteristics. Finally, the historical and cultural value system of Qinghai with "5 categories - 15 themes-27features" was constructed, and the core values of Qinghai in "Four Area" were integrated and condensed: national ecological security, strategic region, national unity, integration and blending. The core values of Qinghai are integrated and condensed into four areas: national ecological security strategy area; ethnic unity integration and intermingling area; red spirit genealogy promotion area; and plateau habitat wisdom inheritance area. Combined with the exploration of the preparation of Qinghai Province's protection and inheritance planning work, it is intended to provide ideas for the recognition of the value of the historical and cultural characteristics of urban and rural areas at the provincial level and the use of cultural inheritance.

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Notes

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Research on the Construction of the Tang-Tibet Ancient Road (Qinghai Section) Heritage Corridor from the Perspective of Cultural Ecology

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Abstract: In the context of advancing the construction of the Belt and Road, the preservation and perpetuation of the Tang-Tibet Ancient Road holds immense significance in promoting development in the Western region. The Qinghai section, with its abundant cultural heritage, has emerged as the focal point for the cultural preservation. However, the current development and preservation efforts lack a comprehensive analysis and evaluation of heritage resources. This paper takes a cultural ecology perspective as its starting point and conducts a comprehensive survey of existing natural and cultural heritage sites along the Ancient Road. Additionally, it utilizes spatial analysis tools to analyse the accessibility and suitability of the corridor space. Ultimately, this paper constructs a cohesive cultural heritage corridor for the Tang-Tibet Ancient Road.

Keywords: Tang-Tibet Ancient Road, heritage corridor, cultural ecology, linear cultural heritage

1. Introduction

In the era of globalization and modernization, the preservation and transmission of cultural heritage are increasingly receiving extensive attention from the international community. As a carrier of human history and civilization, cultural heritage not only has profound historical, artistic and scientific values, but also serves as a symbol of the spirit of a country. Nevertheless, the development of urbanization has resulted in the continued monolithic and isolated mode of conservation of the majority of cultural heritage[1]. Consequently, the effective safeguarding and transmission of cultural heritage have emerged as a pressing contemporary concern.

Cultural ecosystems are integrated systems in which people and culture, culture and nature, and culture and society are closely linked[2]. It focuses on the relationship between culture and the natural ecology in which it is located and its changes[3]. It emphasizes the organic interaction between humans, culture and the physical environment. The concept of heritage corridors was first proposed by American scholars as a strategic approach to the overall protection of regional historical and cultural heritage and its natural environment[4]. The construction of heritage corridors emphasizes ecological integrity and cultural heritage continuity, connecting natural landscapes with cultural heritage, while integrating recreational, educational, aesthetic and other functions [5]. This integration enables the historical and cultural heritage to be integrated with regional spatial characteristics.

The Tang-Tibet Ancient Road, an ancient route connecting the Central Plains with Tibet, has been witness to numerous significant historical events in Chinese history. As a significant component of the Tang-Tibet Ancient Road, the Qinghai section encompasses a multitude of historical artefacts, ethnic settlements and natural landscapes along the route. Nevertheless, in the context of changing times and external environmental factors, these cultural heritages confront a multitude of challenges and threats.

This paper adopts a cultural ecology perspective to delve deeply into the theory and implementation of heritage corridor construction. It explores the profound cultural significance of the Tang-Tibet Ancient Road and delineates a potential heritage corridor space with the technical assistance of ArcGIS 10.8. Ultimately, it constructs a heritage corridor of the Tang-

Tibet Ancient Road. The objective is to promote the protection and inheritance of heritage resources along the Tang-Tibet Ancient Road.

2. Overview of the Qinghai section of the Tang-Tibet Ancient Road and basic data

2.1 Overview of the study area

The Tang-Tibet Ancient Road stretches for over 3,000 kilometers, traversing five provinces including Shaanxi, Gansu, Qinghai, Sichuan, and Tibet, with the Qinghai segment constituting more than half of its total length. After reviewing a large amount of data to sort out the route of the Tang-Tibet Ancient Road within the territory of ancient Qinghai [6-8], the specific scope of this study encompasses administrative regions such as Minhe Hui Autonomous County, Ledu District, Huzhu Tu Autonomous County, Ping'an District, Xining City, Huangyuan County, Gonghe County, Xinghai County, Maduo County, Chengduo County, Yushu City, as well as Zaduo County(Figure 1).

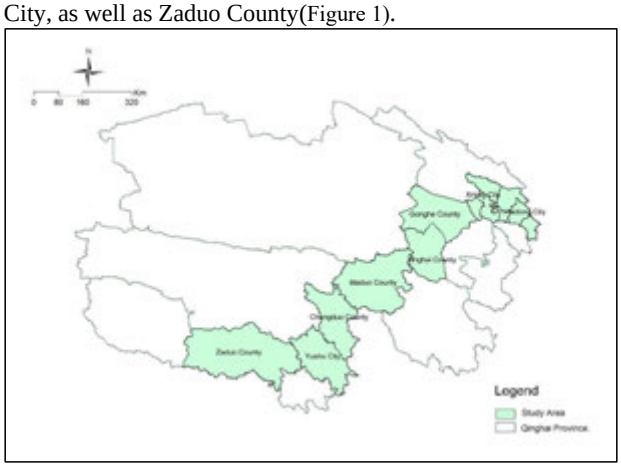


Figure 1 Study Area

The Qinghai section of the Tang-Tibet Ancient Road is an integral and significant component of the route. Its rich natural and cultural heritage serving as an evidence to the grandeur of ancient civilization and the harmonious cultural exchange between Chinese and Tibetan peoples [9]. The Qinghai section of the Tang-Tibet Ancient Road is indelibly marked by the interdependence of its millennia-old cultural heritage and ecological environment.

2.2 Data sources

The data required for the study include: (1) DEM digital elevation data and land use type data of the study area in 2022, obtained from the Geospatial Data Cloud of the Chinese Academy of Sciences (http://www.gscloud.cn); (2) Information on cultural and natural heritage sites, such as cultural relics protection units, traditional villages and scenic spots at all levels, obtained from the cultural and tourism bureaus of prefectures and municipalities in Qinghai; (3) Road traffic and water system data obtained from the Open Street Map platform (https://www.openstreetmap.org/); (4) POI data of public service facilities, such as restaurants, hotels and car parks, obtained from the Baidu Map platform.

3. Research Ideas and Methods

3.1 Research ideas

This paper aims to establish a comprehensive and scientifically sound heritage corridor for the Tang-Tibet Ancient Road. We employ the Analytic Hierarchy Process to quantitatively evaluate and classify the natural and cultural heritage resources. Then, the spatial distribution of heritage resources at all levels was analyzed using GIS kernel density. A comprehensive resistance surface was created to conduct in-depth research on spatial resistance patterns related to corridor construction. A potential Tang Tibetan ancient road heritage corridor network was identified and constructed using cost connectivity tools. Finally, considering environmental sustainability and the preservation of cultural diversity, we propose a heritage corridor protection strategy that integrates macro-strategic considerations with the micro-level requirements of urban development. This strategy aims to foster the overall rejuvenation and enduring prosperity of the Tang-Tibet Ancient Road region.

3.2 Research methodology

The advancement of science and technology has significantly propelled the innovation of heritage resource research methods. Approaches, such as the Analytic Hierarchy Process (AHP), Kernel Density Analysis (KDE), and Minimum Cumulative Resistance model (MCR), have gained widespread adoption among international scholars for conducting in-depth investigations and establishing heritage corridors.

The Analytic Hierarchy Process (AHP), originally introduced by Thomas L. Saaty in the 1970s, is a multi-criteria decision analysis technique that integrates qualitative and quantitative aspects. In the context of heritage assessment, it effectively constructs a hierarchical model of heritage value by establishing a quantitative weighting system through the comparison of varying indicator importance levels[10]. This study incorporates ecological indicators, emphasizing the significance of heritage within the ecological environment and its harmonization with the surrounding landscape to ensure the symbiotic growth of culture and ecology during corridor development. Despite its value, a notable limitation of this method lies in its subjectivity, where expert opinions can influence decision outcomes. To address this concern, 12 experts with relevant backgrounds are engaged in independent evaluations to uphold the objectivity and scientific rigor of the assessment results.

To reveal the spatial heritage distribution pattern and pinpoint heritage concentration zones, scholars globally have increasingly integrated Kernel Density Analysis (KDA) into heritage research. This non-parametric spatial analysis method involves the construction of judgment matrices, computation of weight vectors, and consistency assessments [11]. Within heritage corridor construction, KDA accurately assesses the spatial clustering intensity of heritage sites, aiding in the identification of pivotal corridor nodes and the optimization of spatial layout. The formula is as follows:

$$f_n(x) = \frac{1}{nh}\sum_{i=1}^{n} K\left(\frac{x-x_i}{h}\right) \quad (1)$$

Where n is the number of points included in the threshold range; h is the threshold value; $x-x_i$ denotes the Euclidean distance between two points; K is the kernel function, the larger the value indicating that the distribution of the points of the element is more intense.

In the pursuit of comprehensively establishing the Tang-Tibet Ancient Road Heritage Corridor within the current Qinghai Province landscape, this study adopts the Minimum Cumulative

Resistance model (MCR) proposed by Knaapen in 1992[12] . The MCR model, leveraging diverse resistance factors like topography, rivers, and transportation, determines the path of least resistance for heritage resource dissemination, consequently delineating priority zones for corridor development. The model formula is as follows:

$$MCR = f_{min} \sum_{j=n}^{i=m} (D_{ij} \times R_i) \quad (2)$$

Where Dij denotes the spatial distance of the tourist from environmental element i to heritage site j; R_i denotes the resistance value of the surface suitability of space i; $\sum$ denotes the cumulative resistance that the tourist must overcome to reach the heritage site, and f_{min} is the value of the minimum cumulative resistance.

A multidisciplinary and multi-dimensional approach serves as a critical foundation for constructing the Tang-Tibet Ancient Road heritage corridor. Hierarchical analysis efficiently evaluates heritage site values, kernel density analysis vividly depicts heritage site distributions across all levels, and the MCR model assesses suitable corridor construction areas based on present conditions. Therefore, the integration of diverse disciplines has become imperative for crafting a scientific and comprehensive heritage corridor.

4. Construction of Heritage Corridor of Tang-Tibet Ancient Road (Qinghai Section)

4.1 Comprehensive Heritage Assessment and Grading

4.1.1 Classification and Evaluation of Heritage

Through field research and consultation of pertinent reports, all cultural and natural heritage sites within the study scope were meticulously cataloged, encompassing cultural heritage conservation sites at various levels, renowned towns and villages, industrial heritage sites, amounting to a total of 365 resource points. In accordance with the guidelines outlined in the Convention for the Protection of the World Cultural and Natural Heritage concerning Cultural and Natural Heritage, the evaluation of cultural heritage should encompass its historical, artistic, and scientific significance, while the evaluation of natural heritage should consider its artistic aesthetics and scientific value. In alignment with the criteria for heritage corridor development and the distinctive attributes of the heritage sites along the Tang-Tibet Ancient Road, this study formulates a comprehensive heritage value assessment framework based on five dimensions: Historical Value, Social Value, Artistic Value,Natural Landscape Value, and Economic Value [13-14]. Subsequently, an assessment and grading process for heritage resources is conducted. Given the varying significance of each evaluation criterion and factor in heritage value assessment, this research undergoes multiple evaluations by a panel of 12 scholars and experts to ascertain the relative weight of each factor meticulously.

The evaluation adopts the combination of expert evaluation method, tourist survey method and professional survey method. Relevant experts are invited to evaluate factors such as "relevance to the ancient road" and "tourism development potential". Tourists and residents are invited to evaluate factors such as "visibility" and "emotional recognition by residents". Other quantitative factors such as "historical longevity" and "level of protection" are evaluated through data.

Table 1 Assessment Table of Heritage Value

Evaluation Type	Evaluation Factors	Categorical Indicators	Scoring Criteria	Weight(%)

Historical Value	Historicity	Before the Tang Dynasty (Before 618)	5	40%
		Tang dynasty (618-907)	4	
		Song (960-1129) and Yuan Dynasty (1271-1368)	3	
		Ming (1368-1644) and Qing (1644-1912) Dynasty	2	
		Modern Times (Since 1921)	1	
	Grade of Protection	World-class	5	30%
		National	4	
		Provincial	3	
		municipal	2	
		Unrated	1	
	Relevance to the Ancient Road	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
Social Value	Popularity	World-renowned	5	40%
		Nationally renowned	4	
		Provincially renowned	3	
		City and county renowned	2	
		Little known	1	
	Resident Emotional Identification	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
	Educational and Research Value	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
Evaluation Type	Evaluation Factors	Categorical Indicators	Scoring Criteria	Weight(%)
Artistic Value	Artistic Rarity	Rare in the world	5	50%
		Rare nationwide	4	
		Rare in the province	3	
		Rare in the city	2	
		Common	1	
	Preservation Integrity	Preserved Completely	5	30%
		Partially Damaged	4	
		Majority Damaged	3	
		Heavily Damaged	2	
		Disappeared	1	
	Aesthetic Appreciation	Very high	5	20%
		High	4	
		Relatively high	3	
		Average	2	

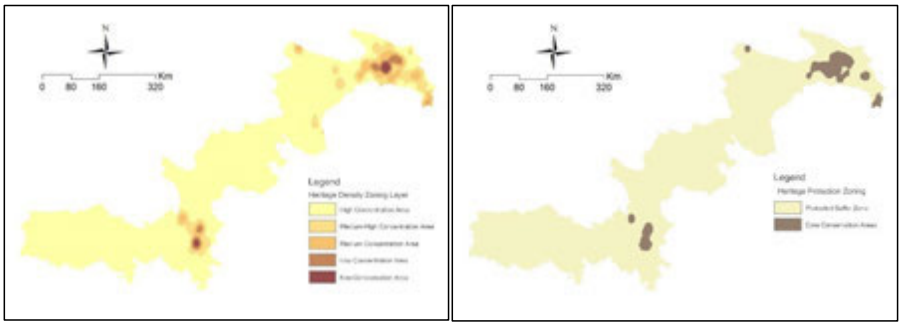
		Relatively low	1	
Natural Landscape Value	Ecological Importance	Very Important	5	35%
		Important	4	
		Moderately Importan	3	
		General importance	2	
		Unimportant	1	
	Grade of Natural Landscape Protection	National Protected Area	5	35%
		Provincial Protected Area	4	
		Municipal/County-level Protected Area	3	
		Proposed Protected Area	2	
		Regular Landscape	1	
	Landscape Coordination	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
Economic Value	Economic Contribution	Very high	5	40%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
	Tourism Development Potential	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
	Transportation Accessibility	Very Convenient	5	30%
		Relatively Convenient	4	
		Moderately Convenient	3	
		Inconvenient	2	
		Highly Inaccessible	1	

According to the heritage value assessment table in Table 1, 365 heritage sites were assessed, and the weighted formula was used to calculate the overall value of each heritage site. A total of 110 heritage sites with a score of 3.50-5.00 were finally identified as Grade I heritage sites; 119 heritage sites with a score of 2.50-3.50 were identified as Grade II heritage sites; and 136 heritage sites with a score of 1.00-2.50 were identified as Grade III heritage sites.

4.1.2 Spatial Classification of Heritage based on Kernel Density Analysis

Based on the evaluation and classification results of heritage sites, the spatial distribution pattern of heritage sites at all levels was explored by the kernel density analysis method. Three kernel density layers were superimposed by the weighted superimposition technique with weights of 3, 2 and 1. The distribution density and importance of different heritage sites were comprehensively evaluated, and the areas of high aggregation, medium-high aggregation, medium aggregation, low aggregation and non-aggregation of heritage sites were identified (Figure 2a). According to the results, areas with a value of more than 326.35 were identified as core conservation areas, mainly located in Xining City, Haidong City and Yushu City. There

have rich natural and cultural heritage and important conservation values, and are important nodes of the heritage corridor. The rest of the area is used as a buffer zone for conservation, where heritage resources are more dispersed, and as a secondary area during the construction of the corridor(Figure 2b).



(a) (b)

Figure 2 (a) Heritage Density Zoning Layer and (b) Heritage Protection Zoning Layer

4.2 Analysis of the Suitability of the Tang-Tibet Ancient Road Heritage Corridor

4.2.1 Construction of Single-Factor Resistance Surface

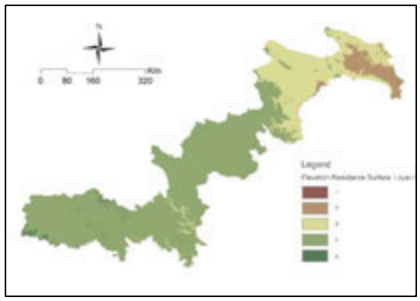
Based on considering the cultural ecological analysis framework comprehensively, the Analytic Hierarchy Process (AHP) method is used to allocate the weights of influencing factors. In Table 2, this study draws on existing research findings to identify and determine 10 key resistance factors in heritage corridors from three dimensions: natural environment, transportation network, and public services. The lower the score, the smaller the resistance, and the more suitable it is for corridor planning [15].

Table 2 Score and weight of resistance factors

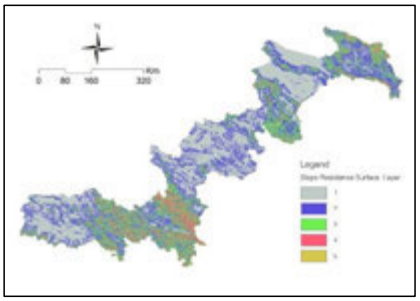
Indicator Type	Resistance Factor	Categorical Indicators	Evaluation	Weight
Natural Environment	Elevation	1500	1	0.12
		2750	2	
		4000	3	
		5250	4	
		>5250	5	
	Slope	3	1	0.16
		8	2	
		15	3	
		25	4	
		>25	5	
	Land Use Type	Unused Land	1	0.22
		Developed Land	2	
		Forest and Grassland	3	
		Farmland	4	
		Waters	5	
	Distance from River	300	1	0.10

Transport		300-800	2	
		800-1500	3	
		1500-3000	4	
		>3000	5	
	Distance from Expressway	<500	1	0.8
		500-1500	2	
		1500-3500	3	
		3500-6000	4	
		>6000	5	
	Distance from National Road	<500	1	0.6
		500-1500	2	
		1500-3500	3	
		3500-6000	4	
		>6000	5	
	Distance from Provincial Road	<500	1	0.4
		500-1500	2	
		1500-3500	3	
		3500-6000	4	
		>6000	5	
Public Services	Dining and Accommodation	>900	1	0.10
		488-900	2	
		180-488	3	
		32-177	4	
		<32	5	
	Parking Lot	>1200	1	0.6
		700-1200	2	
		280-700	3	
		48-280	4	
		<48	5	
	Service Area	>52	1	0.4
		30-52	2	
		15-30	3	
		4-15	4	
		<4	5	

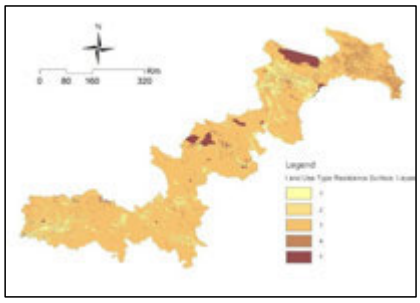
At the natural environment level, based on the principle of harmonious coexistence between human activities and the ecological environment, three resistance factors were selected: Elevation, Slope, and Land Use Type[16]. The higher the elevation and the greater the slope, the higher the resistance value, and the resistance value of regional land use type with more convenient human activities is smaller. At the transport network level, the distance to rivers and roads was selected as the key resistance factor [17]. At the level of the public service system, the distribution of service facilities such as dining and accommodation, parking Lots, and service areas were analyzed by the nuclear density tool, and areas with a high-density value can bring a better experience and feeling to tourists [18]. Finally, based on the weight and value of each resistance factor, the single-factor resistance surface of heritage corridor construction is generated (Figure 3).



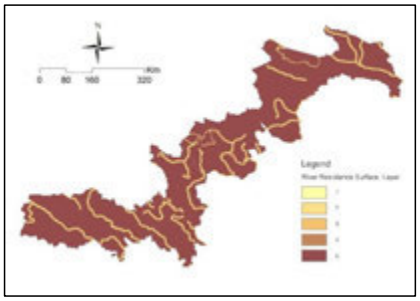
(a) Elevation



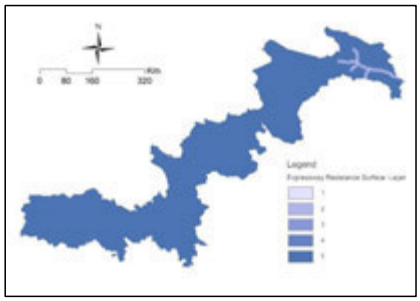
(b) Slope



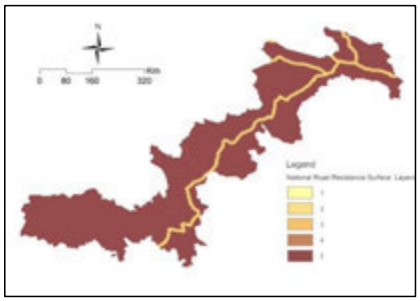
(c) Land Use Type



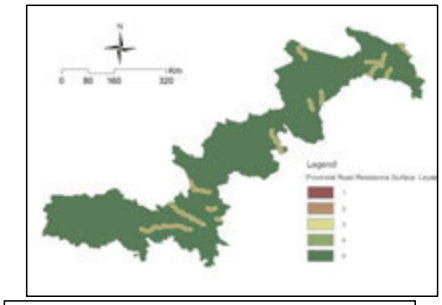
(d) River

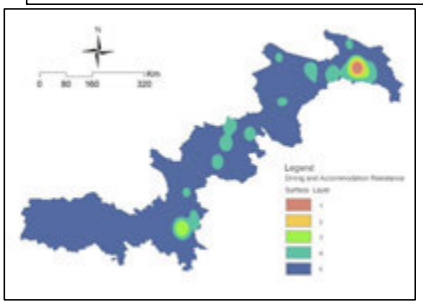


(e) Expressway



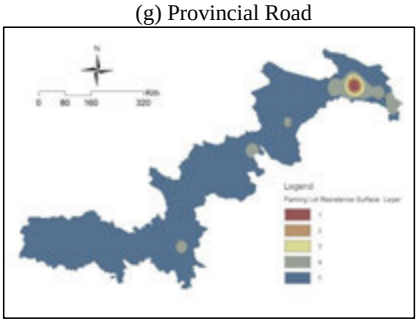
(f) National Road

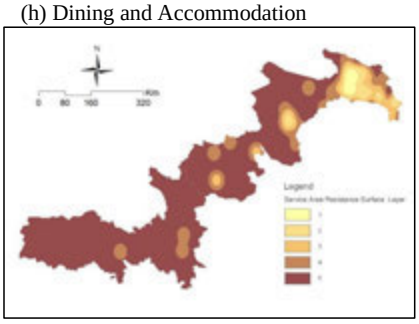




(g) Provincial Road

(h) Dining and Accommodation





(i) Parking Lot

(j) Service Area

Figure 3 Single-factor Resistance Surface resistance surface

4.2.2 Corridor Suitability Analysis

Using the ArcGIS raster calculator tool, 11 single-factor resistance surfaces were overlaid according to the specified resistance factor weights to construct a comprehensive resistance surface model that comprehensively reflects the resistance distribution in different areas of the study area. Based on this layer, the natural breakpoint method was employed to categorize the comprehensive resistance surface into five distinct classes of suitability zones: High Suitability Area, Moderately High Suitability Area, Medium Suitability Area, Low Suitability Area, and Unsuitable Area [19] (Figure 4). The area centered on Xining City is a high suitability zone, indicating that the heritage in this area has a high suitability and accessibility, and therefore a greater advantage in the construction of the Tang-Tibet Ancient Road heritage corridor. This suitability classification offers valuable guidance for formulating tailored protection and development strategies for different regions, thereby facilitating the scientific preservation and sustainable utilization of the cultural and natural heritage along the Tang-Tibet Ancient Road.

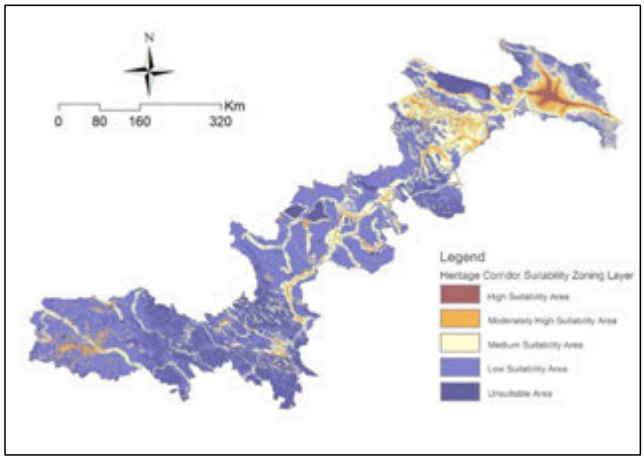


Figure 4 Heritage Corridor Suitability Zoning Surface

4.3 Construction of Tang-Tibet Ancient Road Heritage Corridor

4.3.1 Generation of Potential Heritage Corridors Along the Tang-Tibet Ancient Road

Based on the analysis of the distribution of comprehensive resistance zones in the Tang Tibet Ancient Road Heritage Corridor, using cost connectivity tools, accurately identify and generate the path with the lowest resistance between each heritage point. These paths simulate the direction of the potential corridor of Tang Tibetan ancient road cultural heritage, showing a clear east-west linear direction and densely distributed in the cultural core area (Figure 5). After a rigorous comparison and analysis of the simulation results in relation to the current river and motorway networks, it was found that these infrastructures are mainly built along national and provincial roads. They efficiently connect the region's historical relics and natural landscapes, demonstrating a deep respect for the preservation of cultural heritage and a balanced approach to natural ecology.

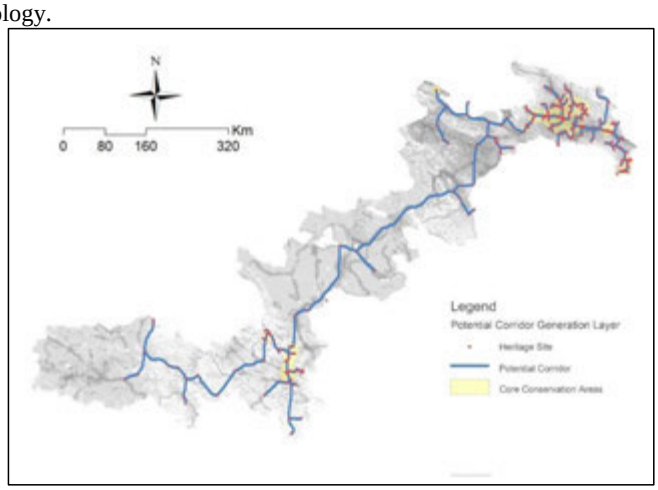


Figure 5 Potential Corridor Generation

Based on the potential of this heritage corridor, a comprehensive Tang-Tibet Ancient Road Heritage Corridor will be established. This corridor will integrate heritage protection, ecological restoration and cultural exhibition, ensuring the sustainable development of the region while safeguarding its rich cultural and natural assets.

4.3.2 Construction of Service Station in Heritage Corridors

The Tang-Tibet Ancient Road heritage corridor's functional integrity is reflected in the protection and display of culture, as well as in the provision of high-quality tourism services. Taking into account the distribution density of heritage and potential corridors, the construction of a corridor service station that integrates tourist rest, cultural exchange, and style display can effectively improve the public service level of heritage corridors. The service station should be situated in areas along the tourist route with a high concentration of tourists, distinctive cultural characteristics, or a limited distribution of heritage resources (Figure 6). The service station of the corridor undertakes the concentration and diffusion of information and functions on the route [19], enhancing the overall coherence of the heritage corridor and further enhancing the overall value and attractiveness of heritage resources in these areas.

4.3.3 Development of specialized tourism routes

Based on the cultural characteristics and protection priorities of the heritage site, construct characteristic tourism routes along the Tang Tibetan ancient road. These routes should include three types: Historic Relic Route, Cultural Experience Route, and Natural Scenery Route [20] (Figure 6).

The route of historical relics is mainly based on core protected areas, which are the areas with the most concentrated heritage and have a large amount of high-value natural and cultural heritage. To enhance the cultural experience of the heritage corridor, rich natural and cultural heritage is linked together through route planning and design while organizing tourists to participate in traditional festivals, handicraft production, and ethnic song and dance performances.

The cultural experience routes are primarily distributed in areas with a relatively low heritage density near the core area. To enhance the coherence and richness of the routes, scientific and technological means can be employed to restore or recreate heritage sites that have been lost or destroyed and integrate them with cultural experience areas such as cultural museums and exhibition spaces.

The main goal of the natural scenery route is to strengthen the connection of each cultural core area. The distribution density of cultural heritage points on this route is relatively low, mainly concentrated in displaying natural heritage and ecological landscapes. By developing and utilizing the natural landscape resources along the route, create a heritage corridor tourism route that simultaneously develops and balances culture and ecology.

4.3.4 Heritage Corridor Interpretation System Construction

The Tang-Tibet Ancient Road embodies a cultural heritage spanning over three thousand years, with its historical value and cultural connotations remaining ever-fresh and enduring. The interpretation system is an effective way to promote and inherit the historical wealth of the Tang Tibetan ancient road heritage corridor. It can effectively convey historical and cultural

information, enrich tourism experiences, promote cultural dissemination and exchange, and achieve the continuity of historical and cultural heritage. Based on the corridor tourist routes and "service stations", the cultural connotation and historical value of the heritage resources in the corridor are conveyed to tourists by means of diversified display methods such as historical images and stories [21].

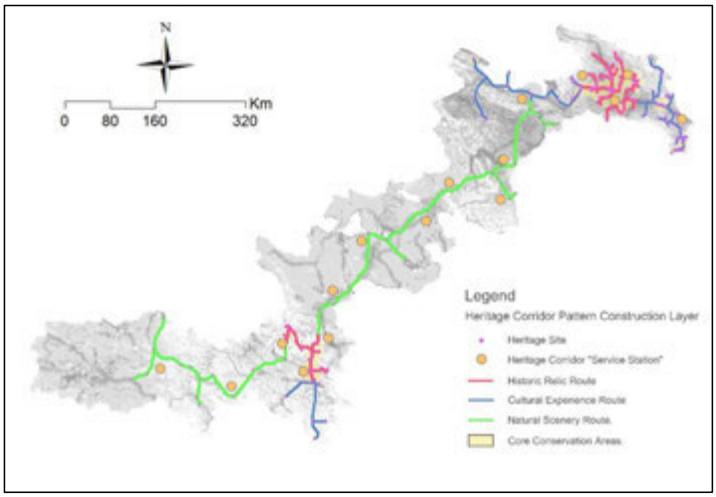


Figure 6 Heritage Corridor Pattern Construction

5. Heritage Corridor Protection Strategy for the Tang-Tibet Ancient Road (Qinghai Section)

To provide a comprehensive and effective protection framework for heritage resources, this paper combines the principles of cultural ecology and focuses on the interconnected elements of "point-line-surface", and puts forward the protection strategy of the Tang-Tibet Ancient Road heritage corridor [20].

5.1 Heritage Resource Hierarchy Protection

Heritage sites represent the core components and main contents of the Tang-Tibet Ancient Road heritage corridor, carrying profound historical and cultural values. The protection of individual heritage sites is the most fundamental practice in the overall protection strategy of the cultural heritage corridor. Grading the protection of different heritage sites according to their importance in the composition of the corridor can ensure the rational allocation of resources and promote the sustainable development of the heritage corridor.

Grade I heritage represents the core and soul of the corridor, carrying rich historical information and deep cultural connotations. It is of vital importance to protect its integrity and originality. Further exploration of its historical, cultural and scientific values should be conducted on the basis of ensuring that its body and surrounding environment will not be damaged. As a significant component of the corridor, the protection and perpetuation of secondary heritage is of paramount importance to the integrity of the entire corridor. It is necessary to fully protect it and strengthen its connection with primary heritage to enhance its status in the corridor system and promote the coordinated development of heritage sites. Tertiary heritage is comparatively less significant, yet its stability is conducive to the comprehensive protection of the corridor.

Therefore, it is necessary to implement certain protection measures to ensure the stability of the aforementioned heritage sites and predict and avoid any potential future threats.

5.2 Overall Protection of Heritage Corridor Routes

The protection strategy for the Tang-Tibet Ancient Road heritage corridor should transition from singular heritage sites to encompass the entire route, emphasizing the dual safeguarding of cultural heritage and the natural environment. Aligning with national and urban development plans, this protection should be integrated into the regional coordinated development framework. Strengthened city cooperation and exchanges are crucial to collectively advance corridor preservation, fostering resource sharing and leveraging complementary strengths. Encouraging community involvement and equitable benefit-sharing can enhance residents' engagement, awareness, and accountability in heritage protection, facilitating a harmonious relationship between economic progress and cultural conservation.

5.3 Protection of Cultural Ecosystems in the Corridor Area

The Tang-Tibet Ancient Road (Qinghai Section) Heritage Corridor traverses 12 districts and counties within Qinghai Province, covering an expansive geographic expanse. The varied natural features of mountains, rivers, grasslands, and forests play a pivotal role in shaping and conserving the corridor's cultural heritage, establishing a distinctive cultural ecosystem. In areas such as Xining and Haidong, which are considered the best for corridor development, priority should be placed on protecting heritage and adjacent ecological environments to maintain the historical and cultural wealth of the region. Simultaneously, the interplay between culture and society is advanced through a range of methods, such as the execution of cultural exhibition events and the augmentation of the area's tourism reception capabilities. In regions with limited suitability for corridor construction, such as Zaduo County and Yushu City, initiatives should prioritize the protection of heritage assets while evaluating and preserving key landscapes and ecosystems. Formulating ecosystem protection strategies can bolster stability and resilience, fostering a harmonious coexistence of cultural heritage and ecology by balancing human activities with the natural environment.

6. Conclusion

The Tang-Tibetan Ancient Road (Qinghai section) spans several cities, counties and natural areas, facing the dual challenges of natural factors such as climate, geology and disasters, as well as social factors including historical changes, urban construction and human forgetting. Therefore, its preservation and inheritance face enormous challenges. This paper analyzes the suitability of heritage corridor construction based on the characteristics of natural ecology and historical and cultural heritage protection in Qinghai. A scientific and complete heritage corridor of Tang-Fan ancient road (Qinghai section) is constructed by using GIS platform to calculate and generate potential corridors, combined with "service stations", characteristic tourist routes and corridor interpretation systems. Eventually, the protection strategy is put forward from the three levels of "point-line-surface", which provides support and guidance for cultural heritage protection and tourism development in the Qinghai area.

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Notes

The authors declare no competing financial interest.

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Integrating Curation and Retail in Chinese Urban Commercial Revitalization: The transnational exchange of the curatorial concept in Shanghai and Beijing, China

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Abstract: Originally from the Latin for "to care for," curation has evolved from organizing and presenting within museums and galleries, to interactive facilities and immersive experience of audiences in contemporary urban space, where art installations transform streets and commercial complexes into vibrant cultural environments. In this vein, the paper focuses on "CURETAIL," a strategy that integrates curatorial practices into retail to rejuvenate urban commercial areas, and attempts to uncover the knowledge exchange behind. It takes two leading contemporary projects, namely TX Huaihai in Shanghai and The Box Chaowai in Beijing as cases. Contextualized in the historical development of retail commercial space and curation practice globally, the paper investigates the conceptualization of project operators, responsive design strategies and consumers' preferences, identifies the characteristics of CURETAIL and reveals the transnational factors behind.

Key words : Transnational exchanges, CURETAIL, retail commercial space, urban regeneration

Nowadays in China's leading cities, a growing buzz emerges introducing curation and art into commercial spaces, as a way to revitalize old declining buildings and districts. CURETAIL (Curated Retail) is created as an innovative strategy to attract younger generations (Youfang, 2023). It has been applied in key urban regeneration projects like Shanghai's TX Huaihai and Beijing's the Box Chaowai, and successfully transformed traditional malls into iconic retail and pop-culture centers. Against the impacts of online shopping and pandemics, CURETAIL provides consumers with choices that go beyond algorithm-led, fixed recommendations at a time of material abundance, and allows the consumers to have a personal emotional experience. The paper accordingly traces the transnational diffusion and exchange of the curatorial concept and intends to uncover the dynamic reasons behind (Souhu, 2019).

1 The birth of CURETAIL in Chinese cities

Fig.1 Dickson Sezto giving talk at TX Huaihai, 2019 (source: https://www.instagram.com/txhuaihai/)

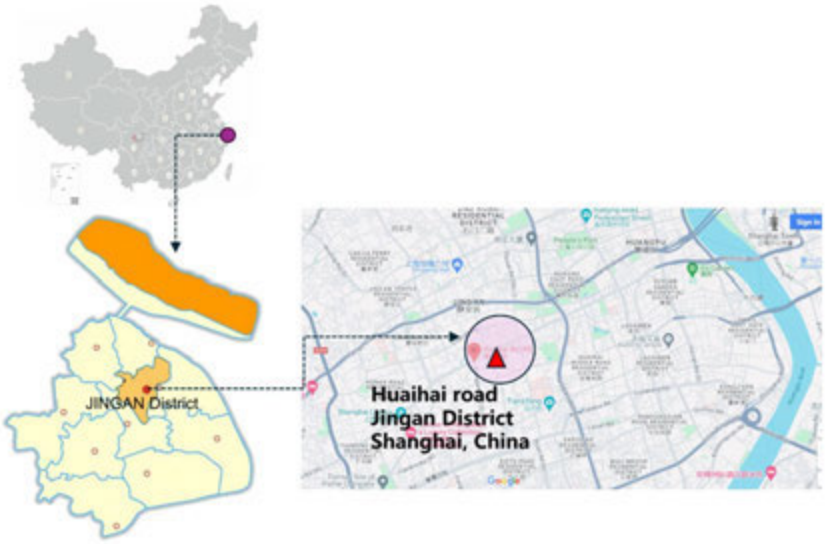

Fig.2 Location of Huaihai Road and TX Huaihai, Shanghai

The CURETAIL concept was proposed by Dickson Sezto (Fig.1), Chairman of URF Yingzhan Group, during the renovation project of the Huaihai Middle Road commercial district in Shanghai. It was first implemented at the Bailian TX Huaihai | Youth Power Center on Huaihai Middle Road (Fig.2). This area, shaded by century-old plane trees and lined with hotels and high-end boutiques, was once recognized as one of Shanghai's most fashionable commercial streets. However, with the rapid development of China's internet economy from

2013 to 2018, physical retail stores, burdened by high rental costs and shrinking sales volumes, were gradually replaced by more convenient and cheaper online stores, forcing many well-known brands on Huaihai Middle Road to close due to financial losses (Souhu, 2019b).

Before Refurbishment, 1990s

After Refurbishment, 2020

Fig. 3 Real scenes of TX Huaihai, Shanghai. (source：https://m.thepaper.cn/wifiKey_detail.jsp?contid=10913161&from=wifiKey)

TX Huaihai was no exception. Formerly home to the First Department Store Huaihai and Isetan (Fig.3), it had been in decline for years and was in desperate need of transformation. On one hand, emerging commercial centers in various districts of Shanghai and internet retail businesses had siphoned off the clientele originally belonging to Huaihai Middle Road. On the other hand, Huaihai Middle Road suffered from typical old-town issues such as insufficient parking and dispersed public transport stops (Karimi, 2023). Sezto's response was to focus on "youth" and "trends." The urban layout of the old district made it difficult to change; middle-class individuals with cars preferred to drive to suburban shopping complexes with better facilities. Elderly people who rely on public transport found it inconvenient, as their physical condition did not support walking several kilometers from the nearest public transport stop to their destination. Only young people, keen on following internet trends and relatively less affluent, would make the effort to travel to places of interest. These potential young customers are known as China's Generation Z. Predominantly university students and young white-collar workers, they are under thirty, mostly unmarried and childless, with some disposable time and a relatively strong purchasing power. On one hand, Generation Z pursues individual interests and emotional experiences, with significant differences among individuals (Zhang and Lee, 2022). On the other hand, due to increasingly frequent and extensive international exchanges, their interests are not limited to domestic cultural IPs but also encompass cultural products from around the world.

Therefore, Dickson Sezto introduced the CURETAIL model, aiming to attract the potential Generation Z consumer group. By consulting with globally renowned trendsetters and incorporating trend culture forums, brands, and events, he transformed the original shopping center into an art gallery, exhibition center, and show venue (Fig.4-6). Considering that the shopping desires of the same consumer group are ultimately limited, it is more effective to rotate exhibitions, pop-ups, parties, and meet-and-greets to meet the varying needs of different consumer groups, ultimately achieving the goal of selling products (Gao et al., 2022). CURETAIL strives to keep the pace of brand scene changes in sync with the speed of young

people's smartphone refresh rates, ensuring that new activities are available in the public spaces every week. The operator continuously attracts new customer sources through these activities, maintaining a steady and sufficient flow of visitors (Zhao et al., 2023).

Fig. 4 Bird view of TX Huaihai （source：https://www.instagram.com/txhuaihai/）

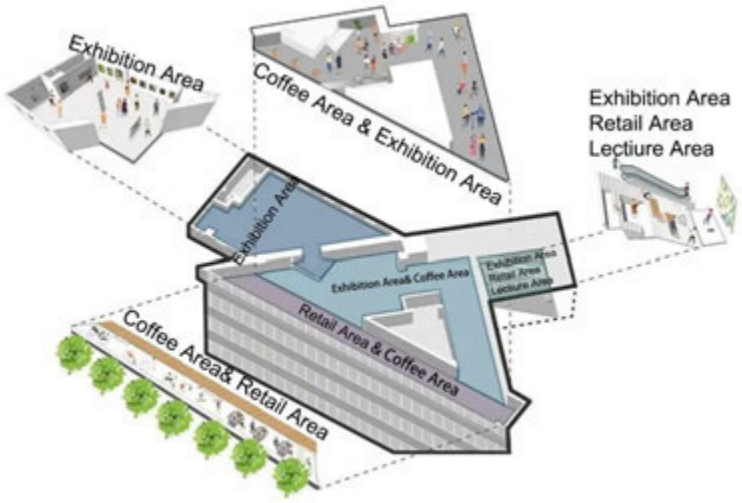

Fig. 5 Functional layout of TX Huaihai

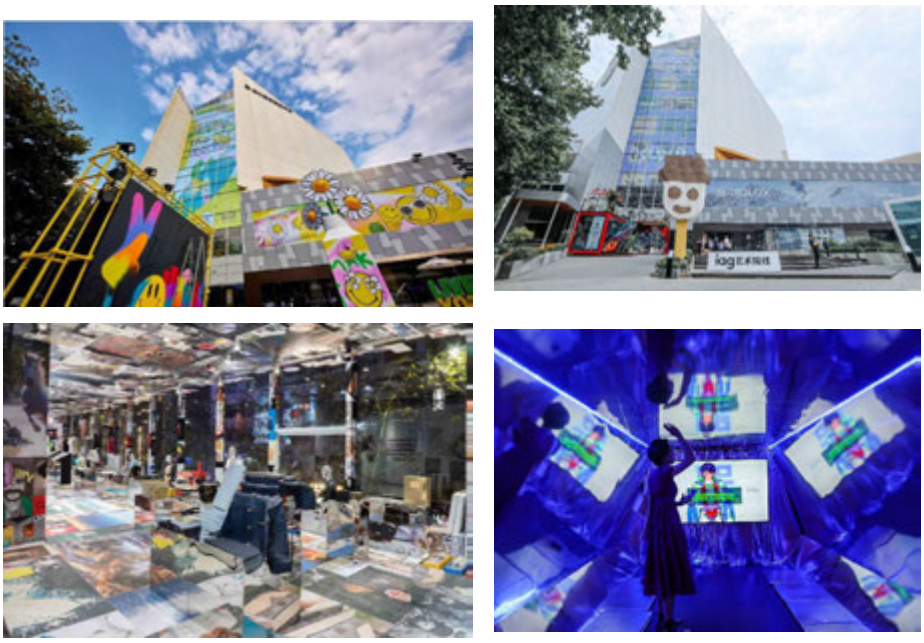

Fig.6 Changing Exhibitions at TX Huaihai, 2019-2020

Dickson Sezto applied the CURETAIL concept once again at The Box | Youth Power Center in Beijing's Chaowai area. Located in one of Beijing's earlier developed regional commercial centers, Chaowai does not have the long history or large scale of other major commercial centers like Xidan, Wangfujing, and Qianmen, nor does it have a diverse range of retail products (Fig.7). Instead, it primarily targets high-income consumers from the Chaoyang district. With the development of Zhongguancun in the Haidian district, the high-income consumer base is gradually shifting northwest, leading to the aging of commercial building facilities in the Chaowai area, which has become increasingly dilapidated (Motomura et al., 2022). Additionally, the area suffers from a severe lack of parking spaces and already has numerous department stores and commercial complexes catering to middle-aged and elderly consumers. To secure a foothold in such a competitive environment, it is essential to develop a new customer base. In 2021, the BaonaoHui, formerly a major electronics marketplace in the Chaowai area, successfully transformed into a retail art experience space themed around home living, thus beginning to attract young people (De Winne et al., 2020). As a result, the CURETAIL concept was chosen for the renovation and redesign of the space at The Box Chaowai (Fig.8).

Fig.7 Location Distribution of Important Business Districts in Beijing

Before refurbishment, 2010s

After refurbishment, 2023

Fig. 8 Real scenes of BOX Chaiwai, Beijing

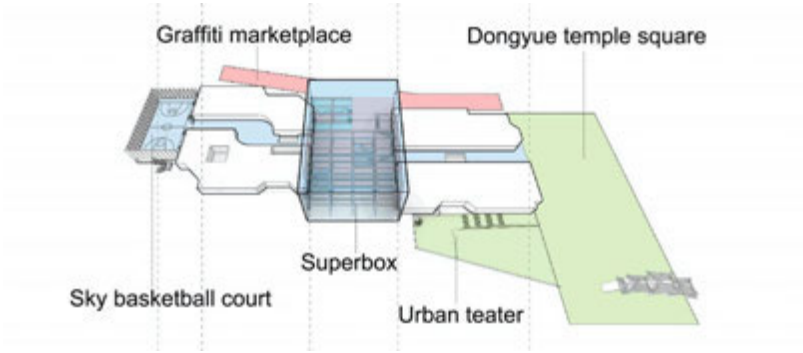

Fig. 9 Functional layout of BOX Chaiwai, Beijing

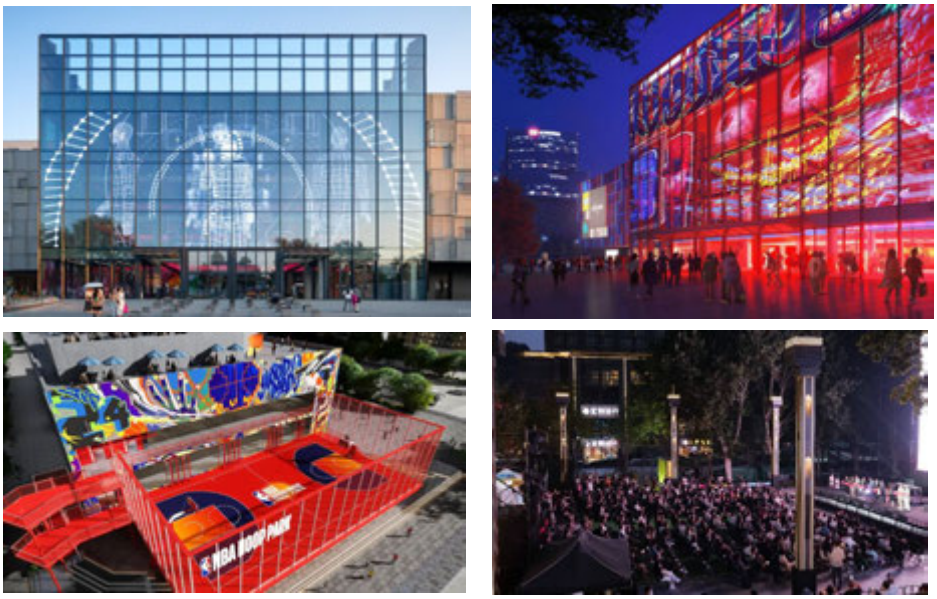

Fig.10 Exhibitions at THE BOX Chaowai, 2022-2023

The main structure of Chaowai THE BOX (Fig.9-10), known as the GLASS BOX Super Trendy Box, retains the original beam and column structure of the KunTai Mall but has been transformed by dismantling and reconfiguring the floor plates into a 360° flexible multi-path space. This space is now used for brand launches, premieres, curated fashion shows, flash retail, and multimedia events. Additionally, it includes numerous functional auxiliary spaces. On the east side, there is an outdoor basketball court and skateboarding area, making it a gathering place for street trend enthusiasts. The south side features Beijing's first graffiti market, while the northwest side has been excavated to create an open-air, immersive "Slope Theater." The west side utilizes the archway of the Dongyue Temple to provide a cultural activity square, offering a variety of spaces for activities and gatherings for young people (Soyinka et al., 2021).

Since its operation began on September 16, 2023, Chaowai THE BOX has seen an average daily foot traffic of about 15,000 people, which increases to 50,000 during weekend exhibitions. The asset value of the enterprise is expected to increase by 20%-30%, with the commercial spaces generating over one billion RMB in annual revenue. Office space rent is expected to grow by 20%-30%, with annual taxes paid amounting to approximately 1.53 billion RMB—an increase of about 1 billion RMB from before the renovation. Additionally, it is projected to create about 3,000 new jobs.

2 The transnational re-shaping of Retail space

When examining CURETAIL within the context of the evolution of retail business, it fundamentally restructures the relationship among "people," "goods," and "spaces" within retail environments (Requena-Ruiz et al., 2023). In the early stages of human society, retail was mostly a small-scale self-producing and self-selling workshop model, with retail spaces

dispersed in narrow fronts and workshops at the back of urban buildings (Fig.11). With the outbreak of the Industrial Revolution in the mid-19th century, the advent of department stores marked the transition of retail spaces indoors, where products moved from being singular and scattered to being centrally displayed and diversified, enhancing the consumer shopping experience significantly. In these department stores, "people" were the main actors in the retail scene, with "goods" and "spaces" playing the roles of objects and backdrops, respectively (Fig.12).

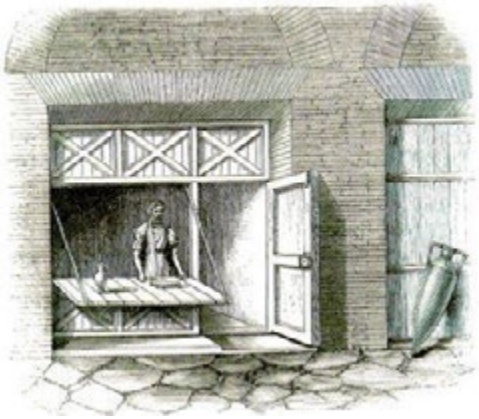

Fig.11 Tabernae in ancient Rome, a plural retail space different from open market

Fig.12 A early 20th century department store in Paris

By the mid-20th century, influenced jointly by the proliferation of automobiles and government housing policies, urban residents massively relocated to the suburbs, and shopping centers made their debut in American suburbs (Fig.13). These centers, composed of department stores and small retail shops, were equipped with large, free parking areas to accommodate consumers who drove there. Beyond "goods," these "spaces" combined indoor and outdoor elements, offering a variety of distinctive public areas that met the social needs of "people," creating an atmosphere conducive to social life and cultural activities.

Fig.13 The Park & Shop in Cleveland Park, Washington, D.C. (1930) is one of the earliest examples of a small center with dedicated on-site parking in front. (source: Neighborhood shopping center - Wikipedia)

Fig.14 The interior of Garden State Plaza megamall in Paramus, New Jersey. (Source: Shopping mall - Wikipedia)

In the 1990s, as urbanization accelerated and land use efficiency improved, the retail "space" moved with "people" back to urban centers, evolving into more intensive and multifunctional urban commercial complexes (Fig.14), serving city dwellers of all ages and incorporating restaurants, cinemas, and entertainment venues to meet diverse free-choice, leisure, and entertainment needs (Liu, 2022). Since the 21st century, as the internal market in cities became saturated, operators of commercial complexes began to strengthen and sustain customer attraction through collaborations with other arts and cultural industries. The CURETAIL analyzed in this paper is one such model.

Under the CURETAIL model, consumer behavior shifts from active to passive, with "goods" being imbued with stories to attract traffic, and "spaces" providing an immersive experience. "Goods" and "spaces" take the leading role, guiding the thoughts and actions of "people" and tying them to consumption. At this point, the exhibitions have become the "social currency" of Bailian TX Huaihai and Chaowai THE BOX, keeping the pace of changing scenes in sync with the rhythm of young

people and using constantly evolving aesthetics to draw them back to once-declining traditional commercial districts.

3 The curate origin of CURETAIL

The term "curate" originates from the occupational meaning of "curator," which itself comes from the Latin word meaning to care or heal, initially used to describe "someone who cares for people's souls," essentially a parish priest (Hu et al., 2022). In the 1660s, the term "curator" began to be associated with the management of art, museums, and libraries. The first recorded curator in history, scientist, inventor, and architect Robert Hooke, in 1667, conducted an experimental project titled "Using a bellows to inflate a dog's lungs to keep it alive." By the 19th century, the term "curator" started to be used for museum curators and independent curators in the modern sense of curation. Subsequently, influenced by the postmodernism trends across various fields in the 20th century, the concepts of "critical curation" and "independent curators" emerged. In 1969, Harald Szeemann, at the Kunsthalle Bern, creatively redefined the relationships between curator, artist, and the exhibition itself in his exhibition "When Attitudes Become Form: Works-Concepts-Processes-Situations-Information." He allowed artists to take over the museum, creating their works on-site, completing most of the exhibits a few weeks before the exhibition opened.

In the 1990s, with the development of internet technology and the advent of the information explosion era, numerous new media platforms enabled everyone to assume the role of a curator in their domain. The concept of "curatorial nature," which encourages exhibition visitors to actively explore the content and meaning of the exhibits, began to enter mainstream vision. As a result, the democratization of curation moved it beyond galleries and museums and into the realm of retail business, emphasizing the interaction between people, the items on display, and the exhibition spaces.

The proponent of CURETAIL is Dickson Sezto, who was born in Hong Kong in the 1970s, a crucial port for international economic and cultural exchanges at the time. Sezto grew up in a bilingual environment where Chinese and English coexisted, deeply identifying with Chinese traditional culture while also being influenced by Western trends and business practices. He graduated in 1992 from Monash University in Australia with a degree in literature, specializing in social statistics and psychological analysis of social phenomena, which honed his skills in statistical analysis and market research, shaping his unique insights and sharp vision as a business executive. Sezto has been dedicated to commercial real estate development, with his most well-known project being the transformation of Shanghai's Xintiandi, an old alleyway, into a landmark international retail and pedestrian area. In 2019, Sezto once again became a focal point in retail business by proposing the CURETAIL model, which led to the creation of the Bailian TX Huaihai | Youth Power Center.

In conceptualizing "CURETAIL as an exhibition-driven business," Sezto drew upon numerous transnational experiences, such as the practices at the Innovation District on Boston's waterfront, the South Lake Union area in Seattle, and the East London Tech City in the UK. These experiences emphasize enhancing the customer experience and creating immersive interactive spaces. Noticing the rapid development of the internet and e-commerce, which has provided consumers with more convenient choices, Sezto realized that shopping is no longer primarily about visiting physical retail spaces. Thus, he focused on creating a rich artistic

atmosphere and a cultural identity aligned with trendy concepts, including virtual and augmented reality displays related to the metaverse, making these the primary attractions of the retail spaces under the CURETAIL model.

4 Conclusion

In general, the CURETAIL includes three main characteristics. Firstly, it emphasizes the open and flexible public spaces. CURETAIL promotes retail spaces that are not confined to indoors but integrate seamlessly with outdoor environments, providing consumers with various options to socialize, enjoy views, or relax over tea. This integration offers more space for activities and ensures a superior experience while walking, viewing, or shopping. Secondly, it frequently updates its exhibitions and displays. The CURETAIL model involves frequent updates of public space arrangements and hosts highly targeted events for different consumer groups. Operators can stay abreast of cultural trends and introduce popular cultural activities, responding dynamically to the changing cultural landscape. Thirdly, it actively collaborates with influential brands and hotspots. Under the CURETAIL model, operators can take advantage of popular influencer spots to forge collaborations with well-known domestic and international brands in specific fields, complementing each other's strengths. Particularly, the "flagship store economy" can be utilized to attract foot traffic and enhance economic benefits.

The formation and successful application of the CURETAIL concept are inseparable from transnational influences. Firstly, global Influence on Interactive Commercial Retail Spaces: Although Dickson Sezto originally conceptualized CURETAIL, similar models of interactive retail spaces have existed worldwide, influenced to varying degrees by the concept of "curated retail." For instance, a subway renovation in East London transformed into the OTHER WORLD gaming experience venue, and in Icheon, South Korea, the NONSPACE café serves as a "cross-cultural space." Secondly, the proponent of CURETAIL Dickson Sezto has transnational background. He grew up in Hong Kong—a melting pot of Eastern and Western cultures. His landmark urban renewal project, Shanghai Xintiandi, was completed in collaboration with Benjamin Wood's architecture firm from the USA and DP Architects from Singapore, incorporating advanced technologies from Germany and elsewhere. During the development of CURETAIL, Sezto frequently consulted with global trendsetters like Hiroshi Fujiwara and Chen Man.

Thirdly, CURETAIL's targeting consumer Generation Z is a transnational generation. The primary target audience for the CURETAIL model is Generation Z, born into the thriving "global village" of the internet age. The advent of the information era has intensified their passion for international trends and cultural shifts, making them particularly sensitive to changes in cultural currents. These factors enable CURETAIL to integrate diverse culture and innovative retail strategies to cater to a globally connected, trend-sensitive consumer base.

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PLANNING HISTORIES OF DELHI: URBAN GOVERNANCE PERSPECTIVE

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Abstract
The city of Delhi, about four centuries old, is a rich example that demonstrates the shades of sustainability. Each of the historical layers were/is comprised of geo-political context wherein the socio-cultural milieu was nurtured: case of Delhi that spans across Hindu, Islamic, Mughals, British to independent India. Delhi was built seven times and the current being the National Capital Region. However, imprints of each one embedded within the city and fairly legible through its fabric, cultural heritage, economies, social connotations' in architectural vocabulary and planning. The paper attempts to highlight the histories from governance perspective and its influence on planning approaches spanning over four centuries. The mapping of planning governed by geo-political through histories for the city of Delhi.
Keywords: Histories, Planning, Urban Governance, Cities of Delhi.

1.0 Introduction:

We must acknowledge that the world is changing but in doing so we must realize that there are still many lessons to be drawn from the past. Whatever design solutions we choose should be conceived in such a manner as to allow evolution and progress to orient us towards the future, rather than retreat into the past for its own sake. Maintaining a sense of historic continuity is essential, especially at a time when our country is striving for cultural identity and survival in the face of standardized values, mass-produced culture and alien influences. The towns, sites and buildings stand out as striking examples of authenticity at a time when new urban development is increasingly impersonal and unimaginative. The preservation of the political power and values of such groups are just as important here, of course as environmental considerations. [Harvey; 1996] In an attempt to find urban development solutions that will not alienate people, it is useful to examine those in history that have accommodated the pressure of technological and social change without alienation. The developed world was once developing, ancient Greece was developed when Rome was developing, Rome was over developed when Byzantine and medieval cities were being established. From all these phases of developing and developed urbanisation there are survivors- towns that exhibit an ability to accommodate the changes of the next generation in an unselfconscious manner. There are patterns of development that on one hand exhibit a seeming indifference to the environment and on the other an environmental quality that transcend time by its neutral rationalism. Our cities should provide visible clues to "where we have been and where are we going" [Ford 1978] or "the excitement of the future should be anchored on the security of the past." [Lynch 1960]. "The sustainability is not a new phenomenon. Historic towns and cities around the world did not have a choice. If they existed for any length of time it was only because they were able to develop and maintain a continually re-balancing relationship among their internal social and economic activities and with their wider natural and agricultural landscape." [Levine 1987] Peter hall [1997] states " The new world will largely depend, as the old world did on human creativity; and creativity flourishes people where they come face to face, only for local milieu will emerge [Willoughby, 1994] or that local culture will be strengthen as Globalises information makes national borders less relevant [Ohmac, 1990; Naisbett, 1994; Sassen, 1994] or that the importance of face to face contact will ensure centres emerge as critical nodes of information oriented production [Winger, 1997].[Sharma.A.K : 2022]

2.0 Planning through Histories

In an attempt to find development solutions that will include people, it is useful to examine those in history that have accommodated the pressure of technological and social change without alienation. The dimensions of urban layout in such cities thus appear to be all important. Space is an asset that permits change to occur progressively and gradually, at low cost and with low expenditure of energy. The historical examples that have enhanced the patterns of change by unselfconsciously adapting themselves to fresh pressure demonstrate a consistency in the shape and size of their irregular grids around which perimeter development has occurred. As the inner city sustains, a city then begins to take its 'inner city' qualities to its suburbs; i.e. in the walled cities, the existing public transport and walking oriented characteristics, mixed land uses with urban design conducive to, face-to-face activity. Hence, it is possible to reach destinations with short distances, without a car, and thus created walk able communities. Interestingly, even today the fastest mode of transportation in historic core cities is walking, rickshaws etc are essentially low carbon in nature. These built environments over a period of time have experienced densification accounting for adaptability and attaining saturation often with the engagement of the local communities. Densification is a cumulative process that takes place over time and it is difficult to define the limits beyond which it may become 'over-developed'. An environment has a limit or capacity up to which it can absorb activities without irreparable form but in historic cities the local communities contribute for the limit to growth i.e. the local communities have an inherent mechanism to stabilise the numbers as a cultural connotation at large.

Delhi has been the administrative capital since its inception dating back to tenth century. Delhi was build many times; interestingly despite the varying political heads the location continued to be same for centuries on. Typically for any city to develop the pillars of sustainability along with governance plays a key role, the role of urban governance influenced the planning decisions with outcome of cities of Delhi each one with a unique identity.
The dimension of city layout thus appears to be all-important. Space is the asset that permits the change to occur progressively and gradually, at low cost and with low expenditure of energy. Those historical examples that have enhanced the pattern by unselfconsciously adapting themselves to fresh pressures demonstrate a consistency in the shape and size of their irregular grids around which perimeter development has occurred. The ground rules for this would appear to be more universal than has hitherto been recognised. Multiplicity of institutions/ agencies, possibilities opened up by new building technologies/ engineering services and a break in the architectural/ planning continuity all have contributed immensely to the physical and perceived economic decline of historic built environments, constrained under blanket bye-laws and regulations which have little relevance to the makeup and historical urbanism of these cities'. Histories are roots for all aspects including planning, as planning is a continuous process over time addressing the needs of the people. People are key for any city therefore when one traces the urban developments from a historical perspective; Knowledge exchanges are insightful. Among the histories of Delhi-seven cities may draw parallel with Rome with 700 years and seven hills.

2.1 Dimensions of historic layers

The historic layers of any city is typically governed across scales from local, regional, national and international as well. Further Globalisation added another dimension of decision making influencing the governance at city level especially mega cities across the globe and Delhi is among the top ten. 2008 crisis large corporate houses investing and for large scale buying of buildings, land, precincts' etc. the land ownership leads to systematic transformations in the city often altering the historic meaning of the city and has significant implications for social equity, local economies and large scale corporate re-development of cities. The re-development meant rebuilding or constructing new buildings that were large, taller, spacious and often luxurious type for offices including apartments. In 2013 to 2014 buying of properties grew by 248% in Amsterdam, 180% in Madrid, 475% in Nanjing, 160.8% for Beijing and in case of Delhi mushrooming of a satellite city: Gurgaon. [Sassen. S: 2015] These mega projects invariably have vast carbon footprint; a typology that is omnipresent in megacities virtually cloning them at the coast of the identity of each of the cities. Cities that were socio-culturally driven were driven by capitalist economy such a paradigm shift from urbanism to gigantic urbanism from public to private: hasn't been healthy for the cities with impacts evident and continuing. Such a dichotomy has made

planning rather complex in more than one ways. Privatisation in 90's resulted in reduction of public buildings with an escalation in corporate ownership's consequently gentrification affecting the social structure,…control of urban land to control of urban governance introducing a universal global typology, a signature of notion of development. However, the paradigm shift also gets translated in other aspects as well i.e. dilution of social classes, role of religion, ethnic diversities etc as the city growing cosmopolitan and in the process the nature of diversity having a paradigm shift as well. The new owners belong to the global culture, irrespective of their birth and origins but are birds of the same flock across the mega cities of the world. [Sharma. A.K: 2022]

3 .0 Historic Cities of Delhi

Delhi, situated on seismically sensitive area is the part of Indo-Gangetic alluvial plain at an elevation ranging from 198m to 220m above the mean sea level. Two major landform systems converge here the Ganga Plain and the Ridge. Physically, Delhi may be divided in to three parts - the plain, the Yamuna flood plain and the ridge. The major part of Delhi is plain area. The Yamuna flood plains are low-lying and sandy and are subject to recurrent floods. The Ridge constitutes the most dominating physiographic feathers in this region. It is an extension of the Aravalli hills of Rajasthan. Climate of Delhi is dry winters humid subtropical climate bordering hot Semi-Arid Climate, extreme temperatures ranging from 2- 48 degrees.
Delhi enjoys a central geographical location in the country; now better known as National Capital Region (NCR). The National Capital Region extends between 28023'17"N & 28053'00"N latitudes and between 76050'24"E & 77020'37"E longitudes. The length is about 51.90 kilometres with breadth around 48.48 kilometres. The area in NCR Delhi is 1483 sq. km. of terrain. Delhi is situated on the bank of the river Yamuna between mountain ranges of the Great Himalayas and Aravallis. The adjoining states are Uttar Pradesh on the eastern side and by Haryana state on northern, southern and western sides.

The time line histories of Delhi may be summarised in broadly three stages as follows:
Stage 1: Seven cities of Delhi- Hindu, Islamic and Moghuls
Stage II: Colonial and Independent India
Stage iii: Satellite cities: Faridabad, Ghaziabad, Gurgaon and Noida: NCR under NCT.

4.0 Seven cities of Delhi

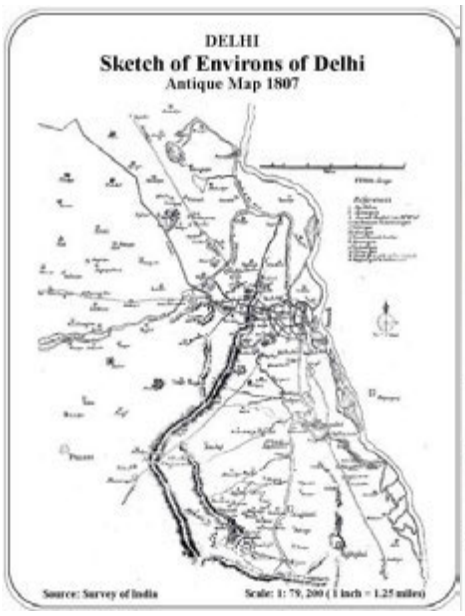
One of the earliest mention of Delhi is by Greek historians who took their accounts from those who accompanied Alexander 327 BC mentions Muttra not Delhi, that depicts unimportance of Delhi then; while one suggestive remark by Arrian's reference from Megasthenes- quotes abandonment of traditional Indraprastha. Further three Chinese pilgrims visited India between 390 AD and 645 AD mention about Muttra however no mention in writings of Delhi. Another reference of Muttra in 1000 AD when Ghazni invaded the country. Thus it may be logical to conclude that Delhi was first occupied around AD 300 and abandoned due to some reasons and rehabilitated in 1052 when Ghazni left. [Risley: 1906]

City Order	City Name	Year Estb.	Founder
I	Lal-Kot	1000	Anangpal
II	Siri	1303	Alau'd-Din Khilji
III	Tughluqabad	1321	Ghiyathu'd-Din Tughluq
IV	Jahanpanah	1327	Muhammad-bin Tughluq
V	Firuzabad	1354	Firuz Shah Tughluq
VI	Purana-Qila	1533	Humayun
VII	Shahjahanabad	1639	Shah Jahan
VIII	New Delhi	1911	Britishers

City Order	City Name	Area Kms2	Dist. from Qutb(Kms)	Real World Coordinates Long.(D:M:S)	Latit.(D:M:S)
I	Lal-Kot	3.40	0.00	77:10:58.799	28:31:51.817
II	Siri	1.70	4.40	77:13:00.306	28:34:21.913
III	Tughluqabad	2.20	7.70	77:15:37.550	28:31:33.227
IV	Jahanpanah	0.20	4.40	77:14:04.633	28:33:17.586
V	Firuzabad	0.10	13.10	77.14.18.928	28.39.07.811
VI	Purana-Qila	0.20	10.70	77:14:26.075	28:36:44.862
VII	Shahjahanabad	4.90	14.80	77:13:00.306	28:42:22.792
VIII	New Delhi	12.20	10.50	77.12.38.864	28.37.13.452

Table 4.1 establishing dates of cities Table 4.2 Areas & Geographical location of cities [Risley Gordon: 1906]

This first Delhi better known as lalkot established around 1000; evidence in Asoka inscription dated 1164 which stands in Firozshah kotla, also mentions Visala Deva probably the grandfather of Prithviraj Chauhan who built Lalkot as old Delhi. [Risley: 1906] the historicity of this Delhi exists only in texts' and cross references; as the city must have been built in timber and with weathering may have deteriorated over time. Also Delhi was unimportant thus resources may have been limited to none therefore no remains of any kind of Lalkpt. It may logical to conclude that the planning of first Delhi of Lalkot not known except for its existence that was recorded.[ibid]



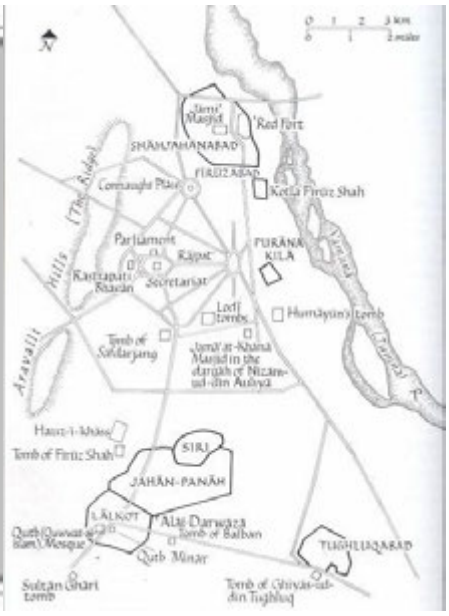


Fig 4.1 Map of Delhi Fig 4. 2 sites of seven Delhi's [Risley Gordon: 1906]

In 1151 AD Chauhan's conquered Delhi, who was defeated by Muhammad Ghori in 1193 AD and Qutub-ud-din Aibak built Qutub minar as a symbol of victory over the Chauhans with existing 27 Hindu temples within the limits. As per Islam personification of Gods' is prohibited thus the structures of existing Hindu temples built in stone with exquisite carvings were retained but with defaced sculpted images of Gods and Goddesses are evident even now. In 1303 AD Alauiddin Khilji constructed the second city Siri occupied by existing village of Shahpurjat and Hauz khaz have had continued existence with parts of remains exist even now. The footprint of second Delhi is legible as precincts' i.e. in Haus Khaz village that has a water body and green spaces that are retained while Shahpurjat the built morphology has transformed to address the need for commercial and office spaces with limited residential. Typically, the stand point of Delhi master plans is that the construction within the laldora: the legal boundary of the village [red thread in Hindi] is to be monitored by the village panchayat the lowest denominator of administration. Next the location of both these villages is extremely strategic as an extension of Lutyens's Delhi and central to the city. Being a village their built morphology is organic in nature which is in stark contrast to the well planned city beyond the laldora. This nature of development offers opportunities i.e. low cost, approvals not a challenge, issues like FAR, building heights, setbacks etc not in place; such a framework offers immense opportunities for one to be creative

exploring scales and urban design issues like element of surprise among others. Hauz Khaz was transformed as fashion hub by individual's entrepreneurs with minimum seed money for the retails'. While Shahpurjat evolved as a hub for retails and office spaces mainly because of low investment required with central location within the city. [ibid]

In 1320 AD Tugluq Shah built rapidly as he lived till 1325 AD he built the third city of Delhi. The city five miles to eastwards around rocky hills largely for security reasons with high sloping walls the remains are still intact. However, the said site did not have any direct access to water which proved prove to be bane and no constriction happened after his death. Conventionally the name of the city followed the name of the king thus Tuqhlakabad the third city. As the king lived for a short duration the city never shaped up also lack of water made it even more difficult. The history of planning neither could get documented nor recorded, whilst the remains of the high sloping walls continue their presence within the Delhi's fabric only. Records states that the minister of the king of Tugluq dynasty built the Khirki mosque [1351-1388] one of the two covered mosques in India; a deviation from the conventional design of mosques'. Thus except for the covered mosque and the sloping walls the planning histories missing but the open spaces including the remains is a bio-diversity park now maintained by Delhi Development Authority cherishes the same name of the dynasty.

1327 AD Muhamad-bin-Tugluq of Tugluq dynasty build a city that accommodated the large population residing on open plains between old Delhi-Lalkot and Siri were insecure and felt the need to build walls resulting in the fourth city: Jahanpanah. In the name of planning histories this city has only remains of the buildings and other structures i.e. tomb of Ghayasudin –Tugluq along with open green spaces that have enjoyed their continued existence. The current master plan Jahapanah forest is acknowledged.

When Firozshah succeeded Tugluq, he constructed the fifth city of Delhi, north east of Siri in 1354 AD towards north and the ridge area. The limits of Firozabad and Shahjahanabad due to close proximity; as it was easier for the inhabitants to pillage the building materials to build. Firozabad had walls only on west side and river edge no walls; thus this city was not a walled city in true sense. Largely it was about access to building materials from the older cities i.e. Siri, Jahanpanah, Tuqhlakabad accessed from three sides road from Qutub Minar, to build the city. The Firozshah kotla fort overlooking the river Yamuna continues its presence in abandoned state. Each of the five cities were built towards the north as river Yamuna the source of water flows from north to the south; thus an attempt to access fresh water moving towards the north was the norm. however, this trend continued till the seventh city only as with the colonial rule and industrial revolution, technologies were in place, when New Delhi-Lutyens' Delhi was built.

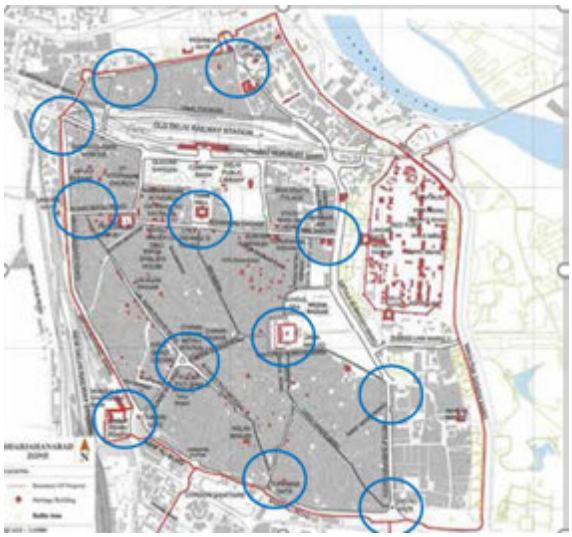
After the Moguls conquest Humayun built the Purana Qila in 1534 AD and the walls for the sixth city occupied a part of Firozabad as well. The walls of Tuqhlakabad and Shahjahanabad are in existence while the remains of the rest four cities are legible in the city's fabric. Often Purana Qila is associated with the Indraprastha as the Hindu city that stood in 1450 BC; as described in poem by Homer. In precedence of the previous cities the fort of Purana Qila with a part of moat with water is the only remain of this city. Within the fort too most of the buildings are ruins now.

In 1648 Shah Jahan built the seventh city also known as Shahjahanabad- a living historic city and recognised as heart of Delhi. Following the norm of building towards north continued; however, towards the east was Red fort overlooking the banks of river Yamuna and instead of city walls a moat was constructed similar to previous city of Purana Qila. Shahjahanabad had low walls as it was built later in time line as compared to Tuqhlakabad for that was built on rocky hills with high walls. A water channel was constructed along the main axis that connected the red fort to Fatehpuri [means conquer in Urdu] Mosque. It is believed that a water channel through chandni chowk the central spine of Shahjahanabad the seventh and living city of Delhi, was a part of channel of Firozabad. Most of the cities were built on the same site and in close proximity site partly due to convenience of building materials readily available for centuries. The transition from city walls to moats and bastions were reconstructed as city expanding the bastions rebuilt accounting for the defence mechanisms. Shahjahanabad had fourteen gates they were built over time largely driven by reasons of governance from economic to security.

Fig 4.3 Map of Shahjahanabad 1857-58 [DUAC: 2015]

The city when planned was characterised by organic nature while the gates that facilitated the ease of movement of people which continued for about two hundred years. All the gates were not built since the inception of the city but added as and when required i.e. in 1852 AD Grand Trunk road brought through Chandni chowk. The Grand Trunk road connected Calcutta to Peshawar now in Pakistan that facilitated the British for administration purposes and economic as well. Parallel in 1854 East Indian railways began again by British and in 1852 Lahori gate were built; these transitions culminated with the British rule from 1858 AD. The change of urban governance impacted the fabric however the transition also observed water supply and sewage systems in place. The impact was largely at city level while the individual buildings continued with the prevailing architectural vocabulary.

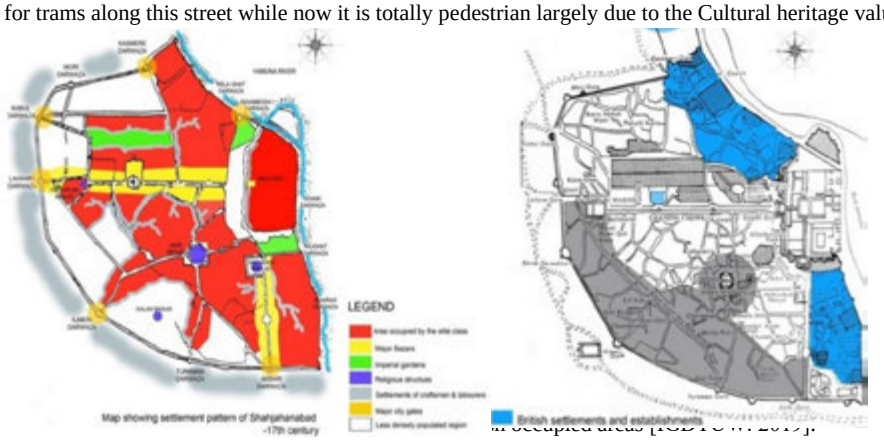
Zone	I	Delhi gate/ Faiz bazaar
Zone	II	Ajmeri gate
Zone	III	Turkman gate
Zone	IV	Kabuli gate
Zone	V	Shah Shabir masjid area
Zone	VI	Hauz Qazi chowk
Zone	VII	Jama Masjid
Zone	VIII	Town hall area
Zone	IX	Bhagirathi palace



Zone	X	Lahori gate
Zone	XI	Mori gate area
Zone	XII	Kashmiri gate area

Fig 4.4 Zones mapped in Shahjahanabad Tab 4.1 Zones in Shahjahanabad [IGDTUW:2019]

The main east-west axis that connects the Red fort to Fatehpuri masjid was/is significant that transformed with time for the needs of the inhabitants often the decisions were governed by administration. Mughals used it as their main commercial street that had a water channel flowing in the centre. British recognised the relevance of the street and constructed a town hall on this street with large open space in front of it for conjugation and built few churches as well. The colonial rule was responsible for trams along this street while now it is totally pedestrian largely due to the Cultural heritage value.



The Socio-Cultural strength was so strong that even the British could not dilute it. Within the walled city they managed to occupy areas that were lived in by lower class of the society then including the adjacent areas as spill over as shown in Fig 4.8.

Fig 4.5 Trams in Shahjahananbad [Above] [IGDTUW: 2019]

Fig 4.6 Main east-west axis image depicting the open space infront of Town hall in Shahjahananbad [right] [IGDTUW: 2019]

The walled city historically enjoyed the status as administration head and over the years have assumed the status of wholesale market for not only Delhi but for northern India. This economic boom increased the demand for storage spaces for goods and this zone strategically located at the edge and easy access to the market was/ is being used such. Significant is that there have been attempts to shift the wholesale markets outside the walled city and even facilitated through master plans allocating spaces but the social response was not favourable. The socio-economic set up was/is very strong and thus decisions related to governance have continued.

Next the Faiz market better known as Dariyaganj that leads to Delhi gate had development planned based on western norms. One can see the stark contrast as illustrated in the case of Delhi gate and connect with the city expanding beyond the gates. Sharing few examples enumerating the planning approaches of Shahjahanabad and new Delhi along the edge of the walled city where two diverse urban tissues co-exist. First one is that of Delhi gate. Dariyaganj main market street erstwhile Faiz bazaar was once a boulevard between Akbarbadigate of the fort till Delhi gate: 1050 yards long, 30 yards wide with 888 shops built in 1650 it was the main commercial street with central canal shaded on both sides by trees similar in design with haveli's, sarai's, masjids on either sides. In 1800's most of the original fabric levelled by the British to make room for the military. This street is popularly known as the Dariyaganj market now. It's interesting to observe that the part of the walled city continues with residential land use except along the main road that has commercial and retail activities. However, the urban texture on either side of the road is in contrast [refer Fig 4.9] the right side development saw the transformations over the years especially during the late Colonial rule and independent India. On Sundays when the shops are closed this street houses market for old books and was an integral part of the Delhi population for years.

Fig 4.9 Delhi gate zone with current land
current land use [IGDTUW: 2019]

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Fig 4.10 Time line urbanisation of Delhi gate zone [IGDTUW: 2019]

Ownerships of properties in the walled city typically are multiple ownerships that too is a deterrent for redevelopment thus stabilising the densities. The real estate prices within the walled city are the highest and often accessibility is a challenge as each ward is inhabited by specific community and thus preference is for the clan over the price. All these aspects are typical for the walled city only and not applicable for New Delhi and satellite cities.

The next case example is that is of Turkman gate. This gate was occupied by middle and low class communities and later taken up as an initiative for redevelopment as well. This was largely as an outcome of first master plan that stated that the walled city is a slum area and needs attention. The proposal to rehabilitate them to a different site outside the walled city was apolitical agenda however, the local community protested and eventually the project had to be shelved; something that could happen only in the walled city.

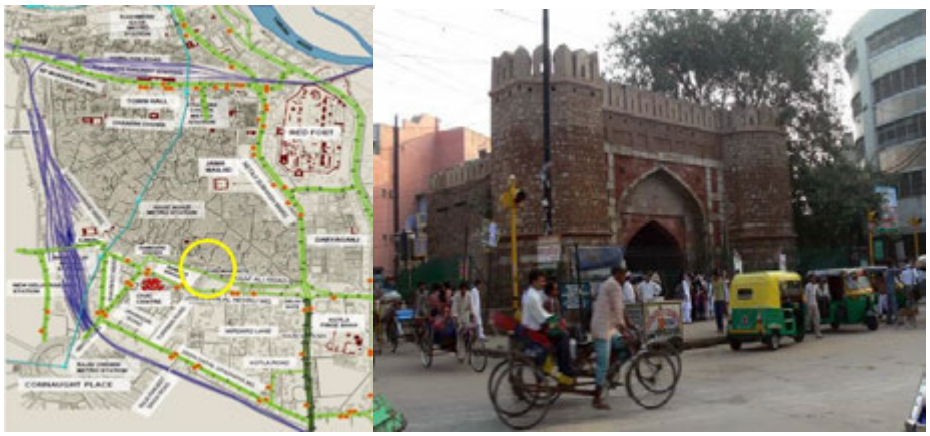

Fig 4.11 & Fig 4.12 location and image of Turkman gate [IGDTUW: 2019]

5.0 Colonial and Independent India

British assumed political power in 1858 and managing the rule from Shahjahanabad proved to be an uphill task with existing city with a planning typology that they were not familier with and to govern decided to have their own establishment as another Delhi : The New Del or Lutyen's Delhi.

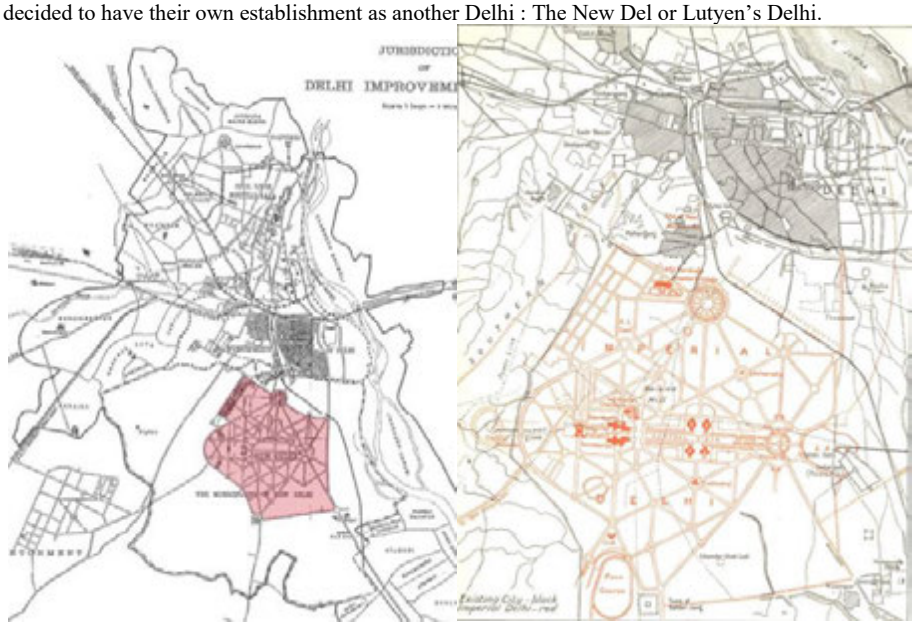

Fig 5.1 & Fig 5.2 Site of Lutyens Delhi and Shahjahanabad [DUAC: 2015]

In 1911 the British Sifted the Capital from Kolkata to Delhi and the birth of Imperial Delhi Community was formed in March 1913 to overseas the construction of the New Capital known as Lutyens's Delhi. In 1916, it was notified as Raisina Municipal Committee under the Punjab Municipal act 1911. In March 1927 this Municipal Committee was redesignated as New Delhi Municipal Committee. [Indian summer:] In 1932 this committee was upgrade as First Class Municipal Committee. MCD act in acted by Parliament in 1957 and Municipal Committee of Delhi election were held in 1958.

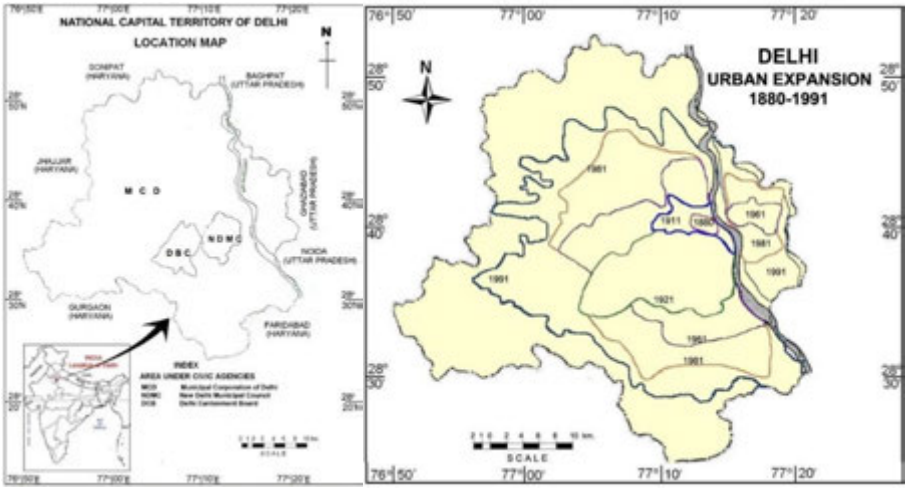

Fig 5.3 Location of Delhi & Fig 5.4 Decadal Expansion of Delhi [Singh.N.C: 2019]

This stage of transition from Colonial rule to independent India and role of Delhi the administration capital. Lutyens' planned the city acknowledging the main axis of the existing cities, river Yamuna and local building materials. Considering the British were to build New Delhi with norms and standards including typologies were rather western i.e. typically the residences in old Delhi were courtyard houses while the bungalows designed had the built in the centre with large open spaces around the built, in total contrast to the traditional typology and so on and so forth. The 'Imperial City' of New Delhi designed on Garden City principles, with a central avenue comprising the President's House and surrounded by government and institutional buildings with residential 'bungalows surrounding the main spine. The plan was conceptually based on the Garden City principles of Ebenezer Howard, with wide tree lined avenues, large plots and bungalows set in them. The main axis was an east-west axis, starting from the Rashtrapati [means President in Hindi] Bhawan atop the Raisina Hill going down to the India Gate; centre of hexagon. The ridge behind the Rashtrapati Bhawan, known as the central ridge, comprises of 864 ha. and most of it has been declared as a 'reserved forest' in the year 1914.

The planning principles were in stark contrast to the compact city, densely populated, mixed land use with low rise high density constructed with locally available materials and vernacular technologies. The statement of avenues, boulevards with bungalow typology was rather an expression of authority and status; something that continues till date. Such a paradigm shift came in for an independent India and the planning of New Delhi was more in sync with the planning vocabulary at global level. The seat of authority is now occupied by first citizen of the nation, the President. The layout of the Rashtrapati Bhawan, North Block and South Block, large bungalow plots and other government buildings with boulevards demonstrates Delhi as a city a grand order, symmetry and unique aesthetic character mainly blended with use of local red sandstone.

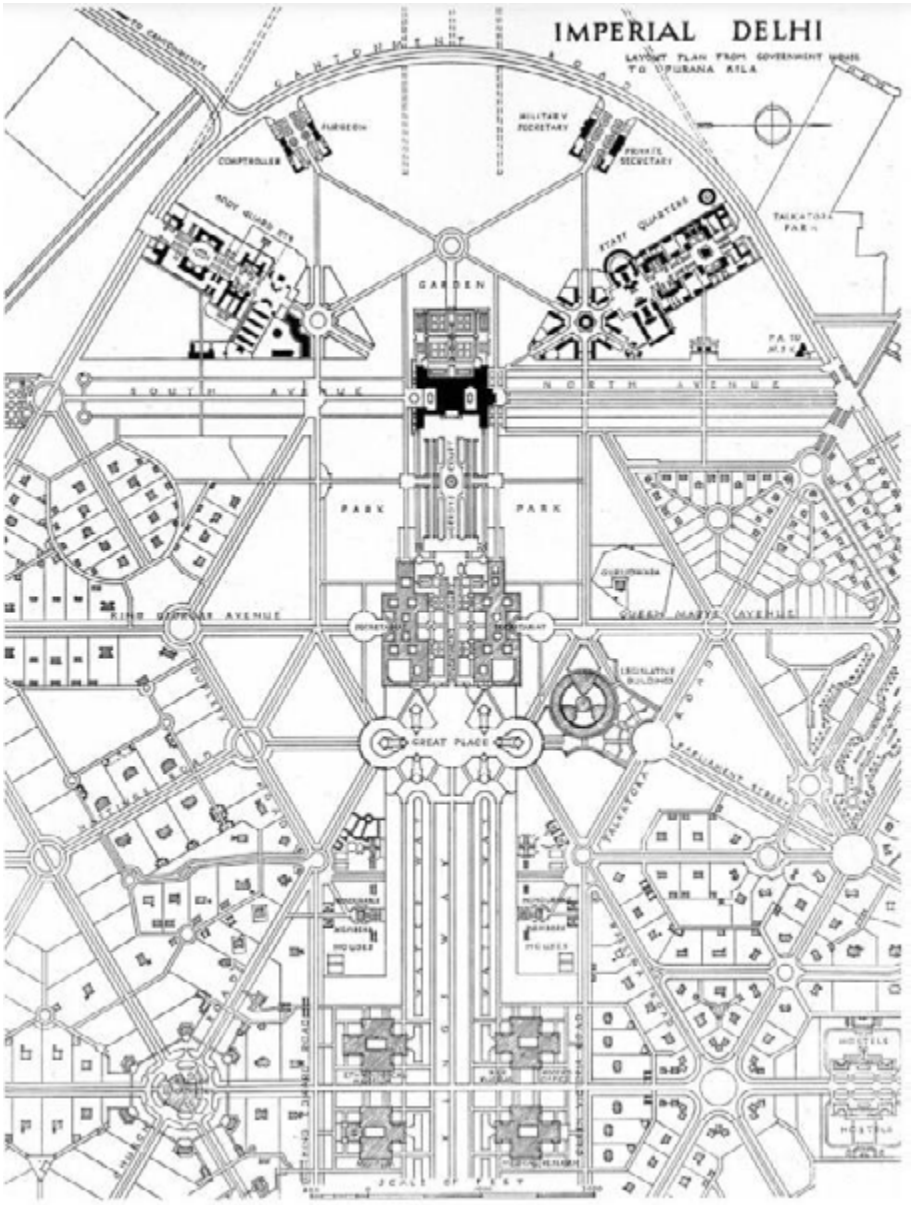

Fig 5.5 Layout Plan of Lutyens' Delhi [DUAC: 2015]

The Delhi master plan 2021 declares Lutyens' Bungalow Zone as heritage zone covering an area of 28.73 sq.km and constitutes approximately 2 percent of the total area of the NCT of Delhi: 1,484 sq.km. The World Monuments Fund has designated Lutyens Bungalow Zone as one of the world's 100 most endangered sites in the year 2002.

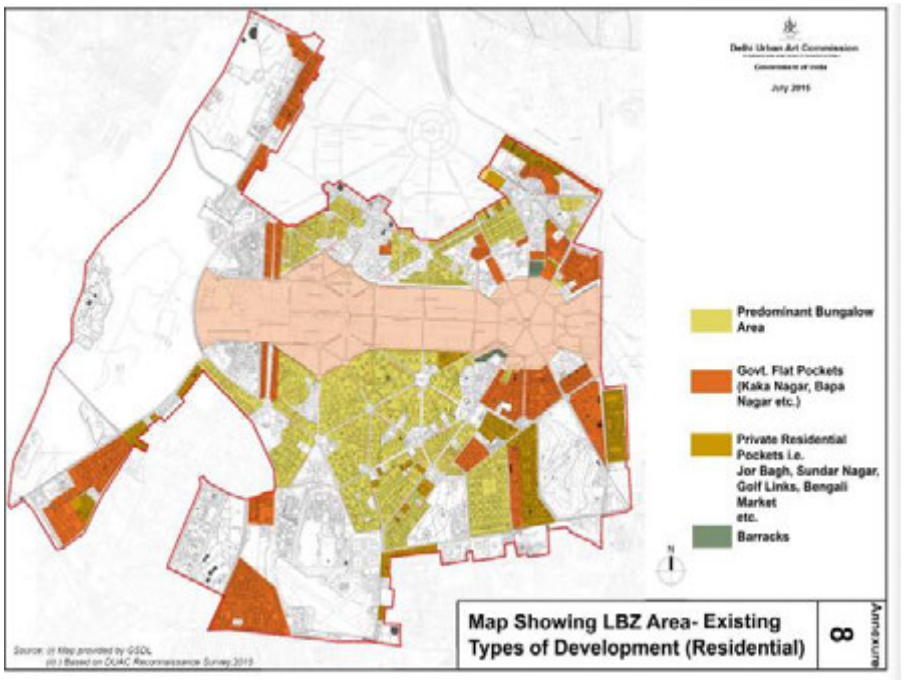

Fig 5.6 Land use of LBZ [DUAC:2015]

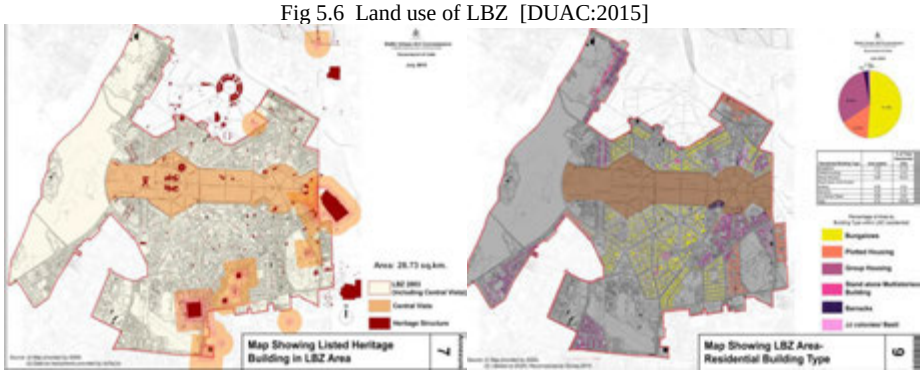

Fig 5.7 Heritage buildings[1] in LBZ Fig 5.8 Land use of LBZ

New Delhi was officially declared as the capital of India after the independence. The State Reorganization Commission 1955 suggested that, 'from the point of view of the law and order, the social life of the people, trade and commerce and common public utility services, old Delhi and New Delhi now constitute one integrated unit and it will be wholly unrealistic to draw a line between the two' [Planning Commission, 2009]. The Government of India accepted the recommendations of State Reorganization Commission, 1955 and Delhi was declared as Union Territory. The Union Territory of Delhi was renamed and now it is formally known as National Capital Territory of Delhi. Key milestones of planning histories of independent Delhi are as follows:

- Original Lutyens's Delhi was planned for an area of 19.12 sq.km, that got revised in 1988 for 25.88 sq.km. in 2003 for 28.73 sq.km and interestingly in 2015 the area was reduced to 23.60 sq.km. Lutyens's Delhi since its inception planned as the administration head continues and

thus the change in areas was to be a part of the prestigious zone. However, with the limitations of building norms coupled with the real estate prices and strategic location propelled such a decision. Although Lutyens's Delhi continued its authoritative position and certain policy decisions encouraged large scale developments initiated both at national level and globalization. One of the earliest local bodies then in place was ASI founded in 1861 by Alexander Cunningham, also the first Director-General. The first systematic research into the subcontinent's history was conducted by the Asiatic Society, which was founded by the British Indologist William Jones on 15 January 1784.

- The independent India among the many challenges with Urban governance and the nations' aspiration to develop was central with this backdrop Delhi was the focus. Therefore, after independence Delhi Development act [1957] was passed by the Parliament. The first master plan for the period 1961-81 was prepared by DDA and notified by the Government of India in 1962. Municipal Corporation of Delhi [1958], National Monuments Authority [2011], ASI [1961]. In 1962 the first Master Plan for Delhi was prepared by DDA, Albert Mayer from Ford Foundation along with Town and Country Planning Organization [TCPO]. The master plans in Delhi were/are formulated based on the provisions of the Delhi Development Act, 1957. Partition of India Pakistan about seventy thousand migrants landed in the city and occupied various pockets In 1985 Enactment of the National Capital Region Planning Board Act was constituted mainly a response to immigration of people to the city and subsequently Zonal Development Plans were prepared in 2001, 2021 and 2041. The first master plan was revised for the extended period up to 2001 by DDA. It was further revised for the standard period for 2001-2021 notified in 2007. Further Delhi fast urbanising was under various local authorities and in an attempt to have uniformity Unified building byelaws were notified by DUAC in 2016.
- The Liberalisation policy in 1991 by the government of India encouraged investors across the globe to setup factories, offices etc and the real estate sector were quick to respond to address the needs of the people i.e. residences, retail etc. Gurgaon shaped up the fastest among the other satellite cities.

6.0 Stage three- Satellite cities: Faridabad, Ghaziabad, Gurgaon and Noida

Delhi after independence being the capital of the nation coupled with its history attracted migration. The earliest mass migration was that due to partition when a large number of people moved to Delhi, both Muslims and Hindus'. The government facilitated them by allocating land parcels to rehabilitate them beyond the limits of Lutyens Delhi. With the city's population growing constantly the need for affordable housing was a challenge. Although the local authorities were at the task to deliver, there was a gap between the demand and supply. Considering Delhi till then was developing and growing on the southern side only but the towns closer to Delhi proved to be a viable option as the land was accessible and affordable. Thus growth of satellite cities of Faridabad and Ghaziabad occurred; parallely the real estate sector was quick to respond to the needs of the society. Proactively the real estate sector along with the local authorities who were struggling with the demand and supply stuck a comfortable balance. Typically the master plans were drawn up for the satellite cities but the nature of development varied. For example, the case of Gurgaon the most recent one; Gurgaon shaped up one of the fastest in Asia. The growing population required transportation thus a plant was set up in collaboration with Japan for affordable cars. Next 20 years later the liberalisation policy gave a boost to Multinationals to invest in India and Gurgaon local authorities were quick to respond to that and facilitated the necessary infrastructure especially internet and with real estate investing the growth began.

It's interesting to note that the neighbouring states looked upon the growth of Delhi as a huge opportunity for the growth of their respective states'. Mainy two states share the edge of Delhi Uttar Pradesh and Haryana; the former towards the east while the rest of the three sides by the latter one. The population growth rate is insightful for the development of the city, with urban land increasing over the years the annual exponential growth rate dipped.

Urban Area and Population of Delhi: 1901-2011

Census Year	Total Urban Area (sq. km.)	Total Urban Population	Percent Urban Population	Annual Exponential Growth Rate	Decennial Growth (percent)
1901	-	214115	52.76	-	-
1911	43.25	237944	57.50	1.1	11.13
1921	168.09	304420	62.32	2.5	27.94
1931	169.44	447442	70.33	3.9	46.98
1941	174.31	695686	75.79	4.4	55.48
1951	201.36	1437134	82.40	7.3	106.58
1961	326.55	2359408	88.75	5.0	64.17
1971	446.26	3647023	89.68	4.4	54.57
1981	540.78	5768200	92.73	4.6	58.16
1991	685.34	8471625	89.93	3.8	46.86
2001	924.68	12905780	93.18	4.2	52.34
2011	-	16333916	97.50	2.38	26.56

Table 6.1: Decadal Population of Delhi source: Census of India 2001 & 2011. Economic survey of Delhi 2008-2009, and Town Country Planning Organisation 2007.

Delhi, being the political head there were many job opportunities and thus influx of population occurred and that explains the cosmopolitan nature of the city; quite apt for the capital of the nation as well with 29 states. The rate of migration was substantial and the efforts of the planning authorities could not cope up and with limited resources made it even challenging. The neighbouring states were smart to tab the potential and equipped themselves to address the spill over of the city. i.e. the connecting roads were the spine along which the development occurred. The states have their own respective governance and Delhi had its own. In order to encourage the spill over of Delhi Gurgaon was fast to respond and through the connecting roads from Delhi; in Gurgaon they proposed land use and facilitated, that was in demand in Delhi. This strategic move yielded fruits and Gurgaon was on the move. Gurgaon typically evolved as a city based on the need duly patronized by political will, as revenue generation proved to be an asset for the state to fund their own, other parts of the state. Multinationals chose Gurgaon as the political will facilitated them with all necessary approvals and required infrastructure this gave momentum to the speed of development. The real estate sector patronised by the political will was/is the main driver for decisions of planning in every way. Thus today Gurgaon boosts of Cyber city including high end residential condominiums'. The strong nexus between the real estate and local authorities under pinned by political agenda: the developers were allocated large land parcels and each one planned them based on the section of society they intended to cater. Therefore, the urban fabric of Gurgaon isn't consistent with disparate planning co-existing; sometimes one often comes across sustainably planned and developed such. But stitching the sustainable pockets do not necessarily yield sustainable city. The land prices too vary with the kind of developments by selected real estate developers.

Noida in contrast; part of Uttar Pradesh observed and planned the city with infrastructure especially connectivity to Delhi. However, people never responded to Noida in the same manner like Gurgaon mainly due to political setup that was corrupt and poor to offer security although recent government has improved the situation but India being democratic people are not certain for sustenance of security issue thus the pace of development has been slow. Also the stakes by real estate sector is much lower thus rather affordable for the middle class of Delhi population. Delhi witnessed these trends and need to get these satellite cities under one umbrella and National Capital Territory [NCT] was created; with standard norms for the region governed by the NCT panning board. The present setup of NCT of Delhi came into existence with the passage of the NCT of Delhi act 1991 [by the parliament by way of incursion of Article 239AA though 69th Constitutional Amendment. This NCT Act came into force in 1992 with this New Administrative setup in Delhi a number of organizational and administrative changes have been brought in by the GNCT of Delhi.In the process among the descriptions of Delhi, one of its locations, Kilokhri, that formed a separate 'city' in the thirteenth and fourteenth centuries, now a part of

the Delhi NCT. [najaf haider] Faridabad and Ghaziabad grew gradually mainly due to their locational advantage only as compared to Gurgaon the prices of the flats were much less.

Fig 6.2 Map of Delhi

Fig 6.3 Map of NCT Delhi [Singh: 2019]

Significant to note is that the spill over of Delhi encouraged gentrification in certain pockets within Delhi housed a section of the society and they relocated such in the NCT i.e. Gurgaon houses condominiums that are high end luxurious apartments followed by Noida. While Faridabad houses mostly middle class affordable flats with Ghaziabad to follow. State of Haryana [Gurgaon and Faridabad] offers better security over state of Uttar Pradesh [Noida and Ghaziabad] reflected such in the development and growth of these cities. although the initial development in these satellite cities were largely driven by political and change in land use was inherent again more a response to demand than an outcome of planning at large. Now all of them have master plans in place and the existing Integrated such.

7.0 Planning histories of Delhi

Delhi enjoyed a central position as administration head since its early days. Therefore the planning was driven by political agenda and the political will only. Tracing the timeline the early cities were aspirations of the kings who established the cities to demonstrate their strength and valour; that continued for Islamic, Moghuls, Lutyens' to independent India and NCT.

The remains of the seven cities clearly enumerates that through religious structures' be it temples or Mosques duly patronised. When the transition time was less the existing ones were defaced etc to meet the political agenda. However, they all utilised locally available materials and indigenous technologies and typically, the planning was a strategic site for the kings with social hierarchy translated in the built morphology surrounding the king. The last of the seven cities the Shahjahanabad was taken care by the British for their own vested interest to rule the nation but did make their presence through planning interventions: location and building Town hall with large open space in front [the only large open space in the walled city] including construction of barracks in Redfort area. Also illustrated in the example of Delhi gate shared in the paper.

Lutyens Delhi and the main buildings constructed then are continuing including the Viceroy's lodge as Rashtrapati Bhawan; the residence for the head of nation, the President, while the rest of the buildings serve for government offices including a few institutional buildings. All buildings placed along the Raj path, the central spine of LBZ now the main public open space for Delhi. Ironically in the recent past the currently elected government proposed a major planning intervention in the Central vista in the Raj path spine; again a demonstration of political agenda to leave a mark in the histories of Delhi. However, among the planner it was a bone of contention but in vain as the political will stood tall.

The planning approaches in the satellite cities again demonstrates the negotiations of political agenda through planning strongly underpinned by capitalism. Planning was incidental with decisions i.e. change in land use, preferences for certain real estate developers including the vested interest of the officials of the local politicians and authorities. The compromise filtered down across all hierarchies i.e. plan of a residential condominium had parks designed in the layout and later they were converted into plots and sold at higher price. Another instance when a large plot was bought for institutional land use at a nominal rate and later negotiated for additional land use. Such decisions impact the use of infrastructures and delivery of the same at city level and the impact is evident in the current scenario.
Another significant dimension for legible histories of Delhi is that in the contemporary situation the investment to preserve and conserve the remains of the history are not universal. The Aga khan foundation has invested in buildings and precincts built by the Moghuls i.e. Humayun's Tomb, Nizamuddin area among others while the others are neglected and in a dilapidated state. Thus the layers of histories construct a narrative that is far from the truth.

However the silver lining is that people were/ are and shall continue to be responsible for the cities. In the case of Delhi as well, all the cities are living and thriving with their own sustaining mechanisms to show their resilience to adapt to varying circumstances. Covid impacted many cities of the world and with the best of communication technologies people moved closer to nature but Delhi with poorest AQI has not been abandoned whilst gentrification got cemented.
The people took the onus onto them and are responding to their built environs for being healthy and improved air quality; partly contributed by the local administration too more to woo the voters as democracy is the norm.

8.0 Conclusions

Delhi being one of the top five largest metrapolis in the world and now with India with highest populated nation in the world puts Delhi in a precarious situation. Delhi has deilivered across varying political heads goverened by administration, economic, religion castes', Social-Cultural, to political agenda. Among the various Delhi's till Lutyens's' Delhi's urban tissue is unique whereas the satellite cities rather clones abiding by the norms of notion ofdevelopment defined by the developed nations. As developing nation then; the need to be a part of the global platform the planning standards were implemented. Ironically the nature of development not being in sync with contextual has incresed the footprint and thereby contributing for climate change. This is important as the so called developed nations have saturated with their growth and concious for the concern and with resources and technolgies are in a position to address the issue. This gives one an opportunity to learn from global examples maybe as best practices i.e. systems in place in London Twentieth century society now Pluralist society only transition of name but existence continued that offers Certificate of immunity [COI] including grading for a limited term subject to renewable with the Intent of histories for buildings by STAB- Society for the Protection of Ancient Buildings setup by William Morris and Philip Webb [1877]. In case of Delhi similar intiatives may be in place and extending beyond buildings for precints to cities too. However, initiaves are being looked at for footprint for developments that are sustainable by allocating addtional FAR-floor area ratio for green rated buildings but the norms to be abided by are non contextual thus do not contribute much for the carbon footprint.

Delhi grew and developed for its geographical, political, economic, social aspects the pillars of sustainability strongly underpinned by Cultural heritage. Globalisation facilitated by liberalisation policy encouraged the satellite cities to develop with the global norms of planning.
The current rate of growth is continuing through TOD-transit oriented development that encourages continuous development along the connecting spines i.e. DMIC-Delhi Mumbai Industrial corridor operational now. Urban governance is a challenge especially for a capital city with strong intervention of geo-political agenda. Delhi demonstrates histories of planning typologies and most of them either in place or documented and NCT has the opportunity to relook at and plan the way forward.

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Annexure-1 TEN CITIES OF DELHI [Gupta.Narayani, 1987]

1. Lal Kot/Qila Rai Pithora {the Tomars): The broken walls of this can be seen on the road to the Qutub (Aurobindo Marg). Many of the stones and carvings of Prithviraj Chauhan's fort were used to build the arches near the Qutub Minar. The Minar, begun by Iltutmish, has 378 steps.
2. Siri (Alauddin Khilji): Much of this has been later built on, but parts of its wall can be seen near the Asiad Village and near the MadangirRoad-Saket crossing.
3. Tuqhlakabad (Ghiyasuddin Tughlak): Notice the sloping walls {to make them stronger) and the beautiful tomb of Ghiyasuddin (which used to be surrounded by a lake).
4. Jahanpanah (Mohammed Tughlak): Vijay Mandal (between Panchshila Park and Malaviya Nagar) was where Mohammed Tughlak reviewed his troops.
5. Ferozeshah Kotla (Ferozeshah Tughlak}: In this fort, notice the Ashoka Pillar that the Emperor had brought to Delhi and placed here. His own tomb is in the beautiful Hauz Khas complex (see Chapter 13).

6. Sayyid and Lodi Delhi: Most of these monuments are enclosed in the Lodi Gardens (Lady Willingdon Park) which was earlier the village of Khanpur. The Lodis also built Masjid Moth, which is near present-day Uday Park.
7. Purana Qila (Humayun and Sher Shah): The enormous gateway on the Bahadur Shah Zafar Marg, outside Ferozeshah Kotla, belongs to Humayun's city. Sher Shah's mosque in the Qila has beautiful marble and sandstone work. The library is of interest because of Humayun's accidental death there when he tripped and fell on the staircase.
8. Shahjahanabad (Shahjahan): If you approach Delhi Gate from Bahadur Shah Zafar Marg., you will see the city wall stretching to the right towards Ring Road.
9. British Delhi: a) The Ridge. Opposite the main gate of Delhi University is Flagstaff Tower, which the British army occupied in the 1857 siege. Further west is the British Victory Tower.
b) New Delhi. Walk or drive down from India Gate (built in memory of the soldiers killed in World War I) to Rashtrapati Bhavan. Look at the Secretariat buildings and notice how they combine Indian and Western styles of architecture.
10. Modern Delhi: The capital of independent India, a) Diplomatic Enclave, Chanakyapuri. An area set aside for foreign embassies.
b) Buddha Jayanti Park. A beautiful open park, sited on the Ridge.
c) Ashoka Hotel. The earliest of the big hotels necessary for a major capital city.
d) Jawaharlal Nehru Stadium. One of the largest stadiums in Asia, built for the Asian Games of 1982.
e) Birla Mandir.

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INTERPRETATION AND PRESENTATION STRATEGIES FOR THE HERITAGE OF THE PAST: THE CASE OF SMYRNA

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Abstract
The port city Izmir has a long history, dates back to Hellenistic times. This multi-layered historic city, known as Smyrna, has enduring powerful connections based on trade within Mediterranean regions. The city was a multi-cultural place especially during the 19th and early 20th centuries, covering diverse typologies of cultural assets formed by diverse communities. Throughout the history, fires, earthquakes, and conflicts affected the urban tissue, which are followed by important planning studies. This paper aims to understand cultural heritage based on the historic roots and develop new strategic framework regarding whole cultural layers. Past plans and spatial maps are analysed in detailed and evaluated. The interpretation and presentation strategies are defined to foster mutual understanding and respect, in a broader sense, building peace among communities.
Keywords: Historic port city, interpretation and presentation, cultural heritage, Smyrna, Izmir.

1. Introduction

In the history, the very first settlement named Smyrna was established in Bayraklı district, known as Old Smyrna today in the Bornova Plain, at an area that forms a natural harbour in 3000 BCE in Izmir (Figure 1). Due to Persian attacks, Alexander the Great reestablished the city on the skirts of Pagos Hill, next to the Meles River and Gulf of Izmir around 300 BCE (Doğer, 2020; Ersoy, 2015; Tanrıver, et al., 2016).

Smyrna had an inner harbour and a port during the Hellenistic Period, and agricultural products from the fertile valleys of the Küçük Menderes (Kaystros) and Büyük Menderes (Meandros) rivers in the south and Bakırçay River (Kaikos) in the north were transferred (Doğer, 2020).

Figure 1: Location of Historic Centre of Izmir

Smyrna went under the control of the Seleucids in 281 BCE, then under Roman Rule in the late Hellenistic Period, and later under Eastern Roman Empire until 11th century. Earthquakes, fires, and epidemics threated the city during ancient times. Components of Smyrna Ancient City, namely the Smyrna Acropolis, Theatre, Agora, Harbour Bath, some parts of main roads, and housing area of Altınpark have reached today, while traces of some components such as Stadium, city walls, and urban pattern are still visible.

The settlement captured by Çaka Bey in 1081 (Daş, 2009) and ruled under Turks' control since then. Aydınid Period was followed by the Ottoman Era. With the increment of trade volume at the end of the 16th century, the city expanded towards the cape called *Punta* on the coastline. The European states opened consulates, and the population of Greeks, Jews, Armenians, and Levantines increased, and they formed their own neighbourhoods (Goffman, 1995).

Figure 2: İzmir at the end of the 17th Century (source: Rijksmuseum, Amsterdam as cited in Nizamoğlu, et al., 2022, p.109)

Figure 3: A Gravure form (Cornelis de Bruyn, source: Archive of Konak Municipality, 2021)

Due to the changes in transportation technology, security concerns, and natural processes, a larger quay and developed port trade functions were required. Hence, the inner harbour of the ancient times was filled starting from the 17th century and expanded over a span of 400 years (Figure 2, Figure3). The infilled area was designed as an Ottoman Bazaar, and diverse types of architectural heritage, such as khans, bazaars, churches, mosques, synagogues, İzmir houses, fountains, significant public and cultural buildings were built (Beyru, 2011b).

In the late 19th century, trading activities were expanded to its largest network in the Mediterranean Basin and beyond (Figure 4). New buildings were developed in the urban area. The banks, post offices, stock exchange building, insurance companies, and entertainment enterprises were at the coastal zone so called Kordon, the Ottoman bazaar on the infilled area so called Kemeraltı, and a modernized bazaar at the north of Kemeraltı, namely as Mimar Kemalettin, and residential areas towards the skirts of the castle skirts.

The revival of the commercial life also led to a vibrant city life. Travelers and tourists visited Izmir and noted that diverse communities with different culture and religion lived in their neighbourhoods, which has characteristic architectural styles based on their lifestyles (Yaranga, 2000).

The defeat of the Ottoman Empire in the WWI was followed by Greece occupation in 1919, then the war between Turkish and Greek armies. The great fire 1922 destructed a significant part of the city, many cultural heritage buildings were destroyed (Naimark, 2002; Biondich, 2011; Neyzi, 2008). Afterwards, the population exchange between Turkey and Greece agreed with Treaty of Lausanne in 1923, and entire Greek, Armenian, and a significant part of the Levantines and foreigners left İzmir.

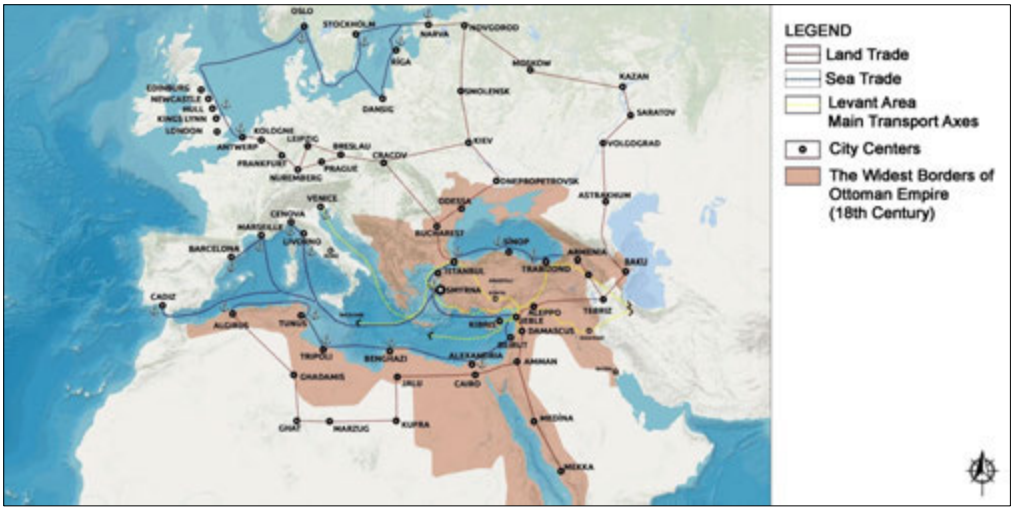

Figure 4: International Trade Routes of Ottoman Empire in the 18th Century (illustrated by authors, Source: Nizamoğlu, et al., 2022, p. 125)

In the Republican Period of today's Türkiye, Izmir still conserves important cultural buildings and urban pattern, which has evolved with cultural layers throughout the history. This settlement still exhibits various layers of civilization including Roman, Byzantium, Ottoman, and Republican Era. Although functions and buildings were altered in times of modernization and globalization, spatial organization and macroform of the urban space has been conserved.

Smyrna, as the historic centre of İzmir, is in the Tentative List within a name "The Historical Port City of Izmir" and studies are conducted for inscription on the UNESCO World Heritage Site. The recent plan, the Historical Port City Site Management Plan (2022-2027) states that interpretation and presentation studies must be conducted for the conserved urban fabric including urban pattern and street forms, also cultural routes to be determined accordingly (Nizamoğlu, et al., 2022). In line with the Site Management Plan, this paper asserts that cultural heritage of the past, which has not sustained today, should be interpreted and presented as a conservation attitude.

The study aims to understand cultural heritage assets based on the historic roots and develop new strategic framework in a way of regarding whole cultural layers of the multicultural urban heritage. The city has a rooted past, yet 19th and 20th centuries are the heydays of cultural diversity. This study aims to expand the question of *how to interpret and present multilayered urban heritage with all aspects, in respect of cultural diversity*. In this regard, plans and maps of 19th and 20th centuries are analysed in detailed, evaluated with comparison of present urban fabric, as well as social and cultural life of those times are indicated. The interpretation and presentation strategies for sustaining cultural diversity are developed in line with the Site Management Plan.

2. Scope, Context, and Methodology

This study focuses on urban heritage of Izmir in Türkiye, mainly the management site of the Historical Port City of Izmir and northern part of the historic city centre, which is beyond the management site. The management site covers 372.40 hectares with diverse conserved areas and listed buildings. The northern part of historic city centre has not survived today with its integrity and authenticity.

The methodology is based on case study, consisting of literature review and illustration of spatial plans and maps via CAD programme. The spatial maps are digitalised by the first author and further illustrated with Adobe programmes. To understand the case, planning history which shaped the urban fabric as a port city in 19th century is analysed to understand previous planning decisions and their impacts on today's urban place. In this sense, spatial maps of 19th century are digitalized on todays' urban pattern. The general macroform of the city is analysed and evaluated, while detailed analyses and evaluation are conducted for the area issued in the Goad Insurance Plans. Afterwards, proposals for interpretation and presentation strategies are developed.

3. Literature

Interpretation and presentation of all layers and aspects of cultural heritage is related to fostering cultural diversity, culture of democracy, and building peace among varied groups of people of the world. International legal framework expands cultural diversity and interpretation and presentation of heritage with diverse layers. In this context, the noted international texts are given in brief.

Universal Declaration on Cultural Diversity of 2001 is one of the earliest binding documents in the context of cultural diversity. The Declaration determines that cultural diversity, which is composed of uniqueness and plurality of the identities of people, is the common heritage of humanity. The Declaration stands on three principles of identity, diversity, and pluralism and states respecting cultural diversity ensures social cohesion and international peace. Cultural heritage in all its forms must be conserved to flourish dialogue among cultures and foster creativity with diversity.

Furthermore, the 2005 Convention on the Protection and Promotion of the Diversity of Cultural Expression by UNESCO defines that cultural diversity is innumerable ways of expression of cultures of groups and societies. The Convention expresses that cultural diversity, which creates rich and varied world, should be preserved for the benefit of all within a framework of democracy, social justice, and mutual respect between peoples and cultures. Hence, cultural diversity is related to culture of peace, strengthening the free flow of ideas, freedom of thought, expression, and information. Including the cultures of minorities and indigenous peoples, recognition of equal dignity of and respect for all cultures are among guiding principles.

The ICOMOS Charter for the Interpretation and Representation of Cultural Heritage Sites (2008) expands objectives and principles on interpretation and presentation strategies and methodologies. Interpretation is defined as “the full range of potential activities intended to heighten public awareness and enhance understanding of cultural heritage site” and covers on-site and directly related off-site installations, trainings, publications, and alike. Presentation refers to “the carefully planned communication of interpretive content through the arrangement of interpretive information, physical access, and interpretive infrastructure at a cultural heritage site”. At that sense, presentation tools can be information panels, displays, guided tours, websites, etc.

The charter defines main principles of interpretation and presentation to enhance public appreciation and understanding of cultural heritage sites. These principles and objectives include encouraging individuals and communities to reflect their own perceptions and develop connections to site, taking into consideration of all groups of people who have contributed to historical and cultural significance of the site and cross-cultural significance of the site, respecting authenticity in designing a heritage program with traditional social functions of the site, cultural practices, and honour of locals and associated communities.

4. Understanding Smyrna with Historic Plans and Maps

Todays’ urban heritage, historic centre of Izmir, was established on the Smyrna Ancient City. The famous historian Strabo (XIV.1.37) described the city as:

> After Smyrna had been razed by the Lydians, its inhabitants continued for about four hundred years to live in villages. Then they were reassembled into a city by Antigonus, and afterwards by Lysimachus, and their city is now the most beautiful of all; a part of it is on a mountain and walled, but the greater part of it is in the plain near the harbor and near the Metroum and near the gymnasium… The River Meles flows near the walls; and, in addition to the rest of the city's equipment, there is also a harbor that can be closed.

The Gulf of Izmir at the west, Pagos Hill at the southeast, and Meles River at the west are the natural edges. The geographical location of the city is suitable for defence, and the port nearby enabled to develop trading activities (Köksal, 2014). The Acropolis on the Pagos Hill, also known as Kadifekale, Theatre, Agora, and Stadium are main monumental structures of the Smyrna Ancient City.

Todays' living heritage place covers Agora, Theatre, Acropolis, Caravan bridge, ancient street, harbour bath, Altınpark residential area, several aqueducts, and some remains of city walls. Although the sketches of Hans Naumann (Konak Municipality archives, as cited in Nizamoğlu, et al., 2022) show a Temple, Harbour Castle, Ephesus and Magnesia gates, they are not visible today (Figure 5).

The multilayered heritage place is still open to new discoveries, there might be new findings as the archaeological studies are conducted. Ibn Battuta (Tanci, 2004) states that the city was largely devasted, especially Acropolis and harbour castle when he came to Izmir in 14th century. After conquered by Ottomans, the harbour castle was demolished in 15th century (Baykara, 1974). The population growth in the Mediterranean during the 16th century, while population of Izmir was mostly composed of Turks and Greeks (Arıkan, 2001).

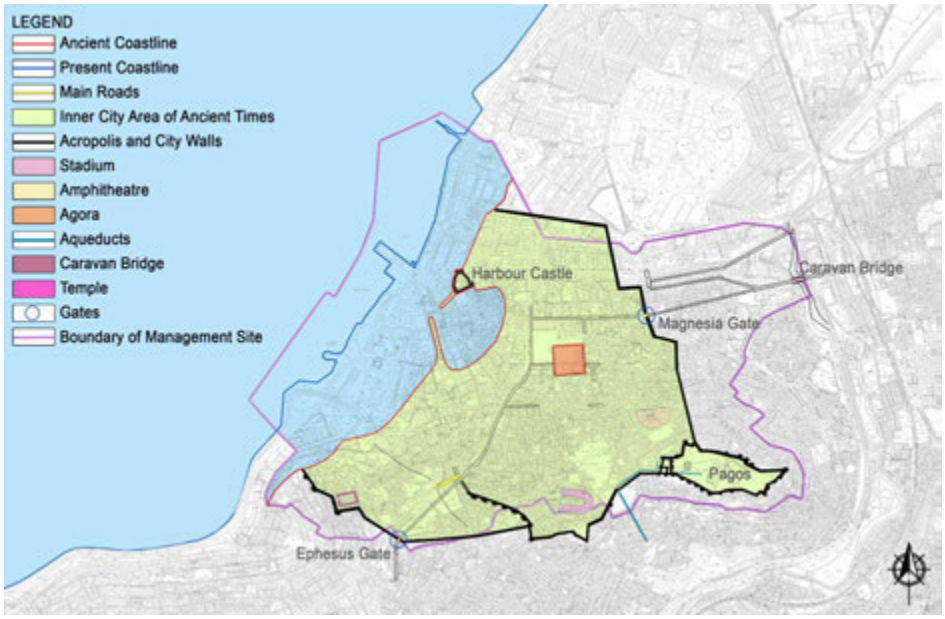

Figure 5: Ancient City Illustration on Present Historic City (illustrated by the authors)

The increment of trade and opening of European consulates also led to increase in population of Greeks, Jewish people, Armenians, Frenchs, Netherlanders, and British people in the 17th century (Goffman, 1995). Turks settled on the slopes of Kadifekale, Jewsih people were around Kemeraltı Bazaar and among Turkish neighbourhood, Levantines were lined up in the part extending from the port to the north along the coast, Greeks were just behind Levantines and Armenian neighbourhood was between Greek and Turkish neighbourhood (Figure 6) (Kıray, 1972).

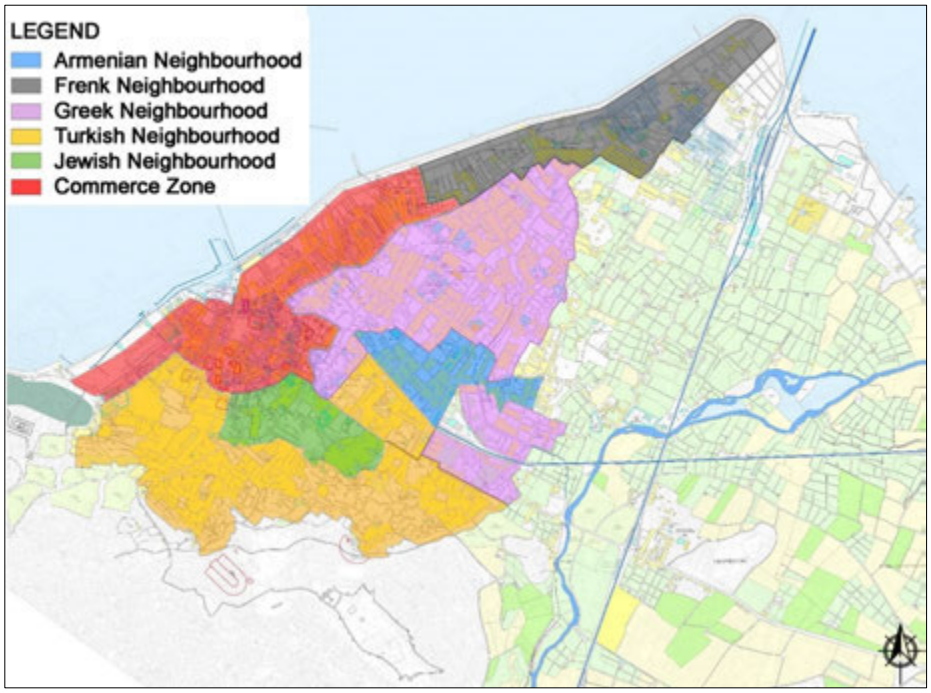

Figure 6: Neighbourhoods in the 19th Century (illustrated by authors, Source: Nizamoğlu, et al., 2022, p. 114)

The city had become an attraction centre for people from diverse religion and nationalities since 17th century. Especially after ahitnames signed between Ottoman and European states, European merchants came frequently to the city and some of them settled (Goffman, 1995).

The inner harbour was filled in 19th century, and several planning studies were carried out for the reconstruction of the city. The overall macroform of the city and components forming urban pattern are investigated throughout plans and maps of the 19th century, which is the heydays colourful and multicultural life of Smyrna.

4.1. Thomas Graves Plan

The Graves Plan, dated 1836-7, shows the city of Smyrna and Vourlah Road and adjacent islands connected by the Gulf of Izmir (Figure 7). The map shows that Smyrna was developed on the remains of the ancient city, oriented to the harbour, and spread to north reaching to the Punta.

Acropolis, and partly Stadium were conserved, while Agora was in a ruined condition, just traces of theatre and temple were noticeable. The site of ancient port is clearly noticeable within the building stocks, close to Governor's House, Barracks, and Parade. The Custom House, breakwater, and port offices shows actively used harbour.

Meles River is crossed by the Caravan Bridge, which is still a main entrance of the historic city. The road reaches to Çorakkapı Mosque and continues to inner part of the city, through partly in the form of Anafartalar street today. The city covers several significant places, such as the Historic Kemeraltı Bazaar (on the infilled area of the ancient port), mosques, churches, hospitals, and cemeteries.

The city had organic pattern with cul-de-sacs and long narrow parcels on the north of the historic bazaar, next to the harbour. In these long narrow parcels, English Consuls, Marina, and cooperage buildings are visible, while English, Sardinian, American and Dutch places are also indicated.

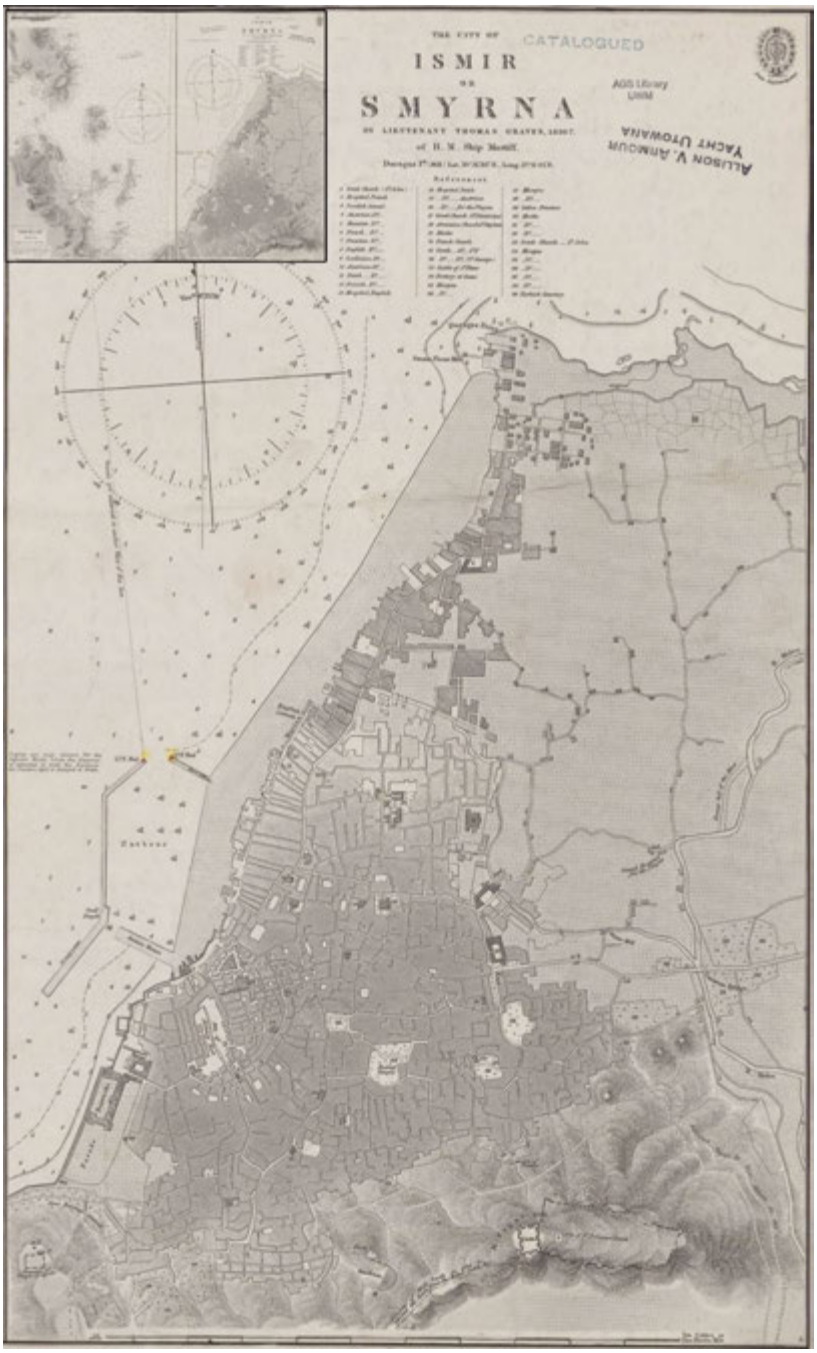

Figure 7: Smyrna Part in Thomas Graves' Plan (1836-7), illustrated by the authors to focus of the City of Smyrna (Source: American Geographical Society, 2021)

4.2. Luigi Storari Map

The two big fire events occurred in 1845 and 1852. The Turkish and Jewish quarters and Kemeraltı Bazaar were highly destructed, while the Armenian Quarter completely disappeared (Beyru, 2011a). Afterwards, the Storari Map was prepared between 1854-1856 to rebuild the city (Figure 8).

The map does not show port and harbour but presents urban layout in detail. It is seen that the city continued its port-oriented development and further extended to the northern side. Punta Region became to develop with building blocks, as quadrangular islands opening to the sea. Long and narrow parcels were extended, behind the quay perpendicular to the sea and new parcels have been formed. Todays' archaeological sites of Agora and Altınpark were used as cemeteries. After the fires, the plan of Armenian Quarter was revised, grid pattern with wider street was introduced instead of traditional organic pattern with narrow streets.

The Storari map also shows that the commercial centre of the city developed, and many khans were built in this period. The bazaar was spread around the inner harbour towards the non-Muslim quarter in the north of the city by the end of the 19th century.

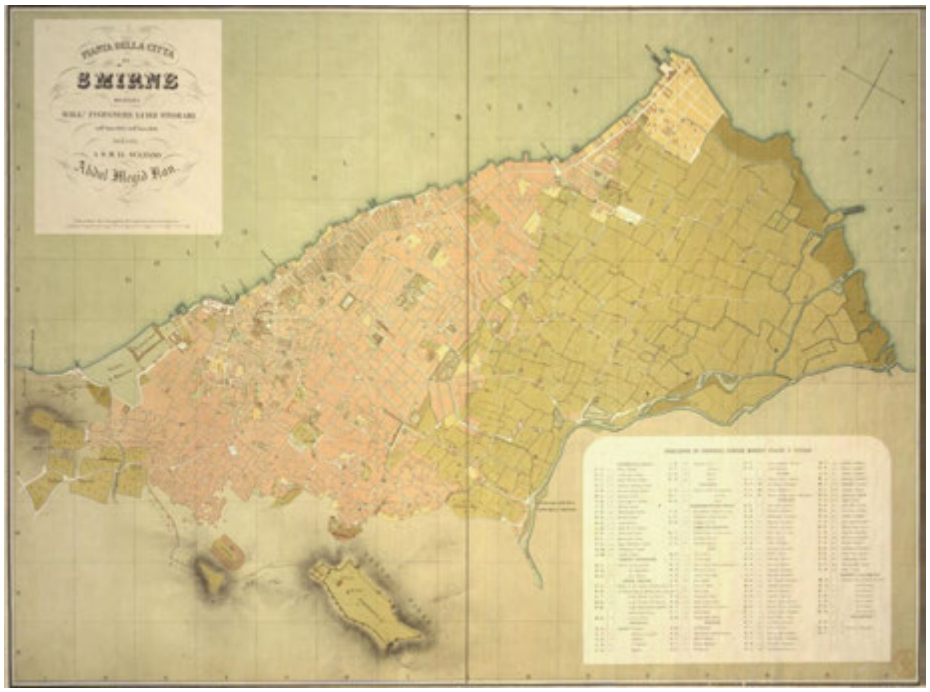

Figure 8: Map of Luigi Storari (1854-56) (Source: Konak Municipality Archive, 2021)

When compared to todays' urban heritage (Figure 9), the hinterland was broader on the southern and eastern part, and the coastal line closer inner to the city. The settled areas in the city were around 429,3 hectares.

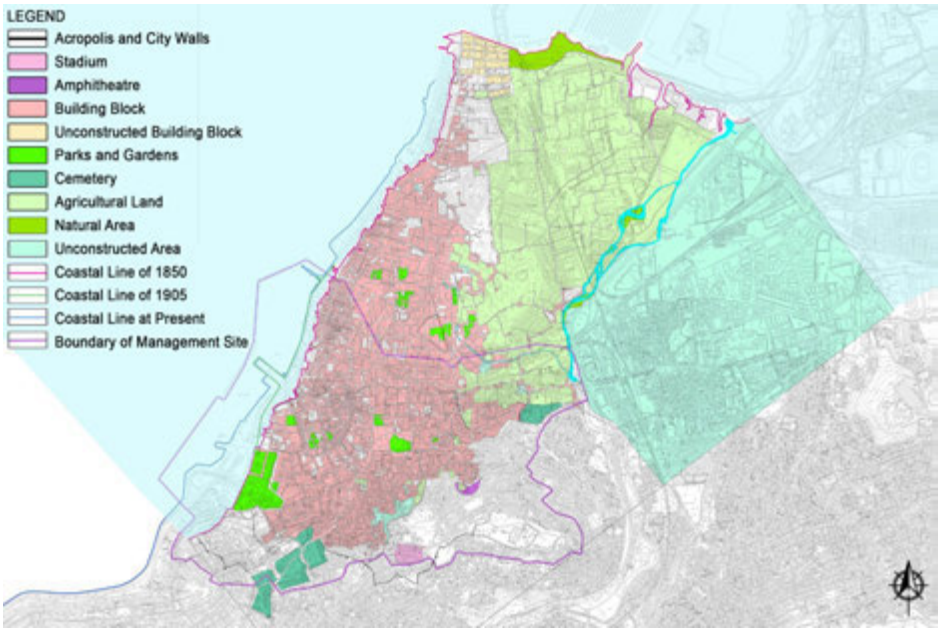

Figure 9: Storari Map on Present Historic City (illustrated by the authors)

4.3. Lamec Saad Plan

Dated 1876, the Saad Plan clearly represents urban layout and main transportation infrastructure at those time (Figure 10). The railway connections were built to export the products grown in the Aegean Region through the port and significantly shaped the urban morphology.

The first railway of the Ottoman period, Aydın-Izmir railway was completed in 1866. In the Plan, Alsancak Station and Basmane Station, railway routes, breakwater and port are seen together for the first time. With Alsancak Station and its facilities, the east of the station was developed as an industrial zone (named as Darağacı today) and the west as a residential area in Punta region. Industrial buildings and density of urbanization increased in this area.

Components of Smyrna Ancient City are also seen in the plan. The acropolis is shown as Ancient Fortresse, traces of Stadium, Theatre, and Temple are indicated, and Agora and Altınpark are shown as cemeteries. The inner harbour is completely filled. Customs of Turks and Europeans were segregated. Today's Governors House is shown as Palas. There were barracks and manoeuvre area, which are not survived today, as also shown in the Graves Map. Near to barracks, there was a prison, which is seen in the first time.

Long narrow parcels between the shore and Frenk Street led to emergence of passageways called "ferhane", distributed across residential areas, storage facilities, and shops erected on either side (Beyru, 2011b). Sanitary Office, Lighthouse Office, Passport Office, Port Captain's Office, Fish Market were located next to lighthouse. Steamboat and Letter Post agencies, foreign consulates, as well as breweries, cafes, and casinos were near to sea.

When compared to todays' urban heritage (Figure 11), the hinterland was broader on the southern and eastern part, and the coastal line were closer to the inner city. Yet, the infilled area became bigger compared to Storari Map. The city in the Saad Plan was around 696 hectares, including both urban and rural settled areas.

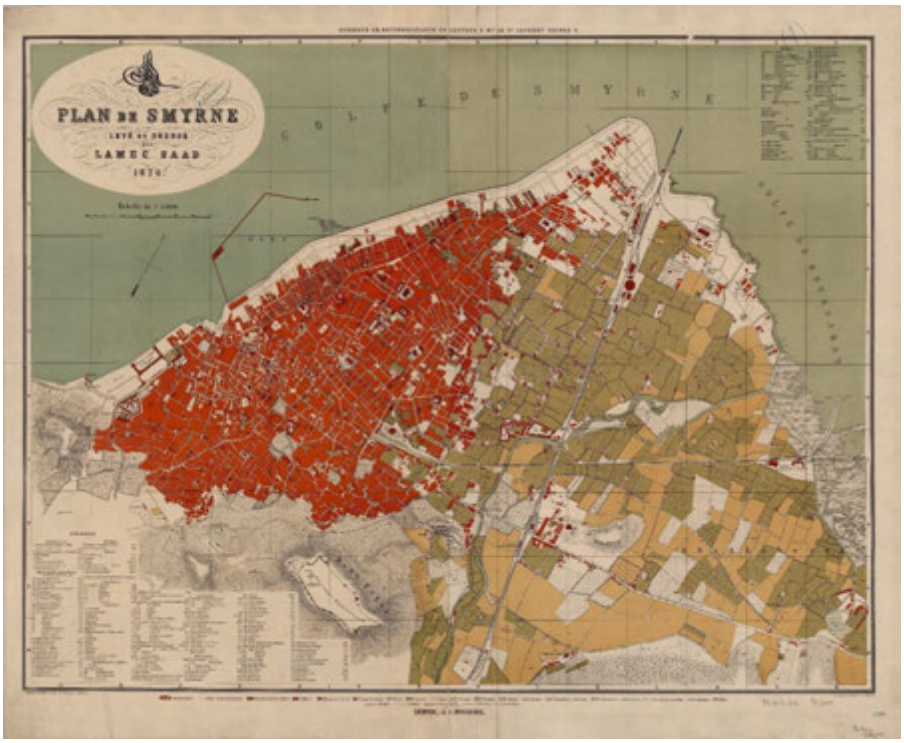

Figure 10: Map of Lamec Saad 1876 (Source: Konak Municipality Archive, 2021)

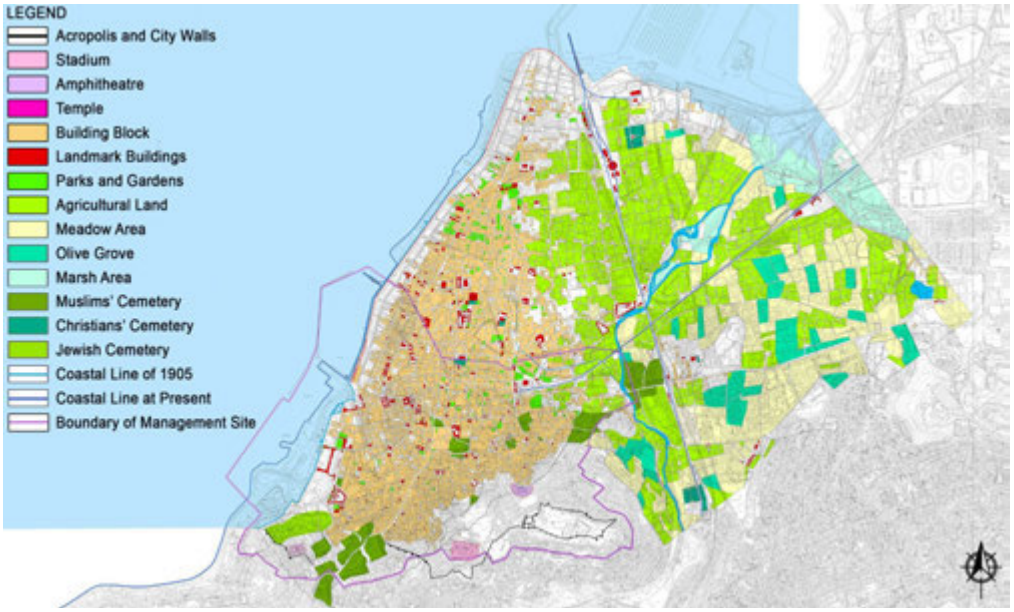

Figure 11: Saad Map on Present Historic City (illustrated by the authors)

4.4. The Goad Insurance Plans

After Lamec Saad Plan, two major fire disasters occurred in the city, which led to preparation of Goad Insurance Plans (Figure 12, Figure 13). The Insurance Plan was prepared by Charles Edward Goad in 1905 focusing on the commercial areas of the city where the need of insurance is high.

The Goad Plans are consisted of 11 detailed maps with scaled 1:3600 and a legend. The maps are significant documents to understand commercial land use of early 20th century. The areas near to port and historic bazaar area were issued in the maps. The area covers 73,5 hectares, 77% of which is in the boundary of management site today. In a way, these areas are valuable for maintenance of port city functions. Also, in the legend several names of owners were indicated. Diversity of these names from different cultures and ethnicities show the cultural diversity in the city at those times.

Figure 12: Index and Legend of the Goad Plans
(Source: Archives of Konak Municipality, 2021)

Figure 13: Insurance Plan of 1905 - Charles Edward Goad Plan (Source: Archives of Konak Municipality, 2021)

4.4.1. Exploring the Goad Insurance Plans

The 1905 Goad Insurance Plans are analysed by matching with today's maps. For the illustration, studies of Rauf Beyru (2011b) and George Poulimenos (2022) are used (Figure 14, Figure 15).

The Insurance Plans covers an area of approximately 73.54 hectares, and 56.80 hectares of which is also in the boundaries of management site today. Commercial uses, production and storage areas, service facilities, houses, and other uses are shown in the maps. Besides, ferhanes and inns are seen as main building typologies in the city. The map indicates that Kemeraltı Region was the administrative and commercial centre of the city in 1905, but the central functions began to spread towards to Punta region.

Figure 14: The Uses of Buildings in the Goad Insurance Maps ((illustrated by the authors)

Figure 15: Legend of the Goad Map

The area distribution of the 1905 map is evaluated (Table 1). The majority of the buildings in number with 34,5% are daily commercial uses, which is followed by housing areas with 21.7%. This also shows the active and vibrant life of the city. Also, inn, bazaar, and ferhane types of buildings covers around 38,8%, and warehouses covers 17,4% of the total area. Hence, commercial buildings are mostly concentrated close to coastal area as the main land use. The Goad Plan illustrates that the city was colourful with commercial buildings, traditional arts, small producers, merchants, as well as residential uses and entertainment and leisure facilities.

Table 1: Distribution of Building Types and Uses in the Goad Insurance Map

Building Types and Uses	Building		Total Area	
	No.	(%)	m^2	(%)
Inn, Bazaar, Ferhane	211	5.7%	201216	38.8%
Warehouses	322	8.7%	90204	17.4%
Housing Areas	806	21.7%	61345	11.8%
Daily Commercial Uses	1278	34.5%	49099	9.5%
Production	394	10.6%	34351	6.6%
Public Buildings	88	2.4%	32794	6.3%
Entertainment and Leisure	279	7.5%	24153	4.7%
Agent, Stock Exchange, Bank, Insurance Companies and Offices	161	4.3%	12301	2.4%
Traditional Arts	80	2.2%	4644	0.9%
Accommodation Facilities	18	0.5%	4625	0.9%
Trade of Other Products	72	1.9%	4321	0.8%
Total	3709	100.0%	519052	100.0%

The commercial buildings such as hotels, cafes, restaurants, clubs were mostly located along the First Kordon, while these types of uses were few in the Kemeraltı Bazaar. These kinds of popular buildings of those times, where people interact with each other, were in associated with the Frenk Neighbourhood, spreading over the ferhanes, shops, passages and commercial streets.

Close to seaside, near to Kemeraltı Bazaar, there were hotels, office uses, banks, stock market structure, agencies and inns used as storage areas, related to the First Kordon Street and Custom Pier. In the Kemeraltı Bazaar, inns and passages were used as commercial buildings and storage areas. The map also shows that the uses such as stores, pharmacies, chapels, flea markets, tailors, shoemakers, candy shops, coal shops, clothing shops and antique shops were intensified. It is also noticed that some streets and bazaars were specialized in certain functions and craftworks, such as Sandıkcılar (means chest makers) street, confectioner street, butchers street, loggers street, glass sellers street, honey sellers, pancakes street, jewelers' bazaar, stoneworkers' bazaar, flea market, fish market, chestnut market.

For the social and economic life, different communities were making living by diverse businesses. For instance, Turks were settled around Kadifekale and near to Kemeraltı Bazaar, and working as tailor, shoemaker, furrier, saddler, herbalist, butcher, turban and cap maker for both women and men, farriers, coppersmiths, jewellers, and alike (Bauden, 2003).

Greeks were the highest population after Turks, from 17th century to middle of 19th century. They were settled neat to commercial district and close to Churches. Greeks works in almost

all sectors, while most of them were engaged in agriculture in the hinterland of Smyrna. They are also work as merchants, boatmen, tailors, bottlers, shoemakers, grocers, tavern keeper, butcher, grocer, greengrocer and tellak (Kütükoğlu, 1992).

Armenians were the smallest population when compared to other communities. Living in the Armenian Quarter, named as Haynots, Armenians were composed of diversified communities, such as Gregorian, Catholic, and Protestants (Hovannisian, 2018). Close to the Caravan Road, Armenians were active in international trade, they were intermediary actors in transfer of Iranian silk carried through caravans and other products to European ports.

Jewish people migrated from Portugal and Spain settled in Izmir. They were both rich and poor Jewish, many of them had their own business (Bauden, 2003), effective in collecting İzmir custom revenues, act as money changer and broker, and served as intermediary for merchants (Frangakis-Syrett, 2006).

Levantine communities are of English, Dutch, Italian, French, Hungarian and Slavic origin. They worked in banking, finance, insurance, and logistics sectors, especially in trade and industrial works. They were active in construction of docks, railway investments, operation of tram and ferry lines, as well as, sustaining communication between local producers and sellers in agriculture sector (Yıldız, 2012).

Levantine's neighbourhood known as Belle-Vue or Bella-Vista was along the Frenk Street (APİKAM, 2020). The narrow and long passages near to coastline were named Frenkhane, which changed into 'ferhane' over time. Residences, shops, and warehouse buildings were lined up on both sides of these ferhanes. Ferhanes also represented western type of consumption (Beyru, 2011b). Levantines constituted clubs, where they followed the printed publications in Europe, which had libraries, arcades, ballrooms, and theatres (APİKAM, 2020).

The inns and ferhanes are analysed further to understand predominant characteristic building typologies in the Goad Insurance Maps (Figure 16, Figure 17). Names of inns and ferhanes in the Goad Plan are determined according to study of Rauf Beyru (2011b) (Table 2, Table 3). Inns are typological buildings used in the commercial life of the city in the past to meet buying, selling, storing, and accommodation needs of people engaged in trade, especially caravan trade (Ersoy, 1988). There are 120 inns, all of which are in Kemeraltı Bazaar and its surroundings on the Goad Map. Most of the inns were in the arc form, adjusting to the Anafartalar street, which was named as Kemeraltı Street in the past. Anafartalar Street, which is the ancient harbour axes at past, gives a unique form to Kemeraltı Bazaar.

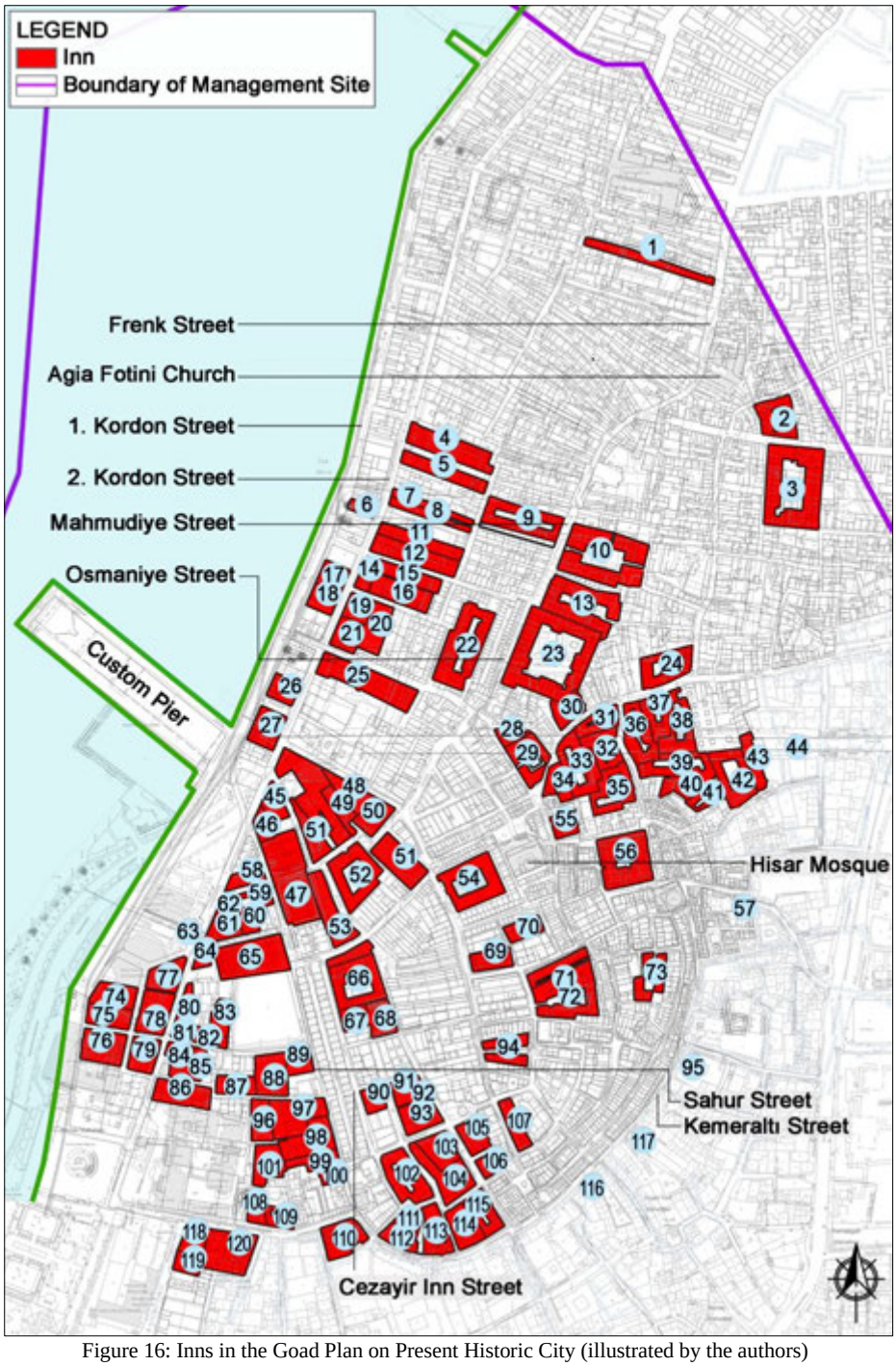

Figure 16: Inns in the Goad Plan on Present Historic City (illustrated by the authors)

Table 2: Inns in the Goad Map

1	Barbaris Inn	41	Kantarcıoğlu Inn	81	Medrese Inn
2	Çamur Inn	42	Fazlıoğlu Inn	82	Enver Bey Inn
3	Dervişoğlu Inn	43	Acem Inn	83	Balasuloğlu (Balasoloğlu) Inn
4	Sen Tom Inn	44	Katiopoğlu Inn	84	Şükrü Bey Inn
5	Hacı Davut Inn	45	Akasoğlu (Akkasoğlu) Inn	85	Yasin Bey Inn
6	Arap Inn	46	Süleyman Efendi Inn	86	Tabur Efendi Inn
7	Sadık Bey Inn	47	Gifrey (Guifrey) Inn	87	Pederi Inn
8	Kırmızı Kapı Inn	48	Maarif Inn	88	Yanya Paşa Inn
9	Coya Inn	49	Kapancıoğlu Salih Bey Inn	89	Arabi Inn
10	Küçük Vezir Inn	50	Maarif Inn	90	Ahmet Efendi Inn
11	Spartalı (Ispartalı) Inn	51	Çakaloğlu Inn	91	Süleyman Efendi Inn
12	Arap Inn	52	Pirinç Inn	92	Müezzinoğlu Inn
13	Küpecioğlu Inn	53	Uzun Inn	93	Hüseyin Bey Inn
14	Venedis Inn	54	Kızlarağası (Kızlarağa) Inn	94	Tütün Inn
15	Arapyan (Arap) Inn	55	Bidayet Inn	95	Küçük Karaosmanoğlu Inn
16	Büyük Akasoğlu Inn	56	Küçük Demir Inn	96	Hacıağabey Inn
17	Balyozoğlu Inn	57	Yemişçizade Inn	97	Şekeroğlu Inn
18	Essayan (Eseyan) Inn	58	Sadık Bey Inn	98	Menekşeli Inn
19	Küçük Akasoğlu Inn	59	General Inn	99	Kapacıoğlu (Kaplanoğlu) Inn
20	Osman Kaptan Inn	60	Nişan Inn	100	Emin Efendi Inn
21	Macela (Maçela) Inn	61	Eseyan Inn	101	Salepçioğlu Inn
22	Girit (Kiritikos) Inn	62	İsmail Efendi Inn	102	Mısırlıoğlu Inn
23	Büyük Vezir Inn	63	Akasoğlu (Akkasoğlu) Inn	103	Kamil Bey Inn
24	Osmanzade Inn	64	Hacı Yusuf Inn	104	Diremsiz Süleyman Inn
25	Vali Paşa Inn	65	Hancıbanoğlu Inn	105	Hasta Hane Inn
26	Nisli Hacı Ali Inn	66	Cezayir Inn	106	Küçük Hasta Hane Inn
27	Haralambo Yusufoğlu Inn	67	Sabri Bey Inn	107	Hacı Mehmet Inn
28	Kuyumcuoğlu Inn	68	Cambaz Inn	108	Rauf Paşa Inn
29	Selvili Inn	69	Abdül Rahmanoğlu Inn	109	Hacı Sadullah Inn
30	Kadıoğlu Inn	70	Müsavvit Inn	110	Küçük Barut Inn
31	Şalvarlıoğlu Inn	71	Keten (Terzi) Inn	111	Tellal Başı Yeni Inn
32	Büyük Kuzuoğlu Inn	72	Büyük Demir Inn	112	Kemahlı İbrahim Efendi Inn
33	Büyük Karaosmanoğlu Inn	73	Çarşılı Inn	113	Bey Inn
34	Mirkelam Inn	74	Balyuzoğlu (Baldızoğlu) Inn	114	Eşrefpaşa Inn
35	Manisalı (Manasoğlu) Inn	75	Sadık Bey Inn (Küçük)	115	Batak Inn
36	Küçük Kuzuoğlu Inn	76	Maksudyan Inn	116	Abacıoğlu Inn
37	Yandevi Inn	77	Karantina Inn	117	Arap (Eski Cezayir) Inn
38	Çukur Inn	78	Sadık Bey Inn (Büyük)	118	Evliyazade Inn
39	Anavutoğlu Inn	79	Halima Inn	119	Yusufoğlu Inn
40	Arap Inn	80	Keşişoğlu Inn	120	Ekmekçi Inn

The inns on the first Kordon Street, nearby the Customs Pier, are in different sizes and forms. In the Kemeraltı Bazaar, the inns lined up one after the other from the beginning of Sahur Street (Mezarlık street) (853 Street today) to Kemeraltı Street. They were followed by the inns lined

up on Cezayir Inn Street (855 street today) located just parallel to Kemeraltı Street. These were the widest streets, linearly extending in Kemeraltı Bazaar, facilitated the access of goods between inns and the pier. In similar, the linear Government Street (today Cumhuriyet Boulevard) was also composed of inns around.

Another region where inns form a cluster is near to Osmaniye Street (todays Mimar Kemalettin Street), which is associated to Basmane Station, and Mahmudiye Street (today's Halit Ziya Boulevard). Besides, there were the Fisherman's Market Mosque and bath, Hisar Mosque and Acem Mosque, which were characteristic to the area.

There were 34 Ferhane buildings, 31 of which were located within the boundaries of management site, as shown on the Goad Map. Ferhanes covered a total area of approximately 47,546 m² and around 42,643 m² in the management site. It can be seen that ferhanes had diverse functions such as businesses related to food and beverage, workplaces with alcohol drinks, agencies, stores, and dealers in Frenk Neighbourhood.

Table 3: Ferhane Buildings in the Goad Map

1	Atanasiades Ferhanesi	18	Lombardo Ferhanesi
2	Tenekides Ferhanesi	19	Sinaitiko Ferhanesi
3	Yusuf Bey Ferhanesi	20	Rossi Ferhanesi
4	Nomsi Ferhanesi	21	Anastas Agha Ferhanesi
5	Kupecioglu Ferhanesi	22	Arapyan Ferhanesi
6	Ruk Ferhanesi	23	Peştemalcıoğlu Ferhanesi
7	Kupecioglu Ferhanesi (Partly Out of Area)	24	Bahaduri Ferhanesi
8	Konstan Ferhanesi (Partly Out of Area)	25	Yusuf Ferhanesi and Bonmarse Store
9	Sayian Ferhanesi (Partly Out of Site)	26	Sofia Ferhanesi
10	Matei Ferhanesi (Partly Out of Site)	27	Baltaci Ferhanesi
11	Aliotti Ferhanesi (Partly Out of Site)	28	Megistis Lavras Ferhanesi
12	Vlisides Ferhane (Partly Out of Area)	29	Greek Consulate Ferhanesi
13	Moraitini Ferhanesi	30	Jerusalem Patriarchate Ferhanesi
14	Mingetti Ferhanesi	31	Sınatikos Ferhanesi
15	Boskovic Ferhanesi	32	Ekizler Ferhanesi
16	Vital Ferhanesi	33	Vercimanoglu Ferhanesi
17	Spanudi Ferhanesi	34	Spartan Ferhanesi

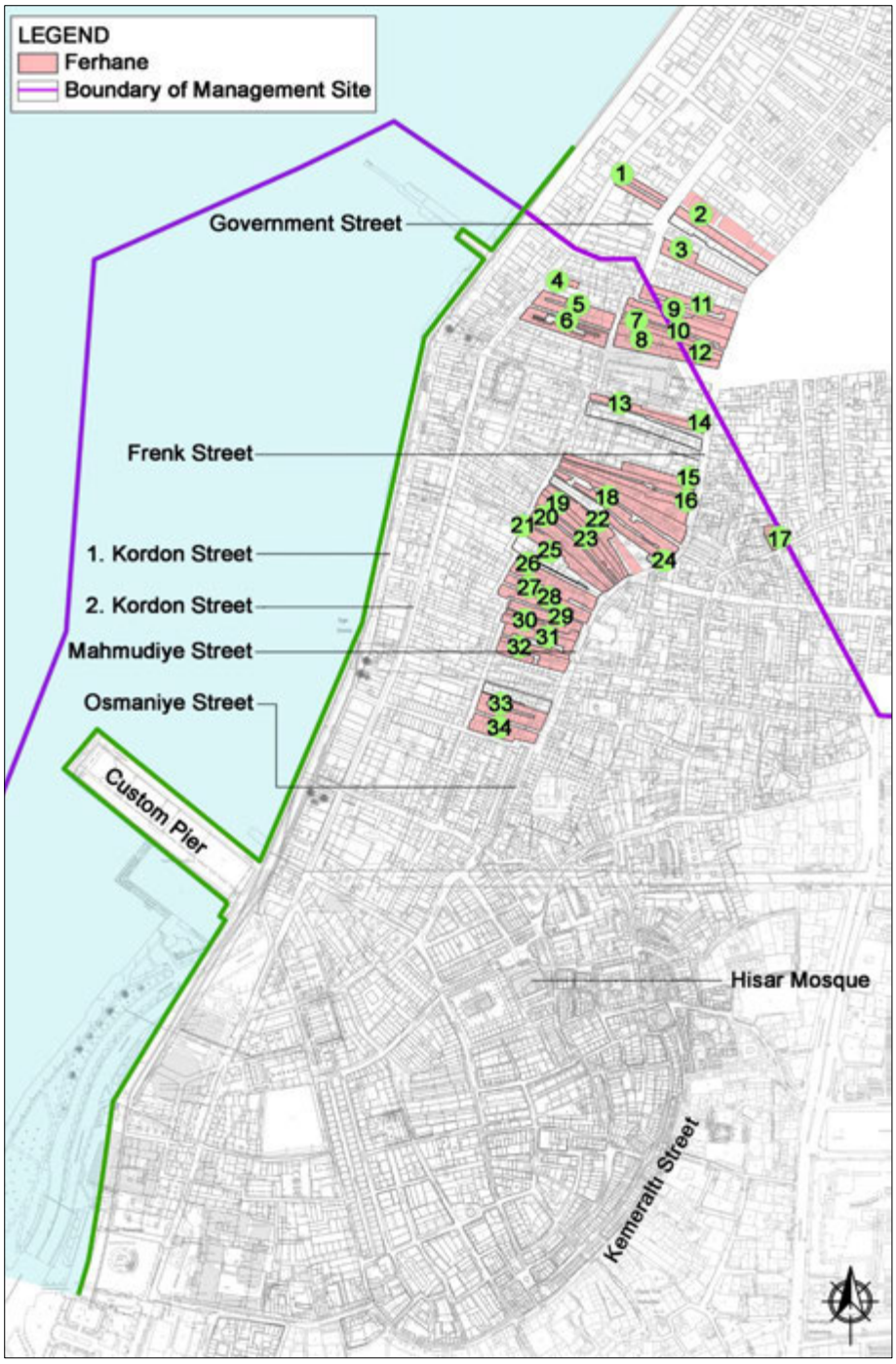

Figure 17: Ferhanes in the Goad Plan on Present Historic City (illustrated by the authors)

5. Evaluation of Historic Plans and Maps

The Graves Plan dated 1837, the Storari Map dated 1852, and the Saad Plan dated 1876 are important documents showing the development tendency of the urban and rural areas, important axes, main land uses, as well as cultural groups living in the city of those times. These plans show the overall urban and rural areas, giving important general view of the historic roots.

The Goad Insurance Plans, dated 1905, presents significant details. The Goad plans show the most significant and vulnerable place of the city, the most vital part of the historic city near to port. This area witnessed to cultural life of heydays of Smyrna, when diverse communities were living side by side, charming intellectual life of the merchants were happening in the 20th century.

When the historic city is analysed throughout the maps, it is seen that settled part increased, building typologies diversified based on daily uses and trading activities, and infilled areas in the gulf changed the coastal line. However, the 1922 fire, also noted as Smyrna Catastrophe and The Great Fire of Smyrna in the history, not only affected built environment but also multicultural life of the city.

The fire affected northern part of commercial area (Figure 18), whole Armenian and Frenk neighbourhoods, significant part of Greek neighbourhood, and some part of Turkish neighbourhood. Spatially, inns, ferhane buildings, public buildings, several religious buildings including churches were destroyed due to the fire. The place of Greek and Armenian neighbourhoods redesigned as urban park, named Kültürpark in the Republican Period. Besides, boulevards were constructed at the north of Kemeraltı Bazaar. The construction of boulevards as main roads not only damaged to the historic pattern but also caused to complete destruction of several inns and partly demolishment of several inns, such as Selvili Inn, Büyük Demir Inn, and Çukur Inn. On the other hand, several inns in Kemeraltı Bazaar, religious buildings, including mosques, synagogues, several churches, as well as street pattern of 1852 and 1905 shaping the urban fabric have conserved today.

Although changes in urban pattern and living population over time, there is still significant conserved urban fabric. This urban fabric is registered as conserved areas diversified as urban conservation area, archaeological conserved area, historic conserved area, and natural conserved areas, also including diversified types of registered buildings based on the national legislative framework. However, interpretation and presentation installations of the historic centre of Izmir is insufficient today. It is not clear for a visitor or local to understand the cultural significance of the historic centre, which is composed of traces of tangible and intangible values from different times, diverse cultures and communities.

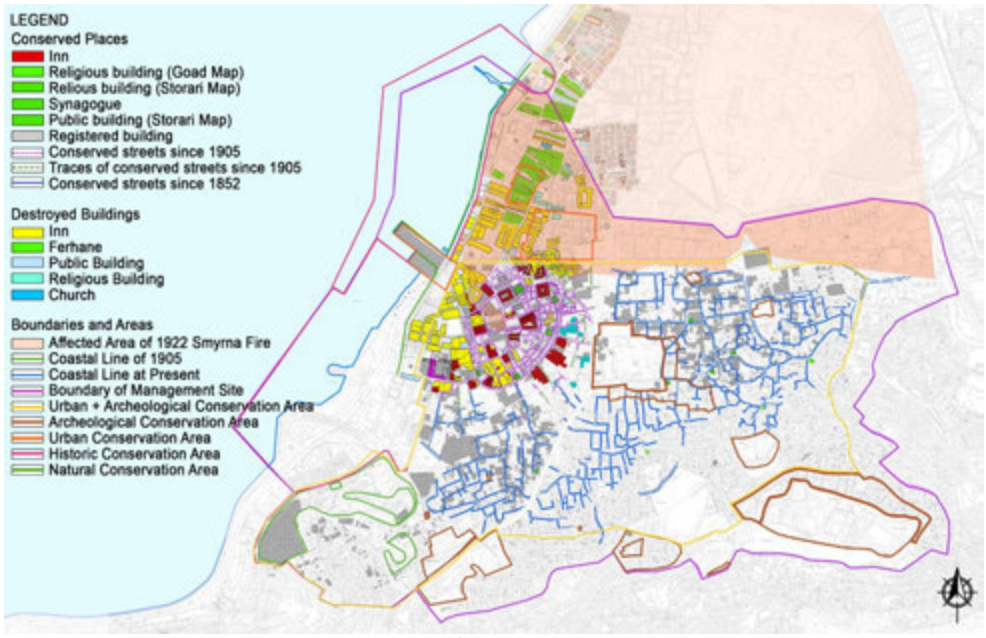

Figure 18: Synthesis of Conserved and Destroyed Places

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6. Proposals for Interpretation and Presentation

The historic city was compact, covering commercial, administrative, entertainment facilities, as well as housing areas. Although, todays' residential areas are not well integrated with the centre, it is important to associate residential area and central functions to foster a vibrant city.

For interpretation and presentation in the historic centre of Izmir, key principles are determined as follows:

- Interpretation and presentation studies are conducted within the framework of culture of democracy, culture of peace, and cultural expressions to sustain equal dignity and mutual respect of all people and communities.
- Memory of the place is interpreted and presented to foster cultural diversity, plurality, and identity as common heritage of humanity.
- Interpretation and presentation techniques supports inspiration, creativity, and imagination of people.
- The heritage information with all layers, tangible, and intangible aspect would be secured and accessible for all.
- Social inclusion and public participation are to be ensured in interpretation and presentation studies, in overall processes of planning, design, implementation, and monitoring.
- Interpretation and presentation studies are to be related to capacity building activities for people on mutual understanding, mutual respect, and culture of living together in a harmonious way.

Based on these principles, several interpretation and presentation strategies are proposed preliminarily:

- The lost and survived cultural heritage with intangible and tangible aspects is to be interpreted and presented with involvement of the representatives of communities from Levantine, Greeks, Armenians, Jews, and Turks. The overall process of interpretation and presentation should sustain building a strong network among communities.
- As mentioned in the Site Management Plan, an urban design guideline to create specific design language for the historic centre of Izmir is to be prepared. The guideline should determine general principles, such as rules to be flowed in historic environment, modern buildings, and new additions.
- From Hellenistic times until today, place names are to be illustrated on the site. The components of Smyrna Ancient City that are not visible at present, such as ancient breakwater, harbour castle, and Temple, as well as historic places, public squares, and street names from Ottoman period are given through information and way finding panels that will arouse people's curiosity.
- The past maps of the historic centre of Izmir, covering diversified cultural and historic layers, are to be illustrated on visitor information systems.
- The monumental buildings such as Aya Fotini Church, places of memory such as Kültürpark, the uses covering big areas such as inns and ferhanes, famous meeting places such as Sporting Club in the historic city at past are to be interpreted and presented. Standard information signs with QR codes can be designed on buildings. Sculptures and installations on public squares can be designed. For instance, visitor information panels illustrating gravures of historic urban landscape with Kadifekale, harbour, and environs can be designed near to Pasaport Ferry Terminal at Kordon.

- The neighbourhoods and communities that lived in the city in history are shown through information panels with flu boundaries. Main information about people and communities are to be given.
- As mentioned in the Site Management Plan, a digital data system to storage and monitor heritage information is established. Collaboration with other relevant information systems such as data in Centre for Asia Minor Studies, the Bologna University Historical Archive, Rijksmuseum Amsterdam are developed to share and exchange knowledge about the heritage of historic Izmir. The security and accessibility of heritage information are to be ensured.
- A set of workshops, panels, and participatory meetings is to be organized periodically with both people and communities left the city and those still living in the city to determine interpretation and presentation aspects. Besides, institutions, municipalities, academicians, professional chambers, NGOs, and all related stakeholders should be involved the whole processes.
- A set of trainings and informative sessions are to be conducted periodically with people who are associated the historic city centre of Izmir to support mutual understanding, mutual respect and equal dignity of people and communities with diversified cultures.

7. Conclusion

Unfortunately, ethnic groups of people, indigenous people, small communities, people with different gender, religion or migrants facing discrimination today. Rise of nationalist trend causes to conflicts within and among societies. These are significant threat for all and should be dealt with sincere collaborative efforts.

In this regard, over all aim of this study to strengthening collaborative efforts to reintegrate cultural heritage to contribute to cultural interaction, cultural diversity, as well as culture of democracy and dialogue. As a multilayered cultural heritage place, the historic centre of Izmir was multireligious, multicultural, and multilingual. Places and societies are dialectical, inseparable parts of the whole, thus interpretation and presentation strategies must cover tangible and intangible aspects of cultural heritage.

Accordingly, interpretation and presentation strategies are preliminarily defined for the historic centre contribute to relation of societies, places, cultures, and memory. The survived and lost cultural values of the historic centre of Izmir are explored to reintegrate tangible and intangible cultural values of all times in today's living urban heritage. In this regard, the study also aims to contribute to foster importance of the historic roots, improve networks, and maintain sustainable development. This is a way of respecting whole cultural layers of the multicultural urban heritage, and respect for the past and todays' communities.

Constituting interpretation and presentation strategies for this historic city with its evolving roots creating its heritage values is a significant issue. Interpreting and presenting the multicultural heritage, which is formed with synthesis of diverse cultures throughout the history, means remembering and recalling the memories and building futures for all. The living heritage places as the historic centre of Izmir can foster mutual understanding and respect, in a broader sense, contribute to building peace among communities and cultural of living together in harmony.

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Rural Heritage Governed as Commons: A Case Study of a Chinese Heritage Village from the Cultural Capital Perspective

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Abstract
The concept of commons in economics and management has been positioned within the heritage field to emphasise their characteristics like Common Pool Resources. Rural heritage governed as commons means building a new understanding of its values, which extends beyond consumerism or state identity to embrace the local community, and implicating dynamic governance processes towards a more sustainable, equal and inclusive development in rural areas. Under the framework of 'Resources-Governance Community-Governance Systems' in heritage commons governance and the perspective of transformation of cultural capital, this paper re-examines the two typical eras governance process of a centuries-old village in southwest China. This study first reveals tensions between community heritage versus official heritage and commercial heritage. Secondly, 'governance community' is more complex than common sense, particularly, local government has different hierarchies and departments with multiple targets. Besides, an effective conservation and development planning with appropriate mechanisms is the core of coordinating heritage management system, tourism development system, rural revitalisation campaign system, and community self-governance and social-engagement system. Lastly, two cases show that social power and community have the vitality to cover the shortage of physicalised cultural capital, constituting an alternative path towards common benefits and inclusive development of rural heritage communities.

Keywords
rural heritage; governance; commons; cultural capital; heritage community

1 Introduction

Popularised by Elinor Ostrom's pioneering work on natural resource community-based management systems (Ostrom,1990), the term 'commons' has been traditionally used in economic analysis to define physical resources which are subject to overuse and appropriation dilemmas, as well as property and governance regimes over resources that are owned in common. More recently, a growing recognition has emerged that important types of humanly constructed shared resources, such as information, knowledge, infrastructures, or urban landscapes, could be appreciated and analysed as new forms of commons (Gould, 2017). It has been observed that while much attention is given to natural resource management, the field of heritage studies lacks sufficient discussion on the relationship between heritage and community, and there are only a few accounts that explore this topic. It is possible to apply the principles of commons governance to the cultural heritage field (Lekakis, Shakya and Kostakis, 2018).

Heritage commons are not only an academic issue but an emerging reality in the field of heritage management. Recently, the cultural heritage conservation approach has shifted from 'object-centred' to 'people-centred' methods, the latter emphasises the concept of 'Living heritage' and 'continuity', which means the core community is responsible for the continuous care of the heritage through traditional or established paths (Wijesuriya, 2015). This trend makes it particularly important to view the relationship between rural heritage and its community from the commons governance perspective to create the necessary tools to develop a community-based approach to conservation and management.

Heritage commons highlights the necessity of analysing heritage as shared resources by a community even a country in terms of tangible and intangible dimensions towards public interest and sustainability principles, constituting an alternative path towards safeguarding heritage and communal benefits (Bertacchinni, 2020). Furthermore, it extends the collective action problem to a wider array of social dilemmas involving the conservation of heritage. There is mounting evidence to suggest that this approach can empower user communities, leading to a more democratic distribution of managerial control and fostering reciprocity and social values (Lekakis and Dragouni, 2020).

Ostrom's research (2002) focuses on two main questions related to the commons, which also happened in the heritage field. Firstly, why are heritage resources often exploited, and how can we accurately define their value? Secondly, what circumstances enable heritage resource users and communities to create effective management rules? In this paper, we draw on an analytical framework applied to the case of China, which is informed empirically by our longitudinal fieldwork research on the area, in order to explore how the resources governance process has happened in the rural community from the past to the present and how cultural capital has transformed in a centuries-old heritage community.

The paper is structured as follows: The primary section discusses a general conceptual analysis of the commons and the specificities of heritage commons. The second section comprises an analysis of two key governance eras and the transformations that occurred in Nuodeng's rural heritage in terms of its economic, social, and cultural capital within a theoretical framework. Lastly, the final section delves into the tensions among resources system, communities and governance systems when rural heritage governed as commons, and presents the possibility of commons-based sustainable development strategies through two social and community engagement actions, highlighting some important issues that deserve the attention of future scholars and researchers.

2 Rural Heritage Commons Governance Theoretical Framework

Hardin’s research(1968) on the ‘tragedy of the commons’ brought the commons into the forefront vision of public resources governance problem. Commons, also known as Common Pool Resources (CPRs), according to the classification of public goods by Ostrom (2002), commons are a kind of public goods that are non-exclusive but competitive at the same time. Commons is understood as any natural or manmade resource that is or could be held and used in common to obtain social wealth and organise social production (Berge and van Laerhoven, 2011; De Angelis 2005). It encompasses not only goods and products but is also conceived as a productive force or dynamic process that is necessarily established and maintained by social groups, which control for their accessibility and use on regulated but equal terms (Hardt and Negri, 2012).

In this sense, commons governance is believed to be an effective avenue for protecting resources. Similar to the peasant lands a few centuries ago, cultural heritage can be formally defined as a Common Pool Resource based on the traits that the commons can be used and disposed of by anyone under certain formal or informal rules (Gonzalez, 2014; Dragouni, 2020). The scholars discuss this issue to respond to the three major contradictions in rural cultural heritage management.

- *Heritage commodification or Disneyfication.* Many rural cultural heritage have turned turn into ‘monuments’ for state identity and ‘products’ for tourism consumption under the

obsession for growth push and economic rationalism, and excessive development of heritage tourism demand in villages has threatened the local and traditional community. However, unlike other standard economic goods, which could gain direct income from their real estate value or tourism revenue, cultural heritage as commons may also generate non-market and non-use benefits, given the component of collective use and significance expressed by its recognition (Bertacchini, 2020).

- *Government-led heritagisation.* This type of dilemma entails a conflict over the heritage values between public authorities and communities. Heritage commons is a concept situated in community and identity contrast to treat heritage as a universal global endeavour (Gonzalez, 2015). When a village becomes heritage recognised by the office, too strict conservation approaches may hinder other heritage values that are more likely to express local traditional practices (Bertacchini, 2020).

- *Unequal distribution of benefits and costs among heritage stakeholders.* Both cultural and natural capital have been inherited from the past and will deteriorate or degrade if not maintained (Throsby, 2016). However, a wilder group of stakeholders(i.e., local community, tourists, private business owners) do not directly pay for its preservation and maintenance (Bertacchinni, 2020) while they enjoy the benefit of the common cultural brand. The authority and right to govern heritage resources are rarely aligned with community organisations, even when they are obvious candidates for managing that heritage (Gould, 2017). Heritage governed as commons provides a possibility to help bridge some gaps among various stakeholders in rural heritage, and it is a treasury of the community's imagined identity, part of the aspired and yet utopian democracy of the commons.

Getting back to the core of the commons conceptualisation, the present study references related analytical frameworks inspired by Ostrom (2009), Dellenbaugh et al. (2015), and Lekakis and Dragouni (2020). Ostrom proposed the Social-Ecological Systems Framework (SES) of common resources, which focuses on 'resources system and resources units', 'actors and governance system', and 'governance interaction and output'. In terms of heritage common governance, Dellenbaugh and Lekakis understood the commons through the tripartite constituent elements: the resources, the communities that manage them, and the regulatory framework for the management process, which Lekakis call it 'commoning' to analyse rural heritage governance and reproduction process.

Furthermore, when discussing the public goods character, cultural heritage such as monuments, museums, and historic buildings may be considered as a form of cultural capital that embodies both economic, social and cultural values (Throsby, 2001). Bourdieu (1984) proposed the concept of 'Cultural Capital' to strengthen elitism and the role of culture as a social distinction mechanism, and cultural capital, economic capital and social capital can be transformed and reproduced under certain conditions. Tsongkha and Wang (2021) reveal the three forms of cultural capital in Tibetan heritage villages in China based on Bourdieu's research: one is the physicalised form, as culture is ingrained in the human body and spirit, like local language and place identity, which is inherited through family, community and school education; the second is object form, such as vernacular architecture and manmade tools; the third is institutionalised form, such as village regulations and non-governmental agreements, particularly in acquiring recognised qualifications, identities, and status. By establishing mechanisms conducive to sustainable resource utilization in heritage communities, the accumulation and reproduction of cultural capital can be achieved (Zhu and Min, 2021).

In this study, we conduct a theoretical framework of 'Resources-Governance Community-Governance Systems' to delve into how rural heritage is governed as commons (Fig.1). The governance process promotes the formation and transformation of cultural capital. Under the framework, we consider the following points in the empirical case:

Fig.1 Rural Heritage Commons Governance Theoretical Framework
Source: the authors.

- *Resources:* In this section, we will examine how natural resources turn into economic-social-cultural capital through traditional governance process and how they have changed in heritagisation. Heritage regarded as commons means to explore how resources are maintained sustainably and how immaterial value or public interest is produced and captured not only under a market consumption regime and will of the state, but also for its surrounding communities.

- *Governance Community:* While the main stakeholders of rural heritage communities are commonly understood through a model of government-residents dichotomy, such understanding tends to neglect the variety composition of intra-government and intra-community. These agencies, often with different goals, create a complex heritage common governance network.

- *Governance Systems:* As Gonzalez (2015) said, the construction of heritage as a social object is a complex process involving many objects and subjects. Heritage must be seen as a terrain of struggle where certain forces tend towards disciplining, segmenting and reconstructing the community. it is necessary to consider how stakeholders construct different governance systems to use and maintain the resources and how the governance output influences the reproduction of cultural capital. Rural heritage governed as commons also points to a polycentric governance model.

3 Commons Governance in the Salt-Industry Era and Heritage Era

3.1 The Case Study of Nuodeng Village

This study takes Nuodeng Village, a historic salt industry village in Yunlong County, Yunnan Province, southwest China, as an empirical example. Since cultivation is the economic foundation of most rural heritage communities in China, there is a lack of research on

settlements that rely on other public resources, such as the salt industry settlements. Traditional salt manufacturing villages have developed a human–nature interaction paradigm based on salt wells instead of agriculture, which indicates specific public resource governance characteristics.

The salt industry played a crucial role in the birth, growth, and fall of Nuodeng Village. With a history of more than 1,300 years, the inhabitants have been mining salt well since the Tang Dynasty (618–907 CE), and the industry has contributed to the village's thriving economy and culture. However, societal changes and the popularisation of sea salt during modern times have caused the salt industry to stagnate and the hamlet to collapse. It wasn't until the last 30 years that the village regained its status as an officially designated cultural heritage, and tourism has since become its primary industry. The salt-producing era has left abundant tangible heritage for Nuodeng Village, which still retains the relatively complete rural scape and fabrics (Fig.2), ancient architectural groups of the Ming and Qing dynasties (1368–1911), including more than 20 temples and over 100 vernacular dwellings (Fig.3). Meanwhile, intangible heritage is also preserved in the community (Fig.4), such as the Dragon King Festival, the Confucius Ceremony, salt-making crafts, and the Dongjing Taoist music. Nuodeng Village has been officially designated as the 'National-level Cultural Heritage Sites', 'National Historic and Cultural Village', and 'Chinese Traditional Village' in the last decades. The heritagisation also brings rural gentrification and commercialisation. In the process of tourism development in Nuodeng Village, local residents and migrants join heritage tourism by opening homestays and selling agricultural products.

The authors have been conducting heritage education activities with a social organisation and long-term field investigations in Nuodeng village Since 2014. During the past 10 years, the authors observed the changes in the village continuously and interviewed more than 30 stakeholders in order to obtain firsthand information, including the county government officials from planning, constructing and tourism development departments, indigenous and migrant residents of different ages and jobs, local organisations and elites, enterprises and related academics and technical experts.

Fig.2 Aerial Photo of Nuodeng Village
Source: the authors.

Fig.3 Vernacular Dwellings in Nuodeng
Source: the authors.

Fig.4 The Resident made salt for tourism
Source: the authors.

3.2 Salt-industry Era: The Formation and Accumulation of Cultural Capital

3.2.1 Resources: Natural Resources in the River Valley

Nuodeng Village's salt brine resources originate from the Bi River, which is a tributary of the Lancang River. About 50 metres below the surface of the Bi River Valley, salt brine from the Ancient Yunnan-Guizhou Sea formed veins of potash due to geological tectonic processes, and these veins erupted out of the surface to produce salt wells. The Bi River Valley is a significant resource system that contains not only brine but also rivers, mountains, forests and land, which

produces additional resources such as the fuelwood needed to boil salt brine and the logs and raw earth for building salt wells and dwellings.

Overall, the brine resource is competitive, non-exclusive, and limited, which is consistent with the qualities of CPR. Individuals acting irrationally by over-exploiting the resource will decrease its availability to other members of the community and the output of the resource. As a result, a governance community is formed through official and local forces, and regulations for the resource's sustainable usage are created.

3.2.2 Governance Community: Production-based, Bloodline-based, and Geography-based Communities

A social network jointed by the salt industry was progressively established, involving salt-producing households, labours that maintaining salt wells and carrying brine, artisans, farmers, footmen transporting salt packages on the ancient roads, merchants in the salt trade, etc. In the Ming Dynasty (1368–1644), the central government established *wujing yanke tijusi* (tax collecting institution on five salt wells) in Nuodeng Village in order to reinforce its authority over the southwest border region, particularly with regard to the salt business. As a result, the officials from the Central Plains moved their entire family to Nuodeng Village and brought Confucian culture to the southwest border. The clan force became a dominant social group in the village after hundred-years of solidification of Confucian values.

During the salt industry era, Nuodeng village saw the steady development of a governance community based on salt production, bloodline and geography. Rural clan statutes managed and restricted the behaviour of the community members.

3.2.3 Governance Systems: Community–Authority Cooperation

Public resources with potential economic value attract more individuals seeking to exploit them. However, due to the limited supply of these resources, it is necessary to establish governance regulations to restrict irrational behaviours and ensure sustainable utilisation of these resources. Hence, the primary objective in establishing a governance system for the commons is to ensure fairness of resource distribution, optimise resource flow without causing harm to the resource system, and facilitate a sustainable exchange with external resources. Furthermore, the formation of a governance system is influenced by the social and cultural environment of the time, including factors such as the level of social productivity, tool-making technology, ethnic customs, and political order. During the salt-industry era, three distinct governance systems were established:

- *Brine Distribution Regulation*

The brine resources were the most significant means of production in Nuodeng Village in the early days. The community distributed all of the brine resources independently and adopted the decentralised family workshop production mode. To avoid over-exploitation, approximately 200 households in the village were divided into 16 ‘stove groups’, each of which possessed 30 barrels of brine (Zhu, 2007). The amount of barrels allocated to each household determines how many days in a month they can produce salt. During the rest of the month, they are not permitted to use the water for salt production. The distribution unit was established based on a lunar month of 30 days, which accounted for the distinct production patterns and measuring techniques of the salt-producing society that differed from the agricultural society.

This spontaneously organised production system operated organically for millennia until the central government implemented a system of salt taxation and established certain zones for selling salt in the Ming and Qing dynasties. However, it primarily adhered to this distribution system and allowed communities to determine their own governance regulations autonomously. For instance, the 'stove manager' was given the authority to administer salt resources with the consent of the government and acted as a representative for the salt-producing households to negotiate with the government. Another example is *longgong*, a group of highly skilled labourers responsible for constructing and repairing wells. Typically, they were hired and remunerated by the government to ensure the welfare of the community. This profession was then passed down from one generation to the next, ensuring the inheritance of these skills. The distribution system as a whole exemplifies the intricate governance relationships between human and the natural world, interpersonal connections, and the individual and the government.

- *The Organisation of Salt-producing Households*

Due to the impact of Confucian culture, the clans held significant importance as community units in salt settlements. The prestige elderly villagers and local elites took the responsibility to establish stove managing association, and set up social norms and regulations to manage public affairs within the community. The association both exhibited the traits of industrial organisations and fostered a strong sense of identity and belonging. Since association members were entitled to the income from production, they had to engage in community discussions, public welfare initiatives, religious activities, and other public matters. Simultaneously, the community also preserved the 'public brine', the profits from which were used towards communal services including building infrastructures and temples, conducting festivals, celebrations and village education, etc. This exemplified the principle of equitable distribution of benefits and expenses in the governance of public resources.

- *Beliefs and Identities*

Community beliefs and identities were strengthened by the compound effect of nature and culture. The Bai minority group had a primitive nature belief, worshipping the mountain rock formations and the water flows where the brine resources come from. The indigenous residents burned incense in the well house every day, and held the Dragon King Festival once a year, in order to pray for the abundance and continuity of the brine. This demonstrated how the resource was kept spiritually intact and demonstrated how the belief in the salt god was in harmony with the natural world. The customs reaffirmed to the villagers the importance of protecting valuable resources while managing public resources sustainably.

Cultural exchanges among the salt well settlements increased after the scale of the salt industry reached a certain level and the economic and cultural level developed accordingly. The Bai culture of the Erhai region, the Buddhist culture of the Indian region, the Confucian culture of the Central Plains, and the Taoist culture merged with the local belief system of Salt Gods to form a distinctive wellsite cultural circle, further strengthening the cultural identity bond within the governance community.

3.2.4 Governance Output: Formation and Accumulation of Rural Cultural Capital

In the heritage community, the formation and accumulation of cultural capital stemmed from the ongoing use and management of salt, a shared resource during the salt industry era. A governance community based on production, bloodline, and geography was formed by salt-

producing households, officials, merchants, horse gangs, etc. Natural resources were converted into economic and social capital through the mechanism of public governance, and eventually accumulated into cultural capital, forming the initial accumulation of rural tangible and intangible heritage resources(Fig.4).

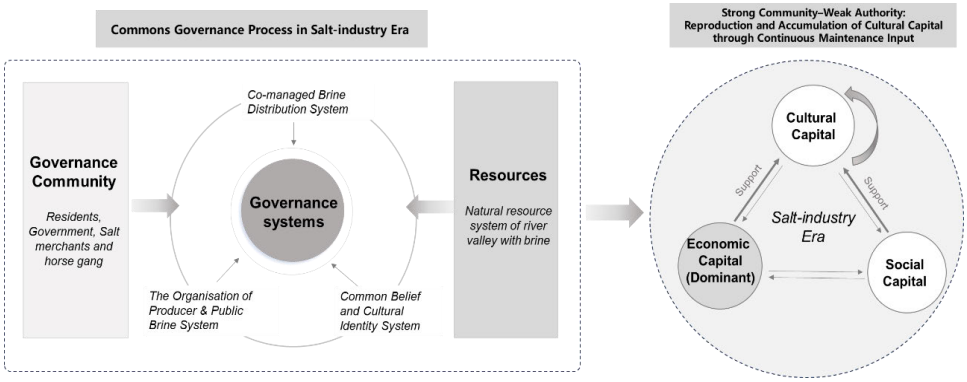

Fig.5 Commons Governance Process in The Salt Industry Era
Source: the authors.

Cultural capital was embodied in three different forms: institutionalised, objectified, and physicalised (Fig.5). The commons governance system that created the cultural capital exhibited a model of community–authority collaborative governance. It reflects the wisdom of sustainable utilisation of public resources in the historic village of Nuodeng, and can still provide insight into the sustainable conservation of heritage resources in the present.

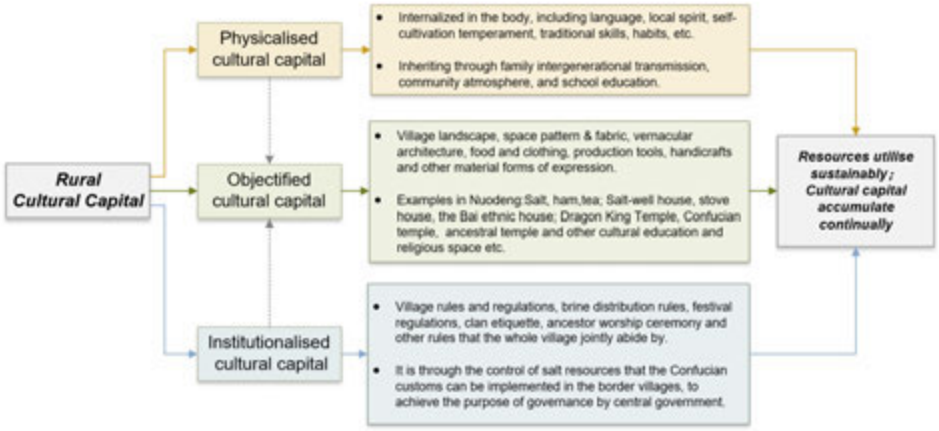

Fig.6 Three Forms of Cultural Capital in the Salt Industry Era of Nuodeng
Source: the authors.

3.3 Heritage Era: The Recession and Transformation of Cultural Capital

3.3.1 Resources: From Natural Resources to Cultural Heritage

Salt production persisted until the 1960s and 1970s, when traditional family-based production gave way to collective production centred on salt factories. However, the traditional system of villagers governing the public commons vanished as a result of the nationalisation of brine rights. The salt factories eventually stopped operations in the 1980s and 1990s due to the advancement of mechanical manufacturing processes and the popularisation of sea salt.

The absence of intentional communal care caused the salt wells to progressively silt up and collapse over the course of the next three decades. Simultaneously, with the rapid growth of urbanisation and globalisation, Nuodeng village, like plenty of other Chinese villages, was facing the issue of aging and hollowing out.

Since the turn of the 21st century, the Chinese government has established and improved national heritage conservation systems, including the World Heritage Sites, 'National Historic and Cultural Cities, Towns, and Villages', and 'National-level Cultural Heritage Sites'. Social projects like the 'Beautiful Countryside', 'Characteristic Small Towns', 'Poverty Alleviation', and 'Rural Revitalisation' have also been implemented at the national level, pushing rural heritage conservation further.

Despite the village's abandonment of salt resource development, local elites have been constantly excavating Nuodeng Village's cultural capital, which attracted the attention of the government and media. With the approval of the Ministry of Construction, Ministry of Culture, and the State Administration of Cultural Heritage, Nuodeng Village was designated as 'National Historic and Cultural Village' in 2006, 'Traditional Village of China' in 2012, and 'National-level Cultural Heritage Site' in 2013.

3.3.2 Governance Community: Hierarchical Local Government and multiple stakeholders

The previous production-based, bloodline-based and geography-based communities have been replaced by hierarchical governance communities with the primary goal of conserving and utilising heritage resources. A variety of actors, including governments and related functional departments at all levels, market forces, communities (e.g. new residents, indigenous residents, and autonomous organisations within the communities), and social forces (e.g. academics from universities, technologists, and social organisations), have replaced the original actors, who were primarily residents and local governments. The primary mode of governance also shifted from community-led and official participation into government-led and community-supported.

Even in the modern and contemporary era, key members of the original governance community, such as cultural elites and prestige people, continue to be involved in the governance of public cultural affairs and preserve cultural heritage. Local elites who work in government will draw greater official attention and obtain resources for the heritage community. For instance, Mr. Y, a cultural elite of the famous local clan, has placed high value on protecting Nuodeng Village's cultural heritage and implemented relatively strict tourism regulations during his time as the county tourism bureau's director. In order to encourage government-community collaboration in heritage conservation and cultural tourism development, he established a leading group within several governmental departments, and also instituted a Heritage Conservation and Tourism Development Association in Nuodeng Village.

3.3.3 Governance Systems: Multi-objective and Absonant Governance Systems

The governance systems evolve along with the change of resources and the composition of the governance community. In the heritage era, four governance systems have emerged in the communities and are nested within each other: a system aimed at conserving the legal heritage, a system aimed at developing cultural tourism, a system aimed at carrying out national political tasks like Poverty Alleviation and Rural Revitalisation, and a governance system of community self-governance and participation of social forces, which is aimed at community development.

- *Heritage management System*

The 'heritageisation' process has given the community's legacy a legal identity and, along with it, the national standards for the preservation of the legal cultural heritage. The various departments within the county government have been collaborating with specialists, academics, and planning institutes to manage heritage sites, including formulating conservation planning, setting up daily monitoring systems, and developing townscape guidelines. Actually, the conservation plan has not truly been implemented because of the disagreement between the departments, leaving the rural scape protection in an empty talk. Furthermore, the management of national heritage properties is frequently standardised, which causes the neglect of local public demands. For instance, the county government has chosen to adapt the national heritage site Salt Bureau in Nuodeng Village into a bookstore and café for the outsiders, with doors opening and closing on a regular basis. This decision has limited the Salt Bureau's original function to serve as a public venue for the elderly's cultural activities.

- *Tourism and Development System*

Gaining national recognition increases institutionalised cultural capital, which indirectly raises the village's popularity in the eyes of the general public. Cultural capital may transfer into economic capital with the momentum of tourism. In order to profit from the cultural brand, local people, both native-born people and recent immigrants, have spontaneously opened hotels and sold regional specialties; on the other hand, the government has partnered with businesses to enact a comprehensive tourism development with administrative will. The county government wants to turn Nuodeng Village into a national scenic spot, so it has given permission for two tourism investment companies to move in. It has also attempted to raise money from higher levels of government and social capital in the name of building tourism facilities. However, the government has encountered challenges in establishing a mechanism for sharing benefits with the local community, and the residents have shown limited interest in participating. As a result, the progress of the development project has been hindered.

- *Rural Revitalisation Campaign System*

The rural areas of China serve as the place for the national large-scale social initiatives, reflecting the government's goal of modernising agricultural practices and rural administration. Within this objective, the central government carries out top-down political initiatives such as Poverty Alleviation and Rural Revitalisation. These state-initiated social engineering often involve a focused allocation of resources and policy direction for a specific duration (Scott, 1998). They possess a significant ability to mobilise local governments due to the evaluation mechanism of government officials. The discourse on how to maintain and utilise cultural heritage as resources has become a means for local government authorities to meet the goals of rural revitalisation. Due to its abundant heritage assets and widespread popularity, Nuodeng

Village is highly likely to attract attention and secure fund from higher authorities when applying for various rural revitalisation projects.

- *Community Autonomy and Social- engagement System*

The initial three governance systems mostly exhibit a government-driven, top-down governance mode, although the formal and informal community self-governance organisations continue to exist in Nuodeng village. In the village, there is an Elderly Association established by local cultural experts apart from the officially-led Heritage Conservation and Tourism Development Association. These associations are primarily composed of highly esteemed elderly individuals who are responsible for organising and executing various ceremonies, including the Dragon King's Festival and ceremonies dedicated to Confucius.

Furthermore, the Women's association led by Ms. H, who holds community respect due to her establishment of the village's first homestay and her lineage as a descendent of the Huang family, plays a significant role. She collaborated with other women to coordinate other smaller celebrations throughout the town. Additionally, she urged the villagers to contribute financially towards the restoration of the San Chong Temple and the repainting of the statue of the Goddess of Mercy. Although the San Chong Temple is an unofficial heritage site, it holds significance as a cultural symbol that is highly valued by community members, who are internally driven to preserve it.

3.3.4 Governance Output: Depletion and Transformation of Cultural Capital

In the salt era, the management of public resources involved the preservation and use of natural resources such as brine, mountains, forests, and fields. On the other hand, in the heritage era, the management of public resources refers to the cultural resources, the physicalised, objectified, and institutionalised cultural capital that was amassed during the salt era, in both tangible and intangible forms. The previous production-based, bloodline-based and geography-based communities have been replaced by hierarchical governance communities with the primary goal of conserving and utilising heritage resources, thus forming a governance mechanism aiming at various objectives.

In contrast to the salt era, which focused on economic capital and later evolved into social and cultural capital, the heritage era centred on the accumulated cultural capital as a core to foster the reproduction of all three types of capital. Indeed, the cultural capital has diminished due to insufficient investment in resources and maintenance, particularly driven by tourism. This has resulted in the conversion of cultural capital into economic capital on a large scale, leading to the commodification and gentrification of rural heritage. As a result, a positive cycle has not been established (Fig.7).

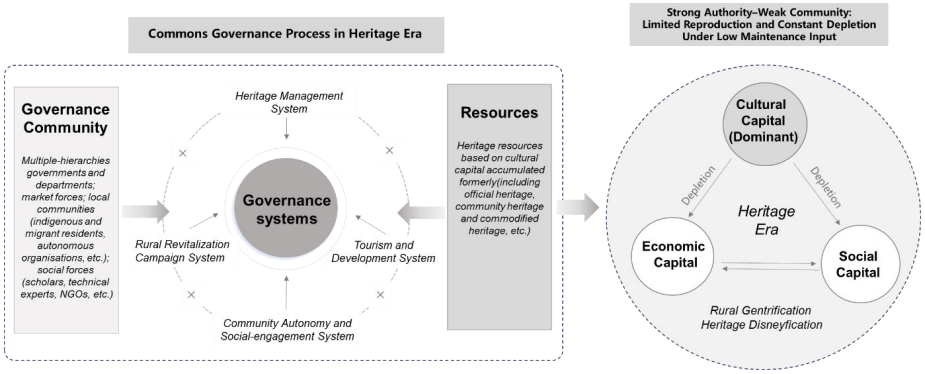

Fig.7 The Governance Process of Heritage Era
Source: the authors.

The implementation of this mechanism has led to the initial transformation and reproduction of the cultural capital in rural heritage communities. However, there are challenges in ensuring sustainable governance. The absence of family education, community education, and school education has caused a significant depletion of physical cultural heritage, of which the core of inheritance is the 'human being'. This also demonstrates that the public management of cultural assets not merely involves the physical artefacts, but also exhibits a multifaceted challenge of governing a social system (Fig. 8).

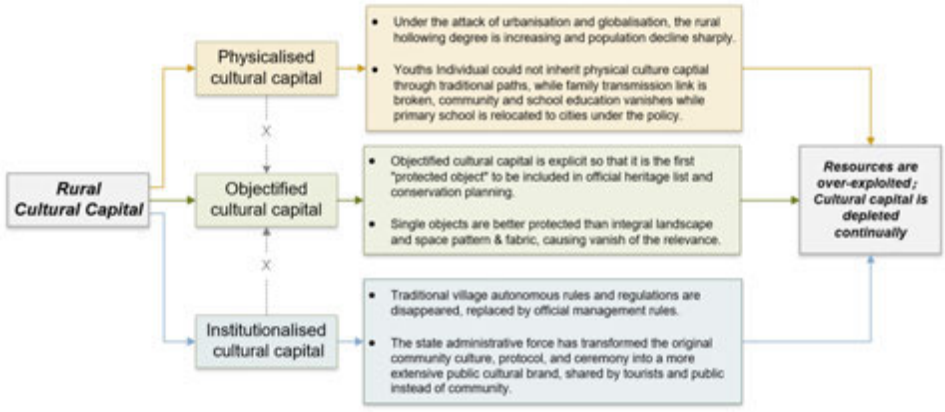

Fig.8 The Change of Cultural Capital in Heritage Era
Source: the authors.

4. Governance Dilemma and Potential Solutions

4.1 Governance Dilemma

4.1.1 Tensions between Community, Official, and Commodified Heritage

The process of heritagisation has resulted in a dual contradiction between community heritage and official heritage in terms of evaluation and administration. While culture is an integral asset for the entire community, the official value-based protection focuses primarily on tangible cultural assets such as buildings and relics. Unfortunately, little attention is given to the preservation and inheritance of intangible cultural heritage, such as social norms, rituals, and ceremonies that used to play a crucial role in rural society. This has resulted in the 'hollowing out' of heritage communities.

At the same time, the official heritage designation highlights the public attribute of heritage and the government's obligation to manage it. As the protection level of heritage increases, the primary responsibility for management and rights for development rests with the county and township governments, limiting the community's initiative to participate in governance. During the field survey, the villagers initially blamed the government for the silted salt wells and decaying buildings, rather than taking responsibility themselves. This passive attitude demonstrated a lack of active participation, and the community's awareness of the need to maintain resources and continue their public use vanished.

Furthermore, the original village full of locality has turned homogenised and gentrified due to the neglect of physical cultural capital. The aborigines of the community, particularly the younger generation, lack a sense of identity and belonging to their hometown cultures and are highly vulnerable to the influence of the 'imaginary countryside style' popularised in social media. New immigrants who have opened upscale lodgings in the countryside that cater to urban tourists have strengthened this imagination. Consequently, numerous recently renovated residences fail to adhere to the townscape preserving regulations, leading to damage to the vernacular architectural style. To some extent, the original 'living community' has evolved into a 'performing community' and a 'commercialised community'.

4.1.2 Management Vacuum Caused by the Expansion of Governance Community

The governance community is comprised of multiple actors who exhibit distinct purposes, resulting in complicated behaviours. Local government departments and technical experts prioritise heritage preservation, while private owners and enterprises focus on economic gains from the cultural brand. The goals of the community's aboriginal people are more multifaceted. On one hand, they have a strong emotional attachment and identity to the community. Particularly, the older generation believes that cultural heritage is of utmost importance and should not be sacrificed for development. However, on the other hand, they also need to earn a living in response to the evolving social and cultural context, attempting to reap the advantages of their cultural legacy by opening accommodations and selling agricultural products.

It is worth noting that in previous studies, the 'local government' is often regarded as a single entity. However, in this particular example, we observe that there are multiple levels and aims of actors inside the government. From a hierarchical perspective, the vertical structure of government involved in heritage governance consists of five levels: national department, provincial department, city-level department, county-level government and corresponding offices, town-level government and village committee. Additionally, there are various

horizontal departments such as planning and construction, culture and tourism, and agriculture and rural affairs, each with distinct requirements for heritage conservation. This results in the challenge of overlapping management for heritage conservation.

County-level government and its corresponding offices take the initial responsibility for local public affairs. The application for national heritage declaration, conservation management, funding allocation, and tourism development are all primarily carried out by the county-level government. The higher-level departments prioritise heritage conservation, but county and sub-county governments have multiple responsibilities and must strike a balance between social stability, economic development, and public services. In order to effectively implement heritage conservation, it is necessary for these governments to incorporate it into their governance tasks. However, this integration can sometimes lead to a distortion of the objectives of heritage conservation.

Contrary to the traditional salt era, the governance community of public resources has now expanded. The previous model of a strong community and weak government has shifted to a strong government and weak community model. This means that the government now has more influence in the heritage commons governance, while the participation of the community and social forces has been hindered. Additionally, the government entity has become more complex with multiple layers, making it difficult to coordinate and work together and finally causing a vacuum in the specific management role.

4.1.3 Lack of Coordination between Four Governance Systems

The primary factor contributing to governance failure in rural heritage communities is the absence of effective coordination across the four governance systems: heritage conservation, tourism development, rural revitalisation, and community autonomy and social engagement. ‘Heritage conservation’ has become a discourse when county-level governments tend to apply for national projects such as cultural tourism and rural revitalisation, since it is more likely to be taken seriously by higher-level government departments. Actually, there is a patchwork of projects and inconsistent use of funds in the name of heritage conservation. The allocation of funds is mostly directed towards infrastructure improvement since the governments prioritise short-term outcomes, thus there is a deficiency in the development of sustainable systems for comprehensive conservation. Although the advancement of cultural tourist services and products has enhanced the local economy, there is now no distribution mechanism for allocating the benefits and costs among the community, which can result in unfairness.

Cultural, social, and economic capital in the bottom-up community autonomous system translates into the ‘prestige’ of local elites, which is crucial for community self-government. But as the cultural elites of the community get older, the younger and middle-aged generations have not been able to acquire enough prestige in the altered governance environment. Additionally, the government’s heavy involvement in the cultural heritage management has resulted in a lack of participation by village associations and social organisations, leaving a void in the community.

More significantly, as Fig.9 illustrates, the cooperative operation of the four governmental systems depends on conservation and development planning and the related mechanism. As regulated by the documents of higher government departments, conservation planning should include the following aspects: a multisectoral synergistic management mechanism; guidelines for the control of townscape; fire safety; improvement of infrastructure and living conditions;

and reasonable use and development of cultural legacy. The conservation and development planning is expect to be the statutory authority for approving new constructions, the guide in tourism development, the source of project in the rural revitalisation movement, and the result of community and social forces' participation. However, the current conservation planning has been stranded because of disagreements within the governance community, which obliquely results in the lack of a dominating department to manage the approval of new constructions, modifications, and additions. A fundamental characteristic of rural governance in China is the project-based governance mode, which also serves as a means of investing funds, attracting government attention, and other aspects of governance. Conservation and development planning should have initially aimed at achieving sustainable development for rural communities and then proceeded to formulate project plans. Nevertheless, in practice, there is a deficiency in addressing pertinent aspects, leading to the heritage community projects that primarily focus on fragmented infrastructure construction. This approach places excessive emphasis on short-term, observable outcomes, which hinders long-term development.

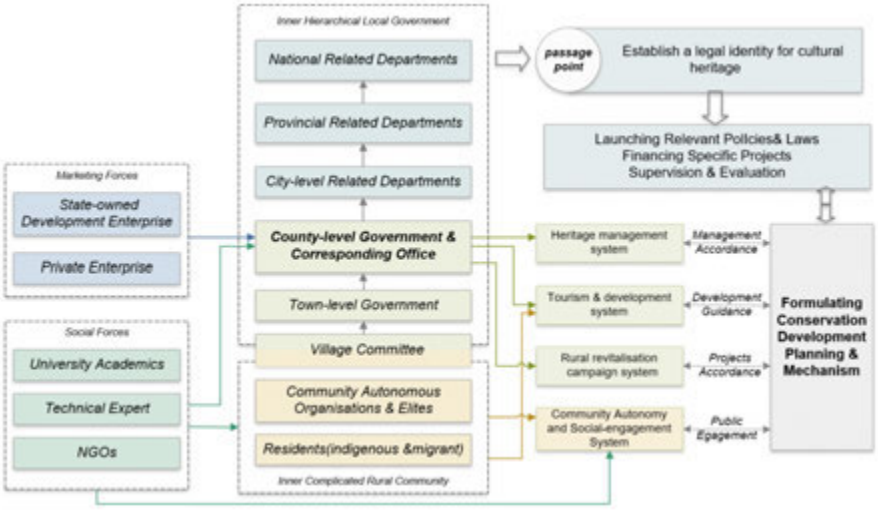

Fig.9 Interactive Analysis of Governance Behaviour in Governance Community
Source: the authors.

4.2 Reconstruction of Common Governance Exemplified by Two Cases

The government-led governance prioritises the objectified and institutionalised cultural capital, while neglecting the transmission of physical cultural capital of the heritage community, which is the core of living heritage that focuses on the well-being of people. Despite the implementation of a strong government and weak community model in Nuodeng Village, the community's spontaneous participation demonstrates the vitality and potential for rebuilding public governance through tactical resistance.

4.2.1 Revitalisation of the Traditional Dragon King Festival

The Dragon King Festival was a significant celebration in Nuodeng during the salt industry era. People would worship the Dragon King who was responsible for the brine vine to impetrate the abundance of the salt brine since it was the main income for the hamlet. Nevertheless, following

the decline of the salt economy era, the festival was halted for over three decades. The revival of the festival was the outcome of a collaborative effort between the local community and the government.

The government, with the support of the local elites, aimed to establish a festival sightseeing project as part of its heritage tourism initiatives. The community responded favourably to the signal, with the respected elderly villagers leading the way. The organisers consist of the Elderly People's Association, the Dongjing Taoist Music Band, and the Association for Heritage Conservation and Tourism Development of Nuodeng Village. Through interviews with the elderly, the ceremonial details of the festival were documented (Fig.10). The revival of this event fulfilled both the governmental and community's objectives, while also revitalising the cultural ambiance of the community, drawing in tourists, and preserving the salt culture in a more dynamic manner.

Fig.10 The Dragon Festival in Nuodeng Village
Source: the authors.

4.2.2 Heritage Education for Community Held by the NGOs

The Beautiful Nostalgia Social Organisation is a non-governmental organisation (NGO) dedicated to promoting local cultural inheritance and providing cultural heritage education. For almost a decade, it has been actively engaged in heritage education initiatives in Nuodeng Village. The university student volunteers have published *Nuodeng Vernacular Culture Reader* and arranged annual summer camps in the village, where they collaborate with local teenagers to design project-based learning (PBL) projects that aim to investigate and comprehend the community's culture (Fig.11). The curriculum incorporates the content of the natural environment, cultural characteristics, and community evolvement, highlighting the landscape, salt industry traditions, rehabilitation of traditional dwellings, and the design of guided tours.

Starting from the children, a greater number of family members were connected, eventually involving the entire community. Various public cultural events were held, such as creative bazaars, cultural exhibitions, and villagers' tea parties. Furthermore, members of the community actively contributed to the programme through musical performances, material provision, participation in activities, involvement in interviews and discussed the protection of community heritage. These new cultural festivals have garnered significant interest from the local government, social media, and the general public.

By combining heritage education activities with community cultural creation, the community residents' physical cultural capital was effectively enhanced. As a result, the case won the 2022 'Global Awards for World Heritage Education Innovative Cases'. This achievement highlights the potential for social forces to engage in heritage governance actively.

Fig.11 The Heritage Summer Camps for Local Teenagers and Community
Source: the authors.

5 Conclusions

In the context of the double failure of the bureaucratic government governance of public resources and the pure market mechanism governance, Ostrom showed empirical studies that people in many communities can successfully implement appropriate governance of certain resource systems through the independent governance and rule-making of communities. We could also find the successful commons governance traditional experience in the traditional salt-industry village in China. However, the community now is facing challenges in protecting and reproducing heritage resources.

This paper proposes a theoretical framework to analyse the process of commons governance and transformation of cultural capital, suggesting that heritage commons can serve as an alternative reality approach in the field of rural heritage management. Governing heritage governed as commons means building a new understanding of its values which extends beyond consumerism or state identity to embrace the local community. Furthermore, 'commons' implicates dynamic governance interaction processes towards more sustainable, equal and inclusive development in heritage communities. It can also facilitate the creation of a shared vision and bridge the gaps in perceptions and behaviours, while it could help to build a common vision and bridge some perceptions and behaviour gaps among the various stakeholders, such as different hierarchical local governments, academics, local residents, market forces, and NGOs, and making. This, in turn, leads to a more democratic decision-making process.

From the cases, we can observe that the introduction of the cultural capital perspective can help better understand how heritage resources, as commons, are formed, accumulated, and transformed. During the era of traditional small-scale natural resource governance, each form of cultural capital was strengthened and the public interest was promoted, thus facilitating sustainable resource utilisation and community development. However, in today's trend of heritagisation and commercialisation, stakeholders focus more on objectified and institutionalised cultural capital, while neglecting the transmission of physicalised cultural capital, which is the core of 'people-centred' dynamic heritage conservation. The community's self-governance and social participation show the possibility of addressing this deficiency.

Currently, there exist four governance systems in the heritage commons of Chinese rural areas—heritage management system, tourism and development system, rural revitalisation campaign system, and community self-governance and social engagement system —that have yet to be coordinated and unified. This is also the cause of the current dysfunction in the governance of public affairs in rural heritage communities. By drawing on traditional governance experiences and establishing a community-led model with multi-level government

coordination, enterprise negotiation and social forces participation, we could achieve a more inclusive, equal and sustainable development in rural heritage communities.

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An Analysis of Value Reconstruction in Constructive Protection Practice for Archaeological Site Parks

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Abstract. Archaeological site parks, as a government led form of site protection and utilization, are reflected in a series of constructive protection practices for the site, involving the site itself and its surrounding areas. In the construction process of the archaeological site parks, not only should the focus be on protecting the site itself, but also on meeting the practical needs of the population. This paper reviews the relevant theories of heritage value and re-examines the important role of value construction in the construction of archaeological site parks in the modern context of aesthetic evolution. It proposes a basic path for value reconstruction based on value selection and creative transformation, and explores the planning strategies and design methods of archaeological site parks through practical cases.

Keywords: constructive protection, value selection, creative transformation, value reconstruction

Introduction

As a constructive form of protection of sites, the *archaeological site park* has gradually developed and improved in the practice of site protection in about 40 years since its emergence in the 80s of the twentieth century in China, along with the rapid construction of the city after the reform and opening up. With the deepening of heritage protection in the past 15 years, the protection form of China's "archaeological site parks" has become more and more mature. As a constructive conservation practice led by the state and the government, under the strong leadership of Authorized Heritage Discourse, although the protection of "parks" is effective, it is always difficult to balance the value selection problems faced in the construction process, which is not only reflected in the contrast between huge investment and meager benefits, but also in the process of aesthetic transformation and cultural value dissolution.

From the perspective of heritage discourse, the AHD（Authorized Heritage Discourse） plays a decisive role in the construction process of archaeological site parks, and top-down intervention can often protect the site in time during the rapid development of the city, but this strong intervention cannot directly revitalize the site, and the result is obvious. In China, although the protection of great sites has achieved fruitful results, there is still a need to face the problem of heritage activation. In 2021, the *14th Five-Year Plan for the Protection and Utilization of Large Ruins* clearly mentions: There are still deep-seated problems in the protection and utilization of *the great sites*①, with a relatively single mode of protection and display utilization. There are not many ways for great sites to come to "live" and their vitality is insufficient.

From the perspective of CHS（Critical Heritage Discourse）, in the process of construction practice of archaeological site parks dominated by AHD, the construction of heritage value is mainly based on the discourse of experts and the government, and insufficient attention is paid to the participation of the public, community and market, which makes the archaeological site parks lack specific objects in operation and use, and it is difficult to establish economic sustainability, resulting in insufficient motivation for cultural dissemination. From the perspective of the practical process of the construction of the archaeological site parks, it is not only necessary to understand the shortcomings of the existing value framework through discourse analysis from the theoretical level, but also to explore the creative transformation methods in the design process as planners and architects, so as to fully respond to the needs of the public and promote the construction of the revitalization mechanism of the archaeological site parks, so as to realize the protection and inheritance of cultural heritage. This is not only an issue for China, but also an important issue for world heritage protection today.

1. The practice of "constructive protection" in parks

1.1 The development of international archaeological site parks

The protection of Italian archaeological sites can be traced back to the Renaissance period in the 15th century, and a relatively complete method of preserving archaeological site parks has been developed during its long process of site protection. The Italian central government promulgated the *Monuments Act* in 1902, confirming that the comprehensive protection of cultural heritage such as historical buildings and archaeological sites is the responsibility of the state (Gianighian G., 2001, p.186). From the late 19th century to the early 20th century, some relics have developed according to the concept of "open-air museums" and have approached the concept of archaeological site parks. In 1998, the Ministry of Cultural Heritage was established, and cultural heritage bureaus were established in various places to assist in the consultation and registration of cultural heritage. In 2012, the Italian Ministry of Cultural Heritage issued *the Guidelines for the Construction and Strengthening of Archaeological Site Parks*, which reflected on and provided suggestions for the interpretation and planning and design methods of Italian archaeological sites and landscapes (Du Qian, Cao Yongkang, 2019, p.83).

In 1943, France promulgated the *Law on the Surrounding Environment of Historic Buildings*, which emphasized the principle of overall protection. Subsequently, in 1960, the *National Parks Law* was promulgated, further expanding the protection of the surrounding environment of archaeological sites, and the concept of "protected areas" was proposed in the 1962 *the French Loi Malraux*. In 1993, *the Landscape Protection and Value Representation Law* was promulgated, which included the surrounding landscapes of the site in the protection scope, laying the foundation for the development of the archaeological site parks. In the process of protecting the site, multiple channels and measures were taken to promote education and promote the use of cultural heritage, in order to mobilize public participation.

The driving force behind the preservation of archaeological sites in the UK mainly stems from the call for the preservation of historical buildings in the 18th century. In 1882, *the Monument Protection Law* was promulgated, and in 1913, *the Comprehensive and Revised Monument Law* was promulgated, which clearly included site protection in urban planning. In the process of protecting the site, the model of national parks is also adopted, in which the government, local residents, and non-governmental organizations jointly participate, and the proportion of personnel is equal, each bearing different responsibilities. Local residents directly participate in the protection of natural heritage and native culture, and are responsible for providing certain economic vitality.

The United States is a pioneer in protecting cultural heritage in the form of national parks, which are the fundamental structure of cultural heritage protection in the United States (Xia Jiechang, Liu Ruiyi, 2023, p.67). In 1832, the United States proposed the concept of national parks; In 1889, the first archaeological national park was established - Big Bend National Park; In 1916, the National Park Administration of the Ministry of the Interior was established and *the Basic Law on National Parks* was promulgated. In 1966, *the National Historical Protection Law* was promulgated to register historical relics in national historical parks. After more than a hundred years of exploration and practice, a relatively complete national park management system has been formed. (Ning Zhaoyong, 2024, p.114) Overall, national parks in the United States are mainly natural landscapes, while also taking into account the protection of historical and cultural heritage. Initially, they were not formed specifically for site protection.

In 1897, Japan promulgated *the Law on the Preservation of Ancient Shrines*, which included ancient temples, shrines, etc. in the scope of protection. In 1919, *the Law on the Preservation of Historical Sites, Scenic Spots, and Natural Monuments* was promulgated to protect the site. In 1966, *the Ancient Capital Preservation Law* was promulgated, and the construction of

①The Great Site： In 2005, *the Measures for the Management of Special Funds for the Protection of Large Ruins* clearly stated that "large ruins mainly include reflecting the various stages of development of ancient Chinese history, involving politics, religion, military, science and technology... and other historical and cultural information, large-scale settlements, city sites, palaces, mausoleums and tombs and other sites, ruins and cultural landscapes with large-scale, significant value and far-reaching influence".

archaeological parks became the norm for the protection of Japanese archaeological sites. In 1996, Japan reformed the system of cultural heritage selection from the top down to a bottom-up registration system, which greatly promoted the participation of local and civil society groups in heritage protection. While protecting the site, great attention is also paid to the protection of the intangible cultural heritage related to the site. Through the "human national treasure" mechanism and a series of reward and subsidy measures, traditional Japanese arts and crafts have been preserved to this day at a high level, which has a good promoting effect on the revitalization and inheritance of the site.

Overall, the construction model of archaeological site parks in European countries is relatively flexible and emphasizes joint management. Communities can play a certain role in the protection and revitalization of archaeological sites. The United States focuses on legislative protection, with federal government leadership and unified management, resulting in high execution and management efficiency, and low public participation in the construction of archaeological site parks. Japan pays more attention to the combination of material and non-material aspects in the construction of archaeological site parks, which can fully grasp the market, transform heritage cultural resources into tourism resources, and activate and inherit heritage culture.

1.2 The Development of China Archaeological Site Parks

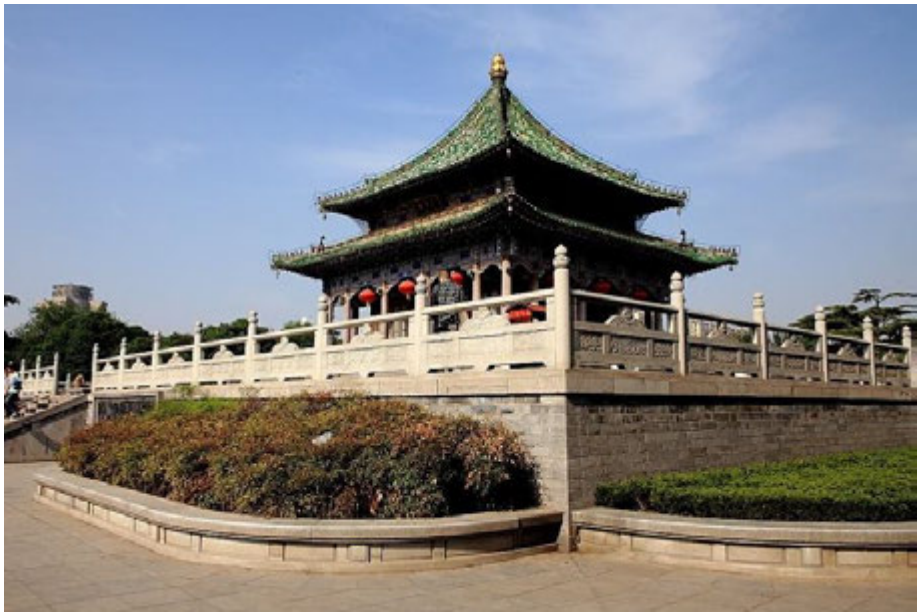

Figure 1. Xingqing Palace Park（https://baike.so.com/doc/5379882-5616132.html）

At the beginning of the founding of the People's Republic of China, some places began to explore the construction of urban parks on archaeological sites. A typical example is the Xingqing Palace Site Park built in Xi'an in the 1950s on the basis of the Xingqing Palace Site, as shown in Figure 1, but there was no clear awareness of the protection of archaeological site parks at that time. It was not until 1983 when the State Council approved the "Master Plan for Urban Construction in Beijing" that it was first proposed to designate the Yuanmingyuan Site as a " Archaeological Site Park ". In 2000, the concept of " Archaeological Site Park " was linked to the management of cultural heritage in the "Yuanmingyuan Archaeological Site Park Plan". Until 2009, *in the Liangzhu Consensus on the Construction of Archaeological Site Parks* formed at Liangzhu Forum, it was clear that "building an archaeological site park" was the way to protect China great sites (Xi Yueting, 2013, p.10). In the same year, the National Cutural Heritage Administration issued the Administrative Measures for National Archaeological Site Parks (for trial implementation), marking the birth of a new management model for the protection of great sites - "National Archaeological Site Park", that is, "a specific public space with important archaeological sites and their surrounding environment as the main body, which has the functions of scientific research, education, recreation, etc., and has nationwide demonstration significance in the protection and display of archaeological sites". (Wang Lu, Liu Kecheng, 2016, p.10). Subsequently, the National Cutural Heritage Administration successively announced a total of 55 national archaeological site parks in 2010, 2013, 2017 and 2022, and 80 of them were included in the project list. From this, it can be seen that the concept of China's archaeological site parks has continuously developed and matured in the process of protecting "great sites".

Since 2009, the National Archaeological Site Park has entered an accelerated development stage as an important carrier for the protection and display of China's major archaeological sites. The "Archaeological Site Park" in China has been continuously developed and improved in practice, gradually becoming an important way of site protection, display, and utilization. With clear requirements for establishment, management methods, and evaluation rules, emphasizing the initiative and purpose of "protection", it is a government led "park protection" model that has emerged with China's rapid urban construction. It is a "constructive protection" that corresponds to "constructive destruction".

From the perspective of the development process of international heritage protection theory and practice, the formation process of archaeological site parks in different countries varies. Due to the early development of heritage protection theory and practice in Europe, the awareness of heritage protection sprouted in the late Renaissance of the 14th century, developed and formed in the early 17th to 19th centuries, and gradually improved after the 19th century. Archaeological site parks also appeared earlier; However, the development of China's heritage protection theory and practice started relatively late, originating from the introduction of Western protection theories by Chinese scholars in the early 20th century, and the full absorption and reference of Japan's heritage protection experience. It was not until the 1990s, with the rapid development of cultural relics protection, that China's heritage protection theory and practice gradually developed.

1.3 International Consensus on the Protection Model of Archaeological Site Parks

Throughout the development of international archaeological site parks, the protection model of archaeological site parks has developed at different stages of the protection process of various countries. Archaeological site parks are widely developed and popularized worldwide due to their outstanding advantages in overall protection, coordinated management, and coordinated development, as well as their wide applicability. In 2015, the International Council on Monuments and Sites (ICOMOS) held its first global conference on archaeological sites parks in Salalah, South Sultanate of Oman, proposing the *Salalah Recommendation*, which stated that "archaeological sites parks" should be a common concept of the International Council on Monuments and Sites. At this point, the global community has generally accepted and adopted this important creation formed in the practice of national cultural heritage protection and utilization(Gao Jing, Zhou Jia, 2023, p.23).

1.4 Reconsideration of Archaeological Site Parks in the Context of Contemporary Heritage Protection

With the development of modern heritage protection theory and people's attention to AHD, in the context of CHS, it is also necessary to reconstruct the concept of archaeological site parks through cognitive reconstruction. Archaeological site parks are not just "parks", they play an important role in cultural dissemination and value recognition. Therefore, in the face of many problems in the construction process of archaeological site parks, it is necessary to first reinterpret two deep-seated issues. Firstly, what is archaeological site parks and why is it a

"park"; Secondly, what has been reconstructed in the practice process of archaeological site parks.

The first question: Firstly, explain the meaning of "site" in archaeological site parks. The author believes that archaeological site parks should first break away from the label of "park". Archaeological site parks, as a form of site protection that has emerged in contemporary urban construction and development, have become very common. The park has shaped the rationality and legality of the protection and preservation of archaeological sites, and is a function that can be better embedded in the city and used by people. Therefore, for the construction and protection of archaeological site parks, "parks" are only a prerequisite, and as the outer shell, "parks" need to be supplemented with more content. The value released by archaeological site parks and the information transmitted need to be truly related to the site. The meaning of a park not only gives legitimacy to the purpose of protecting archaeological sites, but also emphasizes the public welfare and openness of public services. Archaeological site parks require both archaeological sites and the public, and "parks" are an important medium for public participation in the protection and construction of archaeological sites.

The second question: In order to cater to the market, under the current situation of site park construction, where cultural consumption has reduced the cultural significance of sites, archaeological site parks have been transformed into highly recognizable typified products, become popular clock-in places, and are collaged and reconstructed in mass consumption. In the process of individual participation in cultural consumption, the cultural significance of archaeological sites is dissolved. However, if we do not inquire about the cultural significance of the sites themselves, do not see the changes and unchanging cultural values, and the role and influence of culture on the public in this process, archaeological site parks will eventually become "symbols" and lose meaning in consumption.

2. Realize the Reconstruction of Culture Values Through Public Participation

This section expands the discussion of value reconstruction, which attempts to examine from the perspective of CHS and pull away from the existing discourse system.

From the perspective of the development of the international archaeological site parks, as a constructive protection practice for the sites, AHD strongly dominates the construction of the archaeological site parks and plays a fundamental role in the construction process of it, which makes public participation and community participation in a relatively weak state. In the regard, countries have paid a considerable attention to the construction process of archaeological site parks and also protected by legislation, incentives, subsidies and other forms of protection. It can be seen that public participation is an indispensable and significant part of the construction of archaeological site parks. The construction of archaeological site parks needs to coordinate the intricate practical problems through public participation and complete the distribution of rights and interests, and establish a bottom-up participation mechanism to balance the contradiction between urban development and site protection.In this process, public participation is regarded as an important part of the construction of the

archaeological site parks, there will give no cause for much criticism if standing in the perspective of supplementing the integrity of the construction system of it. However, accomplishing the sustainable construction of the archaeological site parks, public participation is not only an important link, but also the ultimate goal of the construction of it.To clarify this point, it has to conduct an in-depth analysis about the role of public participation in the value reconstruction of heritage culture.

Under different national conditions, the construction mechanisms of archaeological site parks are different. But the problems China faces in the construction of archaeological site parks are also faced by other countries. While protecting the archaeological sites, fully responding to the public's needs through the park is an important issue that cannot be avoided in the construction of archaeological site parks. The following is a detailed discussion of the process of construction practice of archaeological sites parks in China, with a view to providing reference and inspiration for common problems faced by the construction of international archaeological site parks.

2.1 Public Participation In the Construction Process of China Archaeological Site Parks

The construction of archaeological site parks can prompt local governments to pay attention to the protection and management of archaeological sites, so that residents where the archaeological sites are located can obtain corresponding benefits from the archaeological site parks, thereby alleviating the contradiction between protection and development faced by archaeological sites (especially great sites) (Sun Hua, etc. 2022, p.04). At present, China's heritage protection has begun to shift from rescue protection to preventive protection, and public participation is also increasingly valued during the construction of archaeological site parks. There are also more and more heritage protection workers and scholars proposing initiatives to improve the vitality of cultural heritage through public participation. There are two stages of public participation in the construction process of archaeological site parks in China, namely the land acquisition, storage and allocation stage at the beginning of park construction and the park construction process and use and operation stage. The former mainly involves the issue of accommodating rural collective land in the face of some large-scale archaeological sites. The land is generally accrued once or in batches through economic compensation, and is mainly completed by the government; the latter is done by the designer during the design process. Public participation is reflected to a certain extent through research and is reflected in the design. When the design is completed and handed over to government operation and management, public participation is mainly reflected in the use of the parks.

2.2 Public Participation that Meets Needs

What the archaeological site "park" coordinates is the balance between historical value and social value, which leads from the issue of site protection to many practical needs. Therefore, it is necessary to conduct a correlation analysis between a series of public's needs and a series of practices in site protection.

In the early stage of the construction of the archaeological site parks, the acquisition and storage of land is mandatory. In principle, the land included in the scope of the archaeological site parks will be owned by the state. The public participation at this stage mainly involved in the process of benefit distribution. The government meets the basic needs of local residents through financial subsidies. The public participation in the archaeological site parks during the construction process and operation stage is post-positioned, supplementary, and relatively passive. The construction process of China's archaeological site parks generally consists of four progressive links: archeology-protection-display-utilization, with a relatively clear paradigm structure (Figure 2). These four stages are all completed by the government and experts. The "utilization link" best reflects the relationship with users. It needs to fully consider the needs of the public and is mostly expressed as an attractive cultural consumption or service, which is a kind of utilization that caters to the market, is popular with the public, and is easier to create economic benefits. It can better meet the public's demand for cultural experience. Compared with "Internet celebrities", it fully caters to the market and the public's cultural consumption psychology. However, the purpose of this kind of utilization is mostly to generate income to make up for the huge financial investment during the initial construction and operation of the parks.

In this way, the construction of archaeological site parks dominated by AHD ultimately serves the issuer of the discourse, and public participation falls into passivity. In summary, both types of public participation reflect the fit with demand. The early stage of the heritage park is in line with the public's basic life security needs, and the middle and later stages of the archaeological site parks construction are in line with the market's cultural consumption needs.

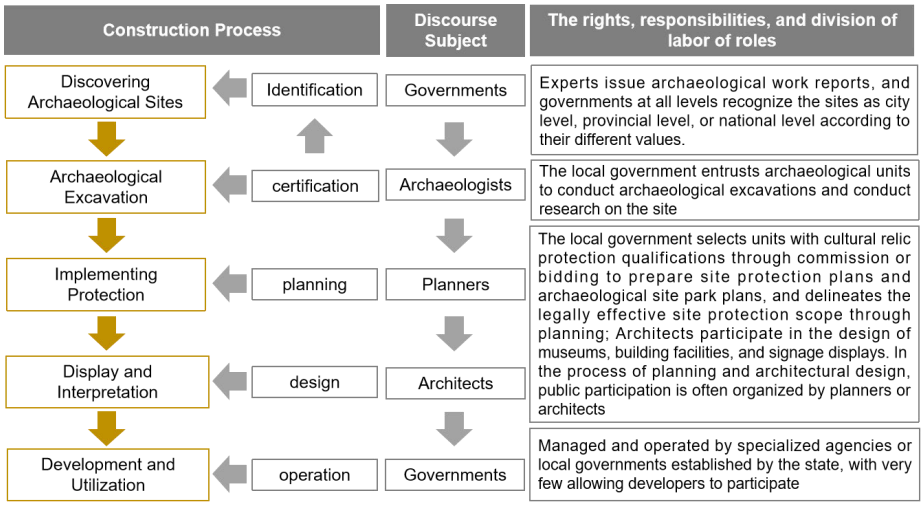

Figure 2. The Discourse Subject in the Construction Practice of Archaeological Site Parks

2.3 The Potential Demand

The construction practice of archaeological site parks meets the existing needs of security and consumption to a certain extent. In addition to this, there is also a potential need—the need for self-realization that creates unique meaning for the individual and is established in the process of dialogue with the site. The individual can fully obtain the freedom of choice to think, welcome, reject, and dispute. rather than being overwhelmed or coerced by authoritative words. Meeting this demand needs to be achieved through public participation in the true sense - in the process of cultural transmission and in the process of dialogue with history, it stimulates individuals to think about their lifestyle. This public participation has a deeper role in promoting a modern translation of the cultural significance of the site.

If you want to get to know the role of this kind of public participation, you first need to fully realize the importance of archaeological site parks in creating or reshaping personal experience and meaning. Secondly, you need to make it clear that this translation is not done by designers, but is completed through the public's experience. What designers do is to realize the dialogue between the public and history through creative transformation, and create a channel for dialogue. Translation is created by individuals, formed from individual experiences, and has meaning for individuals. It needs to be emphasized here that the meaning created by this cultural experience should be rooted in an individual's thinking about lifestyle, rather than arising from a cultural consumption behavior. Translate the cultural significance of the site through individual experience and experience to generate individual meaning and value, making it contemporary, thereby giving the site new commemorative and cultural value. The contemporary translation of heritage culture is not achieved through design; design is just a passage.

2.4 Coping with the Malady of Cultural Consumption

The utilization is limited to the level of "park" form and the level of market demand,which makes essentially no real public participation in the entire process of archaeological site parks construction, only cultural consumption, whether at the beginning of construction or after it is put into operation. Because of the shortcomings of marketing-style cultural communication, the cultural value of archaeological sites is at great risk of being eliminated in the market. The reasons why cultural value is eliminated in the process of market consumption may come from the commercialization of cultural products, the impulse of consumerism or the diversity of consumers. The preventive measures are also multi-faceted. Such as strengthening the guidance and education of cultural consumption, improving the public's understanding and attention to cultural value, strengthening the innovation and quality of cultural products, etc. However, the underlying reason for the dissolution of culture comes from the elimination of the potential needs of the crowd in the process of market operation. In the current era of aesthetic evolution, the marketing of parks by consumerism eager for quick success and quick gains cannot achieve true public participation. At this point, the premise of a value choice has been established.

3. The Value Framework under Discourse

3.1 The Authoritative Discourse Composition of Chinese Archaeological Site Parks

The construction of archaeological site parks under AHD has its existing discourse subject, which expresses the value recognized by authorities.In such a value framework, authoritative discourse generates the first driving force and serves as the starting point and guarantee for the construction of archaeological site parks. Authoritative discourse is often effective in protecting heritage sites. But it cannot play a role in the subsequent operation of the site park, as the operation of the park is directly related to the needs of people's use.For the National Archaeological Site Park, the current main target audience is tourists, while for provincial and municipal level site parks, their main target audience is residents of surrounding communities.In this case, archaeological site parks are important living places for the surrounding communities, different from the construction of scenic areas, because public participation is highly routine and the main purpose of visiting archaeological site parks is not for cultural consumption, but mainly for leisure. At this time, public participation cannot be achieved through the path of scenic areas.It is necessary to examine from a daily critical perspective what kind of creation can attract tourists to stop and become a community monument or symbol to reflect the community spirit or accumulate community memories.

This is also a new perspective that CHS can bring us. The sustainable driving force of archaeological site parks serving the community directly comes from the people's experience and thinking of daily life. The relationship between people and sites is established in daily life and is related to the memory of the community population.This type of public participation and community participation directly points to people's daily lives and specific needs. This bottom-up force is the key to establishing a revitalized and sustainable archaeological site park, which can provide new clues and thinking for the organic development of the site park.

3.2 The Path and Dynamic Cycle of Value Reconstruction under Discourse

The research on cultural capital in heritage value in China is still in its early stages. According to David Throsby's(2010) theory, cultural capital is defined as another asset in addition to the traditional three types of economic capital (material capital, human capital, and natural capital). In addition to the potential full economic value, cultural capital also reflects, stores, and provides cultural value. In his research on the value of industrial heritage, Xu Subin(2024a, p.50) defined the inherent value of industrial heritage as material capital, human capital, natural capital, and cultural capital. The value of cultural capital is reflected in the form of cultural value and economic value. This definition also applies to archaeological sites. Due to the long history and strong cultural significance of archaeological sites, as well as their high degree of damage, their cultural and potential economic value constitute a greater proportion of cultural capital in their inherent value compared to their material capital. The material capital, natural capital, and human capital in the inherent value of archaeological sites are consolidated and strengthened by their cultural significance (Figure 3-a).

According to the "Guidelines for the Protection of Chinese Cultural Relics and Monuments", there are five values: "The value of cultural relics and historical sites includes historical value, artistic value, scientific value, social value and cultural value. Social value includes memory,

emotion, education, and other content, while cultural value includes cultural diversity, the continuation of cultural traditions, and intangible cultural heritage elements.". We can temporarily understand the cultural value in cultural capital as a broad concept, which includes the five types of values mentioned above. In the market environment, the above-mentioned cultural values (five values) also have potential economic value that can be transformed. The potential economic value and cultural value (five values) together constitute cultural capital in the inherent value of archaeological sites. Because the economic value in cultural capital often accompanies the generation of cultural value, economic value is referred to as potential economic value here (Figure 3-b).

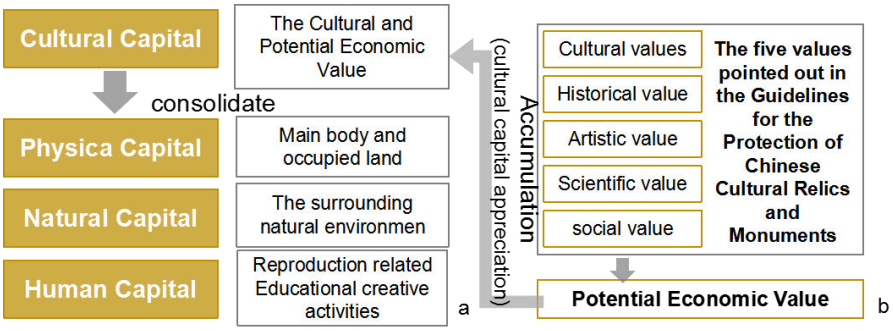

Figure 3. The Intrinsic value of archaeological sites

Authoritative heritage discourse plays an important role in the protection of archaeological sites and the recognition and dissemination of their cultural value. This value is officially recognized, and when heritage departments and governments formulate and implement cultural and funding policies, they participate in heritage manufacturing (Smith, L., Zhang Yu, 2011, p.67). In the process of cultural dissemination and interpretation, the official creates cultural IP, enhances the influence and attractiveness of the site culture through marketing methods, and then converts it into economic benefits through the consumption behavior of tourists. In this process, the national and ethnic level memories carried by the site are interpreted and disseminated through authoritative discourse, in order to achieve the goal of national and ethnic identity.

Under the authorized heritage discourse, the recognized heritage value is reconstructed for the first time by artists and designers through creative transformation, manifested in four levels of cultural industry. They are respectively creative arts, core cultural industries, broad cultural industries, and related industries (Xu Subin, Qingmu Xinfu, 2024b, p.53) (Figure 4-a). From the perspective of the relevant levels of creative value, architecture itself is not the best way to reflect the creative value of heritage. It should reserve sufficient space for the entry of creative art as much as possible, or it should reflect the characteristics of creative art itself, and should have stronger publicness and openness. The creative activities related to heritage in the city are all aimed at building a channel for dialogue with history, but the architecture is more expressed at the spatial or site level. When architects participate, they should first clarify their identity as builders of historical and cultural channels, paying special attention to the

interaction between the building and the surrounding environment, society, culture, and history. Corresponding to the level of creative value, the closer the form of public participation is to creating art, the higher the degree of freedom of participation, and the more number of communities can participate. Therefore, attention should be paid to the importance of artistic creation in the dissemination of site culture and promoting public participation (Figure 4-b).

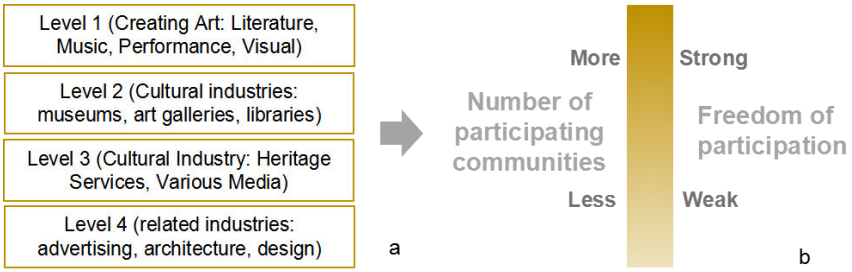

Figure 4. Creative industry hierarchy and public participation level

In the environment of market and cultural consumption, public participation is passive, and the transformed and processed cultural information is transmitted from top to bottom through various creative activities. When the public participates in the services provided by the creative industry, they process, translate, and remember this information through their own experiences. In this process, good ideas often mobilize personal emotional and cognitive initiative, inspire thinking, and trigger resonance. The stronger the individual's emotional and cognitive agency, the deeper the individual's memory, and the stronger their desire to express themselves. In the process of participation, the public actively participates with new understanding, evaluation, advocacy or creation through hands-on experiences, reconstructs the value of heritage, endows the site with new cultural value, and participates in the co construction of archaeological site parks. From this perspective, design should inspire and guide people's attention to history as much as possible, stimulate their interest in history, and involve them in the process of dialogue with history.

In summary, the cultural value of the site is recognized in authoritative discourse, consumed and disseminated in the process of creative transformation, translated in individual experiences, and thus endowed with new cultural value, forming a cycle (Figure 5). In this dynamic cycle, the cultural value of the site continues to accumulate in the social development of aesthetic evolution and the involvement of the public, with potential economic value expanding, cultural capital increasing, cultural industry iterating, and cultural resilience enhancing.

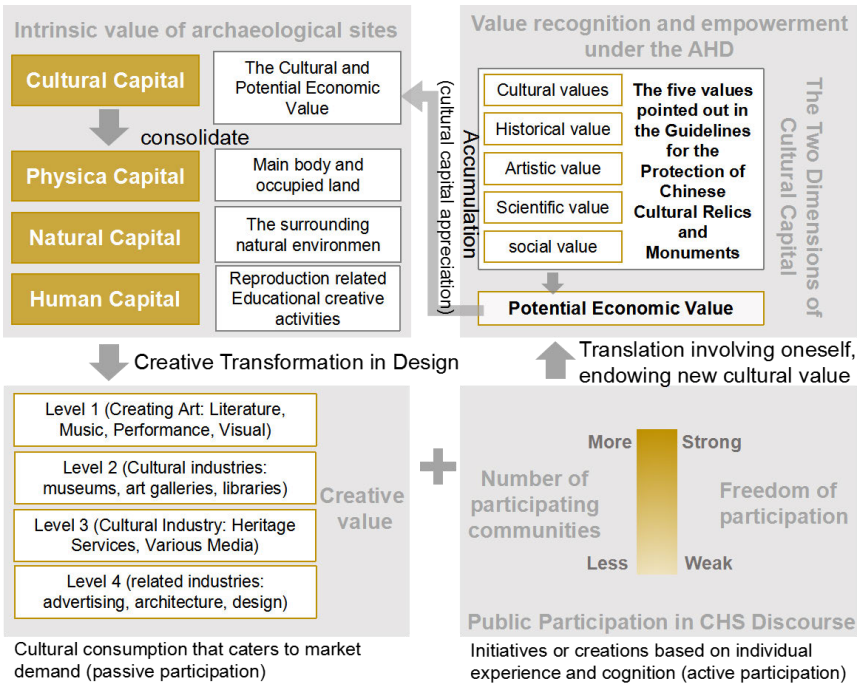

Figure 5. The Path of Cultural Value Reconstruction under Discourse

3.3 Creative transformation with critical color

During the construction process of the archaeological site park, designers need to clearly define their role in every value selection process. As the builders of the channel, the translation of historical and cultural information is completed through every immersive experience of public participation. The channel can take various forms, but its purpose is to allow the public to enter the site that carries historical information for free retrieval. Through public participation in immersive translation, the dialogue with history is completed, awakening the public's thinking about the current way of life, and weaving history and reality.

This is not a simple process, it requires us to deeply and accurately grasp the cultural connotation of the site, uphold the spirit of criticism, and explore potential needs through creative transformation methods. Overlap and reconstruct the self-worth that potential needs can provide with the cultural value of the site, connecting history and the present. Creative transformation should have a color of daily criticism, which often requires a certain amount of time to be accepted by the public, requires time to precipitate, and its form may be unconventional, anti status quo, and needs to be reconstructed in public evaluation, discussion, and controversy. Its transmission of culture is not directly given, but needs to be digested in the form of dialogue. Only cultural cognition or identity reconstructed through personal experience can have strong resilience and vitality. The park is not the end of protection, but the shell of protection and the beginning of involvement.

4. Design for the public

This article takes the design practice of the "Daren Site" Park, a provincial-level cultural relic protection unit in Xi'an, Shaanxi Province, as a case study to respond to the current situation of insufficient construction of provincial and municipal level archaeological site parks in China. It tries to detach from the discourse framework of authoritative heritage as much as possible and focuses on discussing creative transformation design methods based on public experience.

4.1 Audiences of the city

The critical heritage discourse emphasizes public participation in heritage construction. So first of all, the audience should be analyzed at the city level, and the archaeological site parks should be examined in the whole urban group structure to meet the needs of future urban development. Accurately grasp the nature of heritage parks in terms of urban audience and functional structure.

At the urban level, different sites have different audience compositions due to differences in their level and location. According to the classification of sites by country, province, and city/county, the audience scope gradually decreases from the national scope to the city/county scope, and the main proportion of the audience shifts from tourists to surrounding residents. According to the different geographical relationships between the site and the city, the audience of urban type sites, suburban type sites, village type sites, and wilderness type sites (Chen Wenliang, 2010, p.9-10) are also differentiated. The first three types of sites mainly used by urban residents or villagers, while wilderness type sites mainly used by tourists.

Therefore, in the planning of the archaeological site park, it is necessary to combine the actual situation, fully consider the differences in objects, flexibly respond, and formulate different design strategies. In the planning of the Daren Site Park, in the face of the current situation of abandoned site and the huge contrast with the rapid construction of the surrounding area (Figure 6), a temporary urban park implementation plan is adopted. On the premise of fully protecting underground sites, supporting block development and matching urban needs,give consideration to both urban ecological and life, and reserving maximum potential for future archaeological excavations.

4.2 Audiences of the community

Figure 6. Current situation of the site and surrounding areas

At the site level, there may be multiple communities distributed around the site, and the population composition of different communities varies. It is necessary to effectively combine the needs of the population to accurately locate. In the design process, the protection of the site should be taken as the premise, and the relevant content of the site display should be combined with differentiated community needs. Through appropriate travel route design and functional settings, organization and arrangement should be carried out to enrich the content of the archaeological site parks.

In the planning of the Daren Site Park, the core ecological status in the CID urban new area is first clarified through environmental and future potential analysis. Combined with the needs of the surrounding community audience, select appropriate cultural images, and connect the specific needs such as leisure, rehabilitation, education, rest, and gaming for residents, patients, students, and healthcare workers, with cultural images that can fully reflect the culture of the site, such as poetry, books, rituals, and music. Implant historical and cultural nodes that reflect the characteristics of the site and vitality sports nodes that adapt to modern life into the park, and construct a modern urban healthy living green space linked by historical civilization (Figure 7).

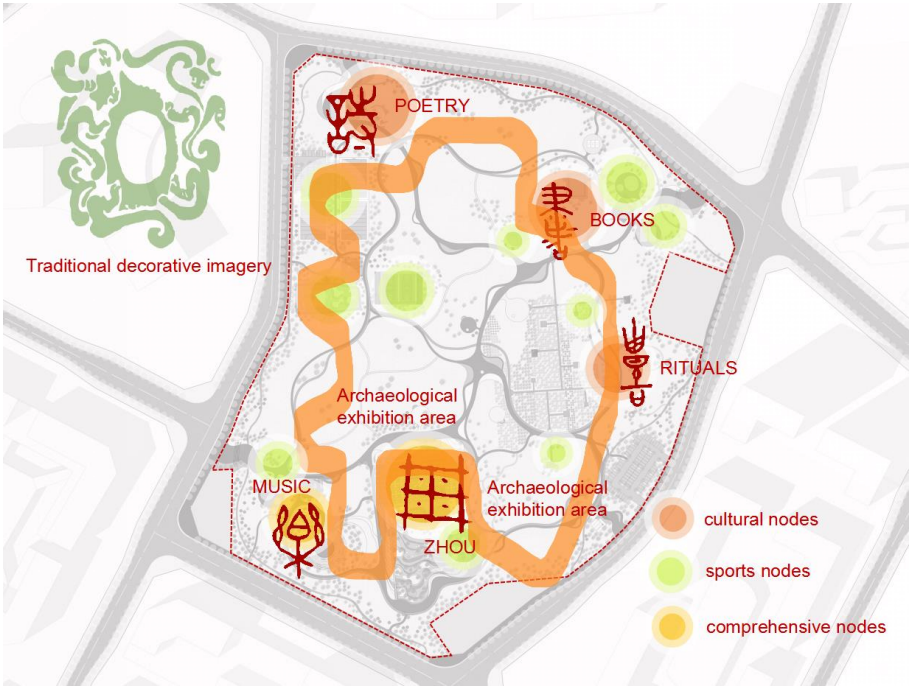

Figure 7. The planning structure diagram of the archaeological site park

4.3 Protection of archaeological sites

Sites protection is a prerequisite for the construction of archaeological site parks. Sites are carriers of historical and cultural heritage. Only by fully ensuring the safety of sites can we continuously explore their cultural value from history and effectively maintain intergenerational fairness.

In the planning of Daren Site Park, in the face of the ash pit, the tombs type site and the shallow burial depth of the site, the planning conforms to the original terrain, and the existing plants in the park are not cleaned on a large scale. Instead, according to the distribution of the site, differentiated disinfection and sterilization, retention, and transplanting are carried out by stages. Shallow root plants are used for greening near the site, and the park road planning adopts a comprehensive strategy of avoiding the site (Figure 8) to minimize surface disturbance and ensure the safety of the site.

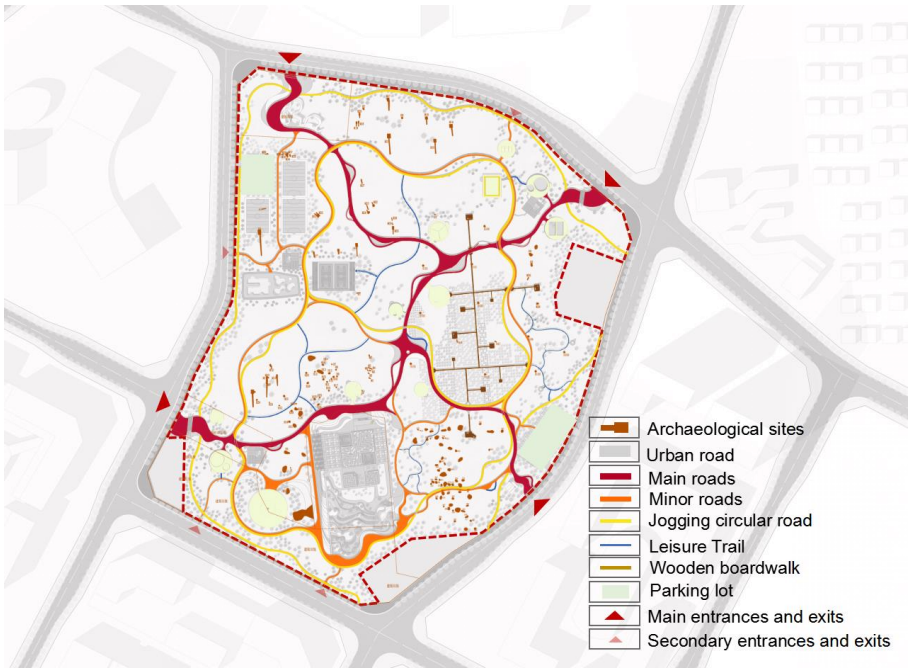

Figure 8.The site park road planning map

4.4 The Passageway of History

The design inside the park is directly related to the public's usage experience. As the creators of historical passages, designers should fully protect the right of the public to participate in the planning and design of archaeological site parks. These rights include the right to know about heritage, the right to approach heritage, the right to understand and interpret heritage, the right to use heritage, and the right to choose their own future lifestyle based on heritage. The protection of power is not only a bottom-up construction of heritage discourse, but also an effective measure to prevent the dissolution of heritage value in cultural consumption. Under the critical heritage discourse, designers should uphold a public oriented attitude and serve the realization of public participation rights.

The focus of the design is on how to enable the public to fully exert their cognitive initiative and complete dialogue with history during the visit of the archaeological site park. The following will explain from four aspects.

4.1.1 Memory in the site

The folk memories in the excavation site of the Pit Square are responded to in the design, interweaving and juxtaposing folk memories with history. Folk memory is a profile of history

and also a dimension of historical channels. The design retains the original deep pit of the site and transforms it into a unique garden at the bottom of the pit, which not only confirms the original brick burning production activities of the villagers, but also serves as a game park for cultural experience in modern cities (Figure 9).

4.4.2 Viewing during Travel: Mirror Maze and Array Ladder

Turn landscape sketches into an interactive device, turn static ornamental into dynamic travel,

Figure 9. The pit Garden

and complete the reading of history through the public immersion experience. The mirror maze and array ladder in the Daren Site Park combine the content of "Zhou Li" culture with the interaction of "technology" to organize exhibits and activities, guide the public to collect historical fragments in dynamic streamlines, and gradually restore the imagination to gradually restore the restoration Historical appearance. (Figure 10)

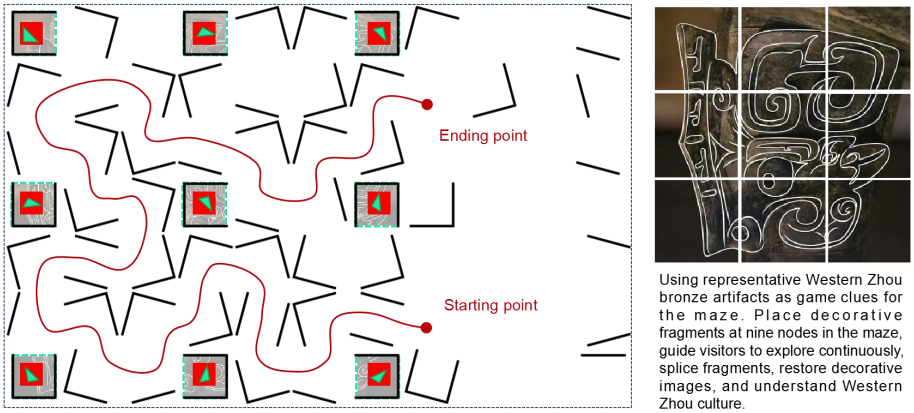

Figure 10-1. The Plane of Huan Yuan

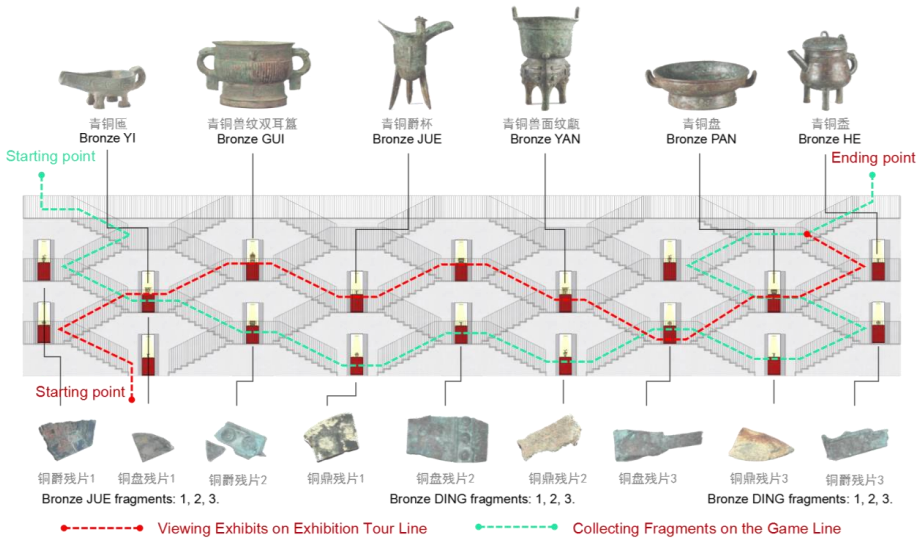

Figure 10-2. The facade of Huan Zhen

4.4.3 Education in the game: Archaeological Sandpit

The response of archaeological site parks to "archaeology" should also be open, the related construction of public archeology should be encouraged. Understanding archaeological activities also helps to deepen understanding of the site and is an important dimension of public participation. Transforming a children's playground sand pit with a single gaming nature into an archaeological sand pit with educational significance in the design, and realizing children's right to participate in heritage in the game.

4.4.4 Guidance in Dialogue: Logo Design

The identification system is an important part of the construction of archaeological site parks, and textual content explanations also need to be designed. History is not a straightforward statement of "I tell you, please listen to me", but rather a narrative of "feel it, experience it". The signage design in the Daren Site Park is presented in a simple form (Figure 11), guiding the public to pay attention to the text content. The text on the signage is presented in the form of dialogue, such as "Take a look!", "Experience it!", "What do you think?", etc.

Figure 11. Signboard in the park

5. Summary

At present, the methods of cultural experience in archaeological site parks are still mostly traditional, and tourists are mostly passively receiving information, which does not consider the possibility of treating tourists as creators and participants. Therefore, tourists should be provided with opportunities to actively participate in the construction and interpretation of cultural content. The name "park" is only the beginning of site protection, and the interior of the park is the place that needs more design.

With the development of cultural relics protection, when archaeological site parks are everywhere, they will eventually become a place for our daily lives. We must interact with the landscape we are in every day and bear its shaping on our body and mind in real-time. Arousing people's reflection on contemporary life is one of the important roles of artistic contemporaneity, enabling each individual's innocence to resist the alienation of grand narratives. (Duan Jianqiang， 2024, p.20) To record the significance of archaeological sites in your life in an individual way is to participate in the contemporary "regeneration" of archaeological sites. The "revitalization" of archaeological sites is the contemporary interpretation of the cultural significance of the sites, and the future of the construction of archaeological site parks is hindered and long. The above are some thoughts of the author on the construction practice of archaeological site parks, which need to be further practiced in future practice. We hope to provide reference and thinking for relevant research on the construction of archaeological site parks.

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Track 16: Networks And Data

NETWORKS AND DATA - Planning and socio-technical systems, digital methods and technologies

Chairs:

- Daniel Florentin, Mines Paris Tech
- Michele Campagna, Università degli Studi di Cagliari
- SaeBom Song, Karlsruher Institut für Technologie (KIT)

Keywords: *-*

Are metropolitan-oriented major infrastructure networks adequate and aligned with growing environmental pressures and raising calls for just and sustainable urban regions? Planning activities are increasingly destabilised when not ontologically questioned by the environmental turmoil and its different facets. Large-scale infrastructure systems have long been framed as resource-efficient socio-technical arrangements of service provision. However, their material and energy footprint and the dynamics of growth of resource-intensive practices they have often supported have largely been neglected. Can the LTS (Large Technical Systems)-urbanism and the thermo-industrial nexus it encapsulates be somewhat overcome? Is one such transformation a shared concern or a new form of geographical divide? Recent examples like the road projects assessment in Wales, where a vast number of infrastructure projects have been halted or abandoned due to their contribution to environmental degradations, shed light on possible new infrastructural trajectories, hence transforming planning practices in the face of climate pressures.

At a larger level, the activity of planning of/for urban/regional infrastructures thus seems to be torn between potentially incompatible transitions and objectives, i.e. the quest for sufficiency and resource-sensitive approaches on the one hand and continuously growing, supply-driven, material-intensive and carbon-heavy infrastructural developments on the other one. There is a vivid need to equip reflections on what ecological networks and a redistributive sufficiency-oriented ecological planning of infrastructures can be, which coalesces environmental and justice concerns and considers the level of material and social interdependences between territories.

Concomitantly to these raising issues, and possibly in contradiction with them, continuous advances in digital technologies and Artificial Intelligence (AI) have had enormous impacts on the evolution of socio-spatial systems and on planning practices. How is such a transformation shifting the type of problems addressed by planning (only those subject to digitalisation and quantification) and the type of urban order that it entails? This questions how digitalisation may create the new broad geographical and social divide and pushes to challenge the so-called promise of smart infrastructural systems that are supposed to improve resource efficiency, to

grasp their variegated contributions to tackle or even to contribute to environmental and social transformations.

This track welcomes critical contributions on substantive and processual issues and socio-technical approaches, such as (but not limited to):

- Ecological expertise in planning practices (presence, implications)
- Sufficiency-oriented infrastructure networks
- Urban justice, urban sustainability, and urban networks
- Planning support methods, technologies, systems
- Conflicts around digital technologies in urban planning
- Articulation between digital and ecological perspectives in planning
- Alternative forms of planning for socio-technical systems and their governance (grass-rooted, demand-oriented, resource-sensitive, etc.)
- Infrastructural violence, inequalities of access to networks and planning
- Big geospatial data for planning (open, social, volunteered, sensors, infrastructures, platforms)
- Urban and regional models (multi-dimensional representations, digital twins, Virtual/Augmented reality, simulation, impact assessment, forecasting, what-if, etc.)
- Artificial intelligence in spatial planning and governance
- Innovative technologies for smart urban and territorial systems (in transport, energy, nature, agriculture, tourism, housing, industry, etc.)
- Diffusion of digital technologies in spatial planning and governance research, education, and practice
- Social appropriation of digital technologies in urban and regional systems.

Digital Modelling and Analysis of the Network Structure for Residential Historic Areas in China

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Abstract
Residential historic areas in China are crucial for urban fabric and cultural heritage. Given the complexity and dynamic nature of these areas, the conservation and renewal efforts demand precise spatial interpretation and effective methodological approaches. Under the hierarchical framework of typo-morphology, the network structure in discrete geometry is used to recognise the spatial pattern. Then a digital model is constructed, which calculates quantitative morphological indicators and clusters elements. This model enables real-time adjustments and feedback of the morphology and has been packaged as a software application. This study advances the scientific rigour and efficiency of the planning process and promotes it from 'the prediction based on human experience' to 'the precise evaluation based on data analysis'.

Keywords
Residential Historic Areas; Urban morphology; Network Structures; Digital analysis; Planning strategies

1. Introduction

1.1 Background

Many cities in China have long histories, and as a result, a large number of residential historic areas with different situations have been formed. Residential historic areas (RHAs) in this study mainly refer to a complete block with relatively old age, a certain scale, residential as the main function, and retaining the traditional Chinese low-rise residential and courtyard model (Pang et al. 2023). These historic areas are not only important components of the urban space but also important carriers of traditional culture in the urban area. As the most complex but necessary object in urban renewal, RHAs' conservation and renewal have become increasingly important issues, hence it is crucial to investigate digital modelling approaches and design strategies.

In the current urbanization process in China, planning and design work for urban renewal has already broken away from the simple mode of large-scale demolition and construction with the gradual popularization of the people-oriented design concept. The corresponding work mode has being shifted towards a more refined and focused direction on the traditional urban spatial pattern. In this process, qualitative analysis and decision-making methods make it difficult to form accurate value judgments when facing the complex built environment of RHAs. Therefore, it is necessary to systematically understand the overall spatial structure of historic areas and the characteristics of each micro unit, and based on this, the corresponding design strategies for each spatial element should be developed, so that differentiated conservation and renewal actions can be carried out.

However, residential historic areas in China have often undergone a long historical evolution. The street networks in historical areas have been constantly destroyed and redeveloped due to residents' disorderly construction of their own houses. The scope of each household's residential plot has also been repeatedly redefined with changes in property rights. Because of this historical process, RHAs often have an exceptionally complex structure composed of various spatial patterns. In addition, RHAs are not static objects, but dynamic material carriers that constantly change and develop along with government protection planning and residents'

independent updates. During the regeneration process, minor updates or constructions from a single sector, such as resident's properties or government's policies, may affect the spatial structure of the entire block. These changes have brought about a lot of repetitive analysis and redesign work.

Based on the above issues, we see that the conservation and renewal of RHAs in China should be guided by a detailed understanding of complex spatial structures. This is a process that takes micro units as the operating object, integrates multiple information and analytical results, and repeatedly formulates reasonable design strategies to achieve progressive work. On the one hand, a clear and accurate interpretive pattern is required. This pattern can accurately provide feedbacks to designer and planners with the overall spatial structure of RHAs and the detailed characteristics of each spatial unit in the complex environment. On the other hand, a more efficient and accurate system is also needed to provide the morphological analysis results of spatial units in real time to assist designers in making design decisions.

Therefore, in order to support and enhance the planning and design work of complex and dynamic environments in historic areas, this study intends to expand the existing form interpretion theory and construct a network structure analysis model that is in line with the current spatial relationship of RHAs in China. Subsequently, based on this network structure, the digital modelling of RHAs was achieved through autonomous programming technology, including the corresponding morphological analysis. At the same time, the methodology proposed by this research should be combined with the progressive and diachronic characteristics of the conservation and renewal of RHAs in practice. The real-time morphological analysis results can be provided during the dynamic evolution of the spatial environment, which can guide refined design decision-making work.

1.2 Literature review

1.2.1 Morphological interpretation research of historic areas

The morphological analysis of RHAs is based on the description and interpretation of its material space. After a long period of systematic research on urban morphology and its evolution, European scholars have gradually formed the Historico-geographical School represented by Conzen (Conzen 1960) and the Process Typological School represented by Muratori and Caniggia (Caniggia & Maffei 2001). The two schools of thought mutually confirm and form a complete system of typo-morphology. Subsequent scholars have continuously improved the interpretive patterns of typo-morphology, such as Kropf's multi-level theory, which integrates the views of the two schools of thought (Kropf 2014). Faced with the complex spatial environmental characteristics of RHAs in China, many researchers have begun to apply various interpretive methods involved in typo-morphology to the study of RHAs. Ji and Ding et al. applied the research method based on Nori maps to the old city of Nanjing and verified the similarities and differences between traditional urban space and modern urban space (Ji & Ding 2021). Dong et al.'s research focuses more on the combination of methods and practice. By drawing typological maps of different eras in the conversation and renewal of the Xiaoxihu Historical and Cultural Block, the evolution patterns of the block's spatial structure have been identified. Based on this, the targeted design of each property rights plot can be conducted

(Dong et al. 2019). Xia et al.'s research is more comprehensive. They analysed the typological characteristics of the block at multiple scales, from street texture to courtyard space, and then to detailed craftsmanship, in the conversation and renewal of the Kaiyuan Temple area in the old city of Bin County, Shaanxi Province. These characteristics were used as the main basis for the design of the block restoration (Xia et al. 2015). The current research demonstrates the feasibility and effectiveness of applying an interpretive system from the perspective of typo-morphology to RHAs. This method can incorporate the complex and disordered spatial environment of RHAs into a relatively clear interpretive framework. However, current research has not been able to fully and effectively adapt to the large number of complex special situations in RHAs, and most methods mainly rely on manual work to complete a large amount of information sorting and graphic drawing. This process requires more effective methods to assist.

1.2.2 Technical Analysis Methods for Historic Areas

The interpretation and analysis of the morphology of RHAs is a complex process. Digital models can make up for the limitations of traditional statistics such as low reliability and slow computation in large-scale data processing, and suggest strategies for solving complex problems in morphological research. Ding and Ma interpreted the layout characteristics of traditional residential buildings in Anhui, Jiangsu, and Zhejiang provinces through spatial syntax, and conducted data clustering analysis using SPSS to explore the different usage patterns reflected by different residential spatial structures (Ding&Ma 2020). Dabbour used Depthmap to analyse the connectivity and visibility indicators of pedestrian movement in the old urban area of Damascus, the morphological characteristics of the urban road network in terms of accessibility have been quantitatively described (Dabbour 2021). Huang et al.'s research used 23 indicators from multiple dimensions such as "physical space vitality", "network space vitality", and "emotional level" to define the vitality characteristics of historic areas and evaluated them using the random forest algorithm. The corresponding methods were written in Python. (Huang et al. 2022). Wang et al. introduced deep learning methods in the study of village morphology and used algorithms written in Mathematica to represent images of over 6000 traditional villages in binary, thereby converting their morphological features into feature vectors. Finally, cluster analysis was performed on the feature vectors to reveal the type patterns of traditional village spaces (Wang et al. 2023). Cai et al. proposed a hybrid data-driven approach to support urban morphological quantification and multi-dimensional similarity analysis, using high-dimensional feature vectors (HDFV) extracted by a deep convolutional neural network (Cai et al. 2021). It can be said that whether based on existing analysis platforms or through programming to build corresponding method systems, digital methods have demonstrated accuracy and efficiency that manual statistical and analytical methods cannot achieve. In the early research process of conservation and renewal of historic areas, it has become a mature method to select appropriate digital technology means to achieve efficient and accurate rapid analysis of problems.

2. Construction of network structure of residential historic areas in China

2.1 General hierarchical structure of the residential historic areas

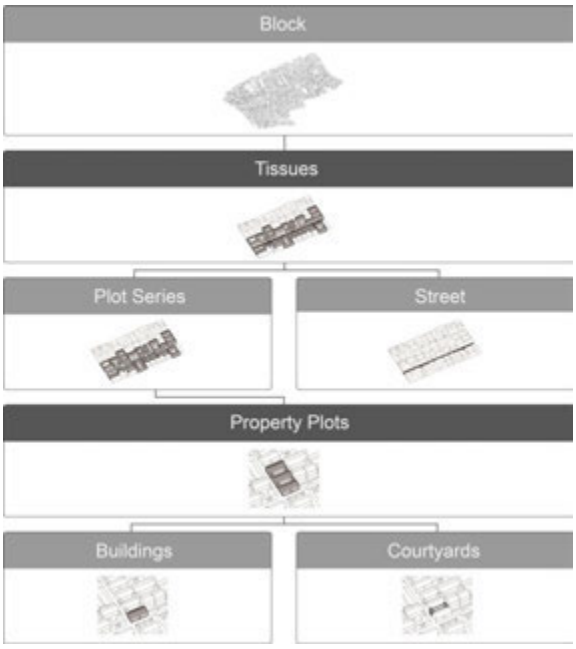

Figure 1. The hierarchical structure of components in residential historic areas in China

The description and analysis of the complex built environment of RHAs is the start point of design work. The scale hierarchy structure in the field of typo-morphology provides a clear descriptive framework for the spatial environment of RHAs, which can connect scattered and multi-class spatial elements into a whole. Based on the combination hierarchy theory of Kropf (Kropf 2014), the interpretive pattern in this study employs the hierarchical structure of 'block-tissues-street and plots series-property plots-buildings and courtyards' to recognize and identify the spatial structure of RHAs (Figure 1). The entire block is often connected by a complete road network, and the plots which are divided based on the evolution of property rights are the basic living units of residents. Therefore, the "simple tissue" composed of each road and its two sides connected in a fishbone shape becomes the basic element of the neighbourhood. Within the plot, traditional Chinese housing often presents a multi-courtyard pattern, with entrances and exits mainly located on the short side of the plot. Therefore, buildings and courtyards become the most basic spatial units. In this hierarchical structure, roads, plots, buildings and courtyards are the three most closely related levels to design, and their spatial characteristics will become the direct focus of this study.

2.2 Spatial complexity of the residential historic areas

Typo-morphology originated in Europe, where many cities often have relatively regular spatial patterns and the boundaries of plots are completely occupied by building facades (Figure 2). So the spatial status can be accurately reflected by a regular hierarchical structure. However, the

RHAs in China are different. On the one hand, due to the limitations of traditional building materials, low-rise brick and wood structure houses often cannot maintain a constant state for a long time. Therefore, most of the residential buildings in the blocks have undergone multiple demolition and reconstruction during their use (Pezzetti 2019). Each reconstruction will make corresponding adjustments based on the property rights and site conditions at that time. This process will not only change the spatial pattern inside the plot but also affect the overall road network spatial structure of the block. On the other hand, in just the past few decades, Chinese residential property rights policy has undergone multiple adjustments, resulting in plots being reclassified multiple times with changes in property rights (Dong et al. 2019). Its morphology has already broken the 'one-way entry, multiple courtyards' pattern which formed during the initial construction (Figure 3). The access and use methods of many plots are far from their actual layout patterns. The above two aspects together contribute to the spatial complexity of RHAs, which contains various special situations that cannot be directly identified using existing hierarchical structure theory.

Figure 2. The spatial patterns of three European cities: Florence (left), Barcelona (middle) and Paris (right).

Based on the spatial relationship between roads, plots, buildings, and courtyards, four special situations of spatial structure within RHAs can be identified: interlocking, overlapping, co-inflection, and a composite condition termed the superposition state integrates these three configurations (Figure 4). Interlocking means that the same plot is connected to multiple roads and belongs to multiple tissues. Co-inflection is reflected at a more subtle level, that is, the same building or the same courtyard belongs to different plots due to the continuous division of property rights (Kropf 2014). Overlapping is relatively common in China's RHAs, that is, the plot is not directly adjacent to any road and must be reached through surrounding plots. (Song et al. 2024). The above three types of special situations often do not appear independently, but often co-occur in the same block or even the same plot. This also leads to the need to establish a more refined spatial relationship description system based on the hierarchical structure so that the morphological characteristics of each subtle element can be accurately reflected.

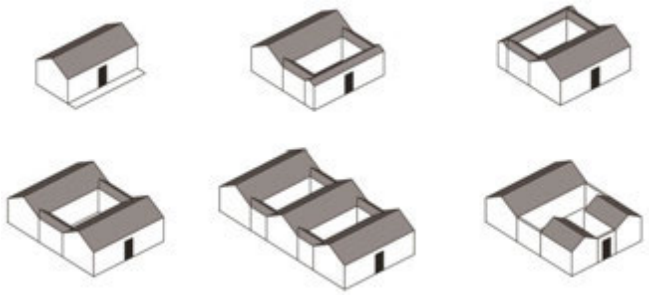

Figure 3. Typical layouts of traditional Chinese residential building groups including buildings and courtyards

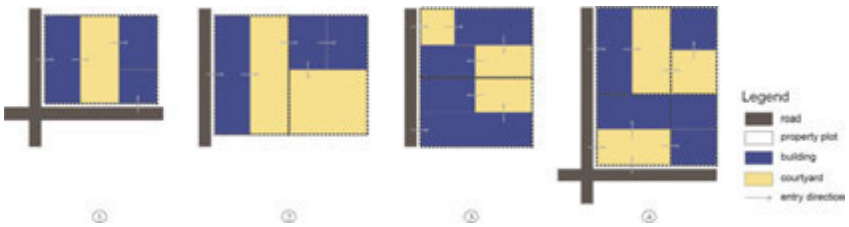

Figure 4. Illustration of 4 special situations of spatial structure within residential historic areas: (1) Interlocking, (2) Overlapping, (3) Co-inflection, (4) The superposition state

2.3 Access Network Structure of Residential Historic Areas

RHAs are generally based on a multi-scale hierarchical structure and contain a large number of complex situations. Faced with this characteristic, this study attempts to introduce graph theory models from the field of discrete geometry into morphological analysis. Under this model, the spatial elements and their connection relationships at multiple levels in RHAs will be abstracted into a network structure diagram composed of 'points' and 'lines'. Multiple quantitative indicators in spatial syntax theory are used to analyse the position of each 'point' (i.e., each spatial element) in the overall network, to clarify the relationship between spatial elements and the overall neighbourhood, as well as the interrelationships between spatial elements.

Firstly, in the road hierarchy, each road is abstracted as a 'point' in graph theory, and the connection between roads is abstracted as the 'line' (Figure 5). The quantitative indicators of road morphology are measured by three values: depth value, connection value, and the proportion of connections with low-depth roads. The depth value refers to the minimum number of spatial conversions required for this road to reach the main roads outside the block. The depth value of the main roads outside the block is defined as 0, and the other roads are calculated progressively in sequence. The connection value refers to the number of other roads connected to this road, which reflects the connecting role that a certain road plays in the entire road network. The proportion of connections with low-depth roads reflects the degree of

commonality of the road relative to other surrounding roads. The calculation method is as follows: the number of roads connected to a certain road is A, the number of roads with lower depth values than this one among these roads is B, and the proportion of low depth value connections is B/A. The above three values can accurately define the position of any road in the road network, they can fully reflect the public and connectivity of a road.

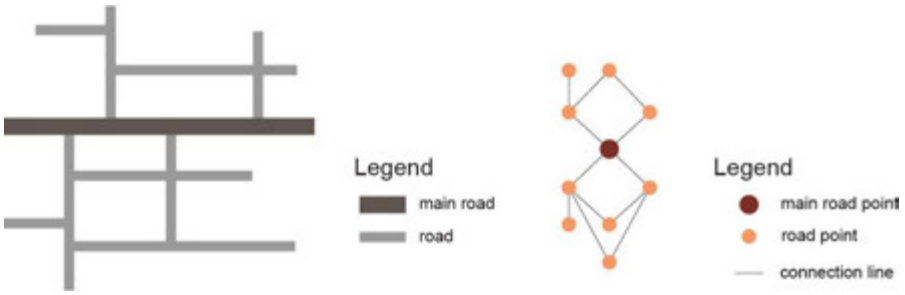

Figure 5. An example of extracting access network structure (right) based on a road-wise morphology instance (left)

In addition, in the plot hierarchy, the plots are abstracted as another set of 'point line' systems attached to the road network. Among them, 'points' represent various plots, and 'lines' represent the connection between plots and roads, as well as the connection between plots (Figure 6). The quantitative indicators of the plot's morphology are measured through external depth values, external connectivity values, internal depth values, and internal connectivity values. The external depth value and external connection value refer to the depth value and connection value of the most public road that the plot can be directly accessed. These two values are derived from the road network and reflect the accessibility and convenience of reaching the plot through the road network. The internal depth value is the minimum number of spatial conversions to reach the plot from the road and reflects the degree of overlap of the plot. In this case, the road is defined as the start point with a depth value of 0. The internal connection value refers to the number of paths that can directly enter the plot, including entering from surrounding roads and surrounding plots. This value is a visual representation of the tightness of the connection between the plot and surrounding spatial elements. The above four values collectively reflect the position of a plot in the street network (i.e. the higher level) and the plot sequence (i.e. this level).

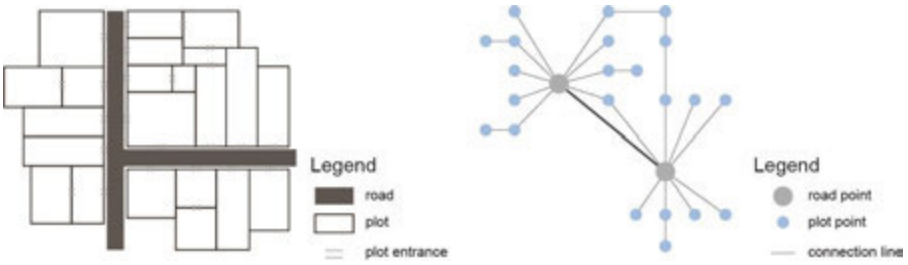

Figure 6. An example of extracting access network structure (right) based on a plot-wise morphology instance (left)

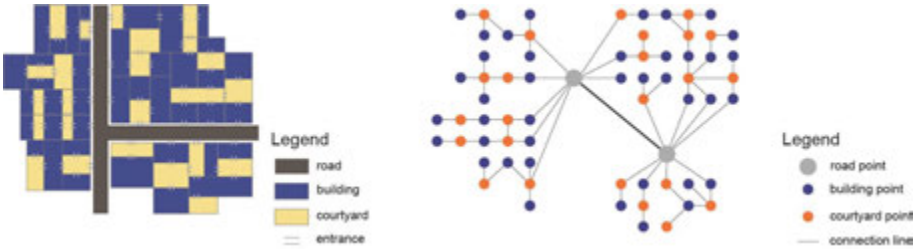

Figure 7. An example of extracting access network structure (right) with a focus on building-courtyard relationship from a morphology instance (left)

Finally, we focus on the hierarchy of buildings and courtyards. Due to the existence of various complex and special situations in RHAs, the access relationship between buildings and courtyards is significantly different from that of property plots. The division of property plots often completely breaks the spatial form of courtyards. Therefore, in order to conduct in-depth research on the position and interrelationships of each building and even each courtyard in the entire block, we need to build an independent 'point-line' network system outside of the property plots. The 'point-line' network system of buildings and courtyards is also attached to the road network. Buildings and courtyards are represented by different 'points', and 'lines' represent the connection relationship between buildings and courtyards and their connection relationship with roads (Figure 7). The quantitative indicators of the form of buildings and courtyards are also measured through external depth values, external connection values, internal depth values, and internal connection values. The calculation method for external depth values and external connection values is the same as the calculation method for plots. The internal depth value is also the minimum number of space transformations to reach the building or courtyard with the road as the starting point of the 0 depth value. The internal connection value refers to the number of paths that can directly reach the building or courtyard, including entering from surrounding roads and from adjacent buildings or courtyards. This value reflects the degree of tightness between the building or courtyard and the surrounding spatial elements. The above four values can also be used to measure the position of the building or courtyard, the most basic spatial element, in the overall network.

After the above process, we have preliminarily constructed an interpretation, representation and evaluation system based on a multi-scale hierarchical structure as the basic framework. In this system, the network structure diagrams have been used to define the connection relationships between spatial elements, the public and connectivity of spatial elements are accurately measured in the network through quantitative indicators. This system can accurately describe the complex spatial conditions of RHAs, and has a clear logical framework and quantifiable measurement methods, making it very suitable for simulation and reproduction through program algorithms.

3. Digital analytical modelling methods and their applications

3.1 Digital analytical model based on the hierarchical structure

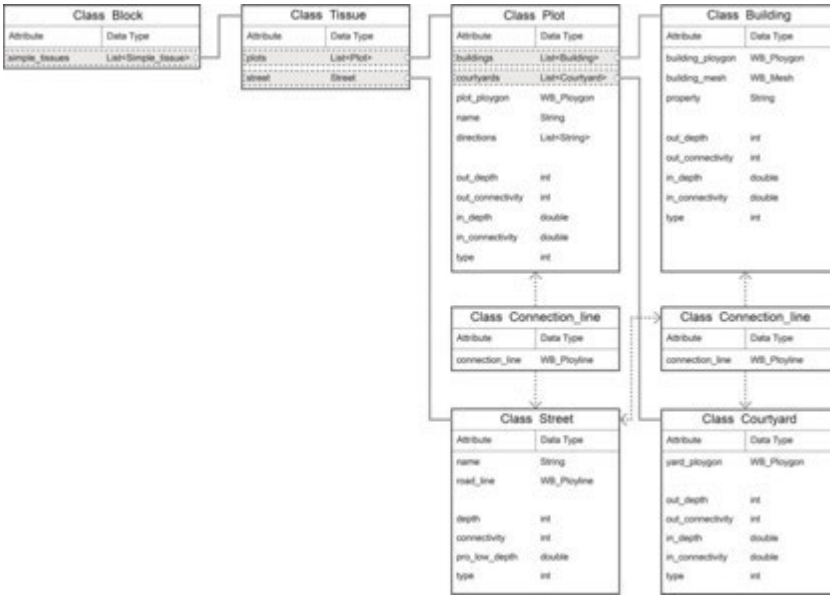

Figure 8. The structure of the digital model

Based on this multi-scale hierarchical network structure, this study constructed a corresponding digital analytical model through Java programming, allowing real-time RHA morphological structure analysis and interactive user interfaces. This model takes the basic class and object structures in the Java language as the main underlying logic, and constructs different classes for spatial elements (i.e., 'points' in the network structure diagram) and connection relationships (i.e., 'lines' in the network structure diagram) at multiple levels. At each level, information on all spatial elements is stored through a dataset containing all objects of that class. The quantitative feature values of each spatial element, the spatial elements of the next level which are contained within them, and their related connection lines are all included in the attributes of each object (Figure 8). At the same time, the various datasets in this digital model are not fixed entities, and the attributes of objects of each class are interconnected. Various datasets can also

be added or reduced at any time. These settings provide an algorithmic basis for the real-time completion of morphological analysis in the progressive conservation and renewal process of RHAs.

In order to have quick feedbacks of the morphological analysis for spatial elements at various levels, we translated the quantifiable feature values and the corresponding calculations from the network structure into mathematical or geometric algorithms, and then we implemented those in our interactive digital analytical model. Whenever the dataset of objects at each level is updated, the program can call the corresponding algorithm to recalculate the quantified values linked in the attributes of each object, thereby the temporal morphological analysis work in the RHAs progressive change process can be completed.

However, the complex quantitative indicators are still not intuitive enough and are difficult to directly guide the design. Hence the clustering algorithms have been introduced into the analysis framework of the program. This study incorporates the K-Means clustering algorithm into the digital model. After each update of the morphological quantification values, spatial elements at each level will be clustered based on the quantification values, the commonality and connectivity of spatial elements in the overall network can be reflected by clear type characteristics. Based on such type characteristics, the planning and design strategies can be referenced from similar cases. It should be noted that the weights of various quantitative indicators of spatial elements in the clustering process are adjustable to match the diverse needs. Users can obtain biased clustering results according to design needs to develop more targeted design strategies.

3.2 Add a front-end interface to form an analytical technology platform

After the construction of the digital model, it is necessary to build a matching front-end interface based on the designer's real-time need to obtain corresponding analysis results according to the updated site status or design adjustments in actual work. The front-end interface is a path for human-computer interaction with digital models. It is mainly used by designers and should be able to reasonably collect users' adjustments to multi-level spatial structures. Within the digital model, this interface should be linked to the backend data structure and algorithms. On the one hand, it should be able to visualize the necessary information in the digital model in real time. On the other hand, it needs to provide real-time feedback to the user's operations in the digital model and update the datasets at all levels.

This interface is based on the overall map of the block, which can visually display the spatial elements on multiple levels within the block, and indicate their type characteristics with colours. It can also display the network structure of points and lines between various spatial elements, allowing users to intuitively identify the entry relationship of the entire block. On the right side of the interface is the data display bar, which can display the overall form analysis results of the block in real-time. This interface has a detailed information query function. Users can click on any spatial element, and its detailed morphological information can be displayed in the data bar on the right (Figure 9). In order to meet the needs of users to obtain multivariate analysis results, the interface also has multiple display modes. Users can view separate analysis maps of spatial

elements at different levels at any time as needed and can adjust the view to three-dimensional for easier observation (Figure 10).

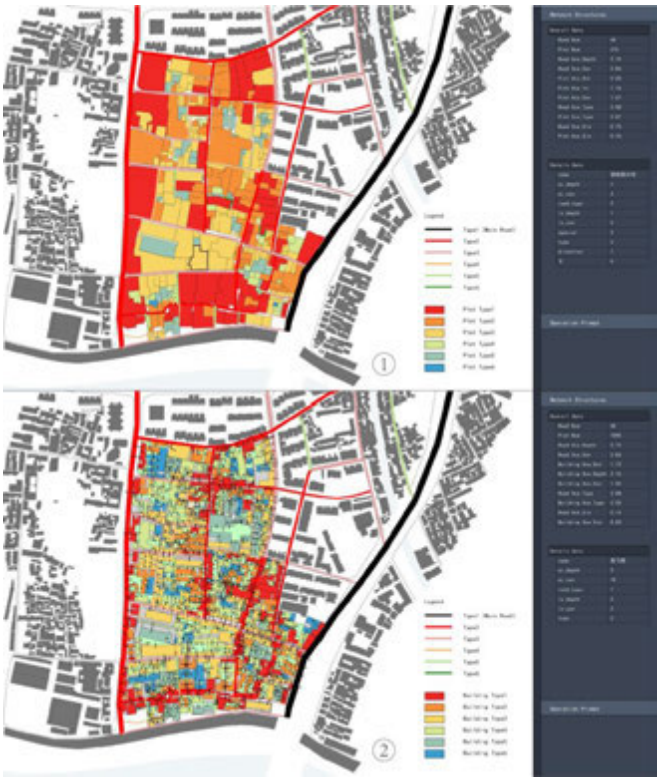

Figure 9. The analysis map and information bar in the user interface, where users can view detailed information of a certain plot (top) or detailed information of a certain building (bottom)

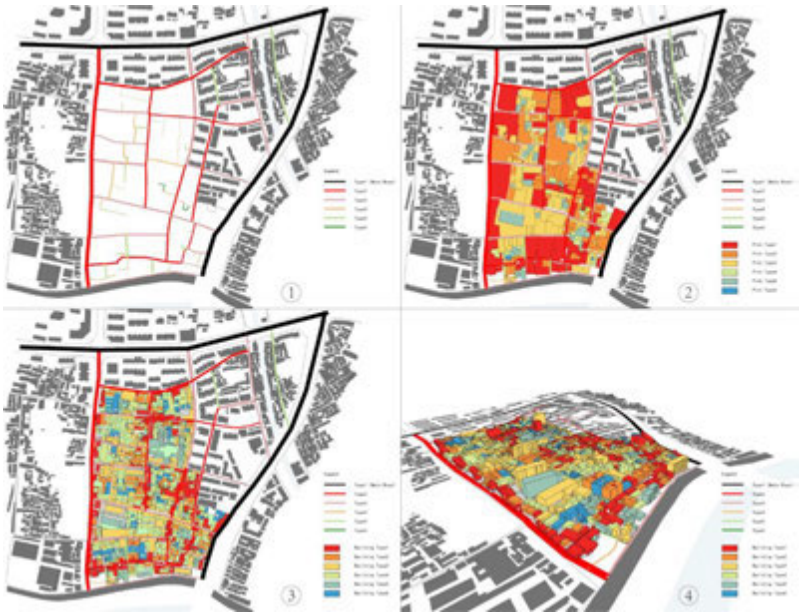

Figure 10. Multiple display modes for analysis map in the user interface, including analysis map of roads (top-left), analysis map of plots (top-right), analysis map of buildings (bottom-left) and 3D analysis map of the buildings (bottom-right)

The diachronic storage, recording, updating, and reanalysis functions are the core requirements in the conservation and renewal of RHAs, and they are also the core functions of our digital model. In the front-end interface, the operation panel is located on the left side of the interface, and users can directly modify spatial relationships at multiple levels on the block map through simple operations (Figure 11). One main mode of operation is to adjust the spatial elements themselves, including adding or removing roads, redefining plots, demolishing buildings, etc. Any operation will directly change the dataset of spatial elements. Another operation mode is to adjust the connection relationship between various spatial elements, users can add or subtract the connection lines between each element at any time to change the network structure of the block (Figure 12). Any modification is operated by the user within the interface based on the autonomous updates of residents in the neighbourhood or the active design of the designer. The digital model can provide new analysis results in real-time based on any modification, thereby providing feedback in real-time during the dynamic and gradual change process of RHAs. At the same time, the model also has the function of information export and storage. Users can export any state of the block and the analysis results in that state in various forms during the adjustment process, including exporting JPG format images of the analysis overall map, exporting Excel lists of various spatial elements and their corresponding morphological analysis results, and exporting dxf files including block topographic maps and corresponding analysis result layers. Through this mechanism, users can store the status of each stage in the design

adjustment process and conduct comparative analysis to find better planning and design strategies.

Figure 11. The complete user interface of the digital analytical model

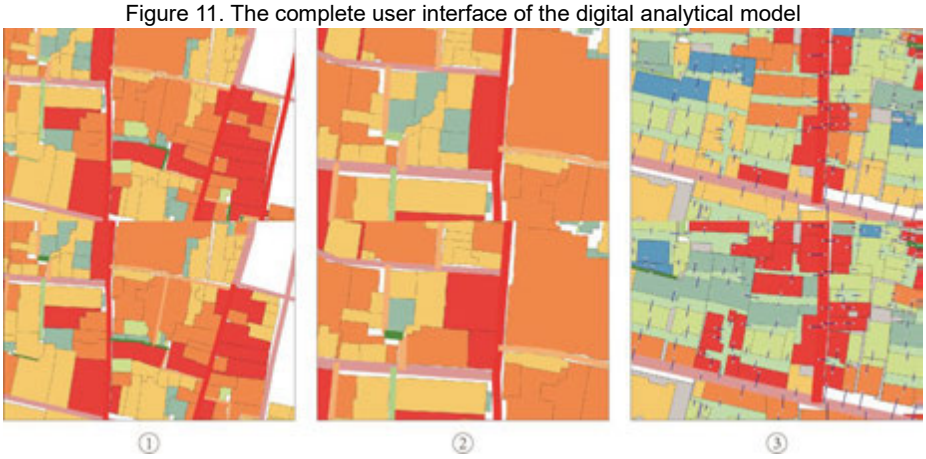

Figure 12. Users can operate data by adding or removing roads (left), redefining plots (middle), and adding or subtracting the connection lines (right) through the digital analytical model.

3.3 Application Trial and Feedback

In order to facilitate the usages for planning designers in practical work, this digital model is packaged into an exe running program through exe4j. Then the relevant files of the program and the running environment are combined into an installation package through Inno setup. This digital model has been developed into an analytical technology platform that can be installed on any computer. The study is based on the actual conservation and renewal work of multiple RHAs (including Xiaoxihu, Diaoyutai, and Hehuatang) in the southern area of Nanjing.

Multiple planning designers were invited to test the value and shortcomings of the analytical technology platform based on the actual workflow.

During the trial process, this analytical platform demonstrates the effectiveness of assisting the planning and design phase of the RHAs' conservation and renewal through digital methods. Users can intuitively obtain detailed morphological analysis results of each spatial element, which serve as the main basis for obtaining design strategies. Quantitative indicators and clear type characteristics are used to guide planning and design work. This technical path makes up for the ambiguity of manual judgment and enhances the scientific nature of the design results. At the same time, the analytical platform has greatly reduced the repetitive analysis work caused by complex and dynamic spatial structures, which effectively improves work efficiency.

However, the designers involved in the trial also pointed out some limitations of the analytical platform. Firstly, in the conservation and renewal design process of RHAs, diachronicity is a very important concept. Although the current analytical platform takes into account the storage and export of analysis results at each stage, it does not form a historical operation path in the platform that can be rolled back, viewed and called at any time, so it cannot fully match the actual work needs. Meanwhile, current platforms can only provide morphological analysis of complex spatial environments from the perspective of network structure. In practical work, various constraints and problems should be considered in the conservation and renewal of historic areas. The platforms have not yet been able to overlay and analyse more information. Finally, this platform can essentially only complete morphological analysis work, it mainly targets the pre-design analysis and strategy acquisition stage. Therefore, the process from design strategy to actual design scheme generation still needs to be manually completed by designers, and technical methods have not yet penetrated the entire process from analysis to design.

4. Conclusion

In the field of planning and architecture, morphological design often relies on morphological analysis (Han 2013). Morphological analysis can reveal the objective laws of the spatial environment and provide early guidance for morphological design. This study applies data-driven techniques to the conservation and renewal of residential historic areas in China. A hierarchical network structure model is used to recognize the complex and dynamic multi-level spatial environment of the block, and accurate morphological analysis results are obtained in real-time to assist design decision-making. This research reflects the great potential of integrating digital methods in the planning and design process in complex spatial environments and involving multiple information, such as in RHAs in China. Digital methods can comprehensively analyse complex problems from a more quantitative and rational perspective, and provide accurate results in real-time. This research brings not only advancements in technical methods but also changes in working models. In this way, we can improve the planning process from 'the prediction based on human experience' to 'the precise evaluation based on data analysis'.

Acknowledgements

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Explore the Improvement of Humanity-Oriented Transportation through Adaptive Topology Optimization of Traffic Networks Using Density Fields

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Abstract

The concept of “humanity-oriented transportation” primarily stems from the negative impacts of "car-oriented transportation," prompting a shift in thinking towards emphasizing a more humane approach to traffic planning to ensure public safety. This involves prioritizing pedestrian and bicycle traffic on roads, increasing pedestrian activity space, and reducing the impact of motor vehicles on road users. This prompted the present study to explore the utilization of Shepard density interpolation method to establish traffic density fields and to introduce topological optimization models to investigate how to reasonably reduce vehicular space within the acceptable range of overall service levels on urban roads, thereby releasing more space for pedestrian activities. By combining adaptive refinement strategy, this allows for more accurate estimation of traffic density, facilitating effective allocation of both vehicular and pedestrian spaces.

Keywords: Humanity-Oriented Transportation, Topology Optimization, Shepard interpolation, Adaptive Refinement Strategy

1. Introduction

The Athens Charter mentions that "transportation" plays a crucial role in connecting residence, work, and leisure. Since World War II, the rapid development of motorized vehicles, mainly cars, has occurred worldwide, starting with European cities, followed by the United States, and later by Asian cities. However, virtually all cities worldwide have been affected. With increased mobility and accessibility, users have multiplied, but so have traffic congestion, conflicts, and accidents between vehicles and users.

The efficiency and convenience brought by car-based transportation come with negative

consequences such as increased traffic conflicts, decreased quality of life, and ecological imbalances. European cities, first captivated by cars, began reflecting in the 1960s on how to break free from the grip of vehicle traffic and return to a humanity-oriented urban environment from a "car- oriented" urban model.

European cities recognize earnestly that "cities cannot continue to be dominated by vehicles. It is impossible and inappropriate for cities to accommodate unlimited traffic and activities by vehicles. People should find ways to reclaim cities, making them humanity-oriented again." Thus, initiatives like the "Vision Zero" were launched, aiming for zero fatalities in traffic accidents. So, some practical actions come out which includes:

(1) Car-Free Movements and Car-Free City Centers: The "International Car-Free Day" originated in France. On September 22, 1998, a group of French youths first chanted the slogan "In Town, Without My Car!" hoping to reclaim their cities from vehicles for a cleaner environment. This movement quickly gained attention and response from neighboring countries. By February 2000, the French-originated car-free day was integrated into the European Union's environmental policies. The first European Car-Free Day took place on September 22 of the same year with 760 European cities jointly organizing car-free day activities, marking a significant milestone. Furthermore, in addition to hosting car-free days in 1999, all participating cities actively identified car-free zones within their city centers as part of action plans to promote old city areas as pedestrian zones.

(2) Bicycle Culture: While pedestrian zones ensure that only a portion of the city remains unaffected by vehicles, the entire city still experiences significant daily transportation needs. Therefore, "bicycles" have once again become a mode of transportation for urban residents in advanced countries like Europe. In the Netherlands, known as the world's cycling country, 70% of urban streets have a speed limit of 30 kilometers per hour, making streets safer for cyclists and pedestrians alike[1].

The US media CNN once described Taiwan's traffic chaos as a "living hell" in its reports. For example, narrow roads filled with motorcycles and cars, obstructed by lampposts and transformer boxes, and storefronts crowded with plants or signs, forcing pedestrians to often walk on the roadway or shuttle between congested lanes and sometimes blocked sidewalks. Additionally, pedestrians must beware of numerous small motorcycles weaving through traffic. When crossing the street, caution is advised as many drivers do not respect pedestrians' right of way or traffic regulations [2].

Furthermore, in Taiwan, in the past five years, there have been over three million traffic accidents annually, resulting in nearly three thousand deaths each year, with over four hundred of them being pedestrian fatalities, accounting for 13% of the mortality rate. In the past decade, nearly fifteen thousand pedestrians have been injured in traffic accidents while walking, leading to long-term impacts on their lives and significant costs to families and society. According to statistics from 2022, those aged 65 and above account for 69% of pedestrian fatalities[3].

In light of this, the Taiwanese government is striving towards the ultimate goal of zero traffic accidents, gradually shifting from the concept of "vehicles" dominating road spaces to a mode of thinking where "humanity" take center stage in urban spaces and transportation systems, emphasizing the humanization of urban spaces and transportation systems and considering both the safety of the public and the environmental burden.

Defining "humanity-oriented transportation" as a system that is oriented towards people, pursuing a transportation system necessary for sustainable and better human life. In a narrow

sense, it can be defined as a transportation system primarily based on "human-powered" modes such as walking or cycling, which are low-pollution and environmentally friendly. However, in a broader sense, regardless of the development of motor vehicles or other mass transit vehicles, or the construction of roads, all should be oriented towards people, meaning they should align with the "values of sustainable and better human life," avoiding harm to people and hindering the ways people achieve a better life.

Its four main contents are:

(1) Maximizing the use of green transportation: Transitioning from past reliance on motor vehicles to prioritizing human-powered modes such as walking and cycling as the main "green transportation."

(2) Natural energy as the primary source of mobility: Transportation development in the new century should aim to achieve comprehensive goals such as health, safety, efficiency, environmental protection, and sustainability, considering the use of natural energy for energy consumption and mobility maintenance.

(3) Target system emphasizes humanization: Adjusting the functional structure of road systems, changing the configuration of road space, coordinating overall greening efforts, reducing the impact of through traffic, lowering the speed of traffic in the area, ensuring traffic safety, and increasing pedestrian activity space.

(4) Construction methods focus on localization and community: Designing an urban living space where residents can achieve various travel purposes by walking, which could potentially change the history of transportation development. Under this design concept, various transportation projects will no longer prioritize car travel but instead focus on walking, cycling, and public transportation. Mixed land use and pedestrian-oriented road systems will be developed based on the scale of community space [4,5].

Current efforts in Taiwan towards humanity-oriented transportation include the establishment of pedestrian lanes, the delineation of marked pedestrian paths, the installation of pedestrian-specific traffic lights and pedestrian refuge islands, the removal of motorcycles from sidewalks, and the reconfiguration of lanes [6,7]. Research directions mostly explore how to adjust vehicular spaces[6-12], seeming to lack rational studies on reducing vehicular spaces. Therefore, this study initiates a preliminary investigation into the rationality of reducing vehicular spaces.

2.Concept of Methodology

The inspiration for this study stems from combining topological optimization with Shepard interpolation method and adaptive refinement strategy, applied to the rigidity assessment of material structures [13,14]. The aim is to minimize material usage while maintaining a certain level of rigidity strength to support loads. Extending this argument to the allocation of traffic lanes, the goal is to reduce the maximum amount of road space while still maintaining an acceptable overall service level.

2.1. Definition and Classification of Traffic Service Levels

In Taiwan, the primary purpose of analyzing urban arterial roads is to estimate average travel speeds to assess the overall traffic function service level of an arterial road. Another purpose is

to assess the traffic operation at intersections that affect the continuity of traffic flow on arterial roads, to help determine which sections need improvement or how to improve them. The division standards for transportation service levels (Table 1) are analyzed.

Table 1. The division standards for urban and suburban arterial road service levels[15].

Level of Service	Average Speed /Speed-limit ($\bar{V}/V_L$)
A	$\bar{V}/V_L \geq 0.8$
B	$0.6 \leq \bar{V}/V_L < 0.8$
C	$0.5 \leq \bar{V}/V_L < 0.6$
D	$0.4 \leq \bar{V}/V_L < 0.5$
E	$0.2 \leq \bar{V}/V_L < 0.4$
F	$\bar{V}/V_L < 0.2$

Here, we define the overall service level and its acceptable range.

(1) Overall service level: Consideration of the individual service levels of each road (main roads, secondary roads, local highways) within the study area (urban areas).

(2) Acceptable range of overall service level: Within the study area, allocation of proportions between service levels based on different road hierarchies (main roads, secondary roads, local highways).

2.2. Construction of Traffic Density Field

2.2.1. Defining the Design Variable Points:

In Fig 1, assume we have n design variable points $x_i = (X_i, Y_i)$, where X_i, Y_i define the ith point location in a Cartesian coordinate system, with the volume values $q_i (i = 1,2, \dots, n)$.

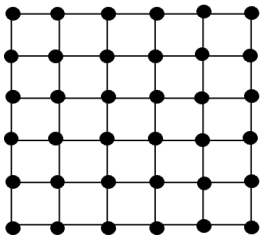

Fig 1. Design variable points are defined in the study area.

2.2.2. Adaptive Refinement Strategy

There are two conditions for adding nodes. One is that the node is located on the boundary of the study area, and the other is that within each unit area set, different speed limits exist on road segments. The estimated volume values of the added nodes (empty circles) are the average volume values between the surrounding nodes (solid circles) (Fig 2).

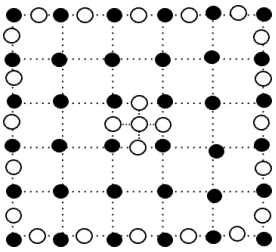

Fig 2. Newly-added nodes by adaptive refinement strategy.

2.2.3. Shepard Interpolation Method

Before using the Shepard interpolation method, it is necessary to define the influence region that affects the calculation of volume value at point x, for example, a circular area with a radius of R_C. The volume value at the interpolation point is then related to the design variables within its influence region (Fig 3).

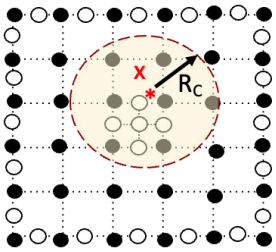

Fig 3. Only design variable points within the influence region R_C. contribute to the volume value of point x

Within the study area, at regular intervals, using the Shepard interpolation method to calculate the volume value:

$$q(x) = \sum_{i \in S_x} \Theta_i(x) q_i \tag{1}$$

where $\Theta_i(x)$ is a Shepard-family interpolation function expressed by

$$\Theta_i(x) = \frac{d(x-x_i)}{\sum_{j \in S_x} d(x-x_j)} \quad (i \in S_x) \tag{2}$$

with $d(x - x_i) = \|x - x_i\|^{-2}$ $(i = 1,2, \dots, n)$ being the Euclidean distance between the points x and x_i and the set S_x denoting the design variable points located within the influence domain of point.

2.3. Topology Optimization

The size of road space will affect the volume value (or flow rate) and average speed of lanes, thereby leading to either a decrease or increase in the level of road service. The premise of implementing humanity-oriented transportation is to first reduce the road space, minimizing road capacity while still meeting the overall level of road service. This involves adjusting the proportion of service levels according to different road hierarchies (main roads, secondary roads, local roads), and the allocation of service level proportions can be adjusted appropriately according to different regions. Therefore, the topology optimization can be expressed as

$$\text{Minimize } C_{Mi} + C_{Sj} + C_{Lk}$$
$$Subject\ to \begin{cases} SL_{\alpha M} * r_1 + SL_{\beta M} * (1 - r_1) \\ SL_{\alpha S} * r_2 + SL_{\beta S} * (1 - r_2) \\ SL_{\alpha L} * r_3 + SL_{\beta L} * (1 - r_3) \end{cases} \quad (4)$$

where C_{Mi} $(i = 1,2, \dots, n)$, C_{Sj} $(j = 1,2, \dots, m)$ and C_{Lk} $(k = 1,2, \dots, o)$ are the capacity of main roads, secondary roads and local roads, respectively. The capacity is calculating by [16]

$$C = F * N * 1000 + (W - P) * 200 \quad (5)$$

where F is the road type correction coefficient, N is the number of express lanes, W is the width of slow lanes, and P is the width of parking spaces. SL_{α}, SL_{β} are different levels of service, with subscripts M, S, L representing main roads, secondary roads, and local roads respectively. r_1, r_2, r_3 are the proportions allocated between different levels of service.

3. Discussion and Conclusion

This study utilizes the Shepard interpolation method, supplemented by adaptive adjustment strategy, to establish a traffic density field. Through topological optimization analysis, it evaluates whether the overall traffic service level remains within an acceptable range to determine the rationality of reducing vehicular space. Since this study focuses on the overall service level rather than the traditional individual segment service level, it assesses traffic flow smoothly. Therefore, even if congestion occurs on certain road segments, other segments may remain unimpeded, resulting in smoother overall traffic.

Thus, through the methodology proposed in this study, it aims to re-examine spatial configurations and adjustments before implementing humanity-oriented transportation. This approach seeks to simultaneously meet the needs of pedestrian and vehicular spaces, contributing modestly to emissions reduction and sustainable development, thus addressing climate change.

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The Game-Changing Role of AI in Urban Development Decision-Making: Trends and Future Perspectives

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Abstract
Urban development in today's rapidly evolving landscape demands the integration of Artificial Intelligence (AI) to foster sustainable growth amidst vast spatial data. AI applications offer invaluable insights, revolutionizing decision-making processes by uncovering patterns, trends, and relationships. This paper explores the transformative potential of AI in urban development decision-making, highlighting trends, challenges, and future perspectives. Through advanced analytics and reporting tools, AI enables targeted interventions for environmental sustainability, resource optimization, and equitable social development. We delve into emerging trends such as Urban AI and synthetic data, examining their role in reshaping urban governance and planning. By addressing challenges and embracing innovative solutions, AI paves the way for sustainable, resilient, and inclusive urban futures.

Introduction
In today's rapidly evolving landscape of urban development, the integration of Artificial Intelligence (AI) has become imperative for fostering sustainable regional growth amidst the deluge of spatial data. AI applications stand poised to revolutionize decision-making processes by offering invaluable insights that inform strategic actions and guide initiatives towards sustainable outcomes. Through advanced data analytics and reporting tools, organizations can sift through vast datasets, uncovering intricate patterns, trends, and relationships that lay the groundwork for informed development strategies.

Consider, for instance, the role of AI in pinpointing critical areas for intervention within urban environments. By analyzing diverse datasets, AI applications can identify opportunities to enhance environmental sustainability and optimize resource utilization. Whether it's reducing energy consumption, curbing waste generation, or preserving biodiversity hotspots, AI-driven insights enable targeted interventions that align with broader sustainability objectives.

AI holds the potential to revolutionize how stakeholders engage with communities and address social and economic disparities. Through the analysis of demographic data, municipalities, cities, and regions can gain a nuanced understanding of the needs and aspirations of their residents. Armed with these insights, decision-makers can craft tailored programs and policies aimed at fostering social cohesion, environmental stewardship, and economic prosperity within communities. From equitable access to services to inclusive urban planning initiatives, AI-enabled decision-making fosters holistic approaches to sustainable spatial development.

AI facilitates dynamic, data-driven approaches to urban governance, enabling real-time monitoring and adaptive decision-making. By harnessing the power of predictive analytics, cities can anticipate emerging challenges and proactively devise strategies to mitigate risks and capitalize on opportunities. This forward-thinking approach not only enhances the resilience of urban systems but also fosters a culture of innovation and continuous improvement in sustainable development practices.

As we navigate the complexities of urbanization and strive to build more inclusive and resilient cities, the role of AI in sustainable regional development cannot be overstated. By harnessing

the power of data-driven insights, AI empowers decision-makers to navigate complex challenges, seize opportunities, and chart a course towards a more sustainable and equitable future. In the following sections, we delve deeper into the transformative potential of AI in urban development decision-making, exploring emerging trends and envisioning future pathways towards sustainable spatial development (Luusua et al., 2023; Cugurullo, 2020; Pellegrin et al., 2021).

The aim of the paper is to contribute valuable insights to the ongoing discourse on the evolving landscape of urban planning and governance, highlighting the game-changing role of AI in driving innovation and progress in urban development decision-making.

2. Trends and challenges of AI in urban development

As we embark on an exploration of the dynamic landscape of AI integration in urban development decision-making, it becomes crucial to examine both the evolving trends and the complex challenges that accompany this transformative process. In this section, we delve into the emerging trends that underscore the increasing role of AI in shaping urban development strategies, alongside the multifaceted challenges that must be navigated to harness its full potential. From leveraging AI-driven analytics to address urban challenges to grappling with issues of data quality, algorithmic bias, and community trust, understanding these trends and challenges is essential for steering urban development initiatives towards a more sustainable and equitable future. Let's delve deeper into this intricate intersection of technology and urban governance, exploring the trends driving AI adoption and the challenges that must be overcome to realize its transformative promise.

2.1. Urban AI

"Urban AI" represents the convergence of AI and the concept of "Smart Cities," where algorithms are trained on urban datasets to develop solutions tailored for urban environments. This concept is closely intertwined with the notion of "Big Urban Data," highlighting the significance of large-scale urban datasets in informing AI-driven solutions.

During a global exploration, two primary branches of Urban AI emerged:

1. Ontology: This branch focuses on transforming urban data into actionable knowledge about the urban environment, infrastructure, and usage patterns.
2. Robotics: This branch involves developing robots capable of navigating urban environments and performing predefined tasks. This includes autonomous vehicles, delivery drones, and cleaning robots, with Urban AI playing a crucial role in the software components of these robots. This encompasses environmental recognition, decision-making processes, and human-machine interactions (Hubert Beroche).

Urban AI refers to any system that incorporates data derived from the urban environment and processes it using algorithms. The resulting insights have practical applications within the socio-spatial fabric of the city.

Three key features distinguish Urban AI:

- Complexity of the City. Urban environments are multifaceted, with intricate interactions among people, infrastructure, and natural systems.
- Policy Contexts. Urban AI operates within specific policy contexts, influenced by local governance, regulations, and cultural nuances.
- Hybridity. Urban AI blends diverse data sources, technologies, and stakeholder interests.

Urban AI not only revolutionizes travel practices but also contributes to the creation of digital twins of cities, fundamentally altering our understanding of urban dynamics and decision-making processes. Adaptive and autonomous algorithms, powered by AI, play a pivotal role in shaping our travel experiences, influencing the routes we take via car, air, rail, or foot. Moreover, accommodation services guided by AI recommendations enrich our travel experiences, ensuring personalized and seamless journeys.

It facilitates the creation of digital replicas of cities, known as digital twins, which amalgamate data from diverse sources to provide comprehensive insights into urban infrastructure, dynamics, and human behavior. By integrating previously disparate datasets, Urban AI empowers decision-makers and urban planners to gain a holistic understanding of urban environments, facilitating more informed and strategic planning processes.

Urban AI transcends traditional boundaries, transforming how we interact with our environment and society. From optimizing travel routes to enhancing decision-making processes through digital twins, Urban AI emerges as a powerful tool for shaping the future of urban development and governance. As cities continue to evolve, Urban AI will play an increasingly integral role in fostering sustainable, resilient, and inclusive urban environments (Luusua et al., 2023; "AI: Revolutionizing Urban Planning and Smart City Development," n.d.).

Urban AI has made significant strides in enhancing cities and improving urban living. Here are some successful examples:

- **New York City's Community-Centric Planning.** New York City utilizes AI to gauge public sentiment on development projects. By fostering community-centric planning, they ensure that urban development aligns with the needs and preferences of residents1.
- **Tokyo's Optimized Public Transportation.** Tokyo leverages AI-driven commuter data analysis to optimize its public transportation system. This approach eases congestion, enhances commutes, and ensures efficient mobility for millions of residents and visitors1.
- **Copenhagen's Eco-Friendly Urban Design.** Copenhagen uses data analytics and AI to track progress toward its goal of carbon neutrality by 2025. This informs eco-friendly urban design decisions, contributing to a sustainable and livable city (AI: Revolutionizing Urban Planning and Smart City Development, n.d.).

These examples demonstrate how AI can revolutionize urban planning, transportation, and environmental sustainability. As cities continue to evolve, urban AI will play an increasingly pivotal role in shaping our urban landscapes.

But implementing Urban AI in the context of smart cities presents several challenges. Let's explore them:

1. **Technical Challenges:**

1.1. **Standardization and Interoperability**. The integration of diverse technologies in urban AI often leads to fragmentation, hindering seamless communication and compatibility between systems. To address this challenge, standardized interfaces and data models are essential. Establishing common standards ensures interoperability, enabling different AI systems to communicate effectively and share data seamlessly. By adopting standardized protocols, urban AI solutions can integrate more efficiently, fostering collaboration and synergy among diverse stakeholders.

1.2. **Data Handling and Storage.** Urban AI generates vast and complex datasets from various sources, including sensors, social media, and administrative records. Efficient data handling, storage, and processing become critical to extract meaningful insights and derive actionable intelligence. Scalable and robust data infrastructure is essential to manage the volume, velocity, and variety of urban data effectively. Implementing advanced data management techniques, such as distributed storage and parallel processing, can enhance the efficiency and scalability of urban AI systems, enabling timely analysis and decision-making.

1.3. **Scalability.** As cities continue to grow and evolve, the scalability of AI systems becomes crucial. Ensuring that AI solutions can handle increased data volume, user demands, and computational complexity is a significant challenge. Scalability issues can arise in various aspects of urban AI, including data processing, machine learning algorithms, and infrastructure capacity. Adopting scalable architectures, leveraging cloud computing resources, and implementing parallel processing techniques are key strategies to address scalability challenges and support the sustainable growth of urban AI applications.

1.4. **Mitigating Network Congestion.** Urban AI relies on real-time data exchange and communication between devices, sensors, and systems. Managing network congestion and ensuring timely data flow are ongoing challenges in urban environments with dense populations and high data traffic. Traffic optimization techniques, prioritization algorithms, and adaptive routing protocols can help

mitigate network congestion and ensure reliable data transmission in urban AI systems. Additionally, investing in robust network infrastructure and bandwidth expansion initiatives can improve the resilience and performance of urban AI networks, enhancing their ability to handle peak loads and unexpected surges in data traffic.

1.5. **Privacy and Security Concerns.** Balancing data accessibility with privacy protection is a fundamental challenge in urban AI deployments. Urban AI systems must safeguard sensitive information, such as personal data and location-based data, while providing valuable services to residents and stakeholders. Addressing privacy and security concerns requires comprehensive data governance frameworks, encryption protocols, and access control mechanisms. Implementing privacy-enhancing technologies, such as differential privacy and federated learning, can help preserve individual privacy rights while enabling data sharing and analysis for urban development purposes. Moreover, raising awareness among citizens about data privacy risks and rights is essential to foster trust and transparency in urban AI initiatives. By prioritizing privacy and security considerations, urban AI systems can uphold ethical standards and ensure responsible data stewardship in urban development decision-making processes.

2. Financial and Legal Obstacles:

2.1. **Funding Complexity.** Implementing large-scale urban AI projects demands significant financial investment, ranging from infrastructure development to talent acquisition and ongoing maintenance costs. Securing funding and allocating resources for these projects can be challenging, particularly in the face of competing priorities and budget constraints. Municipalities, government agencies, and private sector stakeholders must collaborate effectively to mobilize resources and secure sustainable funding sources for urban AI initiatives. Innovative financing mechanisms, public-private partnerships, and grant programs can help address funding complexities and ensure the long-term viability of urban AI projects.

2.2. **Regulatory Complexities**. Navigating the complex landscape of regulations, compliance requirements, and legal frameworks is another obstacle in the adoption of urban AI technologies. Legal considerations related to data privacy, cybersecurity, intellectual property rights, and liability pose significant challenges for urban AI deployments. Urban AI initiatives must comply with various regulations, such as the General Data Protection Regulation (GDPR) in Europe or the California Consumer Privacy Act (CCPA) in the United States, which mandate stringent data protection measures and transparency requirements. Moreover, emerging regulatory frameworks specific to AI technologies, such as AI ethics guidelines and algorithmic accountability standards, further add to the regulatory complexities that urban AI projects must navigate. Collaborative efforts between policymakers, industry stakeholders, and legal experts are essential to develop clear guidelines and frameworks that balance innovation with regulatory compliance in the urban AI space.

2.3. **Ethical Dilemmas.** Urban AI decisions have profound implications for human lives, communities, and society as a whole. Ensuring ethical practices and transparency in urban AI deployments is paramount to build trust and mitigate potential harms. Ethical dilemmas may arise from algorithmic biases, discriminatory outcomes, and unintended consequences of AI-driven decisions. For example, AI algorithms used in predictive policing or resource allocation may inadvertently reinforce existing inequalities or perpetuate social injustices. Urban AI initiatives must adopt ethical principles, such as fairness, transparency, accountability, and inclusivity, to guide decision-making processes and mitigate ethical risks. Stakeholder engagement, public consultation, and ethical impact assessments are essential tools to identify and address ethical dilemmas in urban AI projects. By upholding ethical standards and promoting responsible AI practices, urban AI initiatives can foster societal trust and contribute to positive social outcomes in urban development contexts.

3. Human Involvement:

3.1. **Active Participation.** In the realm of urban AI, where projects intersect with the intricacies of the human-built environment, the active involvement of people is paramount at every stage of development and implementation. From conceptualization to deployment and beyond, incorporating the perspectives, insights, and feedback of diverse stakeholders is essential for ensuring the success and sustainability of urban AI initiatives. Active participation from community members, urban residents, local businesses, and other relevant stakeholders enriches the decision-making process, bringing valuable local knowledge and contextual understanding to the table. By engaging with those who will be directly affected by urban AI projects, planners and developers can gain deeper insights into the needs, preferences, and concerns of the communities they serve. Involving people in urban AI projects fosters a sense of ownership and empowerment, cultivating a shared vision for the future of the city. Collaborative decision-making processes that prioritize inclusivity and transparency build trust and foster positive relationships between stakeholders and project implementers. Active participation enables ongoing monitoring and evaluation of urban AI initiatives, allowing for course corrections and adjustments based on real-time feedback and evolving community needs. By maintaining open channels of communication and fostering a culture of continuous engagement, urban AI projects can adapt and evolve in response to changing circumstances and emerging challenges.

The active participation of people is not just a nicety but a necessity in the realm of urban AI. By embracing inclusivity, transparency, and collaboration, urban AI projects can harness the collective intelligence and creativity of diverse communities, ultimately leading to more equitable, resilient, and sustainable urban futures (Sampath Lonka, 2023; A Guide to Urban Artificial Intelligence, 2023; Smart Cities: Navigating Urban Frontiers with AI and IoT, 2023).

In autumn 2022, the collaboration between the Paris-based think tank Urban AI and Cornell Tech's Jacobs Urban Tech Hub marked the inception of "The Future of Urban AI" project. Their shared goal was to delve into the evolving landscape of Urban Artificial Intelligence (AI) and its profound implications for urban life. The project aimed to deepen understanding of how AI technologies can shape the trajectory of cities, particularly as they undergo rapid transformation due to technological advancements and societal shifts.

The project unfolded through a series of engaging webinars, each focusing on a specific aspect of Urban AI. These sessions featured thought leaders and experts from various domains, shedding light on critical topics such as participatory planning, trustworthy cartography, self-repairing cities, software-defined sensing, anticipatory government, reimagining offices, and decolonizing smart cities. Each webinar provided valuable insights into the applications, challenges, and potential of AI in urban contexts, fostering informed discussions and sparking innovative ideas.

Central to the project's ethos was the aim to build a diverse and inclusive community of experts, comprising researchers, public servants, startups, and subject matter specialists. This global network collaborated at the intersection of cities and technology, working on multidisciplinary projects to assess the impacts of AI on urban life and vice versa. Through shared knowledge, expertise, and experiences, the community aimed to shape the future of AI-driven urban innovation, prioritizing resilience, inclusivity, and forward-thinking approaches.

The project prioritized accessibility and inclusivity, holding all webinars on Zoom and making them open to anyone interested in the intersection of AI and urban development. This approach fostered global dialogues, encouraging knowledge exchange and collective insights from participants across diverse backgrounds and geographies. By facilitating broad participation, the project aimed to democratize access to cutting-edge discussions and empower individuals to contribute to shaping the future of urban AI.

Building on the success of its inaugural season, "The Future of Urban AI" project entered its second season, delving even deeper into the realms of urban AI. Drawing on insights from Cornell Tech's Future of Urban Tech Horizon Scan, the project remained at the forefront of AI-

driven urban innovation, exploring emerging trends, opportunities, and challenges. Through ongoing exploration and collaboration, the project remained committed to driving positive change in urban environments, ensuring they evolve in a sustainable, inclusive, and future-ready manner.

"The Future of Urban AI" project exemplifies a collaborative effort to harness the potential of AI in shaping cities for the better. By fostering knowledge exchange, community building, and ongoing exploration, the project seeks to create resilient, inclusive, and forward-thinking urban environments powered by AI technologies. For more information and registration details, interested individuals can visit the Urban Tech Hub's event page, contributing to the collective effort of shaping the future of urban AI (Urban AI x Cornell Tech, 2023; The Future of Urban AI: Towards Participatory Planning, n.d.; Leading the way in artificial intelligence research, n.d).

2.2. Synthetic data

Synthetic data refers to information that is artificially generated rather than produced by real-world events. Today exist a lot of different definitions of synthetic data. For example, world leader in artificial intelligence computing NVIDIA (NVIDIA, n.d.; NVIDIA. What Is Synthetic Data?, n.d) define it as annotated information that computer simulations or algorithms generate as an alternative to real-world data. Put another way, synthetic data is created in digital worlds rather than collected from or measured in the real world.

It may be artificial, but synthetic data reflects real-world data, mathematically or statistically. Research demonstrates it can be as good or even better for training an AI model than data based on actual objects, events or people.

On the other hand, Indian multinational information technology services and consulting company HCLTech (HCL Technologies, 2019) shows that synthetic data is a type of data which is generated based on the characteristic of different variables, understanding of the probability distribution of the expected data, and the relationship between the different variables.

They defined, that there are three types of synthetic data, i.e., fully synthetic, partially synthetic, and hybrid synthetic. Fully synthetic data: The data is fully generated from scratch, based on assumptions around the probability density function of the data, the correlation among the variables, and constraints/rules on the variance of data. Partially synthetic data: If there are some variables which are sensitive for disclosure in a large data set, such variables can be replaced by synthetic data. Imputations are applied to mask the data and make it untraceable. E.g.: Personally identifiable information (PII)

Hybrid synthetic data: A limited volume of original data or data prepared by domain experts are used as inputs for generating hybrid data. The underlying distribution of original data is studied and the nearest neighbor of each data point is created, while ensuring the relationship and integrity between other variables in the dataset. This ensures that the generated synthetic data closely resembles the original data.

In a June 2021 report on synthetic data, Gartner predicted by 2030 most of the data used in AI will be artificially generated by rules, statistical models, simulations or other techniques (HCL Technologies, 2019).

“The fact is you won’t be able to build high-quality, high-value AI models without synthetic data,” the report said (NVIDIA.What Is Synthetic Data?, n.d.).

In IDC was defined, that companies offering synthetic data solutions are mostly doing so within their existing product offering for computer vision AI software and are largely not offering it as a standalone solution.

"Synthetic data will be a tool used for positive benefit in computer vision AI software applications. It will permit not only the creation of models with sparse data sets but also help with the elimination of bias in models to better reflect real-world edge cases," said Peter Haas, research director, Computer Vision AI Software at IDC. "Synthetic data can provide a path to learning from sparse examples in certain domains, such as medicine, where some rare conditions may only have a few examples in the literature; this will be a game-changing technology." (IDC. The Fundamentals of Synthetic Data for Computer Vision Applications, n.d).

Synthetic data plays a crucial role in enhancing urban planning models. Let’s explore how it contributes:

1. **Testing and Simulation.** Synthetic data allows urban planners to create prediction models and simulate various scenarios using artificial intelligence (AI) and data analytics techniques.
   These models can:
   - Forecast the city's future growth and development.
   - Evaluate the potential effects of various planning choices.
   - Efficiently allocate resources.
2. **Privacy Protection.** In cases where real-world data cannot be released due to privacy concerns (e.g., individual mobility data), synthetic data provides an alternative. It enables testing and analysis without compromising confidentiality.
3. **Resource-Efficient Mapping.** Mapping street trees, for example, is labor-intensive. Researchers have used Google Street View images and machine learning techniques to quantify green canopy in cities at the pixel level. This open-source algorithm allows cities worldwide to plan and increase greenery efficiently.
4. **Addressing Data Gaps.** Urban planning often grapples with incomplete or insufficient data, particularly in rapidly evolving urban environments where traditional data collection methods may struggle to keep pace. Synthetic data fills these data gaps by generating realistic and representative data that complement existing datasets. Whether it's demographic information, transportation patterns, land use dynamics, or environmental factors, synthetic data provides planners with the necessary insights to gain a comprehensive understanding of the urban landscape. By augmenting real-world data with synthetic data, planners can overcome limitations in data availability and ensure that their analyses are robust and comprehensive.
5. **Fine-Grained Exposure Assessment.** When measuring residents' exposure to pollutants, synthetic data can provide finer spatial and temporal resolution. By considering not only home addresses but also commute and work/school locations, it enhances exposure assessment.
6. **Inclusive Decision-Making.** Synthetic data enables urban planners to explore scenarios and make informed decisions. It bridges the gap between theoretical models and real-world applications, ensuring more inclusive and effective planning. Synthetic data empowers urban planners to test hypotheses, protect privacy, and optimize resource allocation, ultimately improving the quality of urban planning models (Duarte, F., & deSouza, P., 2020; Grover, N., 2023; Weiler, C., 2020).
7. **3D Urban Models.** Urban designers can generate synthetic 3D urban models from open city data. Environmental Analysis: These models are used for environmental analysis, such as assessing sunlight exposure, wind patterns, and energy efficiency. Integration with Urban Design Tools: By integrating synthetic data into existing urban design tools (e.g., QGIS), planners can make informed decisions (Chen, K., & Norford, L., 2016).

Synthetic data offers a powerful tool for enhancing urban planning workflows, addressing data gaps, and ensuring effective decision-making in a rapidly changing urban landscape.

The future of synthetic data in urban development is brimming with potential, offering innovative solutions to complex challenges and driving positive change in cities worldwide. City Digital Twins (CDTs), representing digital replicas of urban environments, stand to benefit significantly from synthetic data, addressing issues surrounding privacy, data availability, and predictive simulations. As cities grow more intricate, CDTs powered by synthetic data promise more accurate predictions and informed decision-making, empowering planners to tackle urban challenges effectively and allocate resources optimally. Agile data workflows are essential for urban planning, and synthetic data seamlessly integrates into these processes, enabling real-time testing, scenario simulation, and resource optimization. Moreover, synthetic data provides privacy-preserving solutions, essential in an era of tightening data regulations, ensuring that urban development initiatives respect individual privacy rights. By leveraging synthetic data for predictive simulations and policy interventions, cities can craft effective strategies tailored to community needs while fostering trust and transparency. Embracing

synthetic data is not just about innovation; it's about driving positive changes, building smarter, citizen-centric cities that thrive in a data-driven future.

3. Discussion

The transformative potential of AI in urban development decision-making is undeniable, yet its implementation poses both opportunities and challenges that warrant further discussion. One key aspect of the discussion revolves around the ethical implications of AI adoption in urban governance and planning. While AI holds the promise of enhancing efficiency, transparency, and inclusivity in decision-making processes, it also raises concerns about algorithmic biases, discrimination, and privacy infringement. Addressing these ethical dilemmas requires a multidisciplinary approach, involving policymakers, technologists, ethicists, and community representatives in designing AI systems that prioritize fairness, accountability, and transparency. By embedding ethical principles into the design, deployment, and monitoring of AI applications, cities can mitigate potential risks and ensure that AI-driven urban development initiatives uphold societal values and respect individual rights.

The game-changing role of AI in urban development lies in its capacity to revolutionize community engagement and participatory approaches. As cities embrace AI technologies to optimize resource allocation, enhance service delivery, and improve infrastructure management, it is essential to involve residents and stakeholders in decision-making processes. Engaging communities in co-designing AI solutions, soliciting feedback on urban plans, and fostering dialogue around AI-driven initiatives fosters trust, ownership, and social acceptance. By prioritizing community engagement, cities can leverage the collective intelligence and creativity of diverse stakeholders, ensuring that AI-driven urban development reflects the needs, preferences, and aspirations of the people it serves.

The discussion should explore the capacity-building efforts needed to ensure that urban stakeholders, including policymakers, planners, and residents, possess the requisite skills and knowledge to harness the full potential of AI. Investing in education, training, and capacity-building programs can empower individuals and organizations to leverage AI tools effectively, interpret data insights responsibly, and make informed decisions that advance sustainable urban development goals. By democratizing access to AI literacy and skills development opportunities, cities can foster a culture of innovation, collaboration, and continuous learning, driving positive change in urban governance and planning practices.

Interdisciplinary collaboration and knowledge sharing play a crucial role in advancing AI-driven urban development agendas. As AI technologies continue to evolve rapidly, collaboration between academia, industry, government, and civil society becomes paramount in driving innovation, scaling solutions, and addressing complex urban challenges. By fostering cross-sector partnerships, sharing best practices, and facilitating knowledge exchange forums, cities can harness collective expertise and resources to accelerate the adoption of AI in urban governance and planning. Embracing a collaborative approach enables cities to tap into diverse perspectives, leverage complementary strengths, and co-create solutions that are contextually relevant and impactful. As cities continue to evolve, embracing AI as a tool for positive change requires a collective commitment to ethical principles, social equity, and responsible innovation, ensuring that AI-driven urban development initiatives benefit society as a whole.

Conclusion

The paper delves into the game-changing role of Artificial Intelligence in urban development decision-making, highlighting emerging trends, challenges, and future perspectives. Through the integration of AI applications, cities can harness data-driven insights to revolutionize decision-making processes, fostering sustainable growth and resilience amidst the complexities of urbanization. From optimizing resource allocation to enhancing environmental sustainability, AI empowers decision-makers to navigate complex challenges and seize opportunities for inclusive and equitable urban development.

The exploration of trends such as Urban AI and synthetic data underscores the transformative potential of AI in reshaping urban governance and planning. Urban AI, characterized by its ability to process vast urban datasets and develop tailored solutions for urban environments, promises to revolutionize how cities are planned, managed, and experienced. Synthetic data

offers a powerful tool for addressing data gaps, enabling predictive simulations, and ensuring privacy-preserving solutions in urban planning workflows. The adoption of AI in urban development is not without its challenges. Technical complexities, regulatory frameworks, and ethical considerations must be navigated to realize the full potential of AI in driving positive change in cities. By addressing these challenges and embracing innovative solutions, cities can harness the power of AI to foster sustainable, resilient, and inclusive urban futures.

Looking ahead, the future of AI in urban development is brimming with potential, offering opportunities for innovation, collaboration, and community engagement. As cities continue to evolve and face new challenges, the integration of AI presents a pathway towards smarter, more responsive, and citizen-centric urban environments. By leveraging AI technologies and fostering partnerships between stakeholders, cities can chart a course towards a more sustainable, equitable, and resilient urban future.

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Citywalk preference: An expanded measurement for informing data-driven urban planning based on social media analytics

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Abstract
Citywalk, a popular trend on social media platforms, is transforming people's preference for walking in cities. Despite its growing influence on street and place-making efforts, the relationship between Citywalk preference and built environment remains undisclosed, let alone their concerted efforts for informing more complex urban planning. In this research, a comprehensive evaluation system is proposed based on space analysis of built environment indicators and data of Citywalk from Xiaohongshu, to reconstruct a new urban perception model and recommend route selections for urban renewal practices. We take Shanghai's historical area as the representative example and find the results well correspond to real pedestrian preferences in LBS data, which suggests this measurement is a potential valuable guidance for urban planning in the future.

Key Words
Citywalk, social media data, spatial analysis, route selection

1 Introduction

Citywalk means "roaming around the city" on foot, referring to a popular way of exploring old buildings, browsing boutique shops, sipping a cup of coffee, or indulging in authentic local snacks. (Borucka J., 2019, p.158-163). In China, the emergence of social media platforms in the digital age has led to the evolution of Citywalk into a popular leisure activity among a diverse range of groups, particularly young people. It encourages individuals to engage in outdoor activities, benefiting health and attracting tourist economy to urban areas (Kordi. A.O. et al., 2023, p.34). Besides, Citywalk represents an opportunity for tour guides and travel service providers to offer a more tailored, professional service to meet with ever-changing market demands. As a popular trend in social media, Citywalk is transforming people's behaviour of exploring cities, with popular walking tours furthermore influencing city image and place-making efforts.

Despite many other social media factors preference found in existing researches to influence people's urban perception and behaviour in addition to Citywalk, the relationship between Citywalk indicators and built environment characters remains undisclosed.

In this vein, this study focuses on 'route' as the fundamental premise, proposing a walking tour evaluation system to assess the correlation between Citywalk preference and existing built environment, reconstructing a synthetical urban perception model, and employing new methodologies to measure these public involvement data for informing more effective urban planning practices. The framework of our study is implemented through a practical case study, in response to the emerging Citywalk trend on Xiaohongshu, a popular social

media platform, with the aim to provide an expanded measurement for informing data-driven urban planning based on social media analytics.

2 Literature Review

Media data has become a crucial indicator of human activities correlating with the built environment vitality despite traditional methods and basic indicators for urban space evaluation. Data accessible on media platforms were frequently employed to discern urban spatial structures imbued with vitality (Chen et al., 2019, p. 102005), and to reveal a series of potential attractions (Jankowski et al., 2010, p. 833–852). For instance, Zhang et al. (2022) measured virtual visiting preference based on data from TikTok filming locations. Salazar-Miranda et al. (2022) focused on street activity measurement around slow-traffic zones using Twitter comments as indicators. Similarly, existing basic environment indicators are also available to evaluate both physical and social features of streets, such as accessibility, quality, walkability and vitality, influencing subjective feelings (Ma, 2024, p. 104797). Li et al. (2022) and Jiang (2022) have provided insights into the association between street vitality and the built environment, utilising urban data such as Location-Based Services (LBS), road networks, building and street data, street view images and Points of Interest (POI). However they overlook the assessment of a street's latest internet-famous properties. Fortunately, advanced technology has opened up the possibility of quantitative research on social-economic analysis, such as interaction between media data and environmental elements. Improved computation methods could hold practical significance on urban regeneration efforts, including street renewal, urban planning and vitality prediction. For example, an application proposed by Li et al. (2022) and Huang et al. (2021) measured the city image perception through social media analytics and proposed instructions for planning practice. Garay Tamajón and Cànoves Valiente (2017) also utilised various data on social media platforms to explore the formation mechanism of people’s city image.

Furthermore, emerging social media trends are shaping pedestrians’ travel preferences, offering an expanded metric for evaluating urban regeneration practices. Specifically, Ye et al. (2023) observed the alterations in Twitter usage leading to the mobility fluctuations during pandemic era in New York City. Liu et al. (2023) discovered that young women's choice of shopping destinations is more influenced by word-of-mouth marketing on social media platforms. In China, Citywalk has been a pop trend that influences many people’s route preference (Liang, 2023, p.72). To finds motivations for planning and design efforts in specific sites, which helps to address the urban renewal position, Ma et al. (2021) utilised the correlation analysis between visual elements and human perception to support city regeneration decisions. In addition, online opinions from residents about city streets also serve as crucial references for street planning improvements (Wang et al., 2022, p.215–230), such as internet investigations of underground pedestrian networks as valuable guidance for city’s infrastructure construction (Chan et al., 2022, p. 104678).

In this context, based on the established muti-sourced data-driven planning system, we chose Citywalk preference as the fundamental premise, applying a systematic framework of methodologies to comprehensively uncover Citywalk’s internet-famous nature as well

as its role within the urban environment, instead of relying on limited manual intuition or isolated data units.

3 Citywalk and Current Situation

Citywalk originated from international media like Twitter, but are currently trending across multiple Chinese social media platforms such as Xiaohongshu and Weibo. This research selected Xiaohongshu, a popular Chinese social media platform, as the channel to obtain relevant data of Citywalk issue in Shanghai. The feasibility demonstrated by previous researches and empirical evidence. Gu et al. (2023) and Zhou et al. (2021) verified that the data crawled from Xiaohongshu notes is correlated with citizens' recreational activities in urban spaces, which affirms its significance in exploring the connection between virtual media space and real physical space. In addition, the data from Xiaohongshu features characteristics of large quantity, time sensitivity, public participation, wide transmissibility, accurate location, etc. Prevailing in its individual convenience for publishing, sharing and recommendation, Xiaohongshu gathers high-quality Citywalk notes, providing representative and operable data for this study.

To improve comprehension of the social media influence on mechanism of route selection, we diagrammed the operation of Citywalk notes on Xiaohongshu platform (refer to **Fig. 1**). Firstly, users browse Citywalk contents using keywords, freely filtering by the hottest, latest, most relevant, most recent, or the notes published by specific users. Secondly, by clicking into any note, users can access routes including their names, mapping locations, itineraries, surrounding internet-famous sites and recommendation reasons, with which travellers can select destinations and travel routes efficiently. Besides, the number of likes, favourites, and comments of the note can additionally help the viewers with insights into the popularity of their travel decisions. Concluded from recommendations on Xiaohongshu, Citywalk primarily takes place on the main streets within the Inner Ring of Shanghai, spanning a comprehensive range of topics including popular commercial activities, public spaces hosting temporary events, and historic districts with pleasant street views.

Fig. 1 The Interface of notes on Xiaohongshu

4 Methodology

4.1 Road as the primary measurement object

This study selects road as the primary measurement object for gathering statistical data on Xiaohongshu and other built environment indicators. When constructing models, we also incorporate roads to analyse correlations and make predictions based on the collected data. The specific methods are as follows.

1) In contrast to activities in huge plots and buildings inside, Citywalk mainly takes place on city streets. However, this does not result in negating the significance of buildings adjacent to or bordering plots, as they will significantly impact the perception of street walking.

2) Besides, considering point data such as Points of Interest (POI), we associate their information with the nearest roads. This is because POIs can significantly influence people's behaviour on the street, particularly when citizens are inclined to follow instructions from social media platforms.

3) The acquisition of street view images provides great help in analysing the built environment of the road itself, including various indicators such as greenery, sky view, pedestrian space, motorisation and diversity.

4) Each road is assigned a unique name, corresponding to the same name used on the social media platform. This allows us to align media data with each road accurately for mapping.

This approach ensures that roads are associated with integrated numerical and spatial data while preserving their spatial connectivity for further applications such as network analysis and route selection.

4.2 Comprehensive evaluation system

To make this comprehensive system more clear, the study divides the paradigm into two main functional modules and four interconnected steps. These parts integrate various data analysis methods based on numerical and spatial aspects, such as Network Analysis and Proximity Analysis within Geographic Information System (GIS), as well as Spearman Correlation and Stepwise regression. Once this synthetic evaluation model is established, it enables quantification of interactions among multiple data sources and facilitates tenable predictions for street utilisation in the future, which is helpful for vitality analysis and urban renewal route selection (see **Fig. 2**).

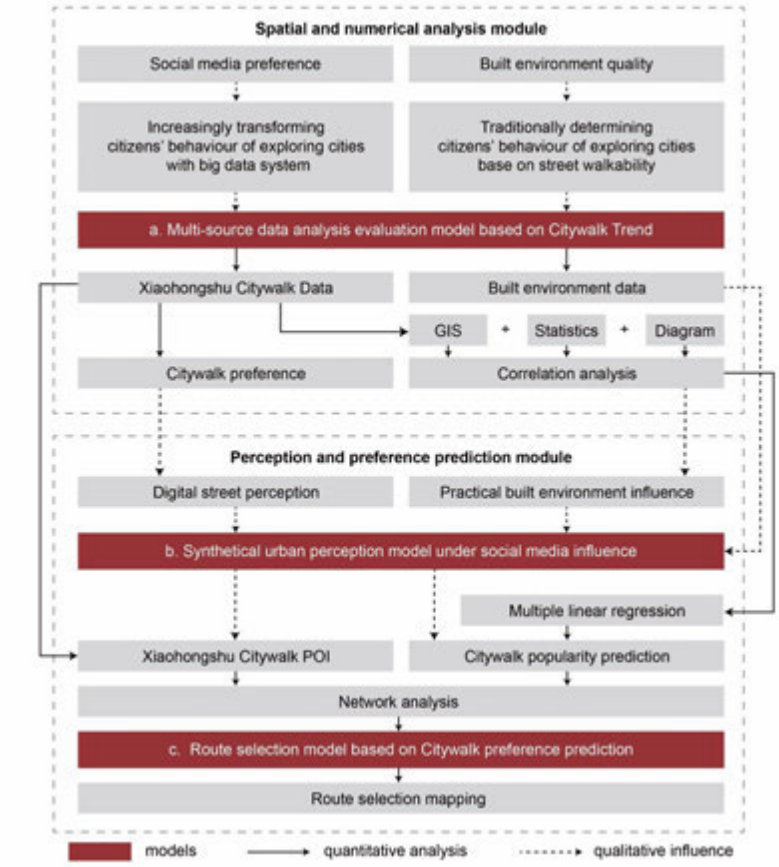


Fig. 2 Research framework and comprehensive evaluation system

4.3 Study area

To effectively establish the data analysis model, this study selects top-typical roads from the crawled data on Xiaohongshu platform as research objects (specific details are in analytical framework *step 1*). We mapped these roads onto the road network, revealing that social media platforms tend to recommend areas with numerous attractions for pedestrians. For instance, roads proximate to tourist attractions and historical districts are more apt to be suggested compared to those situated within residential communities. Therefore, the inner ring of Shanghai (refer to **Fig. 3**) is more suitable for conducting correlation analysis and predicting Citywalk patterns, following the selected Hengfu historical area in introduction.

Fig. 3 Most popular Citywalk roads are circled in the Shanghai Inner Ring.

4.4 Analytical framework

Step 1 Data acquisition and preparation

To thoroughly validate the quantifiable relationship between Citywalk preference and built environment, this study adapts three categories of data based on key indicators from existing research. Firstly, popularity data related to Citywalk destinations on social media platforms is employed to inform Citywalk preferences. Secondly, built environment data including transportation stops, street accessibility, Points of Interest (POIs), adjacent Floor-Area Ratio (FAR), and building density is integrated for route preference correlation analysis in different Citywalk themes among 'shopping districts', 'tourist attractions' and 'historical streets'. Lastly, street view image data containing information on greenery, sky view, pedestrian space, motorisation diversity and other factors is also included as street quality measurements, which can influence Citywalk preference.

The quantifiable indicators and quantification methods are presented in **Table. 1** below. Given that roads are the final measurement units, we adopt the proximity principle to attach the data to each road segment. This involves directly adding average numerical data to road attributes and converting spatial data into area density for calculation.

Data Categories	Indicators	Quantification method

Citywalk preference	Citywalk point vitality Citywalk road vitality	Points | average value Numerical attributes | average value
Built environment	Living facilities Tourist attractions Shopping places Restaurants Metro Stations Bus stops	Points | density (numbers/m²)
	FAR Building density	Polygons | average value
Street view image	motorisation ratio sidewalk ratio Building ratio Greenery Sky view Urban furniture Colour diversity Façade permeability	Numerical attributes | average value(0~100%)
Accessibility	500m_accessibility 300m_accessibility Full_accessibility	Numerical attributes | value
Vitality	Location Based Services (LBS)	Grids | qualitative mapping

Table. 1 Citywalk preference data and built environment data.

For data acquisition, we utilise all publicly accessible open data online, which is also readily available in other regions worldwide if using the similar technique framework of this study. The following are the resources we utilised in Shanghai for example, along with the detailed data processing methods.

1) To quantify Citywalk preference, the data obtained from the Xiaohongshu platform (a widely used social media app, particularly among individual users in China) is classified into three categories: texts, number of likes, and release time (refer to **Table. 2**).

Texts(i)	Number of likes	Release time
从[**武康路**]步行到[**徐家汇**]，今天成功打卡[**武康大楼**]……	6667	2023.11.1
…	…	…

Table. 2 Each text includes many places of interest with preference data.

Considering Citywalk is a time-sensitive activity and may change over time, this study only takes data from November 2023 to December 2023 as an example， And we convert it into a quantifiable indicator, as shown in the following formula:

$$Activity_{j-place} = \sum_{i=1}^{i} \frac{likes_{i,j}}{time_{i,j}} \quad (1)$$

Here, $Activity_j$ represents the vitality of each place with its unique name code such as [武康路]. $likes_{i,j}$ and $time_{i,j}$ represent the *likes* number and *duration time* of each i text containing each j place in this stratified framework.

Since the locations mentioned in the texts include both roads and points of interest, we compute the average value of the vitality-related data surrounding the measurement roads, using GIS buffer with the following formula:

$$Redu_{z-road} = \sum_{j=1}^{n} \frac{Activity_{j-place,z}}{n} \quad (2)$$

As roads are linear features, this study utilizes a spatial buffer consisting of circles at both ends of each road segment and a band area along its length to gather road-related data. Here, $Activity_{j-place,z}$ represents the places within this buffer, and n represents the total number of places nearby (refer to **Fig. 4**). Therefore, each road is able to obtain an average activity $Redu_{z-road}$ from places around. Considering pedestrian's walking habit, we apply the distance of 500 metres (5-7min walking) from *15-Min Pedestrian Neighbourhood* theory in China's urban planning.

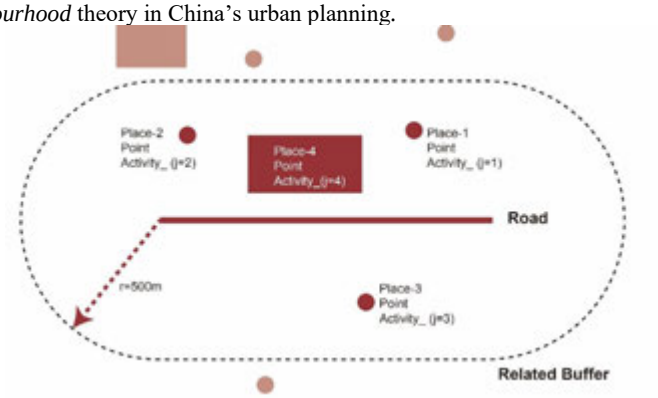
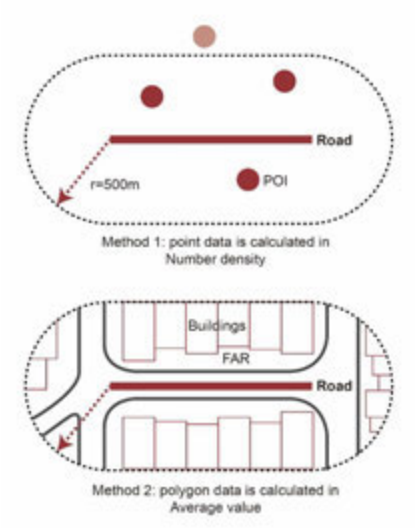


Fig. 4 Buffer is employed to collect Citywalk preference data for each road.

2) To pithily measure the various built environment indicators, we mainly acquire POI data and basic urban 3D spatial information from Amap (a popular mapping APP in China), utilising GIS for subsequent processing. Similarly, the data of each indicator is linked within different buffers of each road, whose radius vary according to the service distance stipulation in planning policy documents and pedestrian perception of the built environment. The two different computing methods and distance radius are shown below (**Fig. 5, Table .3**).



Indicators	Radius(metres)
Living facilities	200
Tourist attractions	600
Shopping places	300
Restaurants	300
Metro Stations	500
Bus stops	300
FAR	50
Building density	50

Fig. 5 Two different computing method;
Table. 3 Different buffer radius according to planning stipulation and urban perception

These two methods mainly focus on numerical computation while the spatial influential factors are embodied in distance radius specified in **Table. 3**. The detailed calculation formulas are as follows:

$$Density_{i-point,\ z} = \frac{N_{i,z}}{Area_z};\ AveValue_{i-area,\ z} = \frac{\sum_i (Value_i \times Area_i)}{Area_z} \quad (3), (4)$$

Here, $Area_z$ represents the buffer area of road z. In method 1, $N_{i,z}$ is the total number of each kind of point data within this buffer. In method 2, $Value_i$ represents either the FAR of including plots or the total floor area of intersecting buildings, while $Area_i$ only represents to the part of buildings and plots in the buffer area. Despite that the average value may be lower than the practical data due to the indicator area being smaller than that of the buffer, it still provides a quantifiable measurement of the FAR and building density along the road.

3) To incorporate factors directly from the street itself, this study supplements street view image to provide indicators of human-scale perception. These measurements primarily concentrate on the visual proportion of different categories of graphic elements. The specific diagram and indicators are shown in **Fig. 6** and **Table. 4**. Given the linear features of street, average computing method is similarly employed for each road.

Fig. 6 Semantic segmentation

Indicators	Practical meaning
motorisation ratio	Proportion of motor vehicle lanes, reflecting motorisation
sidewalk ratio	Proportion of sidewalks, reflecting walking environment
Building ratio	Proportion of building objects, reflecting building density
Greenery	Street greening degree, reflecting environment quality
Sky view	Sky visibility, reflecting street openness or width
Urban furniture	Urban Infrastructure construction degree
Colour diversity	Colour richness, which reflects visual richness
Façade permeability	Proportion of transparent doors and windows on façade

Table. 4 Each text includes many places of interest with preference data.

Using this quantifiable measurement with Citywalk preference and built environment data, we can establish the statistical table with each selected road as the fundamental data preparation for next computation.

Step 2 Correlation analysis

In the first analysis module, we primarily address the qualitative correlation between the Citywalk preference and miscellaneous built environment indicators. Since there is no direct computation on practical meaning of the data, normalisation is employed to simplify small or large values into range [0,1] for improved calculation. The normalisation is indicated in the following fumula:

$$Value_{indicator-normalised} = \frac{Value_i - \min(Value_i)}{\max(Value_i) - \min(Value_i)} \quad (5)$$

Meanwhile, to enhance precision, we excluded abnormal high $Redu_{z-road}$ values which may be more influenced by recommendation algorithm of Xiaohongshu platform, together with those low values that include only one or two Citywalk places.

Step 3 Synthetical urban perception model

To convincingly establish prediction and route selection models from human-scale perspective, we employ a new synthetical urban perception model to address digital influence like Citywalk preference or internet-famous phenomenon on social platforms. Extended from the research framework on spatial perception based on psychological processes, this urban perception model integrates digital street perception from media platforms and practical built environment feelings (refer to **Fig. 7**), reflecting on the various indicators selected above. In addition, the potential causation from objective feelings to subjective behaviour generates a more complex issue, for which we utilise another relatively quantifiable regression method in step 4 to explain.

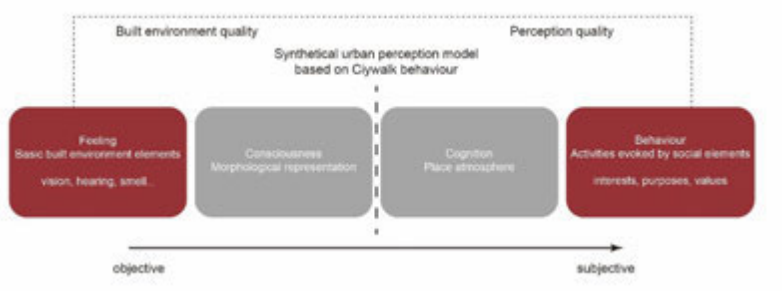


Fig. 7 Synthetical urban perception model based on Citywalk

Step 4 Regression and prediction model

To quantitatively address the relationship between built environment and Citywalk preference, this study apply multiple regression analysis, constructing an objective expression to estimate the popularity of future Citywalk routes upon the built environment data (refer to **Fig. 8**). Through this regression, other roads without current Citywalk preference may realise their potential to become lively in the next social media trend.

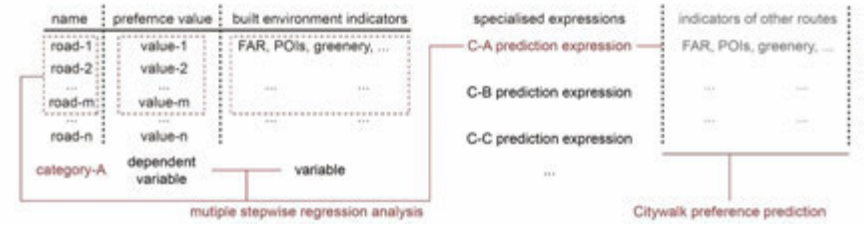


Fig. 8 Regression analysis and preference prediction of different route categories

To improve the precision of regression, we classified the selected road into three main groups through text analysis in module 1 and subsequently implemented three pertinent prediction from 'shopping districts' to 'tourist attractions' to 'historical streets', which allows for more nuanced insights into the relationship between the built environment and different Citywalk preference.

Step 5 Route selection

Route selection model is established based on regression analysis, integrating popular Citywalk destinations identified during data preparation as penetration points. Additionally, subjective manual adjustments are supplemented to connect road segments into cohesive routes in the final part.

Considering the diverse characteristics of Shanghai's political districts, we chose four central areas, with built environments similar to those of the popular Citywalk sample roads selected in data preparation, ensuring that the selected roads are not excessively repeated (refer to **Fig. 9**). Subsequently, network analysis in GIS is applied with popular Citywalk places as penetration points and three categories of Citywalk preference predictions to ascertain road throughput (shown in **Fig. 10**).

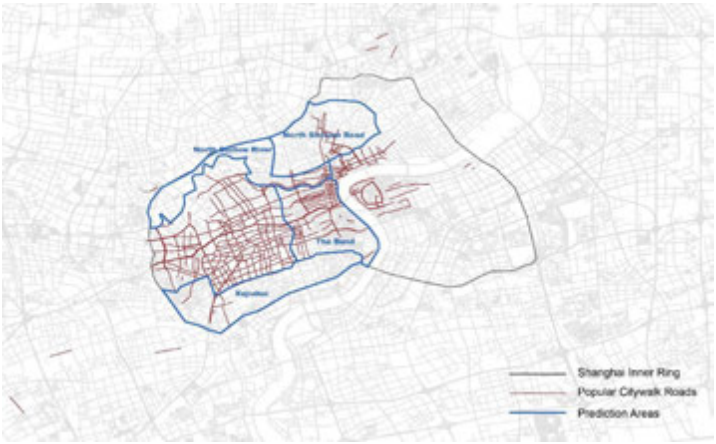


Fig. 9 Four prediction areas in contrast to popular Citywalk sample roads.

Fig. 10 Route selection framework using GIS and manual adjustment.

5 Results

In this present study, after cleaning the relevant data from Xiaohongshu platform, a total of 822 outstanding Citywalk road segments were included in the research. Following text analysis of all preferred Citywalk places, we categorized them into three groups with different themes - 'shopping districts', 'tourist attractions' and 'historical streets'. Category

'shopping districts' comprised 362 roads, featuring texts related to special shops, exquisite stores and restaurants. Category 'tourist attractions' included 350 roads, containing more texts of tourist destinations and scenic spots. Category 'historical streets' consist of 361 roads, representing streets with texts focusing on historical buildings and sites. All categories of road segments are attached with the computed built environment data, including both direct and normalised values (details refer to **Appendix Table. 1**).

5.1 Indicators Correlation analysis

Centred on the calculated Citywalk preference value as the dependent variable, we separately listed the Spearman's rank correlation for three categories of road datasets (refer to **Table. 5**). Despite the key computational indexes R^2 remaining around 0.3~0.4, which are tenable to reveal socially interactive relationships, the outcomes potentially indicate the comparative advantage of certain indicators such as Tourist attractions, Shopping places, Restaurants and Metro Stations.

Indicators (normalised)	C-shopping districts Preference R^2	C- tourist attractions Preference R^2	C- historical streets Preference R^2
Living facilities	0.142(0.007***)	0.165(0.002***)	0.153(0.004***)
Tourist attractions	0.351(0.000***)	0.313(0.000***)	0.404(0.000***)
Shopping places	0.262(0.000***)	0.259(0.000***)	0.284(0.000***)
Restaurants	0.235(0.000***)	0.209(0.000***)	0.275(0.000***)
Metro Stations	0.302(0.000***)	0.292(0.000***)	0.283(0.000***)
Bus stops	0.118(0.024**)	0.113(0.035**)	0.191(0.000***)
FAR	-0.084(0.112)	-0.079(0.141)	-0.053(0.316)
Building density	0.045(0.389)	0.088(0.101)	0.041(0.433)
motorisation ratio	-0.098(0.062*)	-0.03(0.577)	-0.042(0.425)
sidewalk ratio	0.22(0.000***)	0.292(0.000***)	0.256(0.000***)
Building ratio	-0.07(0.183)	-0.108(0.044**)	-0.126(0.017**)
Greenery	0.148(0.005***)	0.172(0.001***)	0.169(0.001***)
Sky view	-0.265(0.000***)	-0.255(0.000***)	-0.285(0.000***)
Urban furniture	-0.086(0.103)	-0.158(0.003***)	-0.147(0.005***)
Colour diversity	-0.063(0.233)	-0.074(0.171)	-0.085(0.109)
Façade permeability	0.256(0.000***)	0.318(0.000***)	0.32(0.000***)
500m_accessibility	-0.032(0.539)	-0.05(0.355)	-0.038(0.478)
300m_accessibility	-0.037(0.482)	-0.048(0.369)	-0.051(0.334)
Full_accessibility	-0.018(0.732)	-0.017(0.748)	-0.01(0.857)

Table. 5 Spearman analysis of Citywalk preference and built environment indicators.

Conclusively based on the results, Citywalk preference is partly correlated with street elements. Individuals are more likely to walk on streets with greater amenities, wider sidewalks, and more permeable façades. This further validates our findings regarding the complexity of citizens' urban perception and Citywalk preference, which are synthetically influenced by physical feelings of built environment indicators in addition to recommendations from social media platforms such as Xiaohongshu.

5.2 Regression analysis

To make predictions of Citywalk preference under different themes for the unselected roads, we employed three distinctive stepwise regression expressions, extracting the original data computed in module 1, which is imbued with practical meanings. The final prediction results should be absolute values, thus it is also essential for other indicators to be realistic values throughout the calculation process. After eliminating the irrelevant indicators through stepwise multiple regression analysis, we obtained three expressions with indexes R^2 around 0.4~0.5 (refer to **Table. 6,** the number is computed without normalisation). In the context of social-economic analysis, it attains a convincing level, particularly for predictions of potential Citywalk roads derived from computed outcomes rather than relying solely on planners' empirical intuition.

-	C-shopping districts		C- tourist attractions		C- historical streets	
Indicators (without normalisation)	Unstandardized Coefficients	R^2	Unstandardized Coefficients	R^2	Unstandardized Coefficients	R^2
Living facilities	-(abolished)		-		-	
Tourist attractions	37276519.308		35079820.375		35233670.141	
Shopping places	292515.051		421365.147		284811.133	
Restaurants	-3314557.03		-5176136.127		-2749375.194	
Metro Stations	62395195.844		46120586.525		63003256.789	
Bus stops	-13282497.56		-		-10715763.545	
FAR	-		-		-	
Building density	-		-		-	
motorisation ratio	-		-		-	
sidewalk ratio	-	**0.387**	6294.353	**0.456**	12687.666	**0.388**
Building ratio	-		-3345.4		-	
Greenery	1444.488		-		1260.088	
Sky view	-		-		-	
Urban furniture	-14363.228		-15051.24		-14187.162	
Colour diversity	-		-		-	
Façade permeability	-		16336.327		-	
500m_accessibility	-		-		-	
300m_accessibility	-		3804.477		3617.647	
Full_accessibility	-		-		-	
Constant term	1253.475		1738.654		722.856	

Table. 6 Stepwise multiple regression analysis results from three categories of roads

5.3 Route selection

According to preference predictions computed by expressions with the given built environment indicators of each roads in the four selected regions, we subsequently employed network analysis in GIS to generate complete potential Citywalk routes.
By utilising high score Citywalk places as penetration points (shown in **Fig. 11** as red points) and Citywalk preference values of roads, we delineated suggested routes in each prediction area following a few manual adjustments (refer to **Fig. 11**), which anticipated

prospective Citywalk behaviour in next social media trends. To further validate the potential vitality of the final selected routes, we compared the data with the layer of Shanghai's daytime average Location-Based Services (LBS) data (depicted by points in **Fig. 12**). The strongly correlated results indicate that the roads outlined in red from the diagrams could indeed provide quantitative recommendations of urban renewal streets for urban planning endeavours in the future.

Fig. 11 Citywalk route selection in four Prediction areas

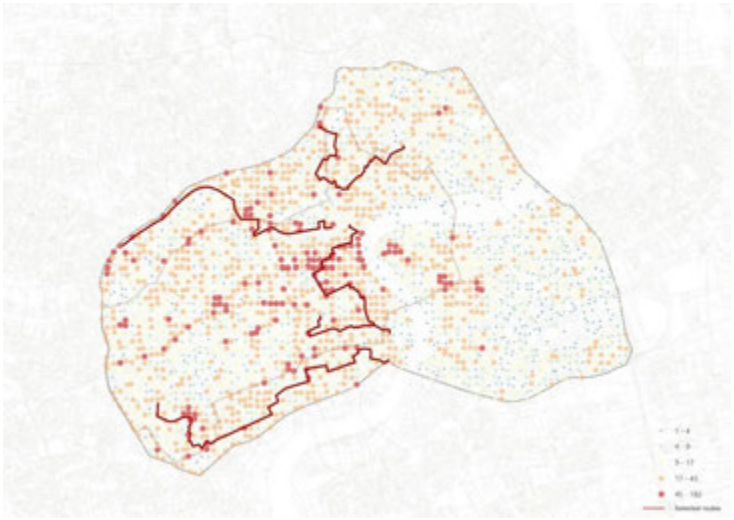


Fig. 12 Citywalk routes compared with LBS vitality data

6 Conclusion and Disscusion

This study focuses on Citywalk, a spontaneous urban exploration behaviour significantly influenced by social media, and constructs a comprehensive framework for route research, encompassing the entire process from exploration to application.

By examining particular behaviour pattern, this research responds to the changing patterns of urban experiences and interaction modes in social media era. Additionally, the quantitative relationship between Citywalk preference and built environment elements is unveiled in our experiment, which is often neglected in previous studies. As a supplement, this study develops a walking targeted comprehensive urban perception model under the influence of social media. To validate our findings in practice, we ultimately employ a prediction model to identify potential Citywalk routes for future urban renewal endeavours.

In terms of theoretical contributions, the study extends the boundaries of existing theories of urban perception and behavioural analysis. The findings deepened understanding of the relationship between urban behaviour and built environment elements, and enriches the understanding of urban walking behaviour. From a practical perspective, this study incorporates multi-source data into the analysis, providing a new data-driven paradigm for public participation in urban planning. Meanwhile, the prediction model offers decision-making reference for urban pedestrian system renewal, providing new possibilities into digitally-driven urban planning practices.

From a technical perspective, taking Shanghai as a significant exploration case allows for the development of an analysis paradigm that can be broadly applicable to other cities globally, by collecting the local data and making route selections tailored to each city's

unique characteristics. However, we claim the limitations of the insufficiency of the quantitative indicators of online social media data, since incorporating more city samples and diversified social media platform resources may raise the coherent influence of superfluous varieties of data on the analysis and modelling, resulting in lower correlation index R^2. Additionally, extended comprehensive analysis of geographic covariance and more precise extraction of human perceptions and evaluations from social media information that we didn't pay enough attention to may enhance the accuracy of the model as well.

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Appendices

Pictures and detailed excel data included in:

https://drive.google.com/drive/folders/1PQLpmnvqjwk11EzIT4xHS7uERfGludHr?usp=drive_link

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Spatial Network Characteristics of Shrinking Areas in Shanghai Metropolitan Area: An Urban-Rural Population Flow Network Analysis

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Abstract

The development of the concept of growth as the mainstream has led to the neglect of the shrinkage phenomenon in China. However, identifying shrinkage areas is significant for regional coordinated development and urban-rural integration. There are few studies on shrinking areas from the perspective of the spatial networks and the characteristics of towns in the urban-rural spatial networks. The study identifies shrinking towns based on traditional demographic data in the Shanghai metropolitan area, then uses massive mobile phone positioning data to build urban-rural and rural-rural population flow networks to analyze the characteristics of shrinking towns and put forward planning strategies. This study explores shrinking towns from a new perspective of spatial networks and provides references for implementing shrinking area management policies.

Keywords: Urban–rural integration; Shrinking area; Mobility network; Shanghai metropolitan area

1. Introduction

In 2019, the National Development and Reform Commission of China issued the "Key Construction Tasks of New Urbanization in 2019", which proposed for the first time "shrinking small and medium-sized cities" and required "slimming down and strengthening", guiding the concentration of population and public resources to urban areas. The task indicated that the country began to attach importance to urban shrinkage. At the same time, many studies have shown that with the implementation of China's regional integration, urban-rural integration and other policies, under the siphoning effect of central cities at all levels, many integrated development areas such as urban agglomerations and metropolitan areas in China have different degrees and types of shrinkage. Currently, most Chinese scholars pay attention to the urban shrinkage caused by long-term dependence on resource-based industries in northeast China and pay less attention to the shrinkage phenomenon in economically developed regions, such as the Yangtze River Delta and the Pearl River Delta. However, some scholars have found that in the Yangtze River Delta, the central urban areas of Shanghai, some counties and small towns of Taizhou, Yancheng, Nantong, Jiaxing, Wuxi and other cities have shown shrinkage phenomenon (Cheng et al.,

2021; Wu, Long and Yang, 2015; Lu, Xu and Zhou, 2023). Therefore, for China, the logic of urbanization dominated by the traditional growth model in long-term planning practice may no longer be applicable. China's urban development has ushered in a post-growth era.

At present, the identification of shrinking areas is mainly based on population statistics. However, no consensus has been reached on the measurement standards due to the differences in the development background and urban statistical calibre of cities in different countries. At the same time, Martinez-Fernandez (2013, p. 303-308) proposed that from the perspective of global urban networks and mobile spatial networks, shrinking cities may also be represented by the gradual weakening or even interruption of the connection with global mobility space. However, there are few relevant studies on this theoretical speculation. Compared with urban networks, there are fewer studies on the characteristics of town networks or urban-rural networks. Therefore, this study hopes to explore the characteristics of shrinking areas in metropolitan areas from the perspective of regional spatial network correlation and the agglomeration ability of town population elements.

Compared with Western countries, population loss is not significant in Chinese cities due to the continuous urbanization process. Meanwhile, urban shrinkage is not only the function of cities themselves but also the result of regional correlation and spatial correlation. Therefore, looking at shrinking cities from the phenomenon and process of element flow can more effectively judge their future trend of change. The "spatial mismatch" of elements and resources is avoided, and the development elements also have the possibility and feasibility of artificial regulation to optimize the allocation of regional resources further and promote regional coordination and urban-rural integrated development.

This study takes all towns in the Shanghai metropolitan area as the research object. The area is a relatively developed area in China with frequent connections to various economic activities and has apparent characteristics of network connections. Firstly, the traditional demographic data is used to calculate the population change of each town and make a preliminary judgment of the shrinking towns. Secondly, by using massive mobile phone data, weighted degree centrality and connection strength, the urban-rural and rural-rural population mobility networks in the Shanghai metropolitan area are constructed, the spatial network characteristics of each shrinking town are extracted, and the spatial connection relationship with different cities and towns is explored. By comparing the spatial location and connection of nodes and the function, the research evaluates the characteristic types of shrinking towns from the perspective of the network, analyzes their main influencing factors, and puts forward optimization strategies. This paper attempts to analyze the characteristics of shrinking areas from a new perspective of population flow networks and provides a new experience for promoting China's coordinated regional development, urban-rural integration and implementing shrinking area management policies.

2. literature review

Although there have been abundant research results on shrinking cities, involving many

disciplines such as economics, geography and urban and rural planning, there is no consensus on the population base, changing years and total scale of shrinking cities due to the differences in the development background and urban statistical standards of different countries. The definition of a shrinking city mainly involves population, economy and time. Even though the definition of the Shrinking City International Research Network(SCIRN) has a high degree of acceptance, there are still many ambiguities, such as the inconsistency of the "city" scope, which makes it impossible to determine a clear statistical range. At the same time, the decrease in population is the concept of a period. If the change in population in a specific period is measured in another period, the conclusion may not be consistent (Wu and Qi, 2021). Although the discussion on shrinking cities in China is on the rise, due to the focus on the "reference" of shrinking cities and its theoretical analysis framework in other countries, the discussion on "Chinazation" is relatively lacking. At present, the concept of shrinking focuses on describing phenomena and ignores the relationship between element and function development (Sun, 2022). Therefore, the current definition of "shrinking city" based on a variety of factors is diversified, and it is difficult to determine a unified judgment standard for shrinking city.

At present, the identification methods of shrinking cities are mainly based on static data analysis and the need for dynamic analysis from the perspective of network connection and essential feature analysis based on the outflow of development factors. The current identification of shrinking cities is mostly from the population perspective, combining statistical and spatial data to build a multidimensional index system. Meanwhile, with the progress of technology, the model simulation method has gradually emerged (Liu, 2016). The measurement and identification units are mainly prefecture-level cities, and the identification studies of counties and towns as the units are gradually increasing.

At the same time, some scholars have proposed that from the perspective of the global urban network and mobile space network, shrinking cities may also be represented by the gradual weakening or even interruption of connections with global mobile space (especially knowledge flow and information flow) (Martinez-Fernandez, 2013, p. 303-308). Inequality is increasing between cities and regions integrated into global networks and those that are not (Allen and Storper, 2003). Shunned by the global network, shrinking cities will enter the black hole of globalization proposed by Castell (1989), so shrinking cities can also be considered in terms of their association with the urban element network, areas with weak or broken connections to the rest of the region can be explored to identify cities with shrinking trends.

Currently, relevant studies on shrinking cities still focus on describing the phenomena. However, with the continuous advancement of economic globalization and regional integration, the traditional "place economy" based on comparative advantages of resource endowment has been gradually replaced by the "mobile economy" centred on capital, technology, market and innovation, and flow space has become the mainstream of The Times (Shen and Gu, 2009). At present, some scholars in economics use total factor productivity combined with econometric methods as the basis for judging contraction or growth (Yang,

Wang and Tao, 2022). Wu and Yao (2021) utilized a unique dataset on intercity investment flows in mainland China to verify that centrality in the investment network is significantly positively correlated with urban population changes. They explored the relationship between shrinking cities and the loss of external investments. Sun (2022) proposed that urban shrinkage is a market behaviour in which the development elements mainly represented by population make "re-location" due to the relative or absolute decline of urban "agglomeration ability of regional development elements" in regional correlation. Population outflow is only a phenomenon, and urban shrinkage can be resolved from the perspective of element flow. With the proposal of the theory of flow space, the research on spatial network has been deepened, and the progress of information technology enables the big data generated by mobile phone signaling and Internet App to identify the flow of various elements. The algorithm is relatively mature and has been widely used in the research reflecting the spatial structure of urban agglomerations and metropolitan areas (Wang et al., 2022). It makes the measurement method of element flow mature gradually and provides the possibility to analyze the contraction area from the perspective of element flow.

3. Methodology and data

3.1 Research area and data source

The Shanghai metropolitan area, located in eastern China, is a vital component of the Yangtze River Delta. In 2022, the governments of Shanghai, Jiangsu Province, and Zhejiang Province issued the "Spatial Coordination Plan for the Shanghai Metropolitan Area," aiming to deepen the implementation of the national strategy for integrated development of the Yangtze River Delta. The planned scope includes the administrative regions of "1+8" cities such as Shanghai, Wuxi, Changzhou, Suzhou, Nantong, Ningbo, Huzhou, Jiaxing, and Zhoushan. The Shanghai metropolitan area exhibits diverse population agglomerations. As the leading area with the most concentrated functions in the Yangtze River Delta urban agglomeration, it experiences a highly concentrated and rapidly developing economy. It features multiple interconnected centres with closely associated networked relationships and demand for close cooperation, driving the coordinated development of various regions. Therefore, urban-rural integration development is also essential to the Shanghai metropolitan area. This study takes the Shanghai metropolitan area as the research area, dividing nine cities into 913 street (town) level administrative divisions. According to the "Statistical Compilation Rules for Administrative Division Codes and Urban-Rural Division Codes" (index no. 410A03-1201-201708-0006) from the National Bureau of Statistics in China, the urban-rural attributes of each street (town) level administrative division are classified based on the first digit of their urban-rural classification code: 1 represents urban, and 2 represents rural. A total of 428 urban streets and 484 rural towns were identified, with all towns within the Shanghai metropolitan area being the subjects of this study, as shown in **Figure 1**.

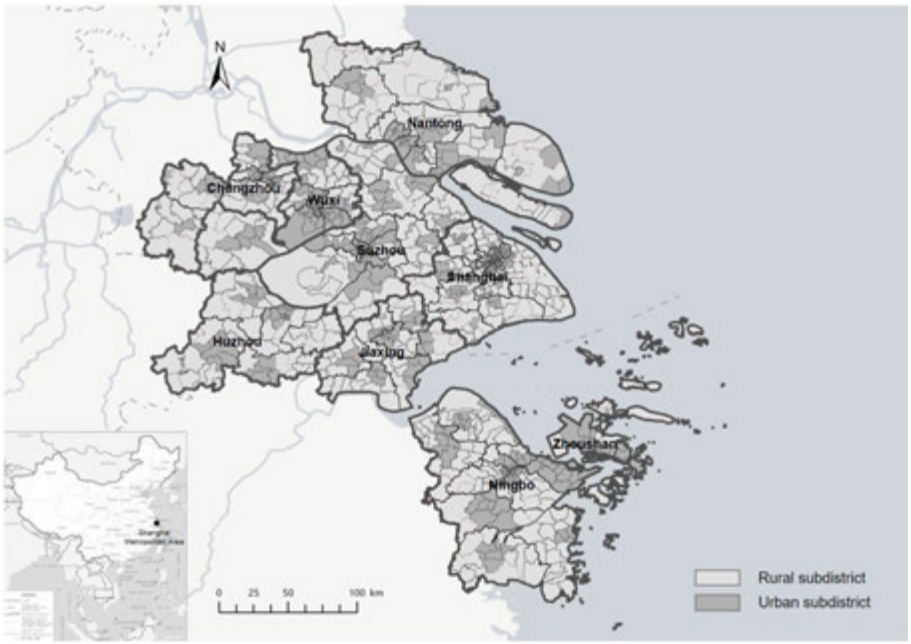


Figure 1. Location and urban-rural classification layouts of Shanghai Metropolitan Area

This study primarily employed statistical data and Baidu LBS (Location-Based Service) data. The population statistics data were sourced from the sixth national census of China in 2010 and the seventh national census in 2020, representing the resident population of each street and town. The LBS data consisted of Origin-Destination (OD) travel data for working days in September 2021. It utilized station grids to locate user travel, determining residential and workplace locations by statistically analyzing users' most extended daytime and nighttime stays. This encompassed home-based work trips, home-based other trips, and non-home-based trips. The population flow statistics for this study included all trip purposes.

3.2 Research approach and methodology

3.2.1 Research approach

In contrast to traditional studies that investigate the characteristics of shrinking areas solely based on statistical data, this study aims to explore the features of shrinking areas within the metropolitan area from the perspective of regional spatial network correlations and the clustering capacity of town population element. Therefore, this paper, departing from the traditional criterion of population quantity changes, first identifies shrinking areas with significant population decrease characteristics by calculating population growth rates. Secondly, based on big data on population mobility, population flow networks within the

Shanghai metropolitan area are constructed, examining the characteristics of shrinking towns in the network from both urban-rural and rural-rural population flow network perspectives. This can respectively characterize the connections between shrinking towns and urban streets or surrounding towns and, to some extent, reflect the clustering capacity of shrinking towns for population development elements in a relatively timely manner. This holds significant implications for the urban-rural integration and coordinated development within the Shanghai metropolitan area.

3.2.2 Identification of shrinking areas

Although the phenomenon of population shrinkage has garnered attention from numerous scholars, there still needs to be a consensus in the academic community regarding methods for identifying population shrinkage. Nonetheless, negative population growth remains a crucial criterion. The continuous development of urbanization in China has led to a sustained decrease in rural population. The Yangtze River Delta region, where the Shanghai metropolitan area is located, is an economically developed area in China with a high capacity for population aggregation. Its urbanization development process differs somewhat from the overall process in China. Therefore, considering the influence of the urbanization process, this study adopts the methodology referenced from relevant research (Wang and Xue, 2016; Cheng, Zhang and Liu, 2021). Firstly, the average annual population growth rate of towns in the Yangtze River Delta region (comprising three provinces and one municipality) from 2010 to 2020 is calculated. Then, the average annual population growth rate of each town within the Shanghai metropolitan area is calculated over the same ten-year period, subtracting the average annual population growth rate of townships in the Yangtze River Delta region from it, with an adjustment of -1.4%. This adjustment accounts for the difference in the urbanization process. The resulting relative population growth rate of towns, after excluding the influence of urbanization in the Yangtze River Delta, is used to define towns with a negative relative population growth rate as population shrinkage areas.

3.2.3 Analysis of population flow networks

Based on Baidu LBS data, this study calculates the total volume of bidirectional purposeful trips between streets and towns as the strength of network connections. Subsequently, an undirected weighted network is constructed. Network centrality is then analyzed, with methods referenced from relevant research (Xie, Zhen and Xi, 2022). To mitigate the impact of significant differences in the area between streets and towns, network centrality is calculated as the sum of the network connection strengths between each street or town and other streets or towns, normalized by the unit area of each street or town. Exploratory spatial data analysis is conducted using GIS platforms, employing natural break methods to visualize the spatial distribution characteristics of network centrality and network connection strengths. The network connection strengths and weighted centrality are calculated and ranked for the 484 towns at both urban-rural and rural-rural levels, with visual representations to explore the characteristics of each town within the urban-rural network.

4. Results and discussion

4.1 Characteristics of shrinking areas based on population changes

Based on the calculation of the relative population growth rates of towns after excluding the influence of urbanization in the Yangtze River Delta, there are a total of 85 shrinking towns with negative population growth in the Shanghai metropolitan area. These shrinking towns are visualized in GIS, as shown in **Figure 2**. Among the nine cities, Shanghai and Nantong have

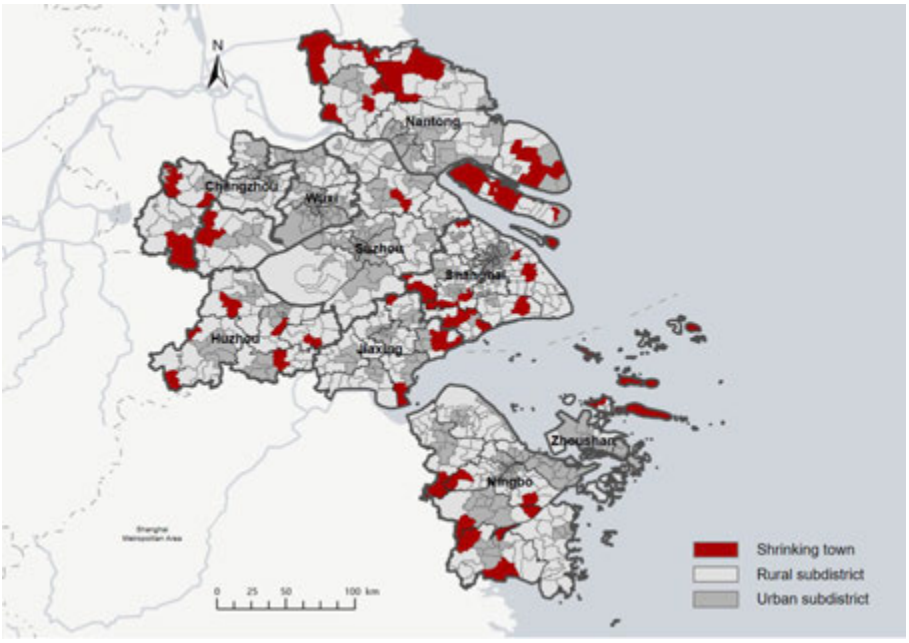


Figure 2. Location and urban-rural classification layouts of Shanghai Metropolitan Area

the highest number of shrinking townships, with 23 and 20, respectively. Suzhou and Wuxi have fewer shrinking towns, with 1 and 2, respectively. Among the other five cities, Zhoushan has 12 shrinking towns, Ningbo has 10, Huzhou has 8, Jiaxing has 5, and Changzhou has 4.

From the overall spatial distribution characteristics, the towns in the Shanghai metropolitan area exhibit localized shrinkage phenomena, which are relatively concentrated or extended. They are primarily concentrated in the peripheral areas of the metropolitan area and at the boundaries between cities. For instance, the shrinking towns in Nantong, Ningbo, and Changzhou are mainly located in the peripheral border areas of the cities, where town development is significantly influenced by geographical location. Meanwhile, the shrinking towns in Jiaxing and Shanghai are mainly situated at the boundaries between the two cities, where the population is notably affected by the central urban area's suction effect. Some shrinking towns in Zhoushan and Shanghai are located on coastal islands and bear more ecological protection tasks, which also have specific impacts on population changes.

4.2 Characteristics of population flow network

4.2.1 Characteristics of urban-rural population flow network

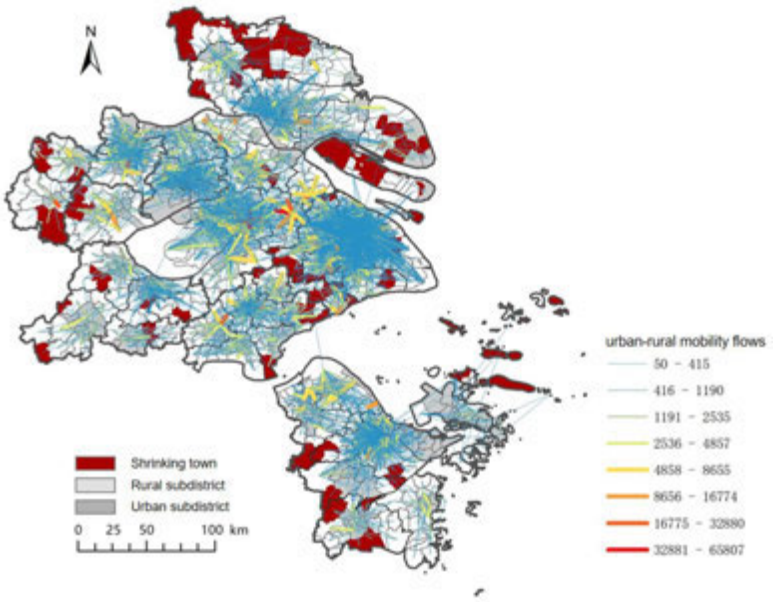
Through analysis of the urban-rural population flow network, using the natural break method in the GIS platform, the connectivity strength and weighted centrality of each town are classified, visually analyzed, and ranked, and relevant information about the shrinking towns mentioned earlier is filtered out.

The spatial characteristics of urban-rural population connectivity strength in the Shanghai metropolitan area are illustrated in **Figure 3(a)**. Overall, Shanghai and Suzhou exhibit relatively frequent urban-rural population connections, with higher connectivity strength within each county (district) and fewer connections across districts or cities. Only some areas have surpassed the constraints of administrative barriers, such as the central urban area of Shanghai with its internal towns and the border towns between Suzhou and Shanghai. However, these connections have limited flow distances, which are associated with the geographical locations of towns and the strong suction effect of Shanghai's central urban area. This indicates significant room for improvement in the urban-rural integration and development of the Shanghai metropolitan area.

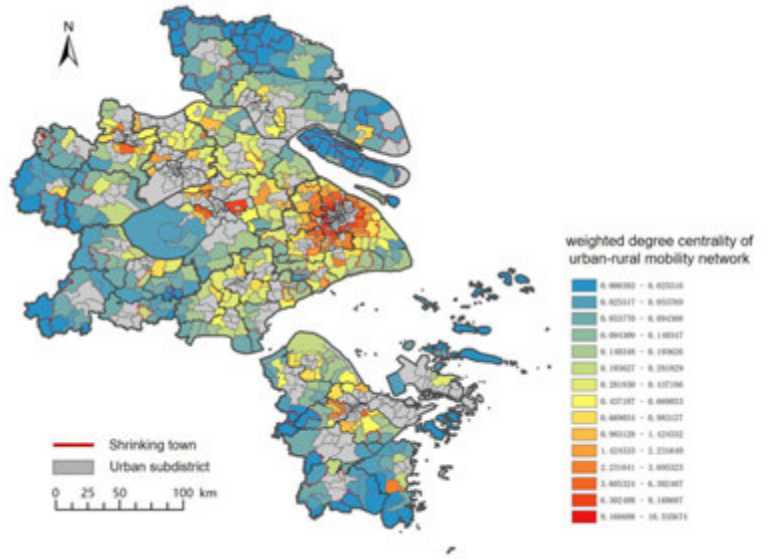
From the perspective of shrinking towns, most of them have low connectivity strength with

urban streets. Only some shrinking towns in Shanghai and Suzhou have strong connections

with urban areas. Examples include Jinqiao Town and Chuansha New Town in Pudong



(a)



(b)

Figure 3. Characteristics of urban - rural population flow network in shrinking towns of Shanghai metropolitan area: (a) intensity of urban - rural population connection, (b) weighted degree centrality of urban-rural mobility network

District of Shanghai and Chedun Town in Songjiang District. These towns have experienced significant population relocation due to the development of large-scale service projects or industrial parks, leading to a substantial decrease in population. However, their economic development remains robust, indicating that they are not in a state of shrinkage. This underscores the limitations of using population decline alone as a criterion for identifying shrinking areas. Additionally, the weak connections between most shrinking towns and cities indicate their marginal status in the process of urban-rural integration and metropolitan area coordinated development.

The centrality distribution characteristics of the urban-rural population flow network are shown in **Figure 3(b)**. Overall, the towns with higher centrality levels within the Shanghai metropolitan area are mainly distributed around the urban areas, closely related to geographical location. For example, there are a large number of medium to high-level towns in Shanghai, distributed in concentric circles around the central urban area. Compared to other cities, Suzhou and Jiaxing, which are adjacent to Shanghai, have more medium to high-level towns, indicating a higher degree of integration between urban and rural areas.

From the perspective of shrinking towns, extracting the centrality rankings of each shrinking town reveals that half of the shrinking towns are ranked at the bottom of all towns in terms of centrality level. Examples include all shrinking towns in the Chongming District of Shanghai, most shrinking towns in Nantong, and the most shrinking towns in Zhoushan, generally located in the peripheral areas of the Shanghai metropolitan area or have implemented related ecological conservation measures.Shrinking towns located between Shanghai and Jiaxing generally have higher centrality levels than other towns, reflecting the driving role of the central urban area of Shanghai on the surrounding towns.

Comparing the centrality levels of shrinking towns within each city, towns like Jinqiao, Chedun, and Chuansha in Shanghai, Guli in Suzhou, Lintuo in Jiaxing, Daochang and Qianyuan in Huzhou, and Putuoshan in Zhoushan, are significantly higher than other shrinking towns in the same city. Investigations into the specific development situations of each town indicate that significant factors influencing development include the development of tourism industry brought by large scenic spots, industrial development brought by industrial parks, and geographical advantages adjacent to central urban areas, all of which contribute to the frequent population flow between urban and rural areas.

Overall, most of the shrinking towns identified based on population changes are positioned relatively low in terms of both connectivity strength and centrality within the urban-rural population flow network compared to all towns. They exhibit a notable "depression" phenomenon in the network, indicating lower frequencies of urban-rural population flow, which is unfavorable for urban-rural integration and regional coordinated development. However, the central urban area of Shanghai gradually exhibits a diffusion trend starting from the aggregation of population elements, influencing nearby cities and towns, thus maintaining a certain level of population flow and aggregation capacity at the urban periphery where shrinking towns are located. At the same time, a small number of shrinking towns still hold

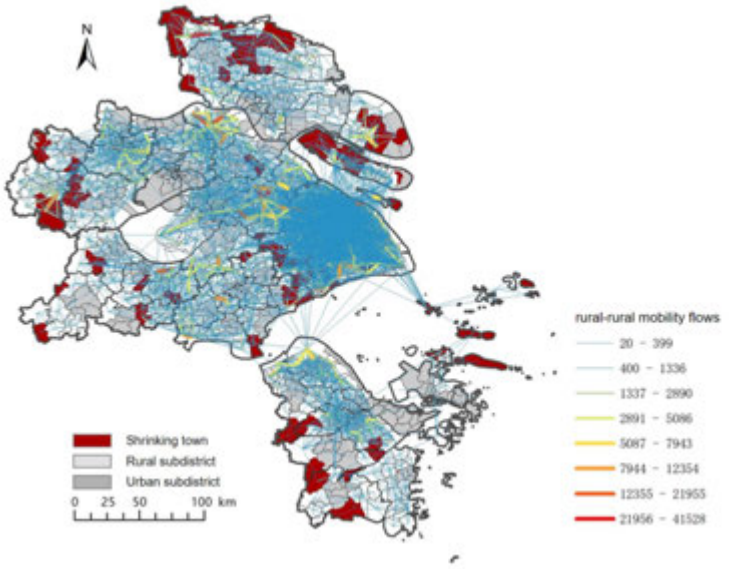
relatively high positions in the network, mainly influenced by factors such as town construction and geographical location, demonstrating higher population aggregation capacity. This also indicates the limitations of identifying shrinking areas based solely on population statistics standards.

4.2.2 Characteristics of the rural-rural population flow network

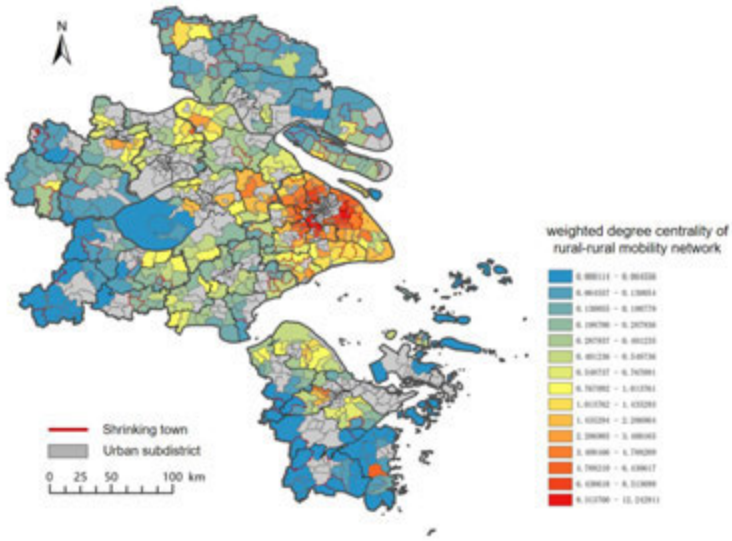
Following the same analytical process as the urban-rural population flow network, the spatial characteristics of rural-rural population connectivity strength within the Shanghai metropolitan area are illustrated in **Figure 4(a)**. Regions with higher rural-rural connectivity strength remain concentrated in Shanghai and Suzhou. While population movement predominantly occurs within each district or county, there is also a notable amount of inter-district flow, with administrative barriers exerting less restriction compared to urban-rural population movement, and longer distances of population flow.

Regarding shrinking towns, certain ones in Shanghai, Nantong, and Changzhou exhibit stronger population connections with other towns. Examples include Fengcheng Town in Shanghai, Tianmu Lake Town in Changzhou, and Huiping Town in Nantong. Fengcheng Town houses an economical park, Tianmu Lake Town incorporates the Tianmu Lake tourist resort, and Huiping Town serves as a significant centre for industry and agriculture. These towns have experienced population relocation due to ecological conservation or industrial park construction, but their industrial development has also stimulated surrounding areas, strengthening population connections between towns. For the majority of shrinking towns, the population connectivity strength with other towns is lower. Examples include shrinking towns in Ningbo, Zhoushan, and Huzhou, as well as shrinking towns at the border between Jiaxing and Shanghai. These towns are primarily influenced by geographical location, and the lower inter-town population connectivity strength within their respective cities indicates limited economic activity between towns.

The centrality distribution characteristics of the rural-rural population flow network are depicted in **Figure 4(b)**. Towns with higher centrality levels are primarily located in Shanghai and Suzhou, with notable centrality levels also observed in the eastern parts of Wuxi and Changzhou, as well as in Jiaxing and the northern parts of Ningbo. This clearly illustrates the frequent population activity radiating from Shanghai, influencing surrounding towns.



(a)



(b)

Figure 4. Characteristics of rural - rural population flow network in shrinking towns of Shanghai metropolitan area: (a) intensity of rural - rural population connection, (b) weighted degree centrality of rural-rural mobility network

Extracting relevant information on centrality from shrinking towns and ranking them, there are 26 shrinking towns ranked beyond the 400th position, compared to 45 in the urban-rural

population flow network, indicating that shrinking towns, on the whole, experience more frequent population movement than urban streets when compared to other towns. There are a total of 58 shrinking towns ranked beyond the 300th position, indicating that, overall, shrinking towns still occupy lower positions in centrality within the rural-rural population flow network, exerting some inhibitory effect on regional coordination.

Among these, shrinking towns located in the peripheral areas of Ningbo, Changzhou, Huzhou, Wuxi, and Zhoushan all exhibit the lowest centrality levels, indicating lower population aggregation capacity. Shrinking towns situated at city boundaries, such as those between Shanghai and Jiaxing, Shanghai and Suzhou, and Jiaxing and Huzhou, have relatively higher centrality levels, reflecting the radiating influence of central cities like Shanghai and Suzhou.Furthermore, compared to the centrality in the urban-rural population flow network, the centrality levels of shrinking towns in Nantong and Chongming District of Shanghai are relatively higher in the rural-rural population flow network, suggesting lesser functional connections with urban streets but more significant potential for coordinated development with surrounding towns.

Overall, most shrinking towns exhibit weak population aggregation capacity, low centrality, and connectivity strength within the rural-rural population flow network. This is likely to negatively impact the coordinated development of surrounding towns and hinder the smooth flow of population elements within the region. Simultaneously, some towns hold lower positions in urban-rural networks, yet they experience a specific elevation in their positions within the rural-rural network. This indicates their clustered development with surrounding towns. Shrinking towns located in cities like Shanghai demonstrate higher network characteristics, which correlate closely with their industrial development and geographical location.

4.3 Classification and influencing factors of shrinking towns

Above, Based on population changes, shrinking towns in the Shanghai metropolitan area were identified and characterized from both urban-rural and rural-rural population flow network perspectives, providing a dynamic reflection of their population aggregation capacity. Overall, combining with the analysis content of the three parts, the shrinking towns can be roughly divided into four types, and have different influencing factors.

The first type of shrinking towns, both in the urban-rural and rural-rural population flow networks, exhibit high levels of connectivity, with frequent population interactions with urban streets and other towns, showcasing strong population aggregation capabilities. These towns are predominantly located in Shanghai, such as Chuansha New Town, Jinqiao Town, Chedun Town, Tinglin Town, Caojing Town, and Dushangang Town in Jiaxing. The primary influencing factors for these towns include: 1. Prime Geographical Location: Benefiting from their strategic geographical positioning and the radiating influence of the central urban area of Shanghai, these towns maintain active population interactions and functional connections with surrounding areas. 2. Development of Tourism Areas or Economic Industrial Parks: The

presence of developed tourism areas or economic industrial parks in these towns drives frequent population movements and functional connections. For instance, Chuansha New Town's Disneyland, despite causing population relocations, has spurred rapid economic growth, while Jinqiao Town's proximity to the Shanghai Zhangjiang Hi-Tech Park has facilitated functional connections in the surrounding areas. Although these types of shrinking towns may experience a decline in permanent population numbers, they still possess significant population aggregation capabilities and hold potential for development.

The second type of shrinking towns exhibit high levels of connectivity in the urban-rural population flow network but lower levels in the rural-rural population flow network. Examples include Guli Town in Suzhou, Qianyuan Town in Huzhou, and Putuoshan Town in Zhoushan. These towns have close functional connections with urban streets but interact less with surrounding towns. The primary influencing factors for these towns include: 1. Proximity to Urban Streets: Being adjacent to urban areas and within the radiating range of cities, these towns have close population connections with urban areas, such as Qianyuan Town. 2. National Scenic Spots: Some of these towns are renowned for their national scenic spots, such as Guli Town, a famous ancient town in Suzhou, and Putuoshan Town, which attracts a large number of tourists due to the Putuoshan scenic area. As a result, these towns have close transportation links with urban areas. These types of towns maintain a stable level of economic development due to their inherent resource endowments. Changes in the permanent population numbers may not accurately reflect their current situation.

The third type of shrinking towns exhibit lower levels of connectivity in the urban-rural population flow network but relatively higher levels in the rural-rural population flow network, with frequent population interactions with surrounding towns. Examples include Luxiang Town, Langxia Town, Fengcheng Town, and Jianshe Town in Shanghai, as well as Tianmu Lake Town in Changzhou. The main influencing factors for these towns with high connectivity to surrounding towns include: 1. Service Function for Surrounding Areas: Some towns serve as functional hubs for surrounding areas, such as Fengcheng Town's bus station acting as a transportation hub for the surrounding region, providing service functions for external connectivity. 2. Interlinked Industrial Development: Towns like Luxiang Town, with its carpet industry, Langxia Town, with mushroom cultivation, and Tianmu Lake Town, primarily focused on tourism engage in synergistic cooperation and development with surrounding towns. These shrinking towns possess a certain development foundation and collaborate with neighbouring towns in a cluster-based development model. However, they may also experience population loss due to insufficient developmental momentum.

The fourth type of shrinking towns exhibits low levels of connectivity in both the urban-rural and rural-rural population flow networks, a characteristic shared by most shrinking towns. These towns demonstrate a noticeable "depression" phenomenon in the regional spatial network, with insufficient population aggregation capabilities hindering the smooth flow of population elements within the region. The primary influencing factors include: 1. Geographical Location: Most of these towns are situated on the periphery of the metropolitan

area, experiencing significant population outflow due to the suction effect of central cities. Additionally, transportation conditions in some areas, such as the reliance on waterways for transportation in towns in Zhoushan, are also hindering population mobility, heavily influenced by external conditions. 2. Lack of Key Industries: The absence of critical industries and lagging economic development result in labor outflow and a lack of inherent population aggregation capabilities. 3. Implementation of Ecological Protection Policies: The implementation of ecological protection policies restricts regional development, leading to population outflow. Overall, these types of towns lack vitality in regional development and have limited functional connections with surrounding areas. Under the processes of urbanization and development of central cities, they may continue to shrink in the future.

4.4 Development advice for shrinking towns

Based on the overall characteristics and types of shrinking towns, and in conjunction with the existing planning in the Shanghai metropolitan area, this study proposes the following recommendations:

1. Attention to Shrinking Areas in Metropolitan Area Coordination: Given the current development context, shrinking areas should be given attention in the coordinated development of metropolitan areas. Current domestic planning primarily focuses on the development of central areas, overlooking regions with relatively lower overall development levels. These areas often create structural "depressions" in the regional coordination network, hindering the free flow of various elements within the region and adversely affecting urban-rural integration. Furthermore, while using population quantity as a criterion for identifying shrinking areas has its limitations, it can preliminarily screen out areas with shrinking trends. Thus, a deeper assessment of shrinking areas should integrate the aggregation capacity of development elements.

2. Breaking Administrative Boundary Constraints: Fragmented administrative boundaries pose obstacles to coordinated planning by impeding the free flow of elements. Most population movements, whether urban-rural or rural-rural, predominantly occur within cities or even within districts and counties. The fragmentation of administrative jurisdictions poses certain obstacles to coordinated planning. Currently, local governments provide corresponding public service facilities based on administrative boundaries, resulting in weak and poorly connected public service facilities in border areas, hindering the cross-border flow of population elements.

3. Development Strategies for Shrinking Towns: Effective strategies should be formulated to drive regional coordinated development based on the characteristics represented by the aggregation capacity of the shrinking towns. Different response strategies should be adopted for each type of shrinking town:

- For the first type of shrinking town, which still retains high aggregation capacity, exclusionary strategies should be implemented. Despite a decrease in population, these towns still possess significant development potential.
- For the second type, existing advantages such as location should be prioritized to promote complementary urban-rural functions, drive the flow of urban-rural elements, fully utilize existing regional advantages, and achieve differentiated urban-rural development.
- The third type, characterized by solid linkage with surrounding towns, should initially adopt cluster development models to achieve functional complementarity with surrounding towns. Leveraging their own industrial advantages, active promotion of cluster development should be pursued, along with strengthening transportation links and industrial cooperation with urban areas to promote urban-rural integration.
- For the fourth type, which is more common, efforts should focus on strengthening infrastructure such as transportation to enhance connections with surrounding areas. Towns under ecological policy protection can consider developing tourism or agriculture under permitted conditions. Towns without pillar industries should actively seek coordinated development with surrounding areas. Aging or severely hollowed-out towns could consider moderate village integration and relocation in line with current development trends.

5. Conclusions

Under the national development strategy of fostering urban agglomeration and metropolitan areas, coordinated development and urban-rural integration have always been topics of concern. This research, based on traditional population data analysis, initially identifies shrinking areas. Leveraging big data technology and network analysis methods, constructing urban-rural and inter-town population flow networks within the Shanghai metropolitan area to deeply analyze the network characteristics of shrinking towns, revealing the following main findings:

1. Based on the traditional population data analysis, the towns in the Shanghai metropolitan area show a phenomenon of local contraction of relatively clustered or extended branches, mainly concentrated in the peripheral areas of the metropolitan area and the border areas between cities. Cities with a large number of shrinking towns include Nantong, Shangha, Zhoushan, Ningbo, etc.

2. Most of the shrinking towns identified based on population change are at a lower level in the rural-urban population flow network. A few shrinking towns still have a higher level in the network under the radiation of Shanghai and other central cities, which are mainly affected by town construction and, geographical location and other factors, and have a higher population gathering ability.

3. Most of the shrinking towns have weak population gathering ability in the rural-rural population flow network, which will adversely affect the coordinated development of surrounding towns and hinder the smooth flow of population elements within the region.

Some towns have a lower status in the urban-rural network. However, their position in the rural-rural network has been improved to a certain extent, indicating the different development modes from the surrounding towns.

4. Based on the characteristics of the network, the shrinking towns can be divided into four types according to different energy levels, and the influencing factors of the four types of shrinking towns are different. The towns with higher energy levels in the urban-rural and rural-rural population flow network should be considered excluded from the shrinking towns, which are mainly concentrated in Shanghai. Different development strategies should be adopted for the other three types of towns. In general, the shrinking towns from the perspective of the network are mainly concentrated in Nantong, Zhoushan, and Ningbo. Due to its strong radiation effect, the inner towns of Shanghai still have a high factor agglomeration ability.

Through the refined analysis of population flow at the street and town scale, this study finds the limitations of judging shrinking areas by population change as the standard and analyzes shrinking areas from the perspective of regional correlation, which can essentially judge their future development trend. In addition, the theory to view shrinking areas from the perspective of urban network and mobile spatial network is preliminatively verified. Most shrinking areas are indeed weakened or even interrupted in the network connection with surrounding areas. By identifying the shrinking areas from the perspective of element flow and differentiating the types simultaneously, we can better judge their development direction and formulate strategies through human manipulation, which will also provide a clearer optimization direction for the coordinated development and urban-rural integration of the Shanghai metropolitan area.

At the same time, this study still has some things that could be improved due to the limitations of time, data and other factors. First, the purpose of LBS data has yet to be fully mined to distinguish the differential characteristics of commuter and non-commuter flow. Secondly, an in-depth coupling analysis of the related factors, such as traffic conditions and economic industries, needs to be conducted. These are the directions that need further research in the future.

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Transforming City Regions: co-designing future planning education

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Abstract
This paper examines the implementation of a co-design approach in planning education, focusing on the M.Sc. Transforming City Regions (TCR) programme at RWTH Aachen University. Through workshops and interviews with focus groups, it explores how diverse students' expectations are aligned with institutional teaching and learning objectives and how interdisciplinary knowledge is effectively integrated into the curriculum. It describes and analyses the outcomes of these workshops and offers empirical insights that shed light on the future trajectory of interdisciplinary planning education and the challenges it faces. On this basis, the paper argues that fostering collaboration and feedback responsiveness facilitates continuous improvement in preparing students for the challenges of contemporary urban transformations.

Keywords
Transforming City Regions; Collaborative; Interdisciplinary; Integrative Urban Planning; European Education Pathways

1. Introduction

Contemporary urban development has reached an unprecedented scale and speed, posing profound global environmental and social challenges. Housing shortages, inadequate service provision, strained social infrastructure, and increased vulnerability to natural hazards and climate change are now pressing issues city regions face. Beyond the urban fabric, accelerated urbanisation contributes to biodiversity loss, land degradation and the need to transition away from fossil fuels worldwide. Balancing the demands of urban growth with environmental and social sustainability is, therefore, a critical imperative, requiring innovative and integrated urban planning and design approaches and pedagogies for the city regions of the future.

These challenges are also evident in the European context, as urbanisation continuously reshapes the European territory. On the one hand, the territory is undergoing significant changes from the dense urban cores of major metropolises to the sprawling suburbs and rural-urban fringes. On the other hand, the European dimension adds evolving layers of complexity as cities across the continent grapple with unique historical, cultural, and institutional contexts. This transformation requires a nuanced understanding of urban dynamics and sustainable development strategies tailored to Europe's diverse landscapes and communities.

In response to such social and spatial challenges, higher education institutions have a key role to play in educating capable young professionals who bring fresh ideas and approaches to address new challenges. As urbanisation accelerates and cities evolve, there is a growing need for skilled urban planners and designers who can navigate complex urban landscapes while integrating sustainability principles into their work. It is imperative that educational programmes equip students with the knowledge, skills, and interdisciplinary perspectives needed to address the multifaceted issues of contemporary urban development.

Against this background, the Institute for Urban Design and European Urbanism, part of the Faculty of Architecture at RWTH Aachen University (RWTH), introduced the master's degree Transforming City Regions (TCR) in October 2019 (TCR 2024). TCR is an innovative degree that consistently integrates different disciplines and planning methodologies to address European regions' complex challenges. Its core premise is rooted in the recognition of the growing territorial complexity and the interplay of structural and substantive priorities with foundations from different disciplines, underlying the need for integrative and conceptual thinking. Emphasising a project-based educational model, TCR not only provides graduates with up-to-date and in-depth knowledge, but also equips them with the tools and methods essential for tackling pressing issues in Europe's developing city regions.

Since its inception and launch, TCR has been committed to the continuous improvement of its teaching content, with a particular focus on internationalisation, interdisciplinarity, and sustainability. In pursuing this commitment, TCR has integrated key principles of RWTH's mission statement on teaching and learning. This approach emphasises, among other things, the recognition of students' diverse backgrounds and needs, the stimulation of research-led and practice-oriented teaching, and the promotion of student and staff mobility (RWTH 2023). In addition, TCR has joined the European Education Pathways exchange programme through the ENHANCE Alliance. This alliance comprises ten leading European universities that are pioneering a common curriculum for various pilot study programmes (ENHANCE 2023). This strategic involvement underlines TCR's commitment to promoting collaborative educational initiatives at an international level.

However, aligning students' expectations from diverse backgrounds with institutional teaching and learning objectives and integrating interdisciplinary knowledge into a well-defined curriculum framework is a multifaceted challenge. Therefore, this paper proposes a co-design approach to update and develop urban planning and design education curricula continuously. The co-design approach consists of three types of workshop formats. Firstly, feedback workshops were held with alumni and enrolled students to gather their experiences with specific and general teaching and learning objectives and the associated module workload. Secondly, semi-structured interviews were conducted with graduates to understand and compare their expectations before starting their studies with their achievements after graduation, i.e. learning outcomes. Thirdly, workshops were convened with the core teaching group to refine the specific and general learning and teaching objectives, revise the description of the graduate profile, and improve the links between modules. This paper describes and analyses the outcomes of these workshops and offers empirical insights that shed light on the future trajectory of interdisciplinary urban planning education and the challenges it faces.

2. Transforming City Regions

2.1 Curriculum framework

TCR’s curriculum framework comprises core courses, compulsory electives courses, and a range of electives courses. This provides a comprehensive curriculum covering theoretical, practical, methodological, and empirical aspects—facilitated by an interdisciplinary and international faculty (Fig. 1).

The core courses of the programme focus on the fundamental dynamics of contemporary cities, the processes that shape their form and structure, and the design tools necessary for urban transformation. These courses, taught by a multidisciplinary teaching staff, provide students with the essential knowledge, tools, and methodologies to address the challenges of evolving European territories. The core curriculum, which emphasises awareness of different spatial aspects such as social, economic, and environmental factors, ensures that graduates are equipped with a solid foundation to understand and address complex urban issues with sensitivity to their multifaceted nature.

The programme offers compulsory elective courses designed to foster integrative and conceptual thinking in response to the increasing territorial complexity and the different priorities within the different structural and content-related areas. These courses cover a wide range of methodological, procedural, morphological, landscape architectural, ecological, legal,

and economic aspects. By exploring these diverse areas, students are encouraged to make connections between disciplines and develop a holistic understanding of urban challenges. Taught by experienced faculty members, these courses provide students with the flexibility to tailor their education to their interests and career goals while ensuring a comprehensive understanding of urban transformation processes.

In addition to the compulsory core and elective modules, the programme offers a range of elective courses supported by a multidisciplinary teaching staff. Like the compulsory elective, the elective courses also cover a wide range of aspects. By focusing on specific topics of interest, students have the opportunity to deepen their knowledge and skills in areas relevant to their career aspirations. These electives provide students with the flexibility to explore specialised areas of study while benefiting from the expertise of faculty members with diverse backgrounds and expertise. Through these courses, students can further refine their understanding of urban transformation processes and develop the necessary skills to effectively address contemporary urban challenges.

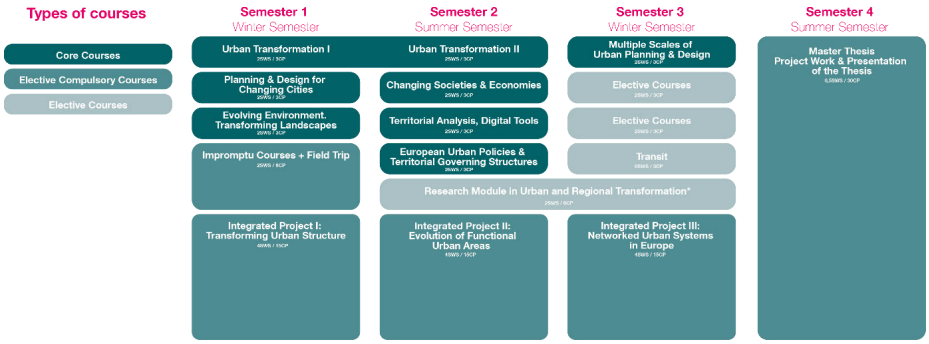

Fig. 1: RWTH's M.Sc.Transforming City Regions curriculum framework. Source: (Authors, 2024).

TCR adopts a multi-faceted approach to teaching, including lectures, tutorials, seminars and projects. Lectures provide specialist knowledge and methods on a weekly basis, while projects offer supervised opportunities to deepen understanding through practical design and planning tasks. Seminars, whether weekly or as compact events, explore complex issues and provide additional factual and methodological knowledge, encouraging critical thinking and discourse. At the heart of the curriculum are projects that integrate various subject areas with a focus on design and planning, allowing students to apply theoretical concepts to real-world scenarios. Assessment methods include written and oral examinations, term papers and presentations of urban design and planning concepts, ensuring that students not only acquire theoretical and methodological knowledge but also develop the presentation skills necessary to communicate visions for urban transformations to a broader audience.

2.2 Learning outcomes

Through TCR's curriculum framework, graduates acquire a robust set of skills, including analytical, conceptual and design skills (Fig. 2). They gain in-depth multidisciplinary knowledge that enables them to understand and manage complex urban problems and systems with a scientific and solution-oriented attitude. Equipped with advanced methodological tools and techniques, they are able to analyse changing urban and regional structures, conceptualise

scenarios for future change, and formulate strategies for sustainability and resilience. Graduates also excel at selecting, analysing, and interpreting spatial data, preparing them to tackle challenges at different scales in interdisciplinary teams. Their ability to communicate urban concepts, ideas and policies to a wider audience ensures that their solutions can be effectively communicated and implemented.

The analytical skills of graduates are sharpened through interdisciplinary training. They learn to describe, analyse, and interpret relationships and interdependencies within European territorial challenges. Equipped with analytical methods from different disciplines, they navigate complex spatial problems with a scientific and solution-oriented attitude. This training fosters practical decision-making skills that are applicable in all professional settings, including the private sector, public institutions, and civil society organisations. Graduates are also instilled with a sense of social responsibility, ensuring that their analytical skills are applied ethically, considering social, cultural, and environmental factors.

The conceptual skills are refined through the exploration of dynamic territorial processes and the conceptualisation of future scenarios. Real-world case studies provide a platform for the application of design and planning methods, considering different spatial aspects such as social, economic, and environmental factors. Graduates gain an in-depth understanding of European policies and governance structures, enabling them to interpret social and economic processes in urban and rural spaces. They can conceptualise strategies for sustainability, resilience, and risk mitigation, ensuring alignment with the evolving needs of European territories.

Moreover, the TCR curriculum emphasises the development of design skills in its graduates. They acquire skills in selecting, analysing, and interpreting spatial data, preparing them to tackle challenges at different scales in multidisciplinary teams. With responsibility for specific tasks, they solve complex spatial problems and present solutions effectively to the public. The final semester, dedicated to the final thesis, offers students the opportunity to showcase their individual skills through integrative projects, whether theoretical-conceptual or design-oriented. Throughout the programme, TCR highlights the importance of design and technical knowledge grounded in social, cultural, and environmental responsibility, ensuring that graduates are equipped to contribute meaningfully to the transformation of urban regions.

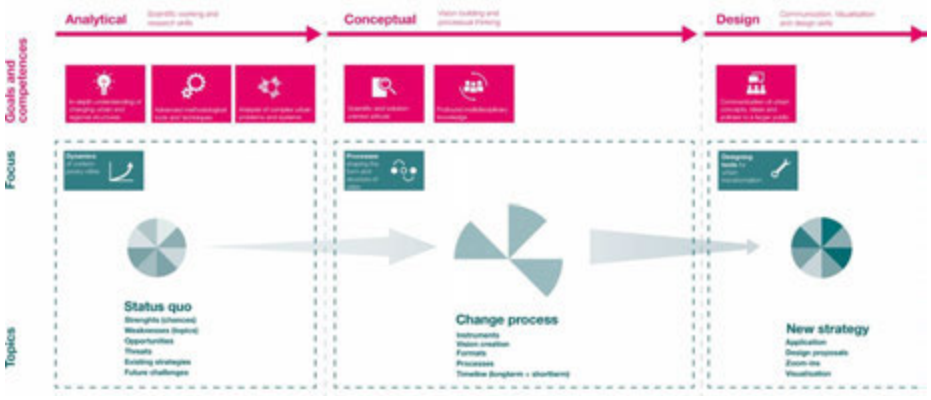

Fig. 2: RWTH's M.Sc. Transforming City Regions academic approach. Source: (Authors, 2024).

2.3 International and multidisciplinary setting

TCR welcomes students from a wide range of academic backgrounds concerned with spatial issues, including disciplines such as urban design, urban planning, architecture, spatial planning, landscape planning, geography, sociology, and cultural studies, among others. Taught entirely in English, the programme attracts students from all over the world, ensuring a rich cultural and disciplinary mix among its participants. Accordingly, the international and multidisciplinary nature of the programme is its main characteristic. On the one hand, this contributes to RWTH's internationalisation strategy and fosters an environment where interdisciplinary teamwork is highly valued and encouraged. On the other hand, it provides an environment that is personally and professionally enriching for students. In combination, TCR offers students valuable opportunities to work with peers from different cultural and academic backgrounds, broadening their perspectives and preparing them to tackle the complex challenges of urban change on a global scale (Fig. 3).

Fig. 3: RWTH's M.Sc. Transforming City Regions student composition. Source: (Authors, 2024).

3. Co-designing future planning education

The relevance of internationalisation and multidisciplinary environments in planning education has become increasingly important in addressing the complex challenges of contemporary urban development. As cities around the world grapple with issues such as housing shortages, environmental degradation, and social vulnerability, there is a growing need for innovative approaches and integrated pedagogies in urban planning and design education. One of the key challenges, however, is to match the expectations of students from diverse backgrounds with institutional teaching and learning objectives, on the one hand, while integrating interdisciplinary knowledge into a coherent curriculum framework, on the other hand. This multifaceted challenge raises a two-fold question. Firstly, of how diverse students' expectations can be aligned with institutional teaching and learning objectives. Secondly, of how interdisciplinary knowledge can be effectively integrated into a well-defined curriculum framework. To address this, the paper proposes a co-design approach involving workshops with alumni, enrolled students, and faculty to continuously refine and develop curricula for urban planning and design education.

3.1 The process

The co-design of a curriculum framework is a collaborative effort in which educators, students, administrators, and sometimes community members work together to build a comprehensive educational structure. This process begins by embracing the diverse perspectives and needs of all stakeholders and creating an environment where every voice is considered. In the context of higher education, it ensures not only a well-rounded curriculum framework but also one that is culturally sensitive and responsive to the community it serves. Through open dialogue and collective effort, the framework becomes a product of shared knowledge, bringing together the expertise and insights of multiple contributors. This approach encourages innovation and adaptability, as the latest educational trends, technological advances, and diverse pedagogical methodologies can be integrated.

Moreover, co-design fosters a sense of ownership and commitment among participants, making them active contributors to the educational landscape. This process cultivates a shared responsibility for the success of the curriculum and fosters a sense of unity and common purpose among stakeholders. Ultimately, co-designing a curriculum framework means taking a progressive and inclusive approach, which is essential for creating an educational roadmap that is versatile, relevant, and responsive to the diverse needs of learners and society.

This section provides a comprehensive overview of the TCR timeline, the co-design workshops, and the key role of each milestone in shaping the curriculum framework. It details the sequence of events and workshops, highlighting their essential contributions at two levels. Firstly, these collaborative workshops facilitated discussion between teachers, students, and administrators, encouraging diverse perspectives and innovative ideas. Secondly, each workshop and milestone provided valuable insights that guided the development of the framework, resulting in a synthesis of collective knowledge. Overall, the section highlights how the iterative process of workshops and milestones significantly influenced the overall design, resulting in a comprehensive curriculum that is finely tuned to meet diverse educational needs with cultural responsiveness and adaptability (Fig. 4).

The timeline of the TCR is marked by four key moments: the establishment of the Chair and Institute of Urban Design at RWTH in October 2018, the official launch of TCR in October 2019, the first feedback workshop in March 2022, and finally the integration of the TCR into the UNESCO Chair of Cultural Heritage and Urbanism in March 2023. Figure 5 illustrates the timeline of the TCR and maps three key workshops that were held with different focus groups to capture their perspectives. The first workshop with the first graduates took place in March 2022, followed by the second with enrolled students from all semesters in February 2023, and, lastly, the third with alumni and enrolled students in November 2024. The results helped to reflect on teaching and learning outcomes in a workshop with lecturers in April 2024.

These workshops provided valuable insights into the programme's effectiveness and highlighted areas for improvement. Feedback from enrolled students and alumni informed ongoing discussions on curriculum development, pedagogical approaches, and the integration of international perspectives. In particular, the integration of the TCR into the UNESCO Chair of Cultural Heritage and Urbanism emphasised the need to revise the curriculum framework, integrate the Sustainable Development Goals (SDGs), and strengthen internationalisation in line with UNESCO and RWTH guidelines.

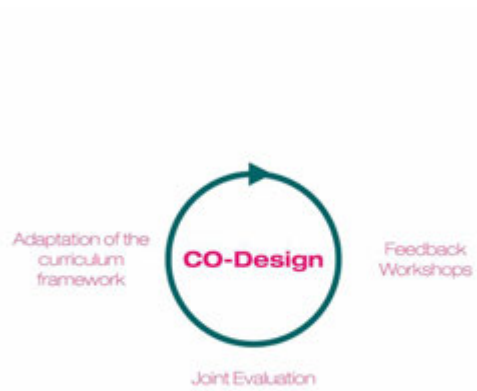

Fig. 4: Co-designing the future of RWTH's M.Sc. Transforming City Regions. Source: (Authors, 2024).

Fig. 5: TCR timeline. Source: (Authors, 2024).

3.2 Alumni perspectives

The first feedback workshop, held in the winter term of 2022 with the first graduating class of TCR, aimed to assess the first impressions of alumni and identify critical issues early on. It provided an opportunity for alumni to reflect on their experiences during the programme and give feedback on various aspects, from the application process to postgraduate concerns. The timing of the workshop allowed alumni to assess the effectiveness of the programme in preparing them for life after graduation and to apply their learning experiences retrospectively.

During the feedback session, the alumni were divided into several themes, including pre-study expectations, courses and workload during the programme, and postgraduate issues. Special attention was given to the Integrated Projects, a key component of the programme, which were heavily weighted with 15 ECTS credits. Alumni were encouraged to record their feedback anonymously on a visual collaborative web platform and to discuss their opinions further during

the session. The workshop began by addressing the alumni's expectations before the start of the programme, followed by evaluations of the application process, the organisation and content of the courses during their studies, and their personal experiences. In addition, alumni were invited to discuss important issues for their life after graduation, and to give free feedback on all areas of the programme.

Initial findings from the workshop identified several areas for improvement. Alumni expressed concerns about the clarity of programme requirements, particularly for students from different disciplines. The level of stress during the programme, especially in relation to the Integrated Projects, was highlighted, as well as the desire for more support for academic work, the preparation of the Master's thesis and design skills. The lack of thematic coordination between courses, particularly in Integrated Projects, was criticised, as was the perceived overemphasis on urban design. Suggestions were also made to improve the programme's relevance to practice, such as increased collaboration with professionals and courses on potential careers. These findings led to short-term actions, including the establishment of a student support forum, the provision of resources and expanded collaborations, with plans for long-term improvements, including a review of the Integrated Projects strategy. A further workshop was planned to validate these findings from the perspective of subsequent classes.

3.3 Students' perspectives

The second workshop, held in February 2023, invited all students enrolled in TCR at that time. Building on the findings of the first workshop, the second workshop aimed to validate and further develop them, focusing on course weighting, course content and post-graduation perspectives. This workshop was informed by internal reflections on the content and structural orientation of the programme. Concrete questions, including true/false and multiple choice, were used to explore different topics, with an open discussion at the end to allow students to raise points of their choice. The interactive platform used allowed students to actively participate in discussions during the workshop and to anonymously share their opinions afterwards (Fig. 6). In total, about 30 people participated in at least one of the two activities.

The results of the second workshop echoed some of the findings of the first. Students expressed a desire for a stronger focus on scientific work and a clearer relationship between courses. They also emphasised the need for more electives to provide opportunities for specialisation and suggested collaboration with specific faculties of interest. In addition, students expressed a desire for more practical relevance in the programme through field trips and a focus on developing software skills. Career prospects were also discussed, with students identifying professions such as urban sociologist, urban designer, AI designer, smart city product manager or consultant, researcher, or architect. Many emphasised the importance of scientific work and software skills for their professional future, especially for those planning to work in Germany. General comments reiterated concerns about the application process for the programme, the workload for few ECTS, and the desire for more individual work.

The results of the second workshop largely confirmed those of the first, and led to ongoing internal reflection and action. These include a redistribution of ECTS and thematic emphases, particularly regarding the redesign of Integrated Projects and a greater emphasis on academic work. Tools are being developed to address criticisms of the pre- and post-study periods, with the aim of providing guidance and support. However, not all students' wishes can be met, such as the offer of a compulsory module in building and planning law for those interested in German design and planning practice. Nevertheless, there is a commitment to increase collaboration

within the university to provide students with greater flexibility in their elective and transit modules to ensure that the programme remains sustainable and adaptable to student needs.

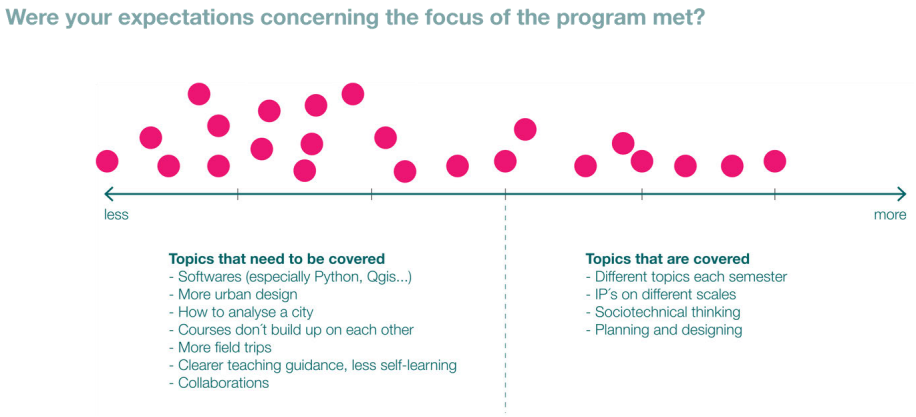

Fig. 6: TCR students' expectations mapped anonymously. Source: (Authors, 2024).

3.4 Mapping expectations and achievements

The third student workshop, offered as part of an impromptu course, gave students the opportunity to conduct semi-structured interviews with TCR alumni. The aim of the course was to illustrate the diverse backgrounds of TCR alumni and to compare their situations before and after their studies, i.e. mapping expectations and achievements. Through the semi-structured interviews, students gained valuable insights into the different experiences of alumni, allowing them to formulate questions related to their own study interests. In addition, participants learned about innovative visualisation and interviewing techniques and had the opportunity to network with TCR alumni, gaining valuable insights into their experiences and career paths.

Questions in the interviews focused mainly on expectations before starting the TCR programme and achievements after completing it. The results were ultimately used to create personas that anonymously represented the alumni (Fig. 7). These personas indicated the alumni's undergraduate background, whether their expectations were met and what they were able to achieve after completing the programme. These personas were then published on the Transforming City Regions website, giving potential applicants an insight into the diverse backgrounds of successful alumni, and helping them to understand the content of the programme through these personas. This initiative not only provided valuable information for prospective students, but also served as a platform for alumni to share their experiences and insights.

The findings from the interviews provided valuable feedback on the programme from an alumni perspective. Interestingly, ratings of expectations were generally lower than ratings of achievements, suggesting that TCR exceeded expected outcomes or needed to be better explained in advance (Fig. 8). Multidisciplinarity was consistently cited as an important achievement, indicating the programme's success in promoting a diversity of skills and perspectives among its graduates. However, practice orientation was rated the lowest overall, highlighting an area for potential improvement. In addition, TCR alumni emphasised the importance of programmes that provided hard skills, although this category was not rated

highly. Perceptions of research orientation varied among alumni, with those working in research-oriented positions rating the programme's skills more highly. This diversity of perspectives demonstrates the programme's ability to enable students to find their own areas of interest and develop their skills, regardless of their undergraduate background.

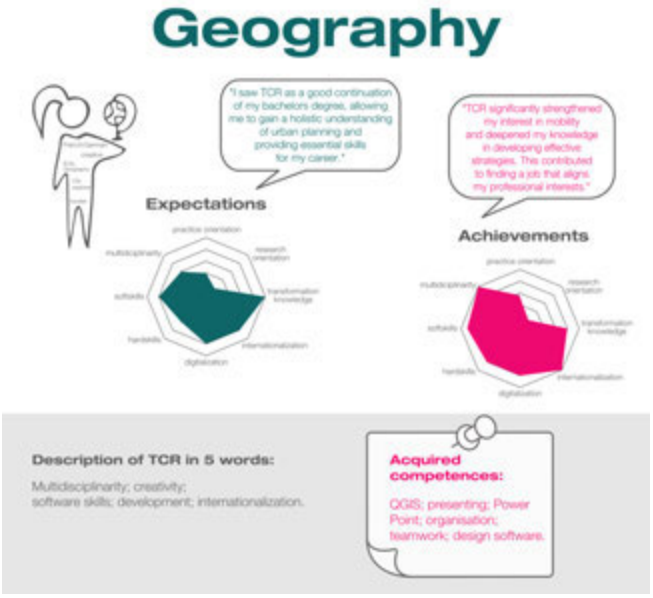

Fig. 7: TCR Persona. Source: (Westerkamp et al. 2023).

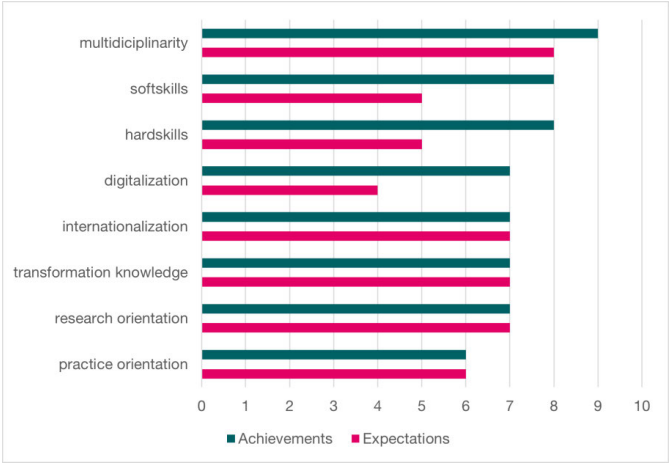

Fig. 8: Mapping expectations and achievements. Source: (Authors 2023).

3.5. Lectures' perspectives

The workshop with lectures was designed to address the alignment between the learning outcomes of individual courses and the overarching objectives of the programme. Core lecturers attended and were tasked with presenting their courses and discussing any issues they were facing. In addition, the results of student workshops were presented to provide insights into the challenges faced by students. Thematic consolidation of courses was a key focus, with examples given of courses that had already been coordinated to support student work. There was unanimous agreement that projects should be supported by core courses, highlighting the importance of coherence in the curriculum.

The workshop explored the challenges posed by the interdisciplinary nature of the programme, which brings together students from different thematic and cultural backgrounds. While students benefit from learning from each other, it becomes difficult to assess them on the same level and to set consistent requirements. Discussion centred on how to bring students to a common level that can be assessed consistently, particularly in areas such as design skills where student levels vary widely. A key outcome was the need for the programme application to be clearer about the requirements that applicants need to meet. This isn't to restrict the interdisciplinary nature of the course, but to give students a clearer understanding of the programme in advance, so that they can acquire the necessary skills before they start their studies. The workshop suggested the introduction of a self-assessment tool for applicants to reflect on their suitability, enabling them to understand what skills are needed for the programme.

The workshop emphasised the importance of regular meetings between lecturers to focus on the main objectives of the programme and to engage in thematic discussions. This ongoing dialogue would help to ensure that courses are aligned with the programme's objectives and that students receive consistent support and guidance. By addressing the challenges of interdisciplinary learning and providing clearer expectations for applicants, the programme can better equip students with the skills they need to succeed and foster a more cohesive learning environment.

4. Discussion

Contemporary urban development presents unprecedented challenges, including housing shortages, environmental degradation, and social vulnerability, and requires a responsive and adaptable planning education to address the complexities of urbanisation. To achieve this, future planning education should focus on multidisciplinarity and internationalisation. The TCR programme at RWTH Aachen University exemplifies this approach, integrating different disciplines and methodologies to address the complex challenges of European urban regions. Accordingly, the core premise of the programme is the recognition of the growing territorial complexity and the interplay between structural and substantive priorities—emphasising the need for integrative and conceptual thinking. Furthermore, TCR recognises the critical need to reconcile urban growth with environmental and social sustainability and aims to equip students with the skills and knowledge needed to effectively address contemporary social and spatial issues. Through a project-based educational model, TCR provides graduates with up-to-date knowledge and essential tools to address pressing issues in Europe's developing urban regions.

However, aligning the expectations of students from diverse backgrounds with institutional teaching objectives, while integrating interdisciplinary knowledge into a well-defined curriculum, is a multifaceted challenge. TCR addresses this challenge through a co-design approach. Through feedback workshops with alumni and enrolled students, as well as interviews with graduates, the programme continuously refines its curriculum. This collaborative effort ensures that the curriculum remains relevant and responsive to the evolving needs of both students and the urban planning profession.

The co-design approach outlined in section 3 emphasises iteration and inclusivity. By involving different focus groups in the curriculum development process, TCR creates an environment where every voice is considered. This process encourages innovation, adaptability, and cultural sensitivity, resulting in a curriculum framework that reflects the collective knowledge and insights of multiple contributors. Through open dialogue and collaborative effort, TCR ensures that its educational roadmap remains diverse, relevant, and responsive to the diverse needs of learners and society.

Alumni, students, and lecturers provide valuable perspectives on the effectiveness of the TCR programme. Alumni highlighted concerns about programme clarity, workload, and thematic coordination, while students emphasised the need for a stronger focus on scientific work and practical relevance. Lecturers discussed the challenges of assessing students' interdisciplinary learning and suggested clearer programme expectations for applicants. Despite different perspectives, all agree on the importance of continuous improvement and alignment with the programme's objectives. The mapping of expectations and achievements, as discussed in section 3.4, provides insights into the effectiveness of the programme from the alumni perspective. While TCR has generally exceeded expectations, areas for improvement include practical relevance and clarity of programme requirements. These findings will inform ongoing curriculum development efforts to ensure that TCR remains responsive to student needs and industry demands. By addressing these shortcomings and continuing to engage various focus groups in the curriculum development process, TCR can further enhance its educational offering and make a meaningful contribution to the community it serves.

While the co-design approach offers valuable insights and improvements for educational planning, it also has several challenges and limitations. Resource constraints, lack of perspectives from practice, and the need for more time to assess programme quality and graduate market readiness are some of the shortcomings highlighted. Balancing expectations for a more scientific or practical education with the complexity of integrating interdisciplinary knowledge is another challenge. In addition, the high expectations of students and the time required to implement improvements can slow progress. Despite these challenges, TCR remains committed to addressing them and ensuring the continuous improvement of its educational offerings. By effectively utilising available resources, seeking input from industry experts, and transparently managing student expectations, TCR can mitigate these limitations and further strengthen its position as a leader in interdisciplinary urban planning education. Through ongoing collaboration and a commitment to innovation, TCR can continue to adapt and evolve, preparing students to navigate the complexities of contemporary urban development and make a positive contribution to the future of urban regions worldwide.

5. Conclusion

In addressing the main research question, the paper explored how the expectations of students from diverse backgrounds can be aligned with institutional teaching and learning objectives and

how interdisciplinary knowledge can be effectively integrated into a well-defined curriculum framework. Through a series of workshops and interviews, we found that a co-design approach involving focus groups such as alumni, enrolled students, and faculty is essential to achieve this alignment. By actively involving these groups in curriculum development, we ensure that educational programmes such as TCR at RWTH Aachen University meet the needs of a diverse student body while maintaining a coherent and comprehensive curriculum. The workshops showed that clarifying programme requirements, improving thematic coordination, and providing adequate support are crucial steps in aligning expectations and effectively integrating interdisciplinary knowledge. This collaborative effort not only ensures that students from diverse backgrounds are adequately prepared for the challenges of contemporary urban development, but also fosters a sense of ownership and commitment among groups, making them active contributors to the educational landscape.

The findings of Chapter 3 on the co-design process have significant implications for the challenges outlined in Chapter 1. As contemporary urban development faces unprecedented challenges, there is a growing need for innovative approaches and integrated pedagogies in urban planning and design education. The co-design approach outlined in this paper offers a promising solution to these challenges by fostering collaboration and responsiveness to stakeholder feedback. By continuously refining and developing curricula through workshops and stakeholder engagement, educational programmes can better prepare students to address the complexities of urban development and contribute meaningfully to the future of city regions. These findings highlight the importance of ongoing dialogue and collaboration between educators, students, and practitioners in shaping the future of planning education. By adopting a co-design approach, educational institutions can adapt to emerging trends and challenges in urban development and ensure that graduates are equipped with the skills and knowledge needed to effectively address real-world issues.

The co-design approach discussed in this paper represents the first step in a larger effort to improve planning education at RWTH Aachen University and beyond. Collaboration with other universities and involvement in initiatives such as the ENHANCE University Alliance (ENHANCE 2023) and the UNESCO Chair in Cultural Heritage and Urbanism (UCCU 2024) are seen as potential game changers—enriching the educational experience and ensuring its relevance to contemporary urban challenges. By embracing this approach and actively engaging with focus groups, educational institutions can foster innovation, adaptability, and cultural sensitivity in urban planning education, ultimately preparing students to navigate the complexities of urban development and make a positive impact on the future of city regions worldwide. This collaborative, inclusive and iterative approach to curriculum development is critical to addressing the multifaceted challenges of contemporary urban development and ensuring that planning education remains responsive and relevant in an ever-changing world.

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Insights into urban spatial dynamics around Marmaray stations in Istanbul: Evidence from social media data

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Abstract

Key hubs like transfer centers facilitate intra-urban travel and accessibility in large cities. Understanding urban activity patterns around these hubs is vital for improving urban planning and infrastructure, thus enhancing livability. However, traditional research methods often fall short in capturing dynamic urban activities, whereas social media data provides rich insights into geographical locations, activity types, and movement patterns. This study uses location-based services from social media to analyze urban activity patterns around Marmaray stations on the Anatolian side of Istanbul. Analyzing Foursquare venue data within a 500-meter radius of 29 stations, Kernel density and K-means cluster analyses revealed four distinct activity clusters. These findings suggest varied urban activities at each station and help refine urban planning and transportation strategies.

Keywords: Activity patterns, Foursquare, Istanbul, location-based social network data, Marmaray stations

1. Introduction

The expansion of public transportation systems in large cities is a crucial strategy to alleviate traffic congestion and promote sustainable urban development. Public transportation hubs, transfer centers, and stations play a pivotal role in facilitating intra-urban journeys and offering accessibility to the activity spaces in their immediate surroundings. However, a better understanding of human mobility and activity patterns around these stations is needed to enhance urban planning, transportation infrastructure, and overall urban livability (Lang et al., 2020). The necessity arises because traditional research on individual activity-travel patterns over extended time periods has relied on labor-intensive surveys and questionnaires (Vilhelmson, 1999). While these methods have provided valuable insights, they are often costly and limited in covering a large number of individuals (Zhou et al., 2018). Additionally, there are data-related constraints in the analysis of urban space and dynamics, such as currency, availability, accessibility, representativeness, objectivity, and diversity of the data.

On the other hand, the proliferation of location-based services in social media applications, which has ushered in an era where people willingly share their activity-related choices, such as check-ins on various platforms like Facebook, Foursquare, and X (formerly Twitter), has emerged as an alternative data source. This has led to the accumulation of a high volume of user-generated data, offering valuable insights into human movement and activity patterns. This data source not only contains specific geographic information but also provides insights into how different types of activities are chosen for various purposes, activity categories, and movement patterns.
In recent studies (Hasan et al., 2013; Zhou and Zhang, 2016; Üsküplü et al., 2020; Ebrahimpour et al., 2020; Mohammadbagherzadeh & Terzi, 2022), location-based data has gained increasing interest due to its rich information, linking each geographical record to a venue category that explains the reasons behind the activities. Consequently, this has opened doors to novel applications, from recommendation systems for physical locations to travel route optimization. Beyond these applications, the data has the potential to revolutionize fields such as travel demand modeling, urban planning, epidemiology, security, and health monitoring (Ling-Yin et al., 2012).

In this context, this research investigates the activity patterns around the stations of the Marmaray mass rapid transit railway system on the Anatolian side of Istanbul, one of the important public transportation lines, by exploring the potential of using data from location-based social networks, specifically venue data from Foursquare. The research aims to answer two key questions:

• What are the differences among Marmaray stations in Istanbul in terms of the distribution of activity spaces?

• What characteristics can be observed through venue data in the surroundings of these stations?

2. Exploring urban spatial dynamics through location-based social networks

This chapter presents the theoretical background for the research, which extends to the activity spaces and activity patterns in urban spatial dynamics, location-based social networks, and their innovative perspectives on the analysis of spatial dynamics within urban research.

2.1. Activity spaces as spatial components of urban dynamics

Activity space is an important component in urban dynamics since it traces its origins to the conceptualization of social space and the analysis of urban time-space patterns in behavior. Activity spaces, defined by Horton and Reynolds (1971) as "the subset of urban locations with which an individual interacts due to their activities," encompass both the physical locations and the subjective experiences within these spaces, reflecting a blend of objective spatial structure and individual urban interactions (Golledge and Stimson, 1997). The concept of activity space has evolved from behavioral geography over time and has been defined with various terminologies in different contexts, such as "activity system" (Chapin, 1968), "awareness space" (Brown and Moore, 1970), and "action space" (Horton and Reynolds, 1971). Activity space is a multidimensional concept with spatial, temporal, and cognitive dimensions (Wang et al., 2012). These dimensions are evident in the diverse ways individuals use urban space, influenced by factors such as mobility and access.

To understand the multidimensional structure of activity spaces, the use of the concept in urban research has also varied, with methodologies including the standard deviational ellipse (SDE), network-based approaches, kernel density estimations, minimum convex-hull polygons (MCP), and other methods (Patterson and Farber, 2015). Each of these approaches offers a different perspective on understanding activity spaces, but within this research, it is important to elaborate more on kernel density estimation (KDE). Each of these approaches offers a different perspective on understanding activity spaces, but within this research, it is important to put more elaboration on kernel density estimation (KDE), as a data smoothing technique, which plays a significant role in examining activity spaces by interpolating point data to create a continuous surface (Bailey and Gatrell, 1995). Since it offers insights into the intensity and distribution of activities within urban spaces with its this feature, it has been used in different research studies (Kwan, 2000; Axhausen, 2002; Kamruzzaman et al., 2011).

Furthermore, the advancements in Geographic Information Systems (GIS) and the availability of extensive geographical data have opened up new opportunities for researchers to digitally define activity spaces. This potential has expanded beyond mobile phone data to encompass crowdsourced information like social media and Points of Interest (POI) data (Yuan et al., 2012). These sources, including social media, POI data, websites, and various online platforms relying on voluntary data sharing, have primarily been utilized for modeling aspects of urban activity patterns, mobility, land usage, location preferences, as well as for conducting semantic and perceptual studies related to spatial analysis (Niu and Silva, 2023). In this context, exploring these new sources of data and methodologies is considered important for gaining a deeper understanding of activity spaces and providing insights into the dynamics of the urban environment.

2.2. Digital footprints for urban spatial dynamics: Location-based social networks

User-generated content has emerged as a critical source for investigating interactions with urban spaces and explaining how people engage with their environment in daily life. This phenomenon demands new theoretical perspectives, as suggested by Cope (2015), to gain a deeper understanding of these interactions. The integration of digital services into daily urban life, noted by Dunkel (2015), offers a valuable lens for exploring the various components and socio-spatial dynamics of urban environments. The advancement of GPS technology has introduced a novel dimension to urban analysis by linking user-generated content with specific geographic locations within the urban landscape. This process encompasses recording, sharing, reviewing, and recommending spaces and functions, significantly enhancing the comprehension of city dynamics (Arribas-Bel, 2014). Within this context, location-based services and social networks represent a convergence of internet-connected devices, location-based technologies, and GIS (Brimicombe, 2002). Social networks, as virtual social structures, are formed through connections such as friendships, shared interests, and collective knowledge among users. These networks enable users to express thoughts, opinions, activities, and interests.

The integration of location-based data into social networks, creating location-based social networks (LBSNs), bridges the gap between online interactions and real-world environments. This integration allows tracking users' interests and behaviors through their location information within these networks (Zheng, 2011). Moreover, LBSNs facilitate the sharing of location-specific data within an existing social network and the creation of new networks where users connect based on physical location. Consequently, LBSNs gather extensive databases containing variables such as text, images, and quantitative data. The database structure, formed by users' location history and the shared archive of geo-tagged content, is instrumental in understanding users' preferences, behaviors, and activities (Marti et al., 2019).

The functionalities and content of each social network vary, but commonalities exist in how they establish networks of contacts and allow users to register with a profile, create, share, or interact with content. Bernabeu-Bautista et al. (2021) categorize current social networks into five types: contact-focused networks like Facebook or LinkedIn, microblogging networks such as X or Tumblr, multimedia sharing networks including Instagram, Flickr, Pinterest, or YouTube, specialized networks like Airbnb, Google Places, Foursquare, or Sina Weibo, and instant messaging services such as Telegram or WhatsApp. Each category serves distinct user interactions and needs. According to Bernabeu-Bautista et al. (2021), the suitability of these networks for urban studies hinges on four key characteristics: precise geolocation of data, accessibility and privacy of the data, the ability of data variables to reflect urban and social activity, and predominant use on mobile devices. These aspects enable the analysis of user behaviors, interactions, mobility, and activity patterns within urban spaces in real-time and dynamic contexts. Choosing the right social network for urban research depends on the study's goals and the required data format, be it text, images, opinions, or quantitative data. In this way, LBSNs have demonstrated extensive potential in urban research. For instance, Lee, Wakamiya, and Sumiya (2013) utilized social media data to discern behavioral patterns and types of spaces within cities. This data, emerging as a by-product of everyday life, contrasts with planned surveys, providing a free and widely accessible resource for urban research, especially valuable in locations with limited official data (Arribas-Bel, 2014). However, the computational exploration of this data often lacks a well-established theoretical or philosophical framework, indicating a need for urban research to establish its own methodological framework to develop a more comprehensive understanding of urban dynamics.

Focusing on geo-tagged data obtained from different LBSN platforms and methods, various studies have utilized it to examine urban dynamics through activity and mobility patterns (Table 1). Liu et al. (2014) focused on intra-urban trip patterns and spatial interactions using Weibo's check-in data, employing a gravity model and particle swarm optimization (PSO) to analyze the data. This approach allowed for an understanding of movement patterns within urban environments. Hasan et al. (2013) suggested that social media users tend to visit different places with decreasing regularity following Zipf's law and analyzed Foursquare check-in data posted on Twitter. In a subsequent study, Hasan et al. (2014) shifted their focus to user-specific activity patterns using geo-tagged tweets from Twitter by applying Latent Dirichlet Allocation (LDA), a method that helped identify patterns based on the content of tweets.

Zhou and Zhang (2016) also explored activity intensities in a temporal context by combining data from Twitter and Foursquare. They analyzed geo-tagged tweets with related Foursquare categories, using hotspot and spatial clustering analyses to study the temporal dynamics of urban activities. Zhou and Xu (2017) extended this approach to the spatio-temporal evolution of natural (heavy precipitation) and specific social events in New York City, employing density-based spatial clustering (DBSCAN), KDE, and sentiment analysis on various features of Twitter data to understand the city dynamics.

Cui et al. (2018) focused on the temporality of frequently visited places by integrating Weibo check-in data with survey data. They used a distance-based clustering algorithm to understand how frequently certain locations were visited and the patterns associated with these visits. Yang et al. (2019) studied human mobility and activity patterns at the group level using geo-tagged Weibo messages. Their approach involved multiple spatial distribution analyses, providing insights into group behaviors in urban spaces. Üsküplü et al. (2020) analyzed activity patterns in parts of historical districts in Istanbul using Foursquare data, specifically POI and check-in data. They applied hotspot and spatial clustering analyses to understand the activities within these culturally significant areas.

Ebrahimpour et al. (2020) focused on socio-geographic human mobility patterns using geo-located Weibo data. They utilized KDE and DBSCAN to analyze the spatial and social aspects of human mobility. Mohammadbagherzadeh and Terzi (2022) conducted a study on activity patterns around metro stations in Istanbul using Foursquare's POI data through KDE and K-means cluster analysis. Since their case area involves the Marmaray stations on the European side of the city, it is considered an important example in terms of both the case, methodology, and the results for comparison among the Marmaray stations on both sides. Lastly, Niu and Silva (2023) employed hotspot analysis on geo-tagged tweets from Twitter to explore spatial, temporal, and demographic patterns of urban activities, offering a comprehensive view of how different demographic groups interact with urban spaces.

In conclusion, this comprehensive exploration of urban research through LBSNs emphasizes the common use of density-based clustering methods for analyzing urban activity and mobility patterns. The studies reviewed in this chapter demonstrate a diverse context of approaches using geo-tagged data from various LBSNs, which has been instrumental in revealing complex patterns of urban life. The different applications of LBSNs in urban studies underscore their potential in shaping our understanding of urban environments and make them an invaluable tool in the realm of urban research.

Table 1. Studies of activity and mobility patterns inference from geo-tagged social media

Studies	Research focus	Data source	Data used	Method/ Algorithm
Liu et al. (2014)	Intra-urban trip patterns and spatial interactions	Weibo	Check-in data	Gravity model and PSO
Hasan et al. (2013)	Activity and mobility patterns	Foursquare and Twitter	Foursquare check-in data posted in Twitter	KDE and statistical distribution analysis
Hasan et al. (2014)	User-specific activity patterns	Twitter	Geo-tagged tweets	LDA
Zhou and Zhang (2016)	Activity intensities in temporal context	Twitter and Foursquare	Geo-tagged tweets and their category links to Foursquare	Hotspot and spatial clustering analyses
Zhou and Xu (2017)	Spatio-temporal evolution of natural and social events	Twitter	Various features pf Twitter data	DBSCAN, KDE, sentiment analysis
Cui et al. (2018)	Temporality of frequently visited places	Weibo and survey	Check-in and survey data	DBSCAN
Yang et al. (2019)	Human mobility and activity patterns at group level	Weibo	Geo-tagged Weibo messages	Multiple spatial distribution analyses
Üsküplü et al. (2020)	Activity patterns of historical districts	Foursquare	POI and check-in data	Hotspot and spatial clustering analyses
Ebrahimpour et al. (2020)	Socio-geographic human mobility patterns	Weibo	Geo-located Weibo data	KDE and DBSCAN
Mohammadbagherzadeh and Terzi (2022)	Activity patterns around metro stations	Foursquare	POI data	KDE and K-means cluster analysis
Niu and Silva (2023)	Spatial, temporal, and demographic patterns of urban activities	Twitter	Geo-tagged tweets	Hotspot analysis

3. The case area: Marmaray stations

Istanbul, with a population exceeding 15 million according to TUIK (2022), is Turkey's largest city, covering an area of 5,461 square kilometers. These characteristics make Istanbul the most densely populated city in Turkey, with around 20% of the nation's population residing within its boundaries. The city is divided into two parts by the Bosphorus, with one side in Europe and the other in Anatolia. Throughout Istanbul's history, infrastructure and transportation projects have played a significant role in the city's expansion and have influenced its spatial and social aspects.

In this context, the Marmaray mass rapid transit railway system, one of the mega-infrastructure projects, enhances accessibility to activity spaces in its immediate vicinity. It has a total of 43 stations, spanning from Halkalı to Sirkeci on the European side (14 stations) and from Üsküdar to Gebze on the Anatolian side (29 stations). By focusing on the stations on the Anatolian side and the different types of venues around them, this research aims to gain insights into how social media data can provide evidence of urban spatial dynamics in response to transportation infrastructure (Figure 1).

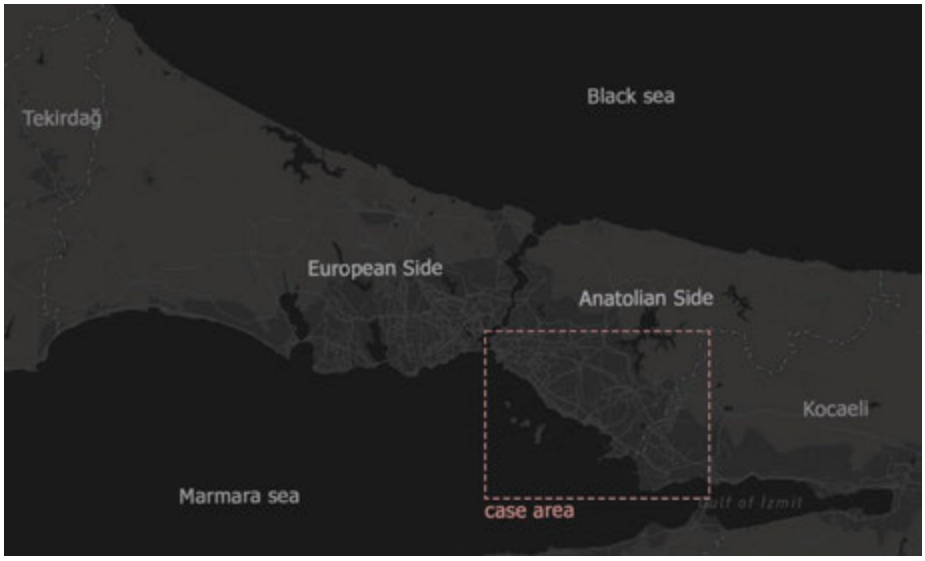

Figure 1. Location of the case area in Istanbul

4. Data and Methodology

This research focuses on integrating geo-tagged social media data, specifically venue data from Foursquare, to develop insights into the spatial dynamics around Marmaray stations through activity spaces and patterns. Accordingly, the methodology of this research comprises three sequential phases with two main analyses (Figure 2):

- Data Collection: Retrieving the data through the use of Social Network's Application Programming Interface (API) for the analyses.

- Kernel Density Estimation: Revealing the spatial distribution of venues/activity spaces' density.
- K-means Cluster Analysis: Evaluating the clustered characteristics of the stations

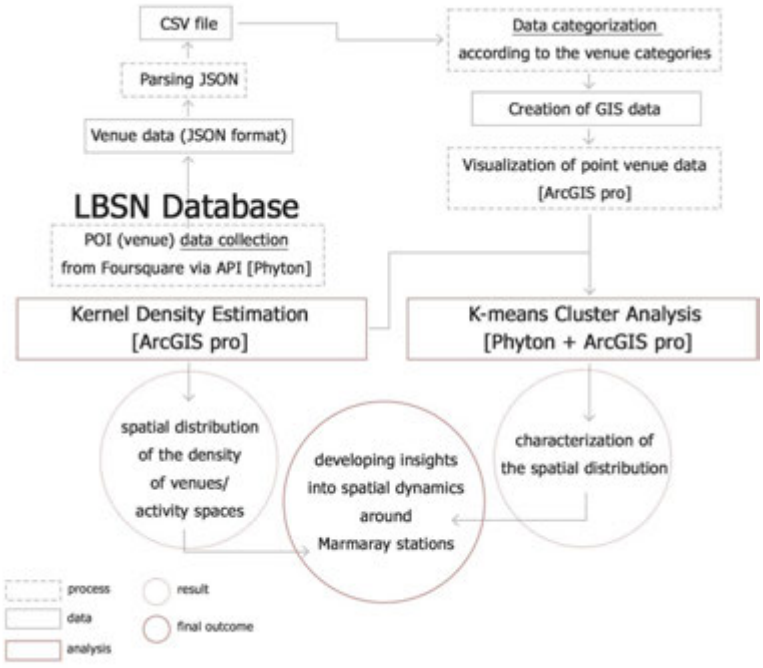

Figure 2: Flowchart of the research design

4.1. Data Collection

As part of this research, venue data from Foursquare—a location-based social network—was employed due to its easily manageable content, inclusion of geographical information, and public accessibility for researchers. To gather venue data within a 500-meter radius of 29 Marmaray stations, a search query was executed through an API, which is an interface that enables users to integrate with data from various social media platforms, using the Python programming language.

Since the Foursquare Public Search API allows a maximum of 50 venues per a single search, the search radius was progressively expanded from 50 to 500 meters in increments of 50 meters. Consequently, the search was conducted ten times for each category. The Foursquare categories searched include: Arts and Entertainment, Dining and Drinking, Landmarks and Outdoors, Retail, Sports and Recreation, Business and Professional Services, Community and Government, Health and Medicine, and Travel and Transportation. The resultant dataset includes venue points with details such as venue ID, venue name, location (latitude and

longitude), category name/id, and sub-category name/id. Duplicated venue points within the overlapping search radii were removed based on their venue IDs, resulting in a total of 4,566 unique venues. The dataset, encompassing nine categories as shown in Table 2, was converted from JSON format into a CSV file for data analysis in ArcGIS.

Table 2. Distribution of the searched categories

Venue Categories	# of venues	% of venues
Arts and Entertainment	344	7.53 %
Dining and Drinking	1939	42.46 %
Landmarks and Outdoors	315	6.90 %
Retail	1686	36.92 %
Sports and Recreation	192	4.21 %
Business and Professional Services	76	1.66 %
Community and Government	6	0.13 %
Health and Medicine	7	0.15 %
Travel and Transportation	1	0.02 %
ALL	4566	

4.2. Data Analysis

In the data analysis process, two main analyses were conducted: Kernel density estimation and K-means cluster analysis, respectively.

4.2.1. Kernel Density Estimation

As mentioned earlier in the literature review chapter regarding its application in urban research, KDE is a widely used method in spatial analysis. It is employed to create a continuous density surface that visualizes the spatial clustering of point or line features in a two-dimensional space (Wilson and Gerard, 2019). To generate a smooth curve within the venue dataset obtained from Foursquare and identify the most significant densities in ArcGIS Pro, several steps were taken. First, the categories "Community and Government, Health and Medicine, Travel and Transportation" were excluded due to their limited venue data. The point venue data from the remaining six categories were mapped in ArcGIS Pro, as illustrated in Figure 3, with the Marmaray line divided into four sections to provide a more detailed view of distribution. Subsequently, KDE was applied to all venues and separately to venues within these six categories (Figure 5).

4.2.1. K-means Cluster Analysis

The K-means algorithm is well-known for its ability to cluster data into n groups, each with approximately equal variance, while minimizing a measure called inertia or the sum of squares within each cluster (Jain et al., 1999). In this direction, to categorize and comprehend the types of activities and their distribution across different stations, the Python library Scikit-learn was

used for K-means cluster analysis. Within the scope of this research, the results of the elbow method, using inertia, were more suitable, with the optimum cluster value (k) being determined as four (Figure 4). The clusters were then visualized in ArcGIS Pro (Figure 6), and the results were evaluated further.

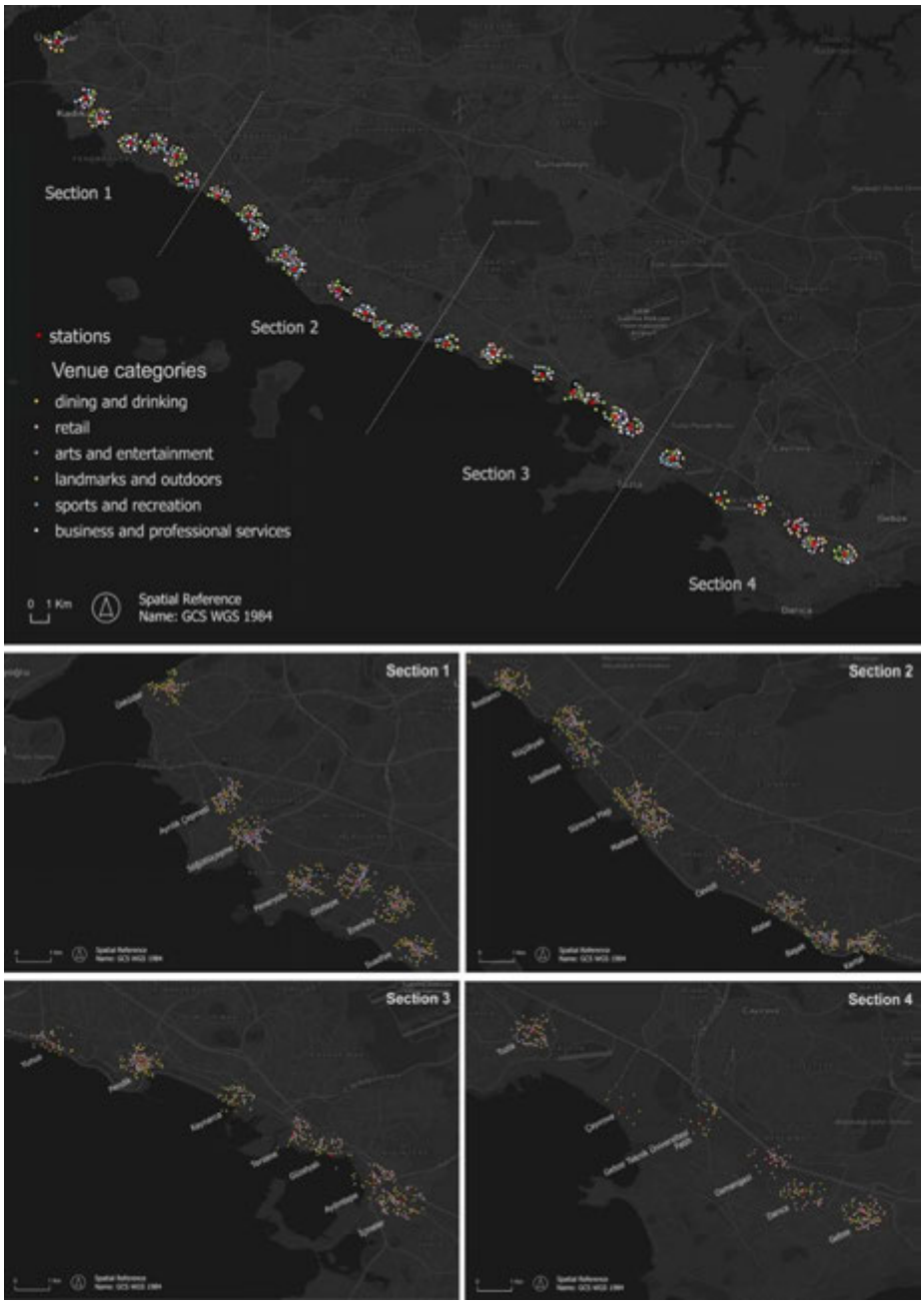

Figure 3. Visualization of point venue data

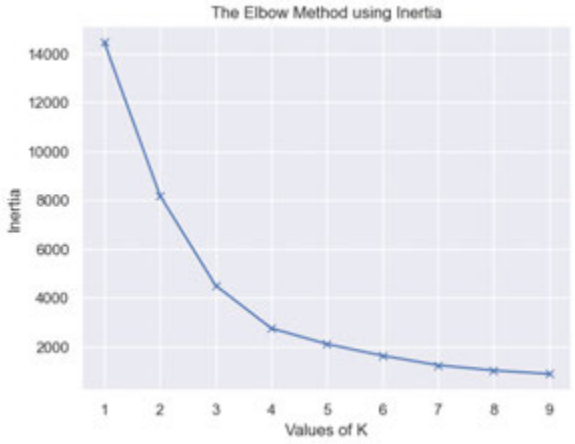

Figure 4. Optimum cluster value (k) according to Elbow Method

5. Results and Discussion

In this chapter, the results and the further discussion are presented in two parts: distribution, and clustered characteristics of activity spaces around Marmaray stations, as parallel to the data analysis.

5.1. Distribution of activity spaces/venues around Marmaray stations

The results indicate significant venue densities around several stations, including Ayrılık Çeşmesi-Söğütlüçeşme in Kadıköy, Göztepe-Erenköy, Küçükyalı-İdealtepe, Süreyya Plajı-Maltepe, and Başak-Kartal. Conversely, venues around Gebze Teknik Üniversitesi/Fatih and Çayırova do not form any significant densities.

Arts and recreation venues create notable densities along the stations Ayrılık Çeşmesi, Söğütlüçeşme, Feneryolu, Göztepe, Erenköy, Suadiye, and Başak-Kartal. Dining and drinking venues show remarkable densities from Göztepe to Maltepe, with the highest concentration at Maltepe. Subsequently, high densities are observed at Ayrılık Çeşmesi and Başak-Kartal. Landmarks and outdoor venues form significant densities at Küçükyalı-Maltepe, Başak-Kartal, and Göztepe-Suadiye. Retail venues show the highest densities at Göztepe-Suadiye, followed by Pendik and İdealtepe-Maltepe. Sports and recreation venues form significant densities at Atalar-Kartal, İdealtepe-Maltepe, and Feneryolu-Suadiye. Lastly, business and professional service venues create significant densities at Güzelyalı-İçmeler and in the areas around Söğütlüçeşme-Göztepe, Kartal, and İdealtepe (Figure 5).

Considering the density distribution of venues along the entire Marmaray line on the Anatolian side, retail venues, while forming significant densities at certain stations, are relatively more evenly spread across all stations. Additionally, a noticeable decrease in dining, drinking, and sports and recreation venues beyond the Pendik station highlights a distinct shift in venue density, giving Pendik and similarly Tuzla stations a unique character compared to other stations. When these results are compared with the existing study by Mohammadbagherzadeh and Terzi (2022), despite differences in venue categories and analysis processes, similar

concentrations of retail venues at stations like Göztepe and Suadiye show high density of shop and service venues found around the Sirkeci station. Furthermore, the European side exhibits strong densities of outdoor and entertainment venues at stations like Sirkeci, Bakırköy, and Ataköy, reflecting a pattern similar to that of the Anatolian side's clusters around stations like Küçükyalı-Maltepe and Göztepe-Suadiye. These similarities in findings underscore the need for a more comprehensive evaluation of all the stations along the entire Marmaray line, including the European side.

5.2. Clustered characteristics of activity spaces/venues around Marmaray stations

The K-means cluster analysis of activity spaces around Marmaray stations, as shown in Figure 6, has categorized the stations into four distinct clusters, each demonstrating unique characteristics in terms of venue distribution. The statistical distribution of venue categories for each cluster is also presented in a boxplot (Figure 7).

Cluster 0, comprising five stations (Cevizli, Pendik, Tersane, Aydıntepe, and Osmangazi), which constitute approximately 17% of all stations, has predominantly a retail-based character, with a considerable number of dining and drinking venues. These stations likely serve as local commercial hubs.

Although their characters are different, clusters 1 and 3 are the closest clusters to each other in terms of the number of stations they have. Cluster 1, with 13 stations (Söğütlüçeşme, Feneryolu, Göztepe, Erenköy, Küçükyalı, Maltepe, Başak, Kaynarca, Güzelyalı, İçmeler, Tuzla, Darıca, and Gebze), accounts for approximately 45% of all stations. In this cluster, retail and dining and drinking venues show a balanced distribution. Cluster 2, with only one station, Çayırova, features limited dining and drinking, landmarks and outdoors, sports and recreation, and lacks arts and entertainment as well as business and professional services. This cluster represents unique characteristics, possibly indicative of a less developed area in terms of urban functions.

Cluster 3 includes 10 stations (Üsküdar, Ayrılık Çeşmesi, Suadiye, Bostancı, İdealtepe, Süreyya Plajı, Atalar, Kartal, Yunus, and Gebze Teknik Üniversitesi/Fatih), making up approximately 35% of all stations. This cluster is predominantly characterized by dining and drinking venues, followed by retail, indicating vibrant commercial and social life. Overall, arts and recreation, landmarks and outdoors, sports and recreation, and business and professional services venues do not have significantly impact cluster formation and show a relatively balanced distribution, except for cluster 2 as an outlier. Therefore, the clusters are primarily characterized by retail, and dining and drinking venues.

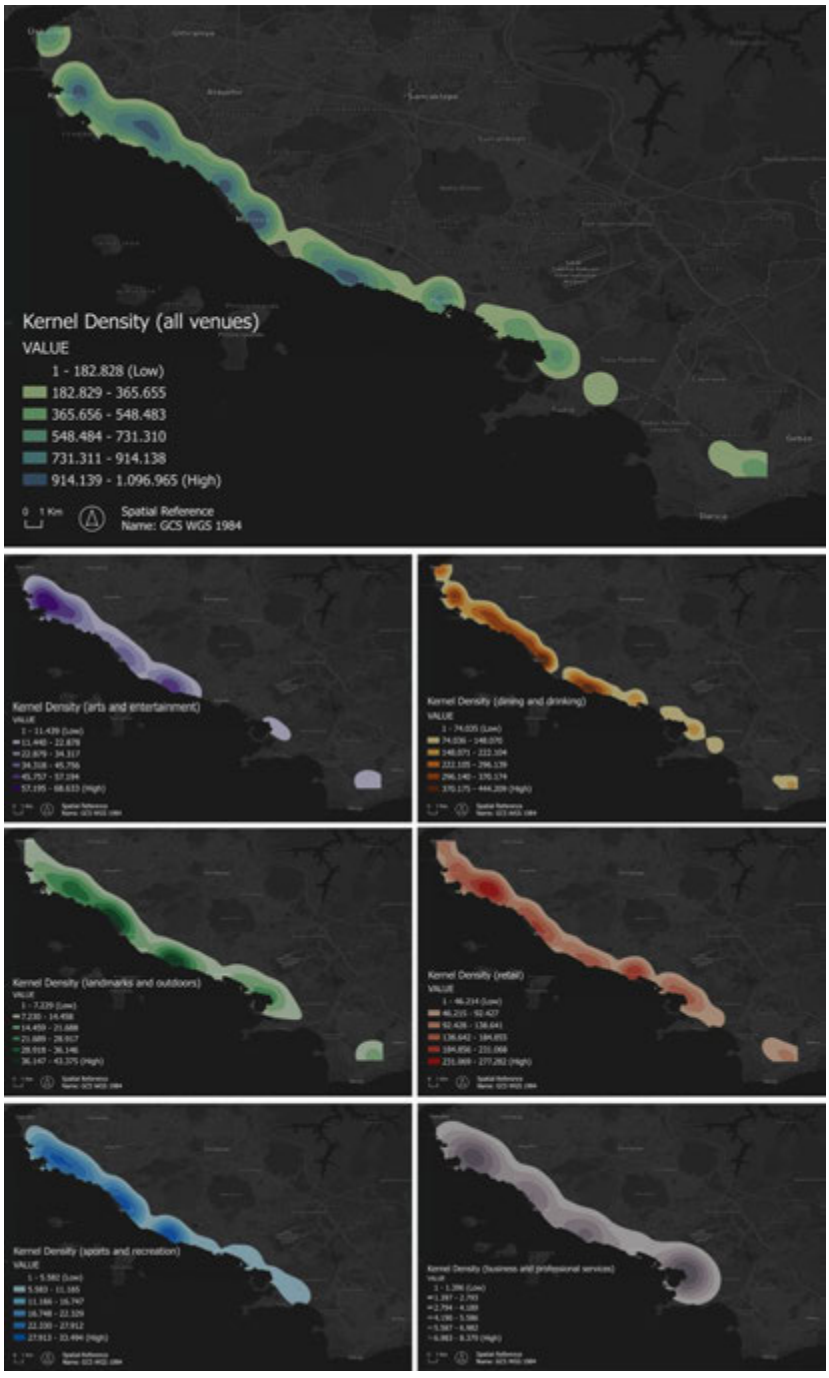

Figure 5. Distribution of the activity spaces around the stations

Figure 6. Clustered characteristics of activity spaces around the stations

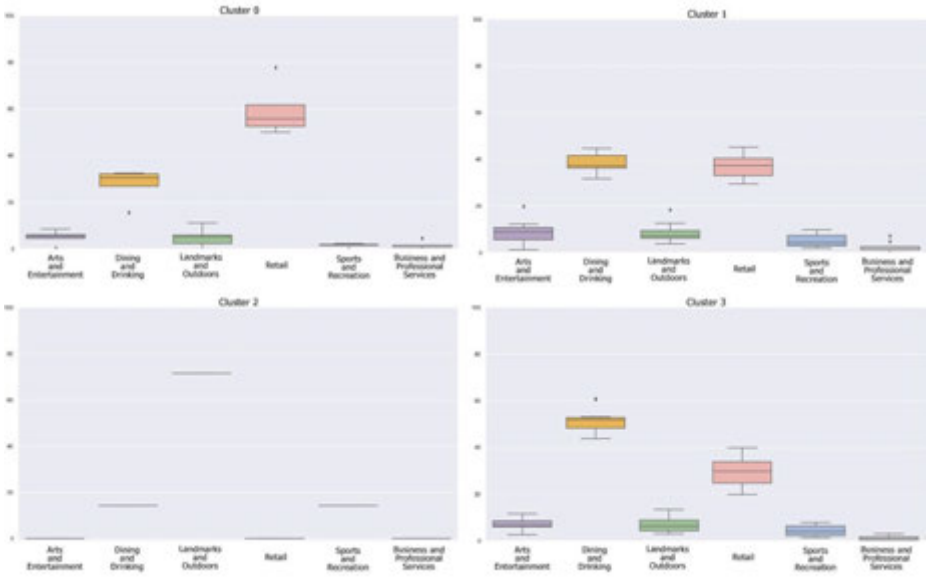

Figure 7. Distribution of categories for each cluster

6. Conclusion

The expansion of public transportation in large cities, particularly the role of transportation hubs like the Marmaray stations in Istanbul, is critical for sustainable urban development and reducing traffic congestion. These hubs are central to accessing nearby activity spaces, yet there is a knowledge gap in understanding their relationship with human mobility and activity patterns through different data and methodologies. This study addresses this gap by using Foursquare venue data to analyze the spatial distribution of activities around these stations.

The findings reveal significant densities of various venues around specific Marmaray stations, with notable clusterings in the characterization of these densities. For instance, cluster 0, including stations like Cevizli and Pendik, predominantly features retail activities. Cluster 1, with stations such as Söğütlüçeşme and Göztepe, exhibits a balanced mix of retail and dining venues. On the other hand, cluster 3, including stations like Üsküdar and Bostancı, is marked by a strong presence of dining and drinking venues and indicates areas with vibrant commercial and social life. These examples demonstrate how clusters differ in their urban function characteristics and the valuable insights offered by LBSN data into urban research more broadly (Dunkel, 2015). This data allows for precise estimation of geographic densities at both global and local scales and facilitates geographic clustering to identify areas with similar characteristics.

However, while the data used in this research was publicly accessible, challenges such as access to, reliability, and management of LBSN data can pose significant limitations. Particularly in this research, findings highlight the need for a more comprehensive evaluation of all stations on the Marmaray line, including those on the European side. Moreover, the study currently focuses only on the spatial dynamics formed by activity spaces. Future studies could extend to include social, perceptual, and/or temporal dimensions to thoroughly discuss urban dynamics, considering the potential of LBSNs in these dimensions. These points as limitations of the current research can also provide clues and direction for future studies.

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Track 17: Risks

RISKS - Planning for adaptive capacity: disasters, uncertainty, long-term problems, preparedness and responsiveness

Chairs:

- Lionel Prigent, Université de Bretagne occidentale
- Ward Rauws, University of Groningen
- Daniel Zwangsleitner, TU München
- Rumeysa Ceylan, Istanbul Teknik Üniversitesi

Keywords: *crises, long-term transformations, urban and territorial planning, uncertainty, public policy evaluation, pandemic, flooding, water management*

A crisis or an accumulation of crises? Which crisis(es)? For a long time now, the word has seemed empty, tired of being used to justify a widening gap between promises of development on the one hand and the stark reality that nothing is going according to plan. There is always a trigger for crises, a primary cause deemed paramount that causes events to fall (Walter Benjamin). It is a war that triggers an oil crisis, a speculative bubble that bursts, a virus that spreads, a storm that breaches a dyke and causes flooding… a shock that can be localised or global, with significant consequences in a circumscribed area or worldwide. However, this explanation of the root cause overlooks the regular waves of transformation that herald the rise of perils. The more perceptible signals of climate disruption and resource depletion are all warnings. The crisis, intended to be brutal and sharp, is then stretched out into a slow slump that feeds the comments of declinist experts and essayists.

Are we still in crisis? Or are we in the midst of a long and profound transformation that affects every aspect of our ordinary lives: our social ties, our relationship to the body and gender, and our historical, economic and geopolitical reading? So much for the social fact; our relationship to the planet, to territories, to ecosystems, to biodiversity and to life itself, for what concerns our relationship to the Earth.

This task invites contributions on the topic of Risk, namely on planning for adaptive capacity. For instance, proposals can deal with topics like the conditions and limits of planning, uncertainty in collective decisions and radical uncertainty, emergent crises like the recent pandemic, environmental disasters like flooding, etc.

Propositions are welcomed that shed light on theoretical principles, methodological approaches and empirical work. They can address, for instance, questions like: Given that we now face long-term transformations, how can we organise and pool our capacities to mitigate the consequences of our daily lives and adapt our practices? How can we even retain the ability to define common objectives instead of being tossed about like corks on the water? How can we express and prioritise, organise and adapt our systems (economic, institutional or social) to cope

with the disaster, the evil that is coming (Pierre-Henri Castel), without abandoning the conditions of fulfilment, solidarity, freedom and transparency that forged our present. How can we express the problems that are already there or will be there in the future, perceptible in the long term and the context of diplomatic, economic and health uncertainties and threats? How can we finally take action on the ground? How can we define planning that will be useful in times of storm, i.e. capable of identifying our capacity to adapt? What diagnoses can we make, and what lessons can we learn? What tools can we use to overcome the uncertainties? Finally, is there a dimension required to carry out this planning?

Resilience building of tourism villages confronting COVID-19 in China's Metropolitan Hinterland: Evidence from Shanghai Metropolitan Area

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*Supported by the National Natural Science Foundation of China "Characteristics, mechanisms and planning strategies of multifunctional evolution of rural areas in the hinterland of metropolitan areas—taking the Shanghai-Sujiahu area as an example（No. 52378071）"

Abstract
Most villages in the world are facing the test of transformation and revitalization in the process of globalization and urbanization. China's "rural revitalization" strategy has allowed rural tourism to flourish, but it has been greatly impacted by COVID-19. How to enhance resilience in response to public health events has become a topic worthy of in-depth study. Therefore, our study takes Guzhu Village in the suburbs of Shanghai, a tourist village that has overcome the epidemic and gained resilience, as the main case. Our research provides a theoretical framework for enhancing rural resilience on a global scale, aims to contribute to the revitalization and recovery of rural tourism during or after crisis events and provides an empirical approach to rural industry transformation, upgrading and sustainable development.

Key words
Resilience, socio-ecological system, tourism village, COVID-19, Shanghai Metropolitan Area

1 Introduction

As globalisation deepens, the relationship between rural and urban areas is becoming increasingly close, and more and more factors of production are flowing from rural to urban areas, thus aggravating the problem of rural population loss and economic decline(Woods and M., 2007,p.485-507). As a matter of fact, the decline of the countryside has become a global problem, and the transformation and revitalisation of the countryside cannot be delayed(Carr and Kefalas, 2010,p.30-34). Since the 1950s, the countryside in developed countries such as the UK and the US has undergone significant changes and reconstruction in the context of urbanisation and counter-urbanisation, showing a shift from productivism to post-productivism(Wilson, 2001,p.77-102). For China, over the past four decades, it has experienced rapid industrialisation, urbanisation and modernisation, and the rural territories have been more and more significantly affected by urban development, and the traditional countryside, with its single agricultural function as the main mode of production, has undergone unprecedented changes(Tu and Long, 2017,p.1169-1184). Especially in the developed areas of China's eastern seaboard and the villages around big cities, the transformation of farmers' lifestyles has been driven by the transformation of production methods, and industries such as cultural tourism, recreational and healthcare experience, farmhouse, and B & B (bed and breakfast) have been incubated and rapidly developed in this context. These villages also experienced greater disruption and negative impacts during the COVID-19 period due to the increased integration of rural livelihood activities into the market economy(Hickey and Toit, 2007,p.).

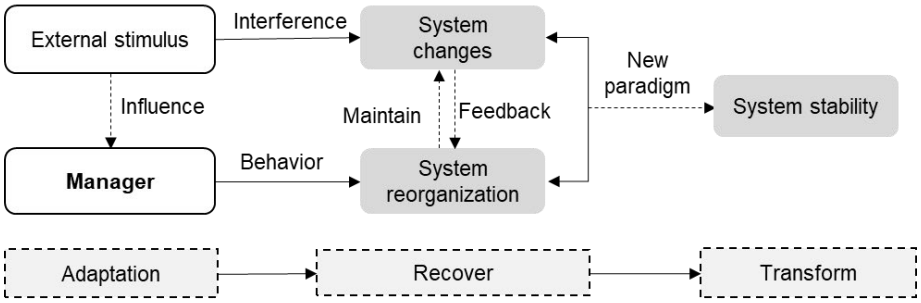
The COVID-19 outbreak made us realise that any localised public health event can spread rapidly across the globe with the movement of people and goods, with serious impacts on national economies, social security and individual health. Shanghai, China, as one of the most representative metropolises in China, has direct or indirect socio-economic links with the hinterland countryside, and the role of urban-rural relations is the strongest(Gu et al., 2019,p.102041).During COVID-19, in order to safeguard the lives of the city residents, the epidemic prevention system set up in Shanghai cut off to a greater extent the links with the neighbouring areas, including the rural areas that received the radiation from Shanghai, and their economies were affected in a comprehensive manner(Bartik et al.). In addition, due to the sensitivity and vulnerability of the tourism industry, its defences against such public crises were relatively weak and it was hit harder than other industries(Gssling et al., 2021,p.). The spatial isolation between Shanghai and the countryside has caused the rural tourism industry to be hit hard, and the B&B industry, which relies on tourism for its survival, has been hit by a cliff, with a large number of rural B&Bs going out of business or even closing down. However, some tourism-based villages survived the impact of COVID-19 and transformed into more resilience-based sustainable development strategies under the catalyst of COVID-19, which triggered more in-depth research and discussion on the rural tourism model and the mechanism of rural resilience(Wang et al., 2024,p.400-421).

Our study focuses on the rural areas in the hinterland of the Shanghai metropolis, and selects Guzhu Village, a tourist-oriented village that survived the epidemic and has the ability to recover, as a case study. We explore how the tourism industry in the rural areas of the Shanghai hinterland experienced and adapted to the economic shock caused by COVID-19, and in the process constructed a resilience mechanism for the rural socio-ecological system. Field surveys, questionnaires and semi-structured interviews are used to answer the question of the resilience construction mechanism and the role of the subject in Guzhu Village after the epidemic impact.

2 Literature Review

2.1 Rural Resilience In Socio-ecological System

Resilience is the ability to retain basic functions in a destructive state and to return to a state of equilibrium after the destruction. resilience undergoes the stage of 'engineering resilience - ecological resilience - evolutionary resilience'. "The recovery path of evolutionary resilience is derived from the evolutionary trajectory of socio-ecological systems (SESs), which are coupled systems of human social systems and natural ecosystems. It is generally believed that the evolutionary trajectory of socio-ecological system has two cycles and four stages(Holling, 1986,p.). Among them, the growth phase (R) and the conservation phase (K) constitute the first slow, cumulative cycle of positive looping, and the collapse and release phase (Ω) and the reorganisation phase (α) constitute the second unpredictable cycle(Gunderson and Holling, 2003,p.). In the study of socio-ecological system, adaptation, recovery and change are three attributes that characterise the evolutionary trajectory of socio-ecological system. Among them, adaptation can be understood as the behavioural activities of managers in human societies, whose decisions and behaviours consciously or unconsciously affect the resilience of the socio-ecological system, and change is the introduction of new components and ways of making a living based on restoration, which defines and creates a new stable state (Figures.1) . Therefore, the essence of socio-ecological system resilience evolution resilience construction is the capacity building of the evolutionary process and circular mechanism of the socio-ecological system.



Figures.1 Building socio-ecological system resilience

Source: Author's own drawing

Rural areas are more vulnerable to shocks and have a weaker resilience than regional and urban areas because they lack the necessary financial and human resources to plan and respond to emergencies(Ge et al., 2022,p.14533). The concept of rural resilience emphasises that rural areas are adaptive, resilient and transformative, moving from decline to regeneration as they interact with their internal and external environments(Huang et al., 2018,p.47-55). Rural areas that interact more frequently with the market economy and have more social and environmental capital are generally considered to have stronger resilience. The village is a component of socio-ecological systems (SESs), in which humans, natural resources and the environment interact at multiple spatial and temporal scales, and the socio-ecological system plays an important role in providing material and non-material support for villagers' production and life(Cheng et al., 2022,p.645-661). Rural resilience played an important role in the COVID-19 shock, and despite the spatial isolation of rural areas in China as a result of the restrictive measures implemented during COVID-19, there are still parts of the countryside that have the governance system, social effectiveness, physical and technological infrastructure, and economic flexibility to organise the flow of local commodities to meet emergency needs(Hu and Zhang, 2022,p.). Most academic studies on the impact of COVID-19 on rural China view resilience as a cross-sectional state, and few studies have explored the process and trajectory of resilience in terms of its formative elements and constructive mechanisms, which require a certain amount of time to follow up. Compared with large-scale tracking surveys, micro-case studies of tourism villages can better illustrate the process and operational mechanisms of resilience. Therefore, it is necessary to study the resilience of the socio-ecological system in the villages that recovered quickly and operated normally after the impact of the epidemic, as to provide theoretical support for the construction of rural resilience in the post-COVID-19 era.

2.2 Social Capital In Rural Governance

Unlike traditional management, governance refers to the process by which public management organisations, whether official or non-governmental, coordinate and cooperate in defining norms and rules for the conduct of public affairs on the basis of common goals(Modelski and George, 1993,p.311-545). Traditional top-down rural governance is no longer suitable for the existing multifunctional rural environment, and flexible multi-participant collaborative models provide adaptive capacity to manage complex rural socio-ecological systems by increasing the economic capital of the system and strengthening industrial linkages. Adaptive governance provides better opportunities for decision-making structures, long-term social welfare and sustainable economic development(Rivera-Arriaga et al., 2021,p.105518). In China, the

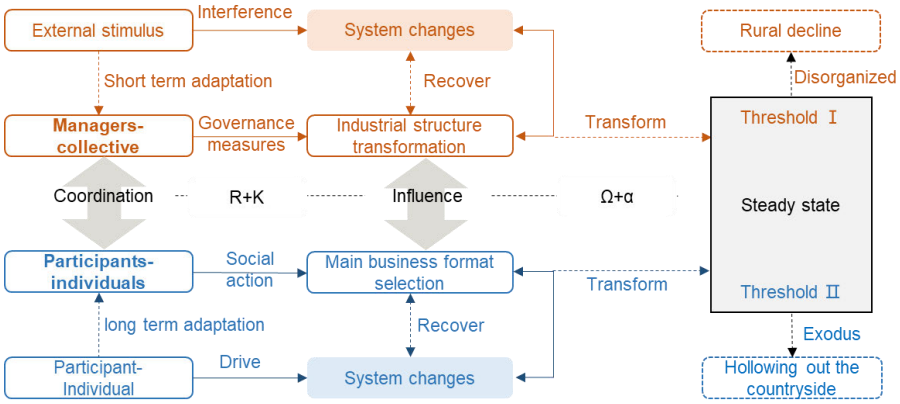
governance system is characterised by a combination of political centralisation and economic regional decentralisation. As rural revitalisation is regarded as a national policy, local governments with the intervention of state power have the right to directly lead, encourage farmers to organise themselves, and promote the participation of enterprises in projects. With the progress of modernisation and the extension of state power to the countryside, grassroots governance in Chinese villages has been transformed from folk clan power to a long-term political-administrative model of governance(Yin and Rui, 2023,p.8882), resulting in the formation of a particularly informal administrative body, the village committee. As local (grassroots) administrators, they can not only ensure the implementation of the work of the state in the countryside, but also promote the stability of the order of the socio-ecological system in the countryside(Ye et al., 2019,p.). In the process of transformational development of villages, village council administrators may have less authority and influence over their residents, but they play a key role in adversity in the face of risky shocks(Liu and Yang, 2019,p.5553).

Due to the characteristics of China's countryside, such as low population mobility and small regional scale, the formation of an acquaintance society is not conducive to the vertical decentralisation of state power for administrative organisations to solve rural governance problems(Hu, 2020,p.012077). Social capital, as an important type of informal system, serves as a lubricant between institutions and the public, and can reduce the transaction and implementation costs for the government to promote and implement policies and regulations(Evans, 1996,p.). At the same time, because villagers have the same identity perceptions, values and emotional perceptions, they interact with each other to participate in public events, and reciprocity or constraints are formed between participants and administrators in order to reduce costs and difficulties, which can improve rural environmental governance(Wang and Li, 2018,p.46-55). Positive and responsive attitudes in this process can effectively improve the relationship between participants and managers to better conduct public affairs and accumulate social capital in the process(Coles and Buckle, 2004,p.6-15). The role of social capital in the socio-economy is accentuated by the lag in the development of formal institutions in the countryside. Social trust provides a structural basis for the formation of social networks and the occurrence of social participation that provides mutual benefits, a process that is conducive to the implementation of public policies and the accumulation of social capital(Wang et al., 2021,p.11883), which provides social, economic, and human resources to withstand a variety of natural disasters, and is an important contributor to the construction of rural resilience(Vesely et al., 2017,p.93-110). The specificity of Chinese rural social capital provides different perspectives for the study of rural resilience, and has outstanding theoretical value and practical significance in enhancing the resilience of rural areas to cope with internal and external perturbations, and thus resolving the impacts and crises of the internal and external environments(Ge et al., 2022,p.14533). Previous studies have mainly focused on the direct causal relationship between rural social capital and resilience and how to use social capital to build resilience, but under the cycle of rural social system, the construction of rural resilience is actually a synergistic effect of multiple elements. Therefore, the interaction and synergistic paths of different elements in the process of building rural socio-ecological system resilience deserve further research and exploration.

2.3 Research Framework

Based on the above discussion, we propose an analytical framework for rural socio-ecological systemresilience(Figures.2). In order to better adapt to the rural governance and social capital context, we add the participant dimension to the original manager dimension, and analyse them as the action subjects of rural governance and rural social capital respectively, to reveal the process of constructing RESILIENCE for the two dimensions of rural subjects under the micro

perspective. Among them, synergy is reflected in the fact that the adaptive governance and participation model of rural socio-ecological system can enhance social capital accumulation. Local managers use the interactive bridge of social capital to connect villagers for the exchange of information and resources, gluing together village functions and social networks, and helping to develop measures and approaches to promote environmental governance and improve resistance to public disaster events. The accumulation of social capital can promote villagers' participation in grassroots governance, and good social network relationships can enhance social trust among villagers. Positive social participation can improve the relationship between participants and grassroots managers, promote the development of new ideas, create the necessary flexibility for ecosystem interactions, and deepen the understanding of socio-ecological system resilience.



Figures.2 Research Framework

Source: Author's own drawing

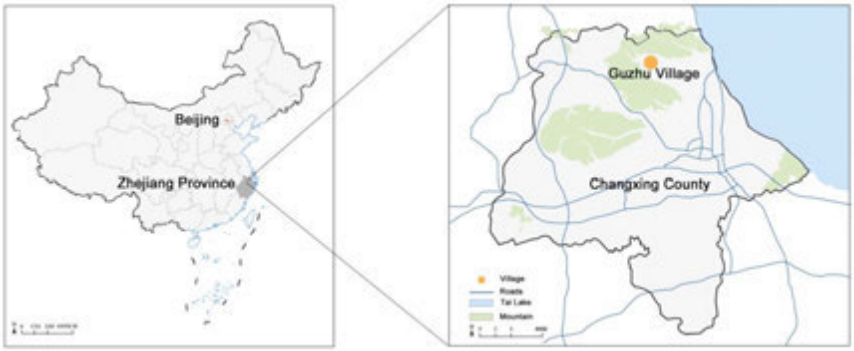
3 Research Design

3.1 Study Site And Representativeness

Guzhu Village is located in Changxing County, Huzhou City, northern Zhejiang Province, China (Figures.3). Although the variety of village resilience models that survived COVID-19 makes it seem impossible to generalise, our case village represents a metropolitan hinterland tourism-based village, which should be applicable to many rural socio-ecological system resilience constructs for the following reasons:

Firstly, the selected villages are representative of rural tourism, with a relatively well-established farmhouse tourism cluster before COVID-19, and a good base of rural governance and social capital. This is also more relevant to the village's location in Zhejiang Province, which is located in the eastern coastal region of China, in the Yangtze River Delta economic frontier circle. after 2002, rural tourism in Zhejiang Province entered a period of rapid development. Guzhu Village is one of the largest rural tourism clusters in the Yangtze River Delta region, and the farmhouse tourism industry has been evergreened for 20 years. Secondly, Guzhu Village farmhouse is spontaneously formed, due to the village's geographical location and convenient traffic. The straight line distance between Guzhu Village and the urban area of

Shanghai is about 160 km, the straight line distance between Guzhu Village and the urban area of Hangzhou, the capital city of the province, is about 100 km, and the straight line distance between Guzhu Village and large and medium-sized cities, such as Nanjing, Suzhou, and Wuxi, is not more than 150 km. Guzhu Village has developed rapidly to form an industrial cluster by virtue of its characteristic industries and transport advantages, and in the process, the government has maintained benign interactions with the operation owners, owners and customers, and owners among owners. In the process, the government and business owners, owners and customers, as well as the owners maintain a positive interaction, showing a more ideal sustainable state of the village.



Figures.3 The geographical location of Guzhu Village

Source: Author's own drawing

3.2 Research Methods

Our research team conducted a field survey of Guzhu Village in 2023, mainly using field surveys, questionnaires, in-depth interviews, and other research methods, distributing research questionnaires to local villagers and tourists, and conducting semi-structured interviews with the main participants in the local farmhouse tourism industry. The research questionnaire was conducted from the dimensions of basic crowd information, family livelihood, spatial environment, rural governance, rural tourism pension, rural resilience, social perception and before and after the epidemic. Interviews were conducted from both groups of managers and participants. The interview process also observed the impact of rural planning on living, production and ecological space.

4 The Evolution Of Farmhouse Tourism Before And After The Epidemic

4.1 Pre-Epidemic: The Growth And The Conservation

Guzhu Village's initial leading industry was the textile industry, where villagers used unused farm buildings for weaving, which not only required 24/7 production, but also earned extremely low processing fees. With the small scale and low income, the farmers lacked the freedom of decision and choice. 1993, a retired Chinese medicine practitioner, Wu Ruian, established the first rehabilitation and convalescent centre for the elderly in Guzhu Village - the "Shenxing Rehabilitation and Nursing Home", which attracted a large number of elderly people from Shanghai to recuperate here. Due to the increase in traffic and the shortage of rooms, villagers in the neighbourhood began to rent out their own farmhouses for the elderly to use. The villagers

realised the business opportunities and in 2000, the first local villager-run farmhouse, Wang Ta Zhuang, was born. As the entry threshold for farmhouses is not high, and farmhouses are relatively easy to run compared to 24-hour looms, local residents have since followed suit, and the development of farmhouses has gradually become a trend.

After 2005, the number and size of Guzhu Village farmhouses grew dramatically. By 2014, the 325 B&Bs in Guzhu Village had received 2.5 million visitors in a year, 80 percent of whom came from Shanghai, making it a well-known "Shanghai Village". After 2015, after a period of growth in the number of dramatically increased, the market competition has become more intense, monotonous, crude farmhouse business model has gradually failed to meet market demand. As the farmhouse tourism industry enters a stable development stage, the production resources of the socio-ecological system are gradually locked, and the system matures with the inevitable rigidity, and the flexibility and resilience of the system will gradually decrease. Specific manifestations include product quality and economic service level failing to keep up, serious homogenisation, lack of public support services, and the need to improve the hygienic environment. Many farmhouse operators began to seek business philosophy innovation and quality enhancement, township government, village committees and other managers combined with the comprehensive improvement of the overall environment to carry out comprehensive renovation and upgrading of the farmhouse in the business environment and quality of service and other aspects of the overall transformation. They rely on farmhouse industry associations to establish and improve industry standards and boost the transformation and upgrading of farmhouses to boutique B&B.

'With regard to the rectification and upgrading of farmhouses, we have carried out the following work: strengthening the rectification of farmhouse food safety, fire safety and security safety. Concentrate on farmhouse environmental hygiene and improve public supporting facilities. Standardise the level of farmhouse services and improve the quality of farmhouse space. Establish farmhouse long-term management mechanism, etc. (Township government staff)'

4.2 Post-epidemic: The Release And Reorganisation

Guzhu Village farmhouse was at the bottleneck stage of industrial development from scale expansion to quality upgrading, and despite the manager's governance measures, little was achieved. Because renovation and upgrading meant a phased closure of the business, which greatly affected the owners' income, the emergence of COVID-19 turned things around. In fact, the impact of the epidemic on Guzhu Village was so great that in order to safeguard people's lives and property, the township government in which Guzhu Village is located activated a comprehensive emergency response plan as soon as the outbreak occurred, made the decision to shut down the entire industry immediately, and summoned all the village cadres, members of the industry association, and volunteers to take measures to prevent the epidemic.

During 2020-2022, in order to properly deal with the problem of migrant workers staying in the village during the epidemic and to improve the scenic quality and supporting facilities for rural tourism, the village committee's rural planning and spatial environment improvement introduced projects such as the Twelve Square of the Tang Dynasty and the Great Tang Nocturnal Street, and called on the stranded workers to form an engineering and construction team to push forward scenic area renovation (Figures. 4). The manager's governance measures address the problem of epidemic impact while providing new components for village change, laying a hardware foundation for resumption of work and production after the epidemic, further

enhancing the village's ability to resist external impacts, and establishing a long-term plan for the village's sustainable development.

'The next relevant planning, will continue in the village public space layout Lu Yu study, Huaxi Valley camp, the new visitor centre, style station, etc., and some tea culture supporting facilities for commercial business to do supporting space, including for some of the young people to Guzhu, the original market has been relatively complete, the subsequent supporting facilities are actually geared to the needs of other age groups. (Cultural Tourism Corporation staff)'

Figures.4 Guzhu Village Leisure Tourist Attractions

Source: On-site shooting and Internet

The construction and renovation of the rural scenic spot project has also led to the renovation and upgrading of 156 rural farmhouses and the construction of beautiful courtyards in three districts. The business owners did not stay in the vicious circle of homogeneous competition, and used the gap time of the epidemic to participate in the village collective skills training, for example, to carry out e-commerce operations, and to carry out the construction of beautiful courtyards and environmental improvement with the help of village committees and associations and organisations (Figures.5).

Figures.5 Skills training, beautiful courtyard construction, and farmhouse upgrades during the epidemic in Guzhu Village (from left to right)

Source: Information provided by the village committee

The cycle of the village socio-ecological system shifts from collapse to restructuring, and turning crisis into opportunity requires a great deal of preparation. In the case of Guzhu Village, the post-epidemic reorganisation was undoubtedly a success, thanks to the adaptive decisions and actions of managers and participants in the face of shocks, as well as to the participation of

the entire population through effective village planning, which prepared them for innovation and transformation in the face of uncertainty during a period of change.

5 Managers And Participants Of Rural Resilience Building

5.1 Adaptive Governance For Managers

5.1.1 The Main Body Of Governance Supports The Development Of The Industry

Although China has adopted a market-oriented development path, the allocation and supply of resources is manipulated by the government, and the Guzhu Village farmhouse tourism industry, although it has formed industrial clusters in which many operators and enterprises have joined, is essentially a village collective type of rural tourism. The village collective type of rural tourism mainly refers to the village to form the appropriate management organisation, the top-down implementation of unified marketing, management, training and supervision mode, the village tourism entities actively participate in it, abide by the rules and regulations of the village, enjoy the rights and interests therein. The support of the local government provided a favourable social environment for rural development, which played an effective macro-control role during the epidemic. The top-down vertical governance system in the implementation of the village collective rural tourism model can better discipline the behaviour of the villagers, integrate resources, and promote industrial transformation and upgrading. This governance model is also recognised by the villagers, with more than 75 percent of villagers believing that the "government" is the main body that supports the development of the tourism industry in Guzhu Village farmhouse.

'During the entire epidemic, the government does not allow crowds to gather, and do not allow mahjong, then we mobilise people to do volunteers, to skills competitions, to promote the construction of beautiful courtyard. At the same time, our government introduced support and encouragement policies, in fact, is to assist in equipping strategic materials, masks can not be bought, temperature guns can not be bought, disinfectant can not be purchased, whoever is doing a good job will be given priority to configure, to improve the overall owner's motivation. (Village Council staff)'

5.1.2 Association Organisation Drive The Implementation Of Decisions

Although the vertical governance body lays the policy foundation for rural industrial development, the implementation and practice of decision-making requires the collaboration and co-operation of many parties to ensure the positive cycle of the socio-ecological system, which is reflected in the existence of the farmhouse association organisation. As the members of the association are spontaneously selected by villagers, they have a foundation of social trust. They have established a social network with the villagers' owners and have a certain sense of identity and reverence. The association managers are willing to take the initiative to undertake the tasks assigned by the organisation, and the participants are also willing to respond positively. Although the association does not have administrative functions and management functions, but the village committee grants the association organisation certain power to maximise the interests of business owners, that is, to win the support of the masses, but also to carry out their work better. While the association promotes the implementation of decisions, it also seeks benefits for the participants, who are themselves farmhouse owners, understand the real needs of the participating groups at different stages, and have a certain degree of voice.

'For farmhouse scenic spot renovation and upgrading, many villagers are also reluctant at first. Then the village cadres, party members, association directors, villagers' representatives take the lead in the first demolition of the first change. For a part of the farmhouse owners who have ideas and concepts and urgently want to renovate and upgrade, we fully support them in terms of design, construction, funding, etc., to create samples, and driven by the samples, the villagers slowly began to renovate and upgrade on their own initiative (Association organisation staff)'

5.2 Social Capital Accumulation Of Participants

5.2.1 Family Business Promotes Social Trust And Reciprocity

The villagers of Guzhu Village are both managers and participants in the construction of the village's socio-ecological system resilience, and more often than not, they play a role in the system and accumulate social capital as participants. In addition, there are also hotel chains and fleet operators, who together with the majority of villagers constitute the group of participants. The family business model created by the participants, mainly farmhouse owners, lays the foundation for the creation of social trust and plays a crucial role in business transactions and daily life. Although this business model is small in scale, low in management, and weak in branding and competitive market influence, the bound social trust has not hindered innovation and adaptation, but on the contrary, has higher risk resistance and lower operating costs, and the flexible business model improves the resilience of system.

Farmhouse owners are getting younger, with an average age of 39.4, and are able to keep up with the times and develop diversified industrial businesses. Although most of the villagers are engaged in commercial services, they still choose to take care of their farmland privately and hire their relatives to do farming, accounting for 79.8 percent, which makes the villagers' incomes more diversified and affluent, and enables them to have enough economic basis to resist external shocks. This kind of family business model is restricted by the geographical location of the village, and is generally composed of villagers from the same village, who rely on the formation of an "acquaintance society" to attract new customers, which prevents the formation of "low-price competition" to a certain extent. The case of Guzhu Village proves the virtuous cycle of the family business model, and also serves as the basis of resilience building to ensure the stable operation of the system.

'In the operation process will also encounter some bottlenecks, for example, now more and more farmhouse well, competition is also more and more. But we are not afraid of competition, because we correspond to different consumer groups in different places, good relations between peers. Sometimes there are things in the family can not receive, other families have a lot of farmhouse ah, can be recommended to other people's homes. (Rural farmhouse operators)'

5.2.2'affectionate'aterelationships strengthen social networks

The patron-client relationship in general business transactions is an interaction based on the goods being traded, where both parties clarify their respective responsibilities and rights, and establish a good relationship of trust and co-operation in order to achieve common business goals. However, in Guzhu Village, after many years of receiving tourists, there is a high degree of integration between urban and rural civilisations, and a high degree of trust has been built up between the owners and the tourists, which goes beyond the relationship between the host and the hosted, and the social network formed as a result of this relationship is more close and intimate. This 'affectionate' relationship is also an important motivation for the transformation

of Guzhu Village into a B&B. On the one hand, the owners will listen to the suggestions of tourists to optimise their products and services, and on the other hand, the accumulation of social capital will increase economic efficiency.

'Having run a B&B for many years, I have kept in mind the points of need of our guests and have made it a point to refer to most of our regular customers. Also, because of this kinship, because of this trust, customers will lend us their savings interest-free to help us with remodelling and upgrading or investing in potential projects in the village. As far as I know, more than 60 percent of the operators in the whole B&B industry get part of their renovation funds from tourists. (Village boutique B&B operators)'

6 Conclusion

China's rural transformation has a different background from that of Western countries, and through the case of Guzhu Village, we can see the evolutionary trajectory and cyclical process of rural socio-ecological system resilience, which forms a better inspiration and paradigm for the construction of resilience in rural areas. Through the incident of COVID-19, our research has deeply explored the construction process and operation mechanism of rural socio-ecological system resilience, and formed the following conclusions.

First, farmhouse tourism provided new possibilities for economic activities in Guzhu Village, triggering an explosive growth of farmhouses. However, the outbreak of COVID-19 revealed the vulnerability of village tourism, and the stagnation of the industrial economy accelerated the collapse of the village socio-ecological system, which in turn catalysed the transformation and upgrading of the village. Second, managers effectively enhance rural resilience. adaptive governance by managers vertically integrates resources from different levels of government to support the operation of the rural socio-ecological system. Horizontal collaborative governance promotes the implementation of decision-making and assists clusters in adapting to external shocks and promoting system change. In addition, participants guarantee system stability. The family business model derived from the villagers as participants is the economic foundation of the farmhouse tourism industry, and the basis for the construction of socio-ecological system resilience, and the "affectionate" patron-client relationship constructs a two-way multi-node social network connection, realising social capital. The "affectionate" patron-client relationship constructs a two-way multi-nodal social network connection, realises the transformation of social capital into economic capital, and enables the system to have a stronger adaptive capacity.

Our case study reveals the construction process and mechanism of rural socio-ecological system resilience under the COVID-19 shock, but inevitably there are certain limitations, as there are many types of villages in China, and villages in the hinterland of the metropolis respond to the shock of public events such as epidemics in different ways, and the mechanism of their resilience needs to be revealed by more extensive research. In future research, we will explore the resilience patterns of villages in other regions.

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Reflection and Prospects on Data Sources, Management, and Application in Chinese Smart Cities from the Perspective of Platform Urbanism

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Abstract

Smart cities are rapidly emerging globally, with data resources being crucial in their development. Currently in China, data in smart cities is largely acquired through tracking and monitoring by sensors and control rooms. Moreover, challenges in managing, transforming, and sharing heterogeneous data result in smart cities facing the issue of "data islands." Furthermore, urban issues and development complexity call for more grassroots collective intelligence. Addressing the above-mentioned challenges, this paper proposes a new approach from the perspective of platform urbanism. It suggests constructing a "platform data ecosystem" for smart city development, contemplating how to enhance data acquisition diversity and human-centric nature, optimise data resource management, and facilitate diverse open data utilisation.

Keywords

Platform urbanism, Smart cities, Data, Human-centric, Collective intelligence

1. **Introduction**

With the advent of the Fourth Industrial Revolution, commonly referred to as Industry 4.0, urban development has been transitioning from informatization towards intelligence (Liu, 2019). The emergence of Smart Cities signifies a paradigm shift towards a more systematic, interconnected, and efficient urban development model, embedding cities into extensive networks of digital and technological infrastructure through the advancement of Information and Communication Technologies (ICT), Internet of Things (IoT), pervasive technologies, Augmented Reality (AR), and Artificial Intelligence (AI). The integration of Smart Cities with various infrastructures such as IoT, sensors, Wi-Fi, among others, has given rise to what is termed as the "digitisation city," aiming to gradually construct urban spaces through the capture and analysis of data. However, as highlighted by Barns (2018), the current mechanistic approach to data collection often leads to a proliferation of disparate data services and assets rather than broadly applicable socio-technical solutions. Similarly, Shelton, Zook and Wiig (2015) argue for the necessity of more location-based and experiential explanations to capture urban dynamics. Currently, data sharing practises and circulation increasingly gather and organise through "urban data platforms," representing a new data-driven governance model characterised by various types of open data services covering the entire process of collection, management, and application.

According to the 17th to the 52nd "Statistical Report on the Development of the Internet in China" by the China Internet Network Information Centre (CNNIC), from 2006 to 2023, the usage trends of the internet have shifted from activities such us online music, streaming, news, search engines, and online gaming towards online shopping, travel booking, ride-hailing, online government services, social media, and public services. Particularly after the widespread establishment of WiFi in 2016, the increase in the number of internet users and robust market demand has fuelled a boom in platform development. Major digital platforms have gradually penetrated all aspects of urban living, transportation, consumption, and governance in China(Caprotti, Chang and Joss, 2022). The scale of China's platform economy has grown significantly, continuously changing urban experiences around the "sharing" and "real-time" organisational logic, and related platform research has also flourished. Meanwhile, the rapid development of digital platforms in China, through the generation of vast amounts of data, and the enhancement of communication and transmission capabilities, has become intricately linked with the development of Smart Cities（Caprotti and Liu, 2020）. Platforms are increasingly

becoming essential for experiencing, regulating, and governing cities, and are critical for the transformation of China's smart cities from informatization and intelligence to intelligent based on new economic development models, new life and work models, and new spatial interaction models.

Amid this trend, the discourse on Platform Urbanism has emerged (Barns, 2014), encompassing discussions on open data, diverse participation, urban economy, urban governance, urban life, and space, aiming to seek more inclusive and sustainable smart city development solutions (Richardson, 2020; Odenaal, 2022). Platform urbanism emphasises bottom-up data creation, promoting diverse, open data management and application as an essential aspect of smart city development in the new era. This paper first reviews the origin of platform urbanism and its relationship with Smart Cities, integrating the discussion of platform urbanism into the framework of smart cities. Subsequently, it summarises the data collection and management challenges faced by China's smart city development, identifying platforms as a new opportunity for data governance in the new era of smart city development in China. The paper proposes a "platform data ecosystem," discussing the role of platform data in smart city development in three aspects: platform database construction, management, and application, providing insights for China's smart city development in the new era.

2. Smart Cities and Platform Urbanism

2.1 The Origins of Platform Urbanism Research

The study of platform urbanism originated from reflections on smart cities, initially proposed by Barns (2014) during the American Association of Geographers Annual Meeting. She suggested rethinking the top-down model in smart cities, advocating for smart citizenship and urban participation, emphasising that "creating data" means "creating cities" and promoting bottom-up urbanism. Additionally, a crucial feature of platform urbanism is viewing data as a resource for urban management and economic development.

2.2 The Relationship Between Smart Cities and Platform Urbanism

As a new concept, the discussion of platform urbanism is rooted in the lineage of smart cities (Caprotti, Chang and Joss, 2022). While there is overlap in content between the two, there are key distinctions: smart cities typically focus on governance entities with clear geographical boundaries, led by governments and supported by enterprises providing digital systems and technologies to upgrade infrastructure. They aim to enhance urban operational efficiency, competitiveness, and long-term public governance services, supporting long-term planning. Smart cities primarily extract data through intelligent technologies, such as digital sensors and control rooms, to track and monitor people and things. In contrast, platform urbanism, although rooted in urban environments, exhibits geographical flexibility, operating across different countries and borders. Platform providers act as intermediaries between producers and consumers, embedding themselves in the daily operational environment of cities and involving users in city operations. Moreover, they support urban governance through real-time data and voluntarily uploaded data (Caprotti and Liu, 2020) (See Table 1).

Despite the varying emphases in different dimensions, platform urbanism can still be seen as an extension and expansion of smart cities. By combining digitalisation with smart cities and leveraging characteristics such as boundarylessness, daily operation, real-time interaction, flexibility, and participation, platforms strive to transform cities into vast ecosystems. They

serve as intermediaries in coordinating cities, enriching the application scenarios of smart cities, and enabling residents to participate more actively in the construction of smart cities in a more daily manner, thus further realising the human-centred, sustainable, and coordinated development concept of smart cities.

Table 1. Key Differences Between Smart Cities and Platform Urbanism

2.3 Data Challenges in China's Smart City Development

Comparison Aspect	Smart Cities	Platform Urbanism
Core Focus	Bounded city, defined by geographical boundaries and governed by administrative entities	Unbounded city, characterised by geographical flexibility
Participants	Government: The government is the main driver of smart cities, serving public governance, enhancing urban efficiency and competitiveness; Enterprises: Enterprises sell digital systems and technologies to the government.	Platform Providers: They provide an attractive digital interface between producers and consumers that can layer, embed, and apply to multiple urban environments. They operate the urban platform through local providers and user participation; Platform Users: They obtain information and consumer services in real-time on integrated platforms and participate in social interactions and public affairs.
Timeframe	Long-term: The investment in smart cities is related to government strategic cycles, such as upgrading long-term infrastructure and administrative management systems, providing support for long-term planning.	Instantaneous: The focus is on daily and instantaneous services and interactions based on short timeframes.
Materiality	Digital sensors, control room	The daily operating environment of urban functions: such as Airbnb houses, food delivery factories, express delivery vehicles
Primary Technology	Smart City Technologies: The Interaction of Digital Infrastructure and Municipal Management	Digital technology and data analysis technology: analysis of real-time data in specific platforms
Digital Resource Characteristics	Extractive data, usually obtained through tracking and detection	Interactive data, voluntarily uploaded by the public

China's smart city construction is booming, and its advanced development stage is believed to involve building digital twin cities—a cyber-space with a mapping relationship to the physical urban space, emphasising real-time interaction between the two (Wu et al., 2022). Real-world urban dynamics are fed into the virtual city in real-time to analyse urban issues on cloud platforms and manage cities in real-time. The key is real-time data collection, storage, computation, and analysis of urban spaces. Through the diverse and multi-temporal data in cyberspace or digital space, the physical city can be analysed in real-time to achieve intelligent management and provide decision-making suggestions for urban governance and future

development.

However, achieving this vision still faces barriers such as limited data acquisition channels, low real-time precision in data collection, low data sharing rates, and non-intelligent data analysis. Firstly, the sources and channels of data acquisition for smart cities in China are relatively limited, primarily relying on extractive data obtained through tracking and detection technologies, lacking diverse and heterogeneous data management, conversion, and sharing data. Additionally, the storage and management of data have not reached an organised state of openness and sharing. Various entities such as government agencies, platforms, and enterprises in urban areas generate vast amounts of data. The challenges of managing, transforming, and sharing diverse and heterogeneous data interchangeably have led to the current dilemma of smart cities facing both a "data explosion" and "data isolation." It is imperative to establish unified management and regulations to facilitate data sharing and security across departments. Moreover, smart data analysis has not yet achieved the desired level of intelligence. The continuous emergence of new technologies, such as the Internet of Things, cloud computing, and artificial intelligence, undoubtedly drives the development of intelligent data analysis. However, addressing the complexity of urban issues and development requires more collective intelligence from the bottom up, as solely relying on technological development may risk deviating from the essence of public life and the city. Therefore, the intelligent level of data analysis requires greater collective intelligence from the grassroots.

3. The "Platform Data Ecosystem": Platform Data Collection, Management, and Application

This paper proposes a "platform data ecosystem" to leverage platforms' broad user base and diverse data content for smart city development. The ecosystem encompasses platform database construction, management, and application strategies.

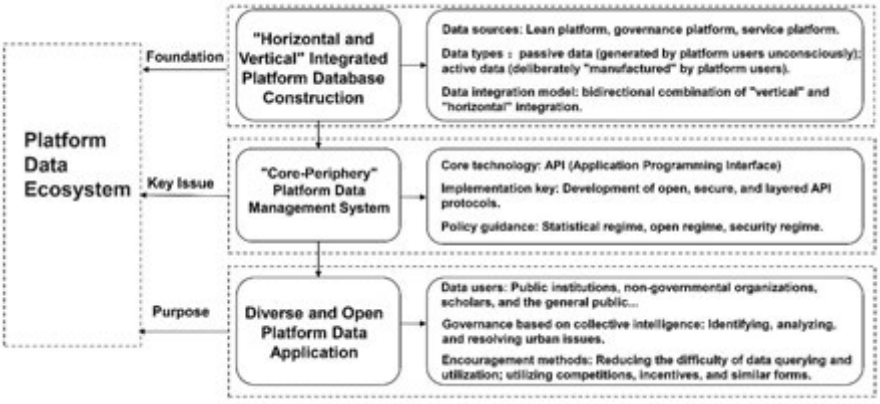

Figure 1. Framework for “Platform Data Ecosystem”

3.1 Platform Types and Data in China

Urban data primarily comes from three sources: remote sensing, infrastructure sensing, and social sensing (Xu, 2023). Among them, remote sensing and infrastructure sensing are relatively "traditional" observation methods in smart cities, while "social sensing" has emerged as a new data source with the development of various platforms. It includes economic data with geographic coordinates, mobility data, emotional data, life data, and resident feedback data on

urban issues.

Based on the platform typology proposed by Caprotti and Liu (2020), this study categorises the commonly seen platforms closely related to cities in China into two types: lean platforms and governance and service platforms. Then, it summarises the characteristics of representative platforms in China and the primary data types they generate (Sun and Wang, 2021; Zhou, Liu and Sun, 2023) (Table 2). These data have been widely used in various aspects, such as urban traffic research, spatial pattern research, urban vitality research, and urban image research, becoming essential resources for smart city governance and efficient urban operation.

Table 2. Common Urban-Related Platform Types and Their Data in China

Platform Type			Platform Characteristics	Platform Examples	Primary Data Types
Lean platform	Commercial/retail platform		Producer/distributor and consumer links. The platform provides an interface for manufacturers and consumers through which goods can be sold and ordered.	Taobao	Economic data
				Ele.me, Meituan	Rider trajectory data
				DianPing	Store scores, location, user's text, image reviews
	Sharing Platform	Transportation platform	Platform operators charge rent or service fees for providing the right to use goods or services. At the same time, through the platform, they can also access goods and services provided by individuals rather than directly owned by the platform operators.	Map platforms: Baidu Maps, Amap, Tencent Maps...	POI, travel trajectory, heat
				Taxi-hailing platforms: Didi Chuxing, Xiangdao Chuxing, Huaxiaozhu Taxi...	Travel trajectory
				Shared bikes/electric bikes; hello bike; Qingju bike...	Travel trajectory, travel location
		Accommodation platform		Wood Bird B&B; Shell Rental	Geographical coordinates, rent, transaction volume, transaction amount
		Office platform		Wework China; Fast Office	Geographical coordinates, rent, transaction volume, transaction amount

Social media platform	Real-time information sharing and dissemination interaction are achieved through broadcast-style information release, which is not limited to text, but also supports pictures, videos, etc.	Weibo, Xiaohongshu, WeChat, Douyin	Check-in information, user text, images, videos, user interaction data
Governance platform	Information and data about the city are aggregated in the platform and analysed through algorithms	city brain	Real-time access to urban transportation, environmental and other data
		pinstreet	Urban problem data with geographical coordinates as reported by users
Service Platform	The government provides services and determines platform functions, usually with a public welfare nature.	Guangzhou E-Government Platform, Zhejiang Li Office, Jiangsu Service Office, Medical Health	Data related to medical, education, municipal administration, etc.

The data generated by the platforms mentioned above can be categorized into two main types: passive and active data.

Passive Data: Obtained without the observed subjects' awareness or knowledge. Platforms can leverage the public as distributed "sensors" in cities (Odendall, 2022), gathering bottom-up, citizen-participatory, and real-time data such as mobile signalling data, map street view data, and traffic trajectory data (Van der Graaf and Ballon, 2019)

Active Data: Data that platform users consciously and voluntarily create. This includes spatial images, text, and emotional data voluntarily created by citizens. For example, text, photos, and videos voluntarily uploaded and reposted by users on social media platforms; evaluations of merchants and scenic spots on consumer platforms—all reflect the public's perception and feedback on cities. Furthermore, another type of "new government data" generated with the construction of urban platforms in recent years also deserves attention. This includes various urban incidents reported by urban management law enforcement officers and community volunteers, and residents' opinions on urban experiences, traffic experiences, neighbourhood renovations, and street quality collected by platforms such as "Lu Jian pinstreet." (Wang, et al., 2020)

Platform users have become a creative infrastructure through platforms, actively participating in shaping, altering, and sharing data content. These data are crucial for experiencing and understanding cities, supplementing bottom-up data sources in China's smart cities, enhancing

the human-centric nature of smart city data sources, and serving as an essential resource for smart city governance and management in the new era.

3.2 "Horizontal and Vertical" Integrated Platform Database Construction

Platform urbanism aims to establish a "horizontal and vertical" integrated platform database. Vertical integration refers to coupling socio-technical elements across physical and digital infrastructure layers to achieve data capture, storage, and utilisation. Horizontal integration refers to extending data collection to different urban fields of human activities and integrating data from different sources and activities into a platform to accumulate cross-domain data (including economic data, mobility data, and public sentiment data) to predict urban issues and provide solutions (Lee et al., 2020). For example, the "Park&Ride" mobile service in the Connecting Digital Cities (CDC) project of the European EIT ICT Laboratory involves data from users (such as mobility trajectories and social networks), data describing the environment (such as weather conditions), and data generated by public authorities (such as public transportation and traffic flow). The Park&Ride service includes a back-end system (Park&Ride Server) responsible for data collection and connected to the CDC platform. The platform processes data integration from various heterogeneous real-time data sources, including standardised RESTful Application Programming Interfaces (APIs) and crowdsourced data sources, and develops wrappers to adapt to different data types, data models, refresh rates, and storage methods. Different modules, such as "Disruption Checker," "Parking Service," and "Route Optimiser," predict traffic congestion, provide parking recommendations, and suggest optimal routes. In this case, the "Park&Ride" mobile service uses vertically acquired data and platform data as the foundational data for traffic services to improve urban traffic efficiency.

This provides new insights for obtaining smart city data in China. On one hand, the development of smart cities in China needs to improve data infrastructure to enhance vertical data integration and improve the "infrastructure-sensor-data storage" vertical data collection process. On the other hand, it is also essential to recognise the new data brought by platform users to enrich the bottom-up data sources in smart cities. The platform itself should serve as an intermediary for integrating and storing both horizontal and vertical data to build a horizontally and vertically integrated platform database, laying the foundation for data management and application in the "platform data ecosystem."

3.3 "Core-Periphery" Platform Data Management Approach

At the management level, platform urbanism describes an interoperable system containing a set of stable core components or services, associated with highly variable external components, thus forming a "core-periphery" data management system that lays the foundation for managing massive platform data. The establishment of API technologies and urban open data policies and regulations are key to the orderly operation of this management system.

Technically, the key to establishing the "core-periphery" relationship through API technology lies in several aspects. Firstly, APIs create an open and programmable environment, allowing developers to build new applications or services on existing platform foundations to expand data scope. Secondly, APIs can set rules to control the collection, use, and sharing of data, and manage third-party access to the platform via keys or tokens, including the accessible data and conditions. Thirdly, APIs ensure security through access control and data transmission limitations, ensuring that only requests that meet specific conditions are processed (Barns, 2020). Thus, API regulations form the fundamental basis for platform data governance.

Reasonable rule formulation is conducive to enhancing the quantity and quality of data, protecting user privacy and data security, and increasing openness and sharing.

Moreover, at the management level, the introduction of policies and regulations related to urban data aggregation, governance, and updates is crucial. This helps break down data barriers, guide the management of authoritative public data sets, and effectively direct open data publishers and users. For example, the INSPIRE (Infrastructure for Spatial Information in the European Community) directive in Europe focuses on environmental, land use, natural conditions, and basic services data, aiming to establish a European spatial information infrastructure. The directive requires member states to ensure the interoperability of geographic spatial data and services, which are made available through open data portals (Živković and Đorđević, 2016).

Currently, data held by the Chinese government and various platform data are often heterogeneous, existing in different formats, and are voluminous. Ensuring the smooth transmission, effective integration, and real-time storage of data from different entities, with different attributes and formats, is a key focus for the new development of smart cities in China. Thus, the Chinese government should establish and improve the legal system for open urban data. Firstly, statistical systems should standardise the minimum spatial statistical unit system, establish spatial metrics for data, and provide data pre-processing to integrate diverse heterogeneous data. Secondly, open systems should be established by the government to define the norms for data opening, guide enterprises and industry associations to legally open data, and promote the multi-dimensional opening and integration of public and non-public data. Thirdly, safety systems should combine public data security requirements, providing secure encryption, logging, and other data management functions for the opening entities, and establish a transparent security management system.

3.4 Diverse and Open Platform Data Application Strategy

One of the goals of establishing the "platform data ecosystem" is to allow and encourage third parties to create value by accessing and using data, which helps promote innovation and transparency. It allows public institutions, non-governmental organisations, scholars, and citizens to access and use the data, directly participating in discussions on urban issues (Pflughoeft and Schneider, 2020). This aggregation of collective intelligence is crucial for identifying, analysing, and solving complex urban problems and helps promote smarter urban governance (Alizadeh, Sarkar and Burgoyne, 2019).

To achieve this goal, it is necessary, firstly, to reduce the difficulty of data querying, reading, and utilisation. This can be accomplished by supporting non-specialist users' access to and utilisation of data through standardisation, visualisation, and other methods. This facilitates citizens in finding urban data related to issues of their concern, enhances citizen interaction with platform data, and leverages public wisdom in identifying urban issues. For instance, Lyon's VLKO (Lyon City Map Observatory) platform is a research and development collaboration project between Lyon's Territorial Development Department, think tank Cité Publique, and the Altercarto Association. VLKO provides geographic information system software for data combination and visualisation, supporting non-professional users in accessing and understanding complex datasets, and organises grassroots workshops to help participants identify interesting issues through related datasets. Additionally, using open-source software encourages users to explore and analyse geospatial data (Slobodova and Becker, 2020).

The second step is to use the platform as a bridge between the public and public institutions.

Competitions, bonuses, and other incentives encourage skilled citizens, academic institutions, and groups to propose solutions to urban problems, and bottom-up solutions are evaluated and improved through voting and discussion to enhance effective data collaboration. For instance, the Apps for Development concept was proposed by former Chief Technology Officer of Washington, D.C., Vivek Kundra. He asked iStrategyLabs to design an open data catalogue useful for citizens, developers, and public institutions. This platform provides a large amount of urban data through competitions, encouraging citizens to develop applications based on this data to solve urban problems. Participants propose innovative solutions based on open data, and the best programmes are selected through evaluation and public voting and awarded prizes.

4. Discussion and Conclusion

Platform urbanism provides a unique socio-technical opportunity for the development of smart cities, and platform data offers a richer, more diverse, and deeper contextual perspective for understanding urban areas. This paper, from the perspective of platform urbanism, explores how to enhance the diversity and human-centric nature of data acquisition in smart cities through active and passive data related to cities on platforms. It advocates improving the openness of digital resources, using the power of the public to help identify and solve problems, and leveraging collective knowledge to achieve smarter, more open, and more innovative urban governance. This paper innovatively proposes a governance framework for the "platform data ecosystem" tailored to the development of smart cities in China, incorporating the integration of platform databases horizontally and vertically, the "core-periphery" management of platform data, and the diversified application of platform data. It calls upon urban planners and managers to adopt new ways of thinking to address emerging challenges, emphasising the role of "platform data" and leveraging platform-related technologies to achieve synchronised planning between digital virtual cities and real cities. This aims to explore new models of intelligent spatial planning and realise new goals for the construction of digital twin cities.

Despite the many advantages of platform data, its inherent limitations in acquisition methods may lead to potential observational biases, including selection bias (Slobodova and Becker, 2020) and information bias (Tripepi et al., 2010). The former means that the observed sample not representing the overall picture of the target population, while the latter refers to errors generated during data collection or measurement. For instance, many studies show that datasets produced by social media platforms are not random samples of the population, excluding a large number of digital disadvantaged groups. Furthermore, platform users, as a type of "sensor," cannot be "deployed" and have the right to choose when and where to upload or not upload specific content. This self-selection may cause information bias. Thus, paying attention to urban data biases, especially those related to human behaviour in active data, and establishing a framework and path for understanding and correcting biases are future focuses of the "platform data ecosystem."

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Response to urban waterlogging control under different topographic conditions

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Abstract: In recent years, the acceleration of urbanization and the occurrence of intense rainfall

have led to urban waterlogging, resulting in property damage and threats to human life. The development of flood resilient infrastructure systems is therefore crucial. However, achieving this goal can be challenging in high-density urban areas due to land resource constraints. This study proposes a framework based on local human wisdom that can withstand, absorb and recover from floods in a timely manner to enhance flood resilience in the urban design process. In this study, we analyzed the hydrological characteristics of Zhengzhou City and constructed a rainfall and flood security pattern using GIS and hydrological models. Corresponding blue-green solutions were determined for different topographic conditions. Finally, a macro-scale rainfall and flood mitigation program was designed and its effectiveness was evaluated using the Storm Water Management Model (SWMM). The results show that the Blue-Green program created 40,000 cubic meters of rainwater storage, resulting in significant economic benefits for the community. This approach can improve the flood resilience of inland cities, particularly in response to heavy rainfall and river flooding.

Keywords: urban waterlogging; topographic conditions; flood resilience; Blue-Green solutions; SWMM

1.Introduction

With increasing urbanization and impervious underlying surface, the risk of urban waterlogging has increased significantly (N. Q. Zhou & Zhao, 2013). The frequent occurrence of extreme weather events and the rising threat and impact of climate variability on cities have made urban waterlogging a major concern in many highly urbanizing areas (Hammond, Chen, Djordjević, Butler, & Mark, 2013; Liu et al., 2023). Urban waterlogging disasters cause huge economic loss and pose a serious threat to people's lives. For example, Beijing was hit by a torrential rainstorm in 2012, resulting in 79 deaths, affected 1.602 million people and resulted in loss of more than US$ 1.64 billion (T. Xu et al., 2021); in 2014, Shenzhen suffered the strongest rainstorm since 2008, with economic loss of more than US$ 11 million (Q. Zhang, Wu, Zhang, Dalla Fontana, & Tarolli, 2020). Urban waterlogging has now become a serious obstacle to sustainable urban development and has attracted widespread attention worldwide (da Silva, Alencar, & de Almeida, 2022; Ward et al., 2017). To address this growing challenge, improving urban resilience and enhancing urban waterlogging risk management has become a new topic in many research fields (Liu et al., 2023; Sharifi & Yamagata, 2014).

The development of flood-resistant infrastructure systems is critical. However, achieving this goal in high-density urban areas can be challenging. On the one hand, traditional urban water control infrastructure, such as retention ponds or pumping stations, take up a lot of land and result in a waste of money. They are usually designed with one function in mind: to store rainwater when it rains, or to drain excess rainwater, but they are not designed for dry days (Cheng, Qin, Fu, & He, 2020). On the other hand, land resource constraints could make it difficult to build infrastructure in high-density urban areas. Therefore, in densely populated urban areas, there is a contradiction between the space required for waterlogging management and the scarcity of space (Q. Zhang et al., 2020). In recent studies, scientists have proposed many new ways to reduce urban waterlogging. The relative concepts include Sustainable Drainage System, Sponge City Construction, Water Sensitive Urban Design, and Low Impact Development (Nguyen, Ngo, Guo, & Wang, 2020; M. Wang et al., 2023; Mo Wang et al., 2023; H.

Zhou, Li, Zhao, & Ding, 2021). These theories and techniques suggest that the problem of urban waterlogging management can be partially solved through adaptive initiatives using nature-based solutions (C. Xu, Jia, Xu, Long, & Jia, 2019). However, relying solely on flood prevention to mitigate disasters will make cities more vulnerable (Liao, Le, & Nguyen, 2016).

Taking the heavy rainstorm that occurred in Zhengzhou City on 20 July 2021 as an example. This study first analyzed the hydrological characteristics of Zhengzhou City and constructed the rainfall and flood security pattern using GIS and hydrological models. On this basis, the corresponding Blue-Green solutions was determined for different topographic conditions. Finally, macro-scale rainfall and flood mitigation scenarios were developed and their effectiveness was evaluated using the SWMM. In order to promote urban flood resilience in high-density urban areas, this paper proposes a Blue-Green solutions for improving flood resilience in the urban design process, based on a framework that relies on local human ingenuity and is able to resist, absorb and recover from floods in a timely manner. This is an example of a flood adaptation paradigm and offers lessons for modern cities. This study provides a theoretical and practical reference for the government and urban planners for urban waterlogging prevention and management.

2. Study area

Zhengzhou is the capital of Henan Province, China, with a population of 12.74 million at the end of 2021 and a total urban area of 7,567 square kilometers. The general topographical trend of Zhengzhou is high in the southwest and low in the northeast, with a temperate continental monsoon climate (Fig.1). There are 124 rivers of various sizes within the Zhengzhou Municipality, spanning the two major river basins of the Yellow River and the Huaihe River. The average annual rainfall is 632.4 millimeters, and the average annual number of rainy days is 78. Rainfall is concentrated from June to August each year, with the heaviest rainfall occurring in August. On 20 July 2021, in less than an hour, Zhengzhou was hit by an extreme 1,000-year storm event in which 201.09 mm of rain, exceeding the historical extreme of meteorological observation records in mainland China, left large areas of the city under up to almost a meter of water (Fig.2). The heavy rainstorms affected 13,664,300 people, with direct economic losses of up to US$12.255 billion, and 398 people were killed or missing in Henan Province as a result of the disaster.

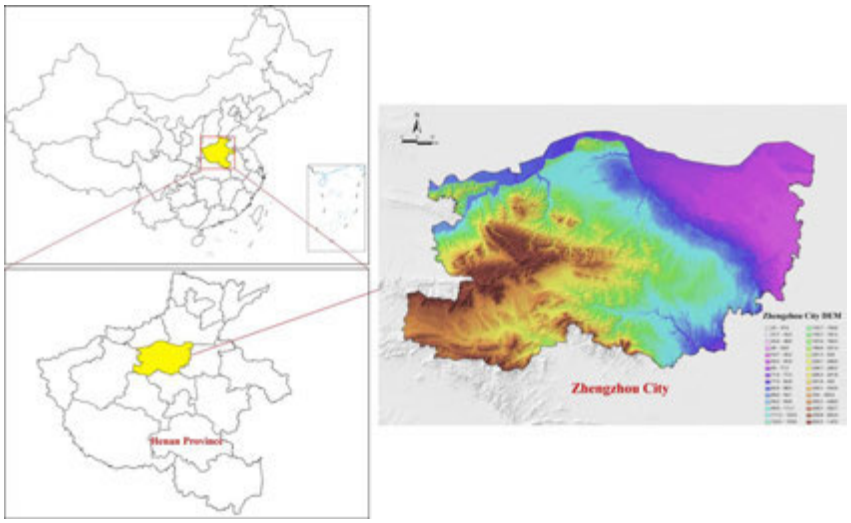

Fig. 1. Study area.

Fig. 2. Waterlogging damage image of Zhengzhou City on July 21, 2021.

3. Data and methods

3.1. Data source and pre-processing

The data used in this study include historical hydrological data, rainfall data, topographic data, and data from the Third National Land Survey in the study area. The data resources are summarized in Table 1.

Table 1

The data and variables used in this study.

Category	Data	Data resource	Abbreviation	Unit
Historical hydrological	Rainfall intensity (2000-2020)	http://ha.cma.gov.cn/	RI-2020	mm/d
	Rainstorm intensity formula (2021)	http://ha.cma.gov.cn/	q	L/s·ha
	Runoff coefficient	http://ha.cma.gov.cn/	y	R/P

	Catchment area	https://www.zhengzhou.gov.cn/	F	m^2
Rainfall data	Rainfall intensity (2021)	http://ha.cma.gov.cn/	RI-2021	mm/d
	Rainfall duration (20 July 2021)	http://ha.cma.gov.cn/	T	min
Topographic data	DEM 30m	https://www.usgs.gov/	DEM	-
Third National Land Survey data	Land use	-	-	-
	Land cover	-	-	-

Enter the relevant data using Arcgis 10.8 to establish a typical rainfall scenario ensemble, record the historical maximum rainfall of the storm at the site as $Pmax/d$, and calculate the required carrying rainfall for the storage cluster Zr

$$Q = qyF \quad (1)$$

$$Z = QT \quad (2)$$

$$Zr = 1.2Z \quad (3)$$

Where Q is the design flow rate of the stormwater system, q is the local storm intensity, y is the local runoff coefficient, and F is the local catchment area; Z is the volume of the storage group, and T is the rainfall duration of the storm.

In Arcgis 10. 8, enter the historical rainfall and water level data of the site, and record the starting time of the field rainfall as T1, the average water level of the regional river network at the time of T1 as W1, the time when the water level of the river network reaches the peak of the field rainfall as T2, and the corresponding peak of the water level at the time of T2 as W2, and the rainfall process from T1 to T2 is defined as the rainfall and water rise period of a field, and in the 24h before the time of T1, the average rainfall intensity should be less than 1mm/d; the maximum rainfall P≥250mm/d in a single day during the T1-T2 period.

3.2. framework of the Blue-Green solutions

The process has been formalized as the Blue-Green Solutions and is implemented through the following five steps: (1) Delineate important mountain and river corridors as ecological protection zones and protect their ecological protection function. The specific way is to accurately identify the extent of the floodway within the corridor, and put forward control requirements -- the road across the ecological corridor should be in the form of a bridge or other does not block the corridor, and leave sufficient safety protection distance on both sides of the floodway and other measures; (2) Include existing gullies into ecological protection. The specific way is to identify the existing gullies that have flood function, delineate the protection line and propose the control requirements - the ecological space within the gullies should be protected from obstruction, filling and construction. The gully within the growth boundary of the town could be landscaped with public recreational demands while ensuring flood safety; (3) Delineate safety groups and calculate water catchment. The safety group is delimited by considering the catchment zoning, the river and the urban growth boundary. Then, the detention space requirements for excess storm water in each safety group under extreme storm conditions are calculated; (4) Implement specific Blue-Green Solutions according to different site

conditions; (5) Attractive development areas are created based on blue-green spaces. The specific way is to landscape the above blue-green spaces and develop them into country parks, riverside green spaces, rain gardens and so on. In normal times, these blue-green systems are superimposed with functions such as pedestrian system, interaction space, agriculture and forestry survival, while in extreme weather conditions, they become important distributed flood storage areas and disaster prevention systems.

3.3. Hydrological Model Selection

There are a variety of ways to assess the effectiveness of the implementation of the Blue-Green Solutions, the most direct and accurate method is using models. A plethora of models have been devised to forecast the consequences of flooding and the efficacy of water systems. Examples of such models include MIKE, Infoworks ICM, and SWAT (Luo & Zhang, 2022; Mignot & Dewals, 2022; Wang, Li, Yu, & Zhang, 2021; Wu et al., 2017). However, it should be noted that the majority of these models are commercially available and are unable to simulate the hydrodynamics of 1D drainage networks and 2D surface flows simultaneously. Consequently, there is a necessity for the development of a comprehensive, accurate, simple, and visual open-source urban flood model for computation (Tan et al., 2024). SWMM is an open-source computational model based on rainfall runoff dynamics developed by the U.S. Environmental Protection Agency (EPA) and is widely used to simulate the quantity and quality of urban runoff (Shahed Behrouz, Sample, & Nayeb Yazdi, 2023). The model is based on physical processes, such as surface runoff, infiltration, surface ponding and flow paths, and can therefore simulate storm runoff volumes (Luan et al., 2017). In comparison to other models, SWMM exhibits superior simulation efficacy and has been extensively employed by scholars engaged in the assessment and forecasting of storm-flood surface runoff processes (Gironás, Roesner, Rossman, & Davis, 2010; Luan et al., 2017; Tan et al., 2024).

In this study, the selected software was SWMM version 5.1, which was employed to describe the dynamic process of rainfall runoff. The construction of SWMM in the study area was based on the urban planning map and the stormwater network layout map. The required basic data, including topographic data, drainage network data, elevation data, and land use type, were analyzed and processed using AutoCAD 2021 and ArcGIS 10.8 software.

4. Results

The topography-based Blue-Green Solutions is applied in Zhengzhou City. The team selected three sites, representing three different topographic and natural conditions, each covering approximately 10 square kilometers in a watershed with high potential flood risk in the center of Zhengzhou City, as demonstration areas to showcase the improved design approach of the Blue-Green Solutions. The final validation was carried out by SWMM to calculate the increased water storage space under the Blue-Green Solutions.

4.1 Trench Ring + Dry Pond mode

This approach has been specifically designed for settlements situated on terraces or sloping plains upstream from the main urban center (Fig.3). The topographical characteristics of these areas typically include steep slopes with gradients greater than 8 degrees and the presence of naturally occurring lowlands, which can be scattered or concentrated. The primary objectives of this mode are twofold: firstly, to ensure the flood safety of the settlement itself and secondly, to prevent the exacerbation of the flood control and drainage burdens on the main city during periods of excessive rainfall. The strategic implementation entails the excavation of trenches

around the perimeter of the town's development boundary, thereby creating a trench ring for each group of settlements. The trenches serve to intercept and manage upstream catchment waters in an effective manner. Concurrently, the delineation of boundaries for flood storage areas, termed dry ponds, is based on the existing natural lowlands. Subsequently, these boundaries are incorporated into the land use plan, with a stipulation that prohibits any urban construction within these designated areas. This ensures the preservation of these critical flood mitigation features.

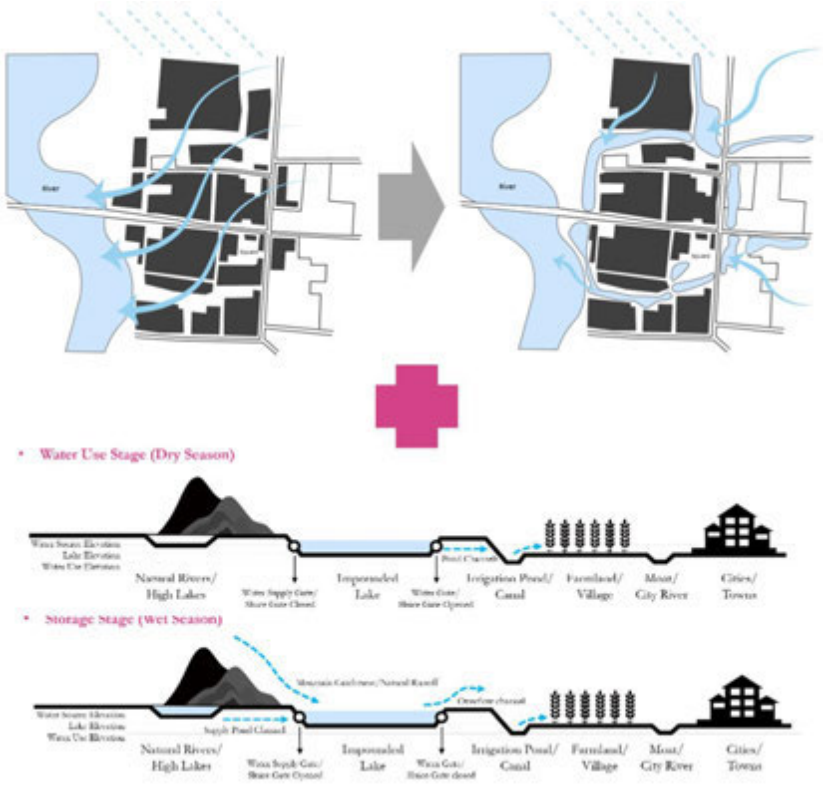

Fig. 3. Trench Ring + Dry Pond mode.

4.2 Connected Ponds + Sponging Infrastructure mode

This mode is particularly suited to main cities located within the plains, which are characterized by a more gentle topography with slopes ranging from approximately 3‰ to 8‰ and a sparse river network (Fig.4). The objective is to address the challenge of urban flooding due to heavy rainfall by providing storage or diversion for such floodwaters. The strategic approach involves the construction of a continuous system of dry ponds, which are interconnected and strategically positioned along natural lowlands and catchment pathways. In areas of the old city where open spaces are scarce, the creation of large, low-lying wet green spaces or natural lands is recommended. Such green spaces are then enhanced through the

integration of grey infrastructure and urban renewal initiatives, such as the renovation of rain gardens in parks and courtyard spaces, and the implementation of eco-roofs and vertical greening on existing buildings. These measures not only contribute to flood resilience but also promote biodiversity and enhance the aesthetic appeal of the urban environment.

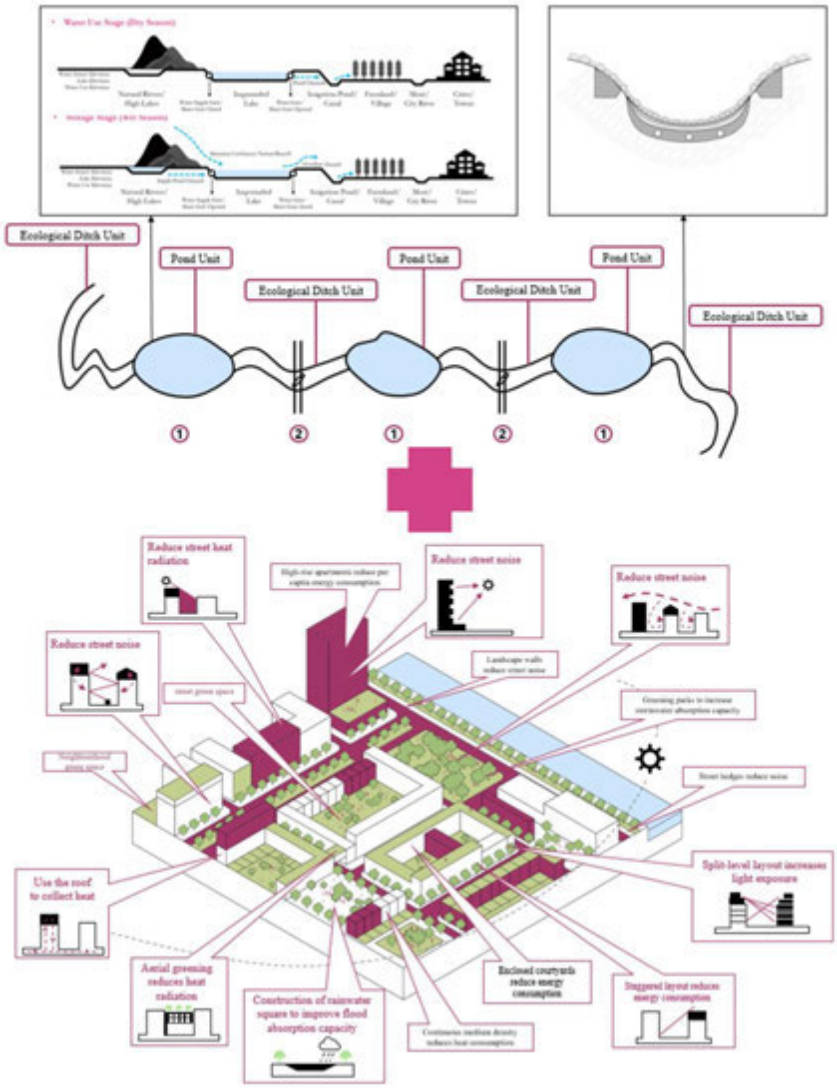

Fig. 4. Connected Ponds + Sponging Infrastructure mode.

4.3 Blue-Green Network + Elevated Groups Mode

This mode is designed for settlements in the low-lying plains downstream of the main city, where the topography is generally flat with a gradient of less than 1‰ and an abundance of

rivers and ponds. The settlements' objectives are multifaceted (Fig.5). They include the storage or diversion of urban flooding resulting from heavy rainfall and the facilitation of the rapid drainage of rainwater through the utilization of blue-green spaces. The strategic response entails the preservation of the site's existing hydrological features and the creation of a landscape comprising ponds, farmland, and streams, thereby forming residential clusters that are surrounded and buffered by blue-green spaces. In order to mitigate the risk of flooding in each cluster, it is proposed that the earth excavated from these areas be strategically used to elevate the road networks and the sites themselves. This elevation provides a crucial buffer, ideally exceeding 3 meters above the surrounding areas, offering protection against potential floodwaters and ensuring the continued habitability and safety of the settlements.

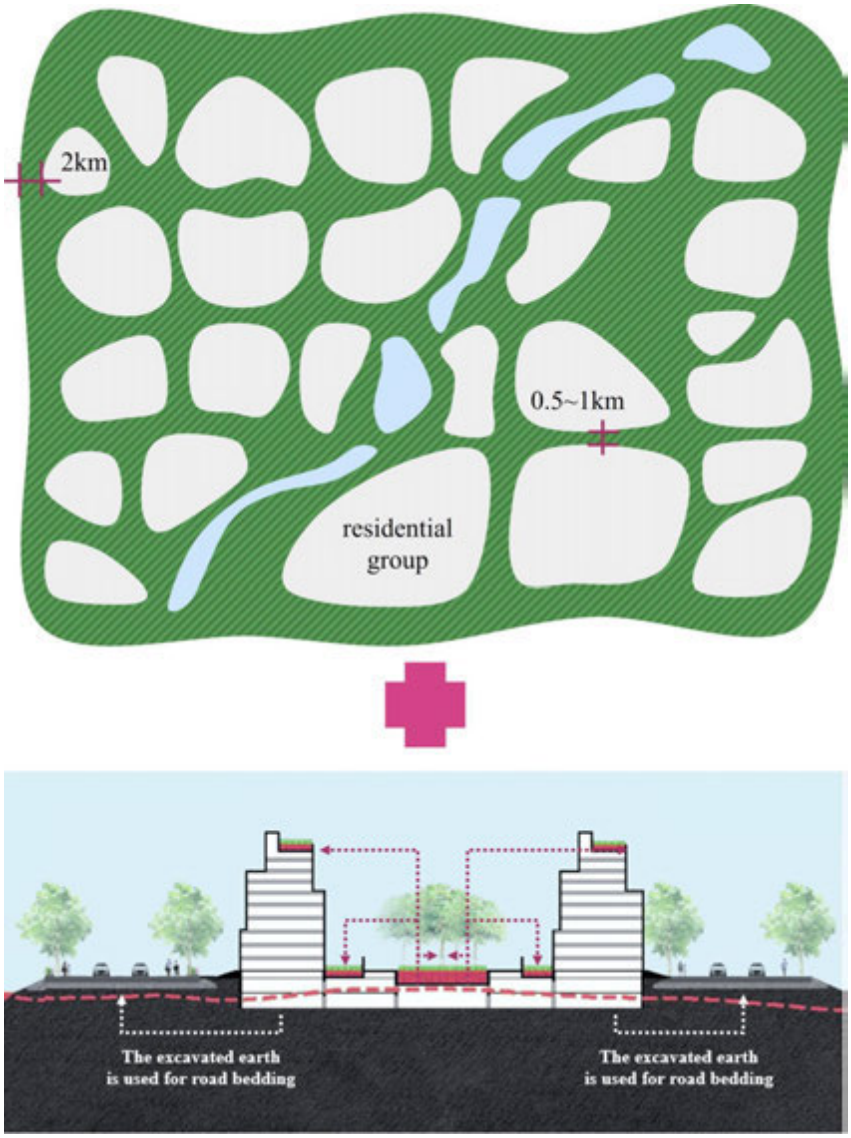

Fig. 5. Blue-Green Network + Elevated Groups Mode.

4.4 SWMM calculates the increased water storage space

In this study, the rainfall data of 20 July 2021 in Zhengzhou City was used to simulate the water storage capacity of the blue-green system under extreme rainfall conditions. A total of three sites were selected as the simulation area (Fig.6), of which Site 1 used the Trench Ring + Dry Pond mode, Site 2 used the Connected Ponds + Sponging Infrastructure mode, and Site 3 used the Blue-Green Network + Elevated Groups mode.

Under the conditions of 1-in-1,000-year rainfall in Zhengzhou City, Site 1 used the Trench

Ring + Dry Pond mode to increase the water storage space by 3918.6 cubic meters compared to the previous one (Fig.7), Site 2 used the Connected Ponds + Sponging Infrastructure mode to increase the water storage space by 2,450.6 cubic meters compared to the previous one (Fig. 8), and Site 3 used the Blue-Green Network + Elevated Groups mode to increase the water storage space by 3,932.9 cubic meters compared to the previous one (Fig. 9). In total, up to 40,000 cubic meters of water storage can be added in Zhengzhou using the three modes above, reflecting the effectiveness of the Blue-Green solutions.

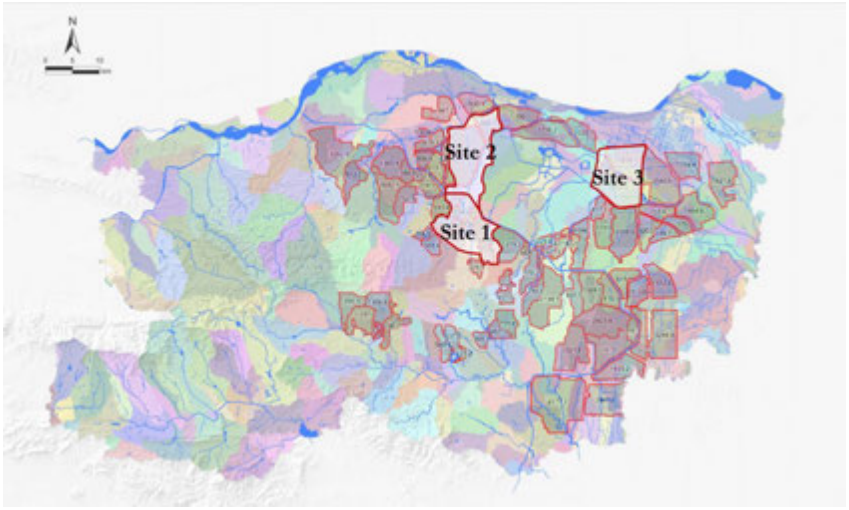

Fig. 6. Blue-Green Network + Elevated Groups Mode.

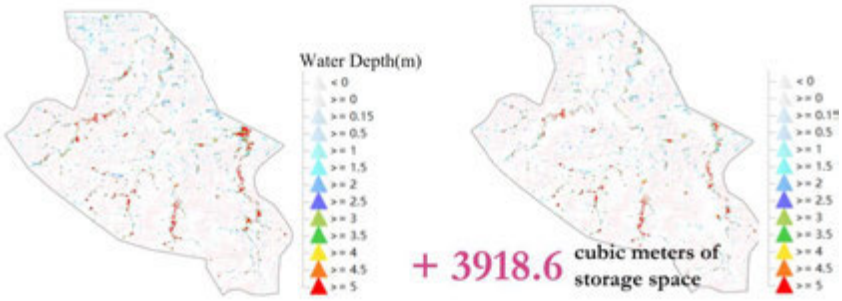

Fig. 7. Blue-Green Network + Elevated Groups Mode.

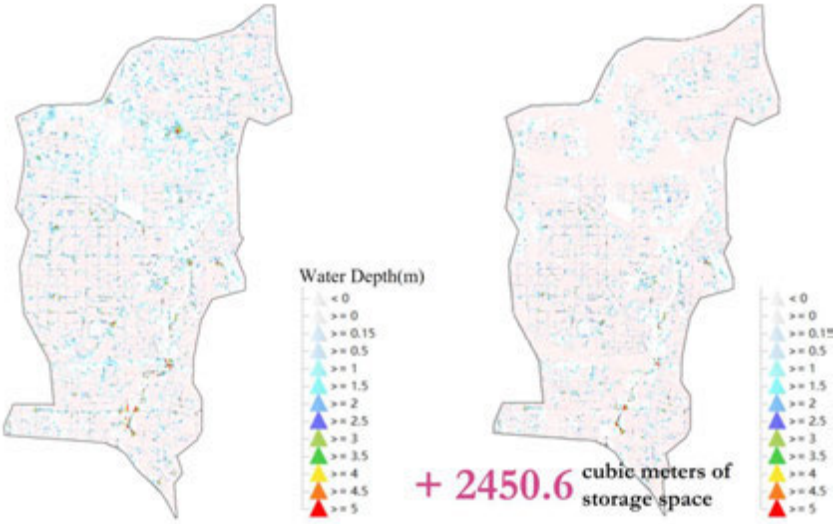

Fig. 8. Blue-Green Network + Elevated Groups Mode.

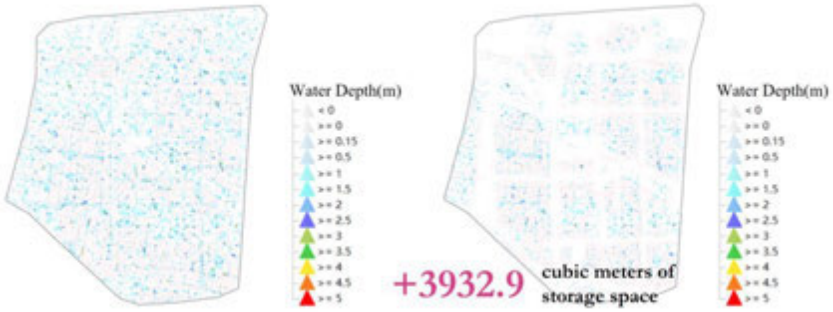

Fig. 9. Blue-Green Network + Elevated Groups Mode.

5. Discussion and conclusion

The results of the study underscore the critical role of topography in controlling urban waterlogging, especially in the context of high-density urban areas such as Zhengzhou City. The application of Blue-Green Solutions tailored to the city's diverse topographic conditions has shown significant potential to improve flood resilience and reduce economic losses associated with extreme rainfall events (Lu, Sun, & Steffen, 2023). At the same time, the study provides some spatial recommendations for policy makers and urban planners to improve resilience.

The Trench Ring + Dry Pond mode, designed for hilly or sloping areas, effectively intercepts and manages upstream catchment waters, thereby safeguarding settlements and alleviating the drainage burden on the main city. This approach aligns with the principles of

Sustainable Drainage Systems (SuDS), which emphasize the importance of source control and the use of natural features to manage water runoff (Nguyen et al., 2020). In contrast, the Connected Ponds + Sponging Infrastructure mode addresses the challenges of urban flooding in plain areas with gentle slopes. The creation of interconnected dry ponds and the integration of grey infrastructure with urban green spaces not only contribute to flood resilience but also promote biodiversity and urban aesthetics (Lu et al., 2023). This multifunctional approach reflects the concept of Sponge City Construction, which seeks to mimic natural water absorption and retention through urban design (M. Wang et al., 2023). The Blue-Green Network + Elevated Groups Mode, tailored for low-lying plains, preserves existing hydrological features and creates a landscape that buffers residential clusters against floodwaters. This strategy resonates with the Water Sensitive Urban Design (WSUD) principles, which advocate for the integration of water management into urban planning to enhance the city's adaptability to climate variability (Hammond et al., 2013).

The use of SWMM for validating the effectiveness of the Blue-Green solutions is a testament to the model's robustness and its widespread application in urban hydrology. SWMM's ability to simulate the dynamic process of rainfall runoff makes it a valuable tool for assessing the hydrological performance of urban water management strategies (Luan et al., 2017). The study's results, which indicate an increase of up to 40,000 cubic meters of water storage through the implementation of Blue-Green solutions, highlight the economic and environmental benefits of these approaches. The savings realized are more than three times that of traditional solutions, suggesting a strong case for the adoption of nature-based solutions in urban waterlogging management. However, the study also acknowledges the challenges of implementing these solutions in high-density urban areas, where land resource constraints can limit the space available for waterlogging management (H. Zhang, Zhang, Fang, & Yang, 2022). This underscores the need for innovative and space-efficient solutions, as well as the importance of policy support and community engagement in realizing the full potential of Blue-Green infrastructure (Xiao et al., 2023).

In conclusion, the study provides a comprehensive framework for improving flood resilience in urban areas through the application of Blue-Green solutions. The findings offer valuable insights for urban planners and policymakers, emphasizing the importance of considering local topographic conditions and the integration of nature-based solutions into urban design. By doing so, cities can become more resilient to the impacts of climate change and extreme weather events, ensuring the safety and sustainability of urban environments.

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Inevitability of Strengthen the Development of Public Transport in Large Cities from the Perspective of Security Resilience

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Abstract
In recent years, extreme weather, geological disasters, infectious diseases and other emergencies have put forward higher requirements for the normal functioning of cities. Large cities with high population density and high construction intensity are facing the dual pressure of disaster emergency support and economic production guarantee. As the carrier of most traffic activities, the public transportation system has the characteristics of closed space, high crowd density and high mobility of personnel, thus is easy to become a high-risk and disaster-stricken area in sudden disasters. This paper analyzes the development trend of individual transportation and public transportation, taking into account the characteristics of the two travel modes, the travel characteristics of large cities, the impact of sudden disasters on public travel, and the value orientation of policy strategies. This paper proposes that ensuring the sustainability of public transportation capacity is an inevitable choice in the face of travel demand, ensuring the safety and controllability of public transportation is the basis for resuming work and production after sudden disasters, and the value orientation of public transportation plays an important role in restoring normal urban life after disasters. At the same time, combined with the existing public transportation system and the attempt of new public transport products, the possible directions for the strengthening and development of public transport in the future are proposed.

Keywords
security and resilience, public transport, individual transportation, travel needs

Full text
Emergency events such as extreme climate, geological disasters, and infectious diseases have brought severe blows and security threats to large cities with high density of people. Public transportation space, as the carrier where most transportation activities take place, has the characteristics of closed space, high crowd density, and high mobility of people. It can easily become a high-risk area and disaster-stricken area in sudden disasters. Taking the COVID-19 epidemic as an example, as the prevention and control stages change, the public transportation systems in China's major cities have successively gone through the stage of high-risk transmission without measures, the stage of suspension of operations under the isolation policy, and the prosecution and resumption stage. Taking the "7.20 Incident" in Zhengzhou as an example, due to problems such as the quality of transportation facilities and traffic scheduling, Metro Line 5 was besieged and became a severely affected area. However, whether it is the normal life needs of residents from the perspective of individual travel, or the needs for efficient urban operation from the perspective of economic efficiency, they all have a high dependence on the public transportation system as the blood vessel of the city. On the one hand, large cities have high population density, complex population sources, and large commuting needs, which make it necessary to further develop public transportation. On the other hand, large cities have a relatively complete public transportation construction foundation and strong intelligent prosecution equipment layout capabilities, making it feasible to further develop public transportation. This paper will discuss this in detail from aspects of necessity, feasibility, and importance.

1. Necessity: The sustainability of public transportation capacity makes it an inevitable choice when facing travel needs

1.1 Characteristics of public transportation and individual transportation

Public transportation refers to transportation services open to the public, of which buses and rail transit are the main parts. Public transportation provides low-cost, high-quality services by integrating similar travel needs in a centralized form. After the preliminary construction of site facilities and network planning is completed, the public transportation system can carry most of the passenger traffic in the central areas of large cities with smaller maintenance costs and lower negative environmental impacts.
Individual transportation refers to a form of transportation in which the vehicle is owned by an individual. It usually has the characteristics of low transportation volume, convenience, flexibility, and good privacy. The early purchase of equipment requires individual residents to have certain financial strength, and in daily operation, the per capita occupation of urban traffic space is large.

Comparing the performance characteristics of public transportation and individual transportation (Figure 1), from the perspective of citizens' travel, the overall cost of public transportation is lower and the service distance is longer. However, buses and rail transit adopt a fixed-station model. Although the station network coverage in large cities is wide and the departure interval is short, there are still station blind spots and a certain waiting process. It is not as good as individual transportation in terms of getting on the bus nearby and getting on the bus immediately. From the perspective of overall urban transportation operations, public transportation has a large volume, a wide range of services, and a small occupation of road space. At the same time, it is more environmentally friendly than private cars and is an efficient mode of transportation to ensure basic urban transportation activities.

便捷度（站点密度、停放需求）	舒适度（乘车环境、天气限制）	是否门到门	费用水平	优势距离 (km)	运行速度 (km/h)	交通方式		高峰时乘客数（人）	人均运行占道面积 (m²)	人均停泊占地面积 (m²)
中	中	否	中	<40	35	轨道交通	公共交通	1800	0.67	0.3
中	低	否	低	3.5-20	25	公共汽车		30	0.3	1
高	高	是	高	>3.5	40	出租车网约车		1	3	10
低	低	是	低	<4.5	12	共享单车		1	2	1.5
中	高	是	高	>5	40	私人汽车	个体交通	1.25	2.4	8
高	低	是	中	<8	20	非机动车		1	2	1.5
高	中	是	低	<3	4	步行		1	0.4	0

运量较高　　运速较高　　运距较远　　占地较少

Figure 1 Comparison of the characteristics of public transportation and individual transportation (left side is from the perspective of passengers, right side is from the perspective of urban transportation system)

Public transportation carries most (especially low-cost) long-distance travel needs and is an indispensable part of the urban transportation system (Figure 2). In addition to limited coverage distance, low-cost options in individual transportation are strongly affected by external factors such as weather. They are more likely to turn to public transportation in extreme weather conditions. This part of the travel demand is also a potential service target of public transportation. The travel efficiency of private cars, which are the most maneuverable among individual transportation, is severely limited by urban road space resources. At present, China's big cities are facing severe road traffic pressure and vehicle parking pressure. Considering that existing roads in big cities are difficult to expand on a large scale in a short period of time, and

the city's motor vehicle capacity is nearly saturated, further promoting the development of private cars will not have positive benefits. Another important component of individual transportation, electric vehicles, as a transitional method between walking and car travel, have the advantages of low price, high mobility, long distance and fast running speed. However, parking and charging are also inconvenient, making it a compromise choice for many low- and middle-income people with frequent travel needs. From the perspective of overall management of the urban transportation system, the chaotic parking of electric vehicles, serious interference with road traffic capacity at intersections, and low driving safety have caused certain damage to the urban traffic environment in terms of road resources and traffic order. The incompleteness of relevant regulations and the complexity of mixed traffic in road planning have put urban electric vehicles in a gray area that is difficult to manage, resulting in the reality that they gain their own convenience at the expense of other modes of transportation. To a certain extent, the large number of citizens choosing electric vehicles is due to the imperfection and incomplete coverage of the public transportation system. We should realize that this seemingly convenient individual transportation mode is not feasible for popularization in large cities with huge motor traffic and tight road resources, nor is it sustainable for carrying major commuting trips.

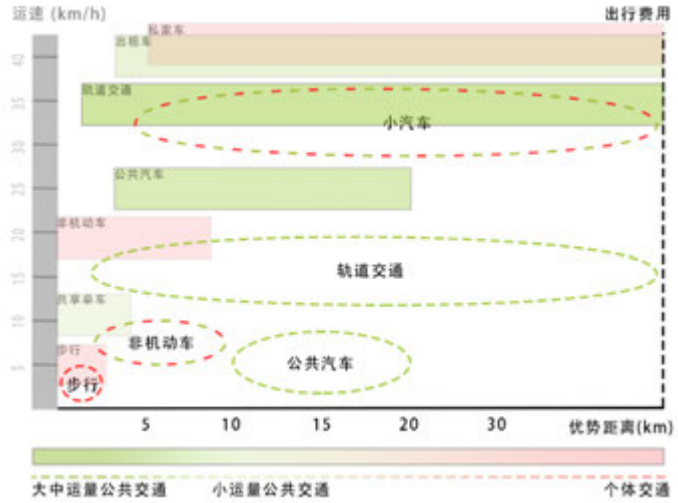

Figure 2 Passengers' willingness to choose travel mode

1.2 Travel demand characteristics of big cities

Big cities integrate the flow of more people within a larger geographical space. Its transportation system faces longer transportation routes, denser commuter crowds, higher traffic intensity, and more complex and diverse circulation options. Under the highly intensive development, the strong attraction of public services and commercial office functions in central urban areas is accompanied by extremely high land rents and housing prices. This makes the phenomena of job-housing separation, commuting peaks, and tidal traffic particularly significant. In addition, the siphon effect of big cities across the country continues to attract young talents and low-level migrant workers from other provinces and cities. These migrant populations do not have strong economic strength but have long-term willingness to settle, making them more dependent on public transportation for daily commuting. Generally speaking, the travel demand in big cities is characterized by long commuting routes, large instantaneous passenger flows, and heavy reliance on large-capacity, intensive and efficient transportation systems. However, the high per capita road area occupied by individual traffic makes it difficult for the city's limited road

space to withstand the traffic flow during peak commuting periods. This part of the daily peak passenger flow must be shared by public transportation with large or medium capacity, especially rail transit using underground space. At the same time, compared with individual transportation that is limited by road space resources, public transportation with adjustable departure frequency and vehicle grouping is also more flexible and can better adapt to the imbalance of daily traffic flow.

In addition, price-sensitive people account for an important part of the complex population structure of big cities. They have a certain spirit of hardworking and are also the main group of urban commuters. Their requirements for the convenience and efficiency of the travel environment are much higher than comfort, thus having a strong dependence on public transportation. Their commuting and employment provide important basic services for the normal operation of the entire city. The guarantee of their travel needs is also a part that cannot be ignored in the urban transportation system.

To sum up, most travel needs in big cities must and can only rely on public transportation to a large extent. The inefficient mode of individual transportation lacks sustainable carrying capacity in terms of road space resources, public economic strength, and natural ecological environment, making it difficult to promote and develop it as the main form of urban transportation.

2. Feasibility: The safety and controllability of public transportation make it the basic guarantee for resuming work and production after sudden disasters

2.1 Traffic characteristics in different periods of sudden disasters

After a disaster breaks out, it goes through different periods such as the disaster emergency period, the post-disaster rescue period, and the post-disaster recovery period. Each stage puts forward different functional requirements for the urban transportation system (Figure 3). Overall, the disaster emergency period truly reflects the ultimate carrying capacity and risk resistance of the transportation system. The long period of rescue and reconstruction after the disaster has had a great impact on citizens' living habits and travel needs.

相关要素		突发灾害阶段		
		受灾应急期	灾后救援期	灾害后恢复期
交通系统职能		应急救援	防控工作	生产生活
道路空间		富余	富余	不足
公交供给		运能空闲	运能空闲	中高水平
出行需求		伤者就医	伤者就医 医护、环卫、社区工作人员到岗	恢复正常通勤、娱乐出行
目的		疾病救治	疾病救治 基本生活保障	复工复产、消费娱乐
强度		低	中	高
替代方案		应急调度	物流配送系统	办公娱乐线上化
空间分布	目的地	医疗点	部分工作岗位 物资供应点	工作岗位 商业休闲场所
	特点	目的地集中	距离短、范围近	复杂多样
时间分布	出行时间	不定时	定时	不定时
		无规律	存在不显著早晚峰	存在显著工作日高峰、 早晚高峰
	特点	紧急	可控	可控
出行方式	公共交通	无	集中统筹 利用富余运能进行专线调度	安全检控
		救护车	救护车	恢复正常
	个体交通	步行、非机动车、私人汽车		
		高度依赖	高度依赖	高度倾向
出行决定权主体		政府	政府 社区、单位	个人
出行优先权主体		获批个体	获批个体 专用公交	无
出行方式选择标准		可达性	可达性 可持续性/便利性	安全性 可持续性
交通问题	**现象**	患者就医难 医护就职难	其他患者就医难 其他岗位就职难	效率降低
	原因	个体交通 覆盖不全	优先出行权分配不周	保障安全

Figure 3 Characteristics of traffic elements at each stage of sudden disasters

Passengers' choice of transportation mode is comprehensively affected by multiple factors such as travel purpose, transportation conditions, and personal purchasing power (Figure 4).

Take Wuhan, where the COVID-19 epidemic first broke out, as an example. As the first place and hardest-hit area of the epidemic, the initial stage of the lockdown was a disaster emergency period, which coincided with the Spring Festival holiday, thus there were no problems with the supply of basic daily necessities in the short term. Under the circumstances at that time, the needs of ordinary citizens for commuting, daily consumption and entertainment travel disappeared. The main purpose of travel became emergency medical treatment for fever patients and commuting for work for medical staff. Coupled with the complete shutdown of the public transportation system, patients and medical workers are highly dependent on individual transportation for travel. Facts have proven that the coverage of private cars and the accessible distances for bicycles or walking in the city are extremely limited, which resulted in a difficult commuting situation for a large number of medical staff in the early stages of the city's lockdown, some of whom had to cycle across the river to work. In big cities, there is a certain

mismatch between the coverage of individual transportation and the people with basic commuting needs. The actual traffic situation during this emergency period truly reflects that under the current economic structure and population structure, individual transportation does not have the supply guarantee for emergency needs, not to mention the transportation demand that has increased dramatically in intensity and complexity after the resumption of work and production.

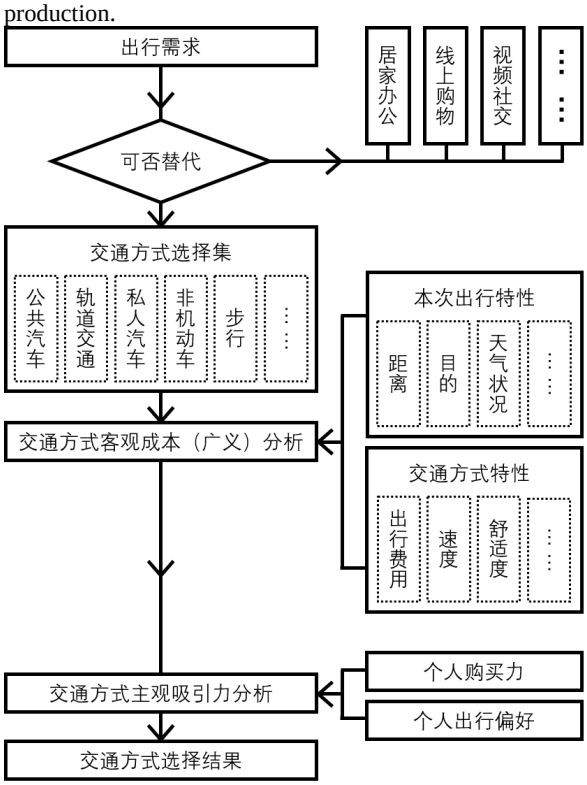

Figure 4 Passenger transportation mode selection flow chart

When severely infected people were basically treated, the number of infections peaked, and the scale of the epidemic was basically controlled, Wuhan launched a two-month home-based prevention and control measure, that is, entering the post-disaster rescue period. This stage lasts for a long time, and the various needs of daily life gradually emerged. The citizens' first principle for the transportation system has changed from "accessible at any cost" in the early emergency period to "accessible and sustainable". Medical treatment for patients with mild symptoms, medical treatment for other diseases, and purchasing basic daily necessities have become the main travel purposes. At the same time, due to the systematic development of anti-epidemic work, a large number of party members, community workers, and sanitation workers were required to commute to work. At this stage, the government uses the surplus road space resources and bus transportation capacity to provide customized buses for hospitals and other units in need to ensure the effective progress of anti-epidemic work. At the same time, the community collected residents' material needs and medical needs in a unified manner, and provided services such as collective procurement and special medical vehicles. At this stage, citizens’ travel mode choice set has been significantly reduced, and the substitutability of each

mode has been greatly reduced. At the same time, the purpose of travel determined whether the right to travel can be obtained. The interruption of low-price public transportation and the competition for travel rights increased objective costs (in a broad sense). Purchasing power became the main basis for determining travel mode. The traffic control measures at this stage have greatly affected citizens' long-term living habits and travel concepts. Network technologies such as home office, online shopping, video social networking, and material distribution systems transform the spatial flow of people into the flow of information and goods. Small-capacity door-to-door public transportation methods such as customized buses and community buses have improved safety and convenience compared with traditional buses. Limited by travel policies and individual transportation capacity, citizens' willingness to seek medical treatment and purchase goods nearby rather than at long distances increased significantly. The flow of people gathered in large hospitals and shopping malls had been divided into various residential areas. This travel habit of weakening intensity, shrinking distance, and reducing mix has also continued in the post-epidemic period after the isolation.

	公共交通	**个体交通**
使用者	公众	工具所有者
	开放	私密
运量	大	小
	人员流动、集聚	人员固定
范围	固定站点	门到门
优点	低费用	安全性
缺点	受灾风险	覆盖人群有限

Figure 5 Characteristics of public transportation and individual transportation during the post-disaster reconstruction period

After the unblocking of Wuhan, public transportation resumed normal operations, but a temperature measurement and code verification process was added at each station to ensure safety in a visible way and at the same time make the transmission path traceable. At this time, the travel mode choice set regained its diversity, but the characteristics of each transportation mode had changed (Figure 5). For example, the addition steps of temperature measurement and code verification had changed the operating efficiency of the public transportation system. The proportion of safety factors in citizens' travel preferences had increased, while the proportions of efficiency and cost had decreased. The purchasing power of citizens had partly declined due to the impact of the national economy, but the sense of depression after not spending for a long time and the concept of life safety first had weakened their price sensitivity and increased their willingness to consume.

2.2 Public transportation safety controllability during the post-disaster recovery period

Although public transportation does have dangerous factors such as dense crowds, it can be effectively dealt with by formulating complete emergency plans, monitoring operating conditions in real time, and accurately dispatching emergency resources. On the other hand, in the context of the demand for normal social and economic operation, it is meaningless to cut off the contact gathering of large flows of people by strengthening individual transportation to completely eliminate the risk of collective disasters. Transforming and improving safety based on the existing public transportation system, rather than turning to the development of "absolutely safe" individual transportation, has absolute advantages in both scientific and economic efficiency.

3. Importance: The value orientation of public transportation plays an important role in supporting the normal life of urban operations in the context of disaster response

The post-disaster reconstruction period means that the city's economic and cultural activities should gradually return to normal operations. As an important part of normal urban life, public transportation has also been a key component of the city's intensive development. Adhering to the development of public transportation systems in large cities has both scientific significance and positive value orientation.

3.1 Establish confidence in preventable and controllable reconstruction

We can all feel the psychological and emotional impact of policy guidance at all stages of disaster response. The positive significance of targeted support, targeted donations, and official media reports from other provinces and cities is largely reflected in the attitude and psychological stimulation of people in disaster areas. Psychological care and confidence building are of great significance in the aftermath of disasters. The enhanced development of public transportation in the context of disaster response is not only an implementation of actions to restore normal life, but also reflects the preventable and controllable value orientation, providing citizens with positive and stable beliefs for resuming work and production.

3.2 Demonstrate concern for public welfare and people's livelihood

As a public welfare urban infrastructure, public transportation is an important part of people's livelihood projects. Its low price and strong transportation capacity provide travel guarantee for many low- and middle-income groups. Among various types of disasters, low-income groups are more severely affected by economic impacts, as they are more price sensitive and more dependent on public transportation. Strengthening the development of public transportation is also a practical concern for people with limited purchasing power and difficulty in paying for individual transportation.

3.3 Continue the environmentally friendly decontamination concept

Strengthening the development of public transportation has always been an important strategy for large cities. Existing urban problems such as road congestion, exhaust pollution, noise pollution, and traffic accidents are mostly caused by inadequate public transportation and oversaturation of individual transportation. From a long-term perspective, a slow-travel-friendly environment based on walking and cycling must also rely on a strong public transportation background. True decentralization, environmental optimization, and future health cannot exist without a strong public transportation system.

On the one hand, the starting point of avoiding the risk of clustered disasters is highly consistent with the original efforts in the city to ease travel, avoid crowded places, and stagger peak hours. Flexible working, home working and other methods can be continued.On the other hand, in limited spaces, the dispersion of people should be based on the optimization of the public

transportation environment, ensuring safe distances and personal space, and achieving intensive and efficient evacuation. It is not feasible to turn to extensive and unsustainable individual transportation, otherwise it will only cause extreme deterioration of the urban traffic environment for the so-called "absolute safety" and bring about more severe environmental safety problems.

4. Possible directions to strengthen the development of public transportation

Strengthening the development of public transportation is essentially to improve the efficiency and quality of citizens' travel. From the overall perspective of urban development, certain intervention and regulation should be carried out on citizens' travel decisions (Figure 6). Optimizing their travel modes from the root (such as shortening daily travel routes through improving basic living facilities, etc.) and optimizing the citizens' travel environment in the process (such as building a slow traffic system to encourage green travel, etc.) will have a good effect on the overall transportation and will also provide a better background environment for urban public transportation.

出行阶段	调控焦点	干预手段
出行产生	交通发生源	土地控制
		现代网络通信技术（线下活动转线上）
出行分布	交通吸引源	土地控制
		优化生活基础配套（就近解决）
出行方式	低容量运载方式	激励政策（费用补贴/增收）
		优化高容量环境
空间路线	拥挤空间	实时路况信息
		硬性路障
时间路线	高峰时段	错时调峰

Figure 6 Regulation methods for citizens' travel decisions

4.1 System improvement and environmental optimization

Controlling the upper limit of the number of passengers in public transportation spaces and ensuring a relatively sufficient personal safety distance have put forward requirements for the waiting and riding environment of public transportation stations. Improving the coverage of the existing line network and improving the smoothness of the connection between rail transit and ground transportation can also effectively disperse the concentrated passenger flow and improve the quality of citizens' travel.

4.2 Personalized services for small and medium-sized transport volumes

Some cities in China, such as Beijing, Jinan, and Kunming, have tried to promote customized buses and temporary routes. This point-to-point transportation mode with small and medium-sized transportation volume and multi-vehicle dispatching serves people with the same or similar needs, avoiding excessive agglomeration of people. This model also relies on the information collection and integration of the Internet platform and the real-time information

exchange system to give full play to the intensive and efficient performance of public transportation through a static reservation mode and a timely response mode, while making up for the blind spots of existing public transportation.As of April 2023, the cumulative number of registered customized bus users in Beijing has reached 90000, and 173 customized bus lines have been opened, with a daily departure volume of 191 buses.

Compared with the traditional single operation model of fixed lines and unified vehicles, small and medium-volume public transportation that adopts a demand response model based on user demand data has the characteristics of high quality, efficiency, comfort and accuracy. It can integrate personalized and differentiated travel services and high-quality bus experience while ensuring efficiency.

4.3 Marketization of operation management

Compared with the traditional urban bus operation model monopolized by state-owned enterprises and subsidized by local governments, market-oriented attempts may be better able to provide personalized and precise services in line with the diverse travel needs of passengers. While adhering to the attribute of public transportation as the basic guarantee of urban public services, two or three public transportation enterprises can be established through area division and other methods. Use social capital and market rules to seek the optimal model based on passenger needs, encourage new public travel products, and achieve diversification of public transportation.

5. Summary

In summary, in the context of sudden disasters such as extreme climate, geological disasters, and infectious diseases, public transportation is fully capable of providing safety guarantees that are no less than the city's overall prevention and control level. Strengthening Developing public transportation is the only and wise choice for my country's big cities, taking into account the high dependence of the normal operation of large cities on public transportation, the sustainability of public transportation from a long-term perspective, the decentralization concept of public transportation under policy guidance, the existing relatively complete bus network system, as well as the trial of diversified bus products.

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A Study on the Path of Enhancing the Social-ecological System Resilience in Shrinking Small Towns in China

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Abstract
In 2022, China experienced its first population decline in decades, leading to an increasingly common phenomenon of urban and rural shrinkage. Small towns, under the dual pressures of the suction effect from larger cities and rural revitalization policies, face elevated development risks. This paper proposes pathways to enhance the resilience of the social-ecological system of shrinking small towns through the territorial spatial planning. These pathways include enhancing buffering capacity both within and beyond urban development boundaries, strengthening self-organisation at all levels, and improving learning capacity through dynamic assessment and adjustment. The aim is to proactively mitigate the risks faced by shrinking small towns, improve residents' quality of life, and offer insights for China's high-quality urbanization development and governance.

Keywords: shrinkage, small town, social-ecological system, resilience, territorial spatial planning

Full text

1. Introduction

Globalization has led to a reconfiguration of population distribution, increasingly resulting in the phenomenon of shrinkage (MARTINEZ-FERNANDEZ, C. et al., 2012), which is drawing scholarly attention at various scales. Scholars suggest that small towns, with weaker development conditions compared to larger cities, face more complex challenges due to shrinkage (Mayer, H. and Knox, P., 2010)(Atkinson, R., 2019)(Caselli, B., Ventura, P. and Zazzi, M., 2020)(Rogatka, K., Kowalski, M. and Starczewski, T., 2023).

China, a vast developing country, has a large number of small towns. Despite regional variations in development levels and potential (Liu, Z., Qi, W. and Liu, S., 2021), small towns generally have lower administrative levels and simpler functional structures compared to larger cities,

making them more vulnerable to internal and external risks. These towns also have smaller populations, economies, and land scales, which diminish their developmental momentum and attractiveness, increasing their risk of shrinkage (Chen, C., Luo, Z. and He, H., 2016). This is not only an issue in underdeveloped areas; even in developed regions such as the Yangtze River Delta and the Pearl River Delta, small towns are experiencing shrinkage (Lang, W., Deng, J. and Li, X., 2020)(Shan, J., Liu, Y. and Kong, X., 2020). Many shrinking small towns are long plagued by social, economic, and environmental risks, necessitating a shift in planning paradigms to address these risks. Since 2019, China's emphasis on new urbanization has repeatedly highlighted the need for "slimming and strengthening" shrinking small towns. As China's urbanization progresses from an intermediate to an advanced stage, the high-quality development of small towns is crucial for the healthy advancement of China's urbanization process.

Internationally, the issues of shrinking towns are increasingly recognized not merely as demographic or economic problems but require a comprehensive approach from a complex social-ecological perspective (Jin, H. et al., 2021)(Haase, A. et al., 2021)(Dona, W, G, T, C., Mohan, G. and Fukushi, K., 2022). As the concept of "resilience" has expanded from ecology to urban and rural planning, "resilient planning" has become a global focus (Folke, C., 2006). In 1999, the Resilience Alliance, an international research organisation from multiple disciplines, was established to conduct interdisciplinary research on the resilience of social-ecological systems worldwide, achieving significant results (Resilience Alliance, 1999). Planning concepts based on the resilience of social-ecological systems are crucial for addressing the challenges faced by China's shrinking small towns. Therefore, it is necessary to develop territorial spatial planning approaches for these towns that enhance social-ecological system resilience, promoting regional high-quality development through scientific planning methods.

2. The Significance of Enhancing the Resilience of Social-Ecological Systems in Shrinking Small Towns

Shrinking small towns face significant risks, with some experiencing various crises in economic, ecological, and social aspects. Addressing the sustainable development of shrinking small towns is an urgent issue. To promote harmonious development between humans and nature, many scholars have begun to understand human-environment relations from a resilience perspective, leading to the emergence of the concept of resilience in social-ecological systems that integrates natural, economic, social, institutional, and cultural characteristics. The Resilience Alliance defines the resilience of social-ecological systems as the capacity of the social subsystem, the ecological subsystem, and their interactions to absorb disturbances, reorganize, and fundamentally maintain the same structure, identity, and feedback mechanisms under change (Walker, B., Gunderson, L. and Quinlan, A., 2010). International experiences show that shrinkage does not necessarily lead to decline but can also present an opportunity to optimize urban system functions (Fitton, J. et al., 2021)(Wirth, P. et al., 2016). High resilience in social-ecological systems is typically recognized by three characteristics: achieving positive outcomes despite high risks, maintaining capabilities under threatening conditions, and

recovering from shocks and stresses (Kerner, D. and Thomas, J., 2014). Resilience in social-ecological systems emphasizes transformation and innovative potential, including attributes of buffering capacity, self-organisation, and learning ability (Speranza, I, C., Wiesmann, U. and Rist, S., 2014). (Figure 1)

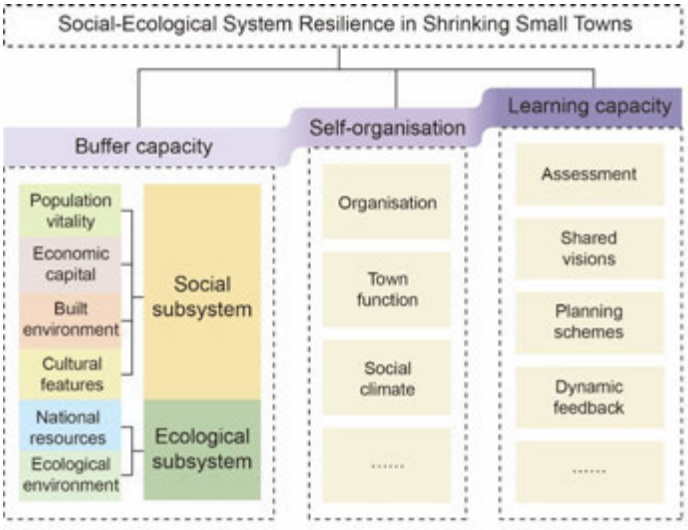

Figure 1: Attributes of the Social-Ecological System Resilience in Shrinking Small Towns

(1) Enhancing Buffer Capacity is Essential for Managing Complex Risks and Responding to Crises

Buffer capacity is the ability of social-ecological systems to withstand, absorb, and maintain their functions and structures when faced with risks (Carpenter, S., Walker, B. and Anderies, M, J., 2001), which is essentially their stability against shocks. Shrinking small towns, with their smaller scale and simpler functions, have relatively lower capacities to resist internal and external risks. Additionally, the increasing severity of climate change brings potential threats such as meteorological disasters, crop reductions, infrastructure damage, and outbreaks of infectious diseases (Haines, A. et al., 2006). On one hand, shrinking small towns need to uphold the functions of maintaining regional food and ecological security; on the other, they must seek stability and development amidst various crises. Modifying elements such as the infrastructure, landscape, land use, aesthetics, and policies of small towns can enhance the buffer capacity of their social-ecological systems (Pickett, A, T, S. et al., 2013). This enhancement improves the towns' ability to react, adjust, and adapt to shocks and disturbances from both internal and external factors, preventing their fragile social-ecological systems from facing significant crises when tackling risk challenges.

(2) Enhancing Self-Organisation is a Key Approach to Improving the Quality of Shrinking Small Towns

Self-organisation refers to the forms, processes, and outcomes through which social structures and human behaviors allow social-ecological systems to function (Obrist, B., Pfeiffer, C. and Henley, R., 2010). The shrinkage of small towns may bring a series of negative impacts, yet there is a continuous increase in residents' demands for quality of life. Residents of shrinking small towns require more comprehensive town functions and better ecological environments. Although generally shrinking small towns have an average level of socio-economic development, the decrease in population frees up some resources and environmental capacity, offering opportunities for ecological restoration and enhancing the overall quality of the town. Enhancing the self-organisation of social-ecological system resilience emphasizes trust and effective interaction between decision-makers and users, requiring the integration of resources from various departments related to the development and construction of small towns. It is also necessary to consider the basic conditions of ecological resources, as well as the economic base of the town and the needs of its residents. This approach coordinates the relationship between human society and the natural environment, promoting the improvement of town services and the protection and rational use of natural resources. This leads to the enhancement of the well-being and quality of life for residents of shrinking small towns.

(3) Enhancing Learning Capacity is a Practical Necessity for Territorial Spatial Planning and Governance

The capacity for learning implies the transformation of knowledge into action through adaptive planning and management measures, thereby improving the performance of social-ecological systems (Armitage, D., Marschke, M. and Plummer, R., 2002). In the adaptive renewal cycle, the development stages of small towns can be divided into four repeating phases: periods of exponential change, periods of growing stasis and rigidity, periods of readjustments and collapse and periods of re-organisation and renewal (Folke, C., 2006). Traditional growth-oriented planning primarily focuses on the first two periods, often neglecting the last two periods, yet these are equally important for system development (Figure 2). The method to address shrinkage involves enhancing the learning capacity within the dynamics of shrinkage through continuous improvement via assessment alerts, planning regulations, and dynamic feedback, achieving balance and development to prevent the system from collapsing. Integrating the concept of enhancing resilience of social-ecological systems throughout the entire process of territorial spatial planning and management can promote the scientific formulation of assessment, planning, and governance strategies for shrinking small towns at various stages.

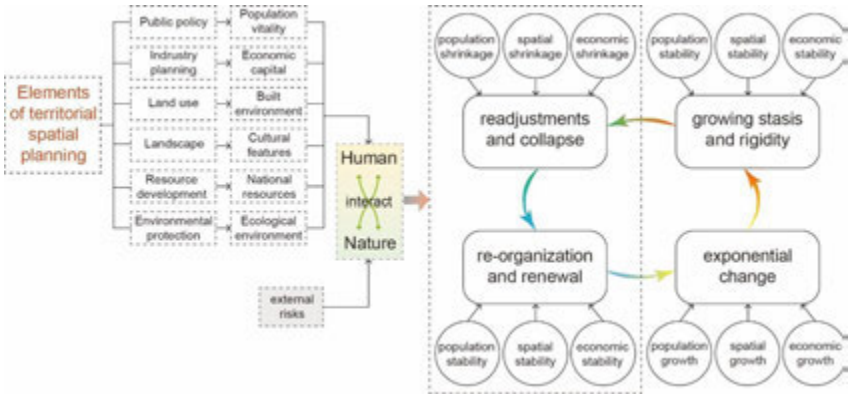

Figure 2: Relationship between Territorial Spatial Planning Elements and Enhancement of Social-Ecological Systems Resilience in Shrinking Small Towns

3. Pathways to Enhancing the Resilience of Social-Ecological Systems in Shrinking Small Towns from the Perspective of Territorial Spatial Planning

When the buffer capacity of a social-ecological system is stable, self-organisation is promoted, and learning ability continues to develop, the resilience of the social-ecological system is enhanced. The means to enhance the resilience of social-ecological systems in shrinking towns include introducing new technologies and industries, strengthening skills training, adjusting town sizes, enhancing cooperation between governments and enterprises, enhancing public participation, and providing external assistance when necessary (He, Y, S. et al., 2017)(Martínez-Fernández, C. et al., 2012)(Rosenman, E. and Walker, S., 2015)(Joo, Y. and Seo, K, B., 2018)(Leetmaa, K. et al., 2013)(Bernt, M. et al., 2013).

With the ongoing application of the results from China's third National Land Survey, the formulation of county-level and township territorial spatial planning will become a focus in the coming period. Therefore, scientific territorial spatial planning is a necessary means to enhance the resilience of social-ecological systems in China's shrinking small towns. Territorial spatial planning can comprehensively enhance the resilience of social-ecological systems in China's shrinking small towns through three pathways: enhancing buffer capacity, strengthening self-organisation, and developing learning capacity.

3.1 Differentiating Buffer Capacity Enhancement Within and Beyond Urban Development Boundaries

Territorial spatial planning emphasizes comprehensive control over all elements and areas. This approach involves differentiated management of spaces within the urban development boundaries and ecological and agricultural spaces beyond these boundaries. At the same time, it aims to enhance the capacity of the social-ecological system to cope with both internal and external risks. This is precisely where the comprehensive enhancement of buffer capacity for

shrinking small towns is targeted.

Within the urban development boundaries, the focus is on enhancing the ability to cope with risks to the social subsystem. This requires considering the current situation of population loss and demographic imbalance. Key areas of focus include talent policies, industrial development, land use, and landscape. Firstly, innovative mechanisms for attracting talent and strengthening vocational training should be implemented to boost the demographic vitality of shrinking small towns. Secondly, based on existing resource endowments, guide the diversified development of industries in these towns while also stimulating income growth for residents. Additionally, create an attractive built environment. Determine the appropriate scale of land use based on reasonable population projections. Towns with weaker development potential could trade surplus land quotas to other regions with greater development needs, alleviating fiscal debt while preventing inefficient land expansion. Inefficient and underutilized lands should be repurposed for service facilities and green spaces. Land degraded by industrial activities should be designated as ecological restoration areas to achieve improved urban functions, manage environmental pollution, improve living conditions, and enhance regional vitality. Moreover, special planning for towns with cultural characteristics should be carried out to fully exploit tourism resources and develop the tourism industry. Towns with weaker capabilities may apply for policy support and external capital to enhance the social capital of shrinking small towns and effectively cope with risks.

Beyond the urban development boundaries, the basic principle should be to protect the ecological environment and food security, enhancing the ecological subsystem's capacity to handle risks. In terms of natural resource management, pay attention to the development and control of non-construction land. Strictly implement controls for ecological corridors, water source protection areas, and other designated zones to protect the ecosystem services of shrinking small towns. Additionally, financial revenue can be increased through ecological compensation policies. For the natural resources of shrinking small towns, utilize excellent ecological and agricultural resources to cultivate cultural, educational, and scientific research functions, and develop ecological research and eco-tourism. In terms of ecological protection, promote the scale operation of agricultural land, improve the land inheritance mechanism, and prevent the abandonment of arable land. Enhance agricultural output while improving the livelihoods of farmers. Intensive and large-scale production and living modes also facilitate centralized municipal facility construction, reducing energy consumption and environmental pollution. High-quality natural resources and a good ecological environment form the ecological capital of shrinking small towns provide necessary support in times of risk.

Additionally, for towns particularly vulnerable to specific risks, special planning should be formulated, such as for managing mining subsidence areas and watershed ecological restoration. These plans should focus on addressing the most urgent risks faced by the towns and filling the gaps in their buffer capacity.

3.2 Strengthening Self-Organisation in Territorial Spatial Planning and Governance at All Levels

It is necessary to establish a well-defined organisational structure that ensures the smooth operation of small towns and fosters a harmonious social atmosphere. In China, county-level territorial spatial planning constitutes the "overall arrangement and comprehensive deployment" of land use, while township territorial spatial planning deals with the "specific arrangements" of land use purposes. Township planning plays a crucial role in transmitting and implementing the content of provincial and city-county level spatial planning to the township level, and in controlling and guiding rural planning. It is key to the new urbanization and high-quality rural development.

Thus, township-level territorial spatial planning plays a vital role in strengthening self-organisation. During the formulation, implementation, and management of territorial spatial planning, it is essential to coordinate governments at the city-county, township, and village levels and different departments such as environment, security, finance, industry, and agriculture. Encouraging local enterprises and residents of small towns to participate in decision-making is crucial to fully understand the challenges and development needs of different stakeholders.

Firstly, in implementing county-level territorial spatial planning, it is important to maintain the overall pattern of land use. Ensuring that ecological protection red lines and permanent basic farmland are inviolable maximizes the ecological and agricultural functions of shrinking small towns. At the comprehensive planning stage, township construction guidance according to county-level spatial planning should be studied. Based on the unique characteristics of different towns, cultivate distinctive industrial features and development directions to avoid homogeneous competition. Given the limited allocation of land quotas in shrinking small towns, territorial spatial planning should prioritize the allocation of construction quotas to industrial development land and public facilities. During the detailed planning stage, smart provision of functional spaces and facilities should be ensured, utilizing limited resources to improve the industrial and public service functions of small towns.

Additionally, in linking rural planning, township territorial spatial planning should guide the development directions of the villages it governs. The migration of rural populations to towns is an important process in urbanization, and the villages under shrinking small towns may also be undergoing shrinkage. In shrinking small towns with development potential, focus on cultivating industries, allocating service facilities, and guiding rural labour to converge in small towns. Lastly, cultural construction should be strengthened. Promoting local historical and cultural heritage through tangible and intangible carriers fosters cultural identity and belonging among small town residents, enhancing their participation in local development. By optimizing the town operation model through top-down transmission by decision-making bodies and bottom-up feedback from town users, the self-organisation of shrinking small towns can be strengthened.

3.3 Developing Learning Capacity through Dynamic Assessment and Adjustment

Having the learning capacity means that shrinking small towns can continually acquire

development experiences from other towns and integrate their own past experiences into current actions. Learning capacity includes aspects such as alerts, shared visions, planning schemes, and dynamic feedback. The concept of "smart cities," widely adopted globally and increasingly combined with artificial intelligence in recent years, greatly aids in enhancing the learning capacity of shrinking small towns.

In the knowledge identification stage, it is crucial to scan and obtain knowledge valuable for enhancing the resilience of shrinking small towns, including the visions of town users, historical data, and current data. Therefore, it is necessary to learn the collection and analysis technologies for integrated data, such as through government transparency platforms and social media to gather users' opinions on town development. After establishing a database for small towns, data analysis and simulation can be performed using computer deep learning techniques and other methods. Under the goal of enhancing social-ecological resilience, deduce key elements such as population and economic changes, land scale, and facility siting to form learning outcomes, which is territorial spatial planning. After evaluation and public participation, planning schemes can be transformed into statutory planning and practical actions. Statutory planning and planning actions become a knowledge-sharing process within the shrinking small town's social-ecological system, thus continuously updating users' visions for the town.

Territorial spatial planning is a dynamically evolving planning and management process, so it is essential to regularly check whether the learning outcomes effectively serve the goals. That is, during the assessment of territorial spatial planning, determine whether the implementation of the plan effectively supports the enhancement of resilience. Develop different indicators for different types of towns and continuously collect data on the effectiveness and issues in resilience enhancement through a normalized monitoring system. Timely transform new data into knowledge, iteratively update decision-making simulation algorithms, thus providing a basis for dynamic adjustments in planning. Also, scientifically arrange the sequence of tasks based on the supply and demand relationships revealed by the assessment results, gradually realizing users' visions. This increases the attractiveness of small towns, mitigates the desire of residents to move out, and attracts rural populations, enabling shrinking small towns to achieve sustainable development.

4. Conclusion

Due to factors such as industry, location, and policy, a number of small towns in China have experienced a continuous population decline. These small towns play a crucial role in linking urban and rural development. Scholars widely recognize that growth is not the only option for small towns. The concept of resilience in social-ecological systems, through a dynamic adaptive cycle, has emerged as an approach to address the challenges faced by shrinking small towns. In the phase of widespread county and township level territorial spatial planning in China, in-depth research on planning for shrinking small towns guided by the enhancement of social-ecological system resilience is of great significance. This paper suggests enhancing the resilience of the social-ecological systems in shrinking small towns from the perspective of territorial spatial planning. It proposes planning response pathways in terms of enhancing buffer

capacity, strengthening self-organisation, and developing learning capacity. The aim is to improve the linkage role of shrinking small towns in the regional urban system and to promote healthy regional development.

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Research on Assessment Model of Disaster Prevention Capability of Urban Residential Area

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Abstract: Urban residential areas are an important unit of urban disaster prevention and reduction, which affects the goals, strategies and countermeasures of urban disaster prevention and reduction. The characteristics of current research on evaluating residents' disaster prevention capabilities are not applicable to urban planning research and practice. Based on the concept of comprehensive disaster prevention, this paper establishes a theoretical formula for assessing vulnerability and constructs six evaluation indicators that affect the disaster prevention capacity of residential areas. The weight of factors is determined by Delphi method and establish an evaluation model. Evaluate the disaster prevention capacity of residential areas using the standard evaluation guideline method. It provide guidance for evaluating the disaster prevention capacity of urban residential areas in China and formulating disaster prevention countermeasures.

Key words: the residential area, disaster prevention capability assessment, vulnerability, assessment model, Standard Assessment Guide Method

As a composite unit of humanities and space, urban residential area is composed of social groups living in a specific area. These groups have common interests, social interaction and corresponding service system (Jacobs,1961). In the process of urban development, residential function has always been one of the important functions it undertakes. With the development of society, large-scale, high-density and high volume rate have become the mainstream architectural trends in modern urban residential areas. The agglomeration of buildings and population leads to more security risks in residential land (Zhao Yiting et al. 2013, Meng Fanliang et al. 2011). However, the planning and construction of residential areas in China generally lack disaster prevention and safety considerations. At the same time, the occurrence of disasters is often sudden, and it is easy to cause secondary disasters, resulting in

serious loss of life and property. Therefore, it is of great practical significance to study the problem of disaster prevention and mitigation in urban residential areas, and to put forward the improvement scheme of physical space and the guiding measures of public policy, so as to reduce the loss of urban disasters and improve the safety and resilience of cities. Through these measures, we can effectively deal with various disaster risks, ensure the safety of life and property of urban residents, and also help promote sustainable urban development (Sun Shiwen, 2021).

Currently, there are more studies on disaster risk assessment in China, while relatively less attention is paid to the assessment of disaster prevention capacity. In terms of residential disaster prevention research, more attention is paid to single-system disaster prevention and safety, while relatively little research is done on comprehensive disaster prevention in residential areas. In addition, many scholars have conducted a large number of studies on disaster prevention planning in residential areas, but there is a relative lack of studies on the evaluation of disaster prevention capacity. In summary, a relatively complete research technical route on the evaluation of disaster prevention capacity of residential areas has been initially formed: the route is based on disaster prevention theory and aims to construct a comprehensive set of evaluation criteria and subdivide the evaluation elements. Next, the disaster prevention capacity of the study area is systematically assessed through quantitative evaluation methods. Finally, based on the assessment results, effective disaster prevention countermeasures are formulated to enhance the disaster prevention capacity of the residential area. For example, from 2009 to 2016, Liu Peng (2017) studied the risk assessment model of residential communities, and proposed 16 kinds of community hazard factor assessment indicators. The risks of Shanghai communities through demographic and economic data were assessed, and the risk maps of Shanghai communities were drawn. The identifying risk types, vulnerable areas, important infrastructure, safe places, countermeasures, and suggestions were proposed. A security risk assessment method for old urban communities based on Bow-tie model (BT) and Bayesian network (BN) was proposed by Gu Tiantian (2023). It was inferred that the personal unsafe behavior, the vulnerability of community infrastructure and the risk of surrounding facilities in Y community of Shenzhen City were high-risk factors. This study evaluated the security risk level of Y community in Shenzhen City. Lian Dajun et al (2017) built a community disaster reduction capability index assessment system with 30 secondary indicators from six aspects: disaster risk assessment capabilities, rescue and support capabilities, engineering defense capabilities, economic base support capabilities, disaster management capabilities, and residents' cognitive capabilities. The entropy grey target model and the approaching degree classification were used to classify and assess the disaster reduction capability of the community, and the disaster prevention capability of the residential area in Suzhou was calculated with the help of GIS spatial overlay analysis technology. In his study, Kong Feng (2019) pointed out that the problems of disaster prevention, mitigation and relief in urban and rural communities are reflected in the obvious regional differences in infrastructure, the prominent problem of coordination of disaster

mitigation resources, the weak applicability and practicability of disaster prevention and mitigation plans in urban and rural communities, as well as the weak awareness and ability of residents to mitigate disasters. Wu Dafang et al (2015) evaluated the fire protection capability of buildings in city villages in Guangzhou. A fire risk evaluation indicator system was constructed based on the fire resistance rating and purpose of the house, the layout of fire hydrants and the setting of fire passages. The analytic hierarchy process, Kriging spatial interpolation, and buffer analysis were applied to obtain the building fire prevention capability evaluation model. The weak links were found to improve the fire prevention capability of the city village. By analyzing and summarizing the potential of enhancing community resilience in disaster prevention and mitigation planning and the impact of improving community resilience on the implementation efficiency of disaster prevention and mitigation planning, Ma Chao et al (2020) proposed to enhance community resilience through four methods. Obviously, in the process of assessing the disaster prevention capacity of residential areas, there are differences in the understanding and knowledge of experts and scholars in various academic fields about disaster prevention in residential areas, which mainly stems from their different research focuses, thus leading to inconsistencies in disaster prevention strategies and goal setting. Therefore, in order to assess the disaster prevention capacity of residential areas as comprehensively and accurately as possible, researchers have adopted diversified evaluation indicators and complex quantitative evaluation techniques, and ultimately come up with a variety of different disaster prevention countermeasures and measure recommendations, with a view to better improving the level of disaster prevention and the ability to cope with disasters in residential areas.

From the perspective of urban planning, this paper focuses on the theory and evaluation index of disaster prevention in urban planning system. Therefore, in terms of evaluation objectives, evaluation indicators and evaluation methods, this paper is significantly different from the existing research. This study focuses on the evaluation of disaster prevention capacity of residential areas by scholars and planners in the field of planning. This study takes the disaster prevention and mitigation of residential areas as the research object, and constructs the theory of urban disaster prevention planning from the concept of urban comprehensive disaster prevention. By establishing the theoretical formula of the vulnerability of the bearing body and coordinating with the planning elements of the residential area, six evaluation indexes affecting the disaster prevention ability of the residential area are constructed. Delphi method is used to determine the weight of factors, and the evaluation model is established. The standard assessment guide method is used to assess the disaster prevention capacity of residential areas. The conclusions of the study have important support for the assessment of disaster prevention capacity and the formulation of disaster prevention countermeasures in urban residential areas in China.

1.Basic thoughts and planning elements of disaster prevention in residential areas

1.1 Basic thoughts of disaster prevention in residential areas

Based on the basic concept of urban disaster prevention, 'a variety of preventive measures for the loss of life and property of urban residents and various types of engineering facilities in order to resist and mitigate all kinds of natural and man-made disasters and the secondary disasters caused by them' (He Lei, 2016), as well as the basic components and formation mechanisms of disasters, this idea is based on the fundamental composition and formation mechanisms of disasters understanding of disasters and aims to protect the safety and property of urban residents and ensure the sustainable development of the city. The idea of disaster prevention can be summarized as follows:

(1) Reducing the exposure of the disaster-bearing body: in order to reduce the probability of a disaster occurring, it is necessary to fundamentally change the environment or conditions of the disaster-forming mechanism in order to reduce the scope of action of the disaster force and separate it from the coverage of the disaster-bearing body so that the disaster is not likely to occur.

(2) Reducing the vulnerability of the disaster-bearing body: in order to reduce the impact of the disaster, it is necessary to change the state of the physical spatial components in order to reduce the vulnerability of the disaster-bearing body, and consequently to reduce the probability of the occurrence of an extreme disaster state.

(3) Improvement of emergency evacuation capacity: In order to reduce the casualties caused by disasters, the emergency evacuation system should be improved according to the occurrence of disasters in order to reduce the casualties. Residential areas are considered to be densely populated 'target areas'[1] where the exposure of disaster carriers is generally stable. Disaster preparedness strategies focus on emergency actions aimed at reducing vulnerability and casualties in the aftermath of a disaster. Self-help and mutual aid by community residents before, during and after a disaster, as well as the timely evacuation and relocation of people to safe areas, can significantly reduce casualties. Therefore, the construction of a sound evacuation and rescue system is an important material foundation. Based on this concept, this paper starts from building an evacuation and rescue system to establish a model of the disaster prevention capacity of residential areas.

[1] refers to the weak areas in the built-up areas of cities that are affected by disasters, have disaster losses, and require emergency rescue.

1.2 Planning element screening

According to the current national standard 'Code for Urban Residential Area Planning and Design', the planning elements of residential areas can be divided into four aspects, namely land use and construction, housing, public service facilities and roads. By carefully combing the planning elements in the national standard 'Urban Residential Area Planning and Design Code', combined with the micro-mechanism of disasters and urban space, the elements closely related to community safety in residential area planning can be determined.(1) In terms of land use and construction, it includes factors such as floor area ratio, building density and population density related to the prediction of the size of the affected population and the spatial layout of the affected buildings after the disaster. These factors are of great significance for post-disaster reconstruction and population evacuation.(2) public service facilities, including facilities such as education, health care, culture, sports, business services, community services, administrative management and public parking lots (garages). These facilities play an important role in emergency services during disasters[2]. (3) Road system, including factors such as road density and road width. Good road planning is essential for emergency evacuation and rescue operations. The goal of disaster prevention in residential areas is to reduce material and property losses and casualties. Therefore, in the combing of the elements of residential area safety planning, it is necessary to comprehensively consider the details and interrelationships of the above factors:

1. Reduce material and property losses and reduce the vulnerability of residential areas.

The factors affecting the vulnerability of disaster carriers can be considered at three levels: (1) the disaster resistance and building quality standards of physical space, which are closely related to the degree of disaster damage; (2) demographic characteristics, including factors such as population distribution and population density, which affect the degree to which people are affected by disasters; and (3) the ability of physical space to recover from damage, which is linked to the local level of economic development and the ability to prevent and mitigate disasters. capacity is associated. However, the characteristics of different population groups affected by disasters are often neglected. Population distribution and population density are closely related to the spatial distribution of buildings, building density, and floor area ratio. In general, the level of economic development and disaster prevention and mitigation capacity are consistent with the development trend of emergency shelter buildings: the higher the level of economic development, the higher the emphasis on safety; the higher the disaster prevention and mitigation capacity, the more balanced the layout of evacuation and emergency shelter sites and the higher the level of service. Therefore,

[2] refers to places and facilities such as medical and sanitation, water storage, material storage and distribution, and fixed refuge necessary for emergency rescue, emergency evacuation, and post-disaster life.

vulnerability has an inverse relationship with building quality and shelter layout, and a positive relationship with building density, building volume ratio, and proximity of spatial distribution. The logical relationship of vulnerability is as follows:

$$\mathrm{V} = \frac{De \cdot Fr}{Qa \cdot \mathrm{Sl}} \cdot \mathrm{Lo} \qquad (1)$$

Among them:
V: vulnerability
De: building density
Fr: floor area ratio
Qa: building quality
Sl: shelter layout

Lo: proximity of building space distribution. According to the distance to the disaster-prone area, the Lo value is between 0 and 1. The Lo value is 1 of the disaster-prone area, and the Lo value is 0 of the area far away from the disaster-prone area, and the value of the rest takes the difference based on the distance to disaster-prone area.

The vulnerability theory of disaster bearing body reveals the following viewpoints: when determining the location of residential area (keeping Lo value unchanged), the area with low plot ratio, low building density, high building quality and reasonable layout of shelter has low vulnerability, that is, less material and property loss. Therefore, the planning elements of residential areas need to meet the following requirements: the overall spatial structure adopts the layout mode of low building density and low floor area ratio. At the same time, the construction quality must be strictly controlled to meet the standards of disaster prevention and resistance.

2. Reduce casualties, including emergency evacuation, emergency rescue and emergency resettlement.

(1) Refuge population evacuation: During a disaster, the number of evacuated people is directly related to the quality of the buildings, the density of the buildings and the plot ratio of the residential area. The quality of a building determines whether or not it is damaged during a disaster: if a certain type of building is completely destroyed, then everyone living in that type of building should be evacuated. According to the ‘Code for design of disasters mitigation emergency congregate shelter’ (GB51143-2015), the size of the emergency evacuation population should take into account the urban resident population and the mobile population. In the area around crowded public places, the size of the emergency evacuation population should be no less than 80% of the annual maximum daily flow. For permanent refugees, the size should not be less than 20% of the permanent population, and the following requirements need to be met: a) the area where the area of buildings (structures) with low

disaster resistance exceeding 60% shall not be less than 45% of the permanent population; b) areas where the area of buildings (structures) with low disaster resistance exceeding 40% should not be less than 35% of the permanent population; c) areas where the area of buildings (structures) with low disaster resistance exceeding 20% should not be less than 25% of the permanent population.

(2) Refuge channel evacuation: Evacuation of evacuation routes is an important measure to ensure effective evacuation of refugees before they enter an evacuation area. The accessibility and capacity of evacuation roads are therefore critical to the efficiency and capacity of evacuation. In community planning, the design of refuge roads is directly related to the layout of the road network, the organization of roads and land, and the width of roads. According to the 'Code for design of disasters mitigation emergency congregate shelter' (GB51143-2015), under the conditions of calculation of the building collapse model on both sides, the width of the main evacuation road should be no less than 7 meters, the width of the secondary evacuation road should be no less than 4 meters, and the width of the general evacuation road should be no less than 3 meters. In addition, there should be convenient transportation access between buildings and evacuation shelters. In order to increase the density of the road network, a square grid-like road network layout is usually adopted, which can improve the connectivity of roads in the community and enhance the efficiency and capacity of evacuation.

(3) Shelter evacuations: During a disaster, buildings and open spaces used to accommodate refugees may include educational facilities such as schools, sports facilities such as stadiums, other large public buildings, squares, and green spaces (especially public green spaces), and these places should have a certain effective refuge area. These functional facilities should not only meet the normal needs of normal use, but also assume the function of sheltering and evacuating refugees in the event of a disaster. Therefore, when planning and laying out these places, it is necessary to take into account their ease of use during a disaster, and their capacity should not only meet the needs of daily use, but also be able to cope with the evacuation needs fixed in the service area. Therefore, the total capacity of such public facilities and green spaces should be designed and checked against evacuation needs.

(4) Emergency rescue channel: The emergency relief channel is the main channel connecting the residential area with the outside world and is used to connect various services in the residential area such as medical and health services, community services, administration and commercial services. It provides a transmission channel for basic living materials such as medical aid, community organization, special people aid, disabled people aid, food and drinking water. According to the 'Code for design of disasters mitigation emergency congregate shelter' (GB51143-2015), the width of the emergency relief channel should be 15 meters, taking into account the model of building collapse on both sides.

(5) Emergency service facilities: they mainly include the functions of medical and health services, commercial services, community services and administration in public service facilities. Medical and health facilities assume the important responsibilities of emergency rescue and rescue of the injured during disasters; service facilities in residential areas are important institutions for vulnerable groups to take refuge during disasters; administrative facilities are the organizational centers for refuge, rescue and emergency services in residential areas; and commercial service facilities are the places for storing and distributing emergency food and drinking water. Therefore, in addition to meeting the day-to-day needs of a residential area, there is a need to assess its configurability for emergency use during a disaster.

(6) Emergency support infrastructure: Emergency protection infrastructure is the municipal public facilities that directly provide emergency water, electricity, road and communication services during disasters. To ensure their reliability in times of disaster, they should be designed and constructed in a disaster-proof manner to enhance their ability to withstand disaster damage. In addition, redundancy and multi-source planning need to be considered to ensure continuity of supply during disasters. Therefore, municipal planning should be reviewed with special attention to the security of water, electricity and information supply during disasters.

(7) Disaster prevention engineering facilities: Disaster prevention engineering facilities are important municipal infrastructures, such as flood walls, levees, and rainwater regulating basins, which are part of municipal infrastructures in a broad sense as disaster prevention engineering facilities to ensure community safety. However, such facilities are usually seldom seen in residential areas because these disaster prevention engineering facilities are usually municipal public investment projects with limited relevance to residential areas. In contrast, people's air defense engineering facilities are more widely distributed in residential areas. When planning and laying out these facilities, they not only need to comply with the requirements of the Civil Air Defense Law and relevant national standards, but also assume responsibility for disaster prevention in residential areas. Therefore, when planning and constructing disaster prevention engineering facilities, comprehensive consideration needs to be given to the rational distribution of different types of facilities to ensure the overall disaster prevention capability of the community.

The above elements are summarized in Figure 1.

Figure 1 Influencing factors of the disaster prevention capability model of residential areas

‘Disaster prevention’ objects	System of planning elements	Segmentation of planning elements	Layout element
Material	Land use and	Residential	Building density

property	construction	building	Building floor area ratio
		Building quality	--
People	Road	Road	Road network density
			Road width
		Road square	Accessibility Effective area meeting evacuation needs。
	Public service facilities	Sports facilities	
		educational facility	
		Parking lot	
		Grassland	
		Medical and health	Accessibility Effective area meeting emergency needs
		Commercial service	
		Community service	
		Administrative management	
	Municipal public service facilities	Water supply	Meeting emergency supply needs.
		Electricity supply	
		Communication	

Source: it is made by the author

2 Weights of element in the assessment of disaster prevention capability in residential areas

2.1 Major issues identification

The basic idea of model construction is shown in Figure 2. The expert scoring method is used. Each expert's opinion passes the consistency test of the pairwise comparison matrix, and qualitative issues are transferred into quantitative calculations.

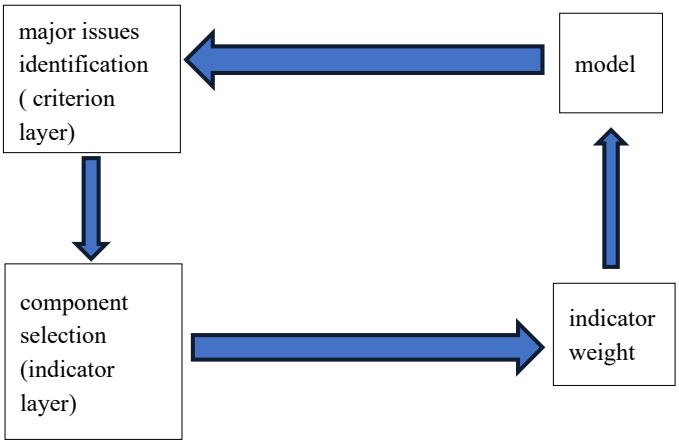

Figure 2 Model building work flow
Source: it is made by the author

The basic goal of disaster prevention in residential areas is to reduce material losses and casualties. Reducing the material loss, that is, reducing the loss rate of buildings and structures when damaged by disasters, is the foundation of disaster prevention in residential areas; reducing casualties, that is, improving the capability of personnel emergency evacuation and rescue, is the focus of disaster prevention in residential areas. Therefore, take the personnel emergency evacuation and rescue in residential areas as the major research issues, and the research is conducted around the relevant elements of the evacuation and rescue system in residential areas. The elements that are not closely related to it, such as the scale of residential buildings (building density, building floor area ratio) are eliminated.

2.2 Component selection

With reference to the research conclusions of the influencing elements of the disaster prevention capability model of the residential area, the main components that affect the disaster prevention capability are as follows:

(1) Building quality: whether the building quality meets the standard determines whether the building is damaged during the disaster, which affects the loss of material property, the number of casualties, further impacting the number of emergency personnel resettlement. Especially public buildings that undertake important functions, such as hospitals, fire stations, stadiums, police offices, schools, etc., have higher building quality requirements to ensure normal functions during disasters.

(2) The road traffic: once the damage to the building is inevitable, the road traffic is responsible for emergency evacuation and rescue of affected people. The density of the road network of road traffic, the width of the main evacuation road and the main rescue road should meet the requirements of safety and capacity.

(4) Evacuation shelters: affected people enter the evacuation shelters through the road traffic. The accessibility, safety and effective area of evacuation shelters should meet specific requirements. The location, their spatial layout with residential buildings, and building capacity (floor area ratio, density) and other indicators of public service facilities, green space, open space, etc. that can be used as evacuation shelters should meet certain requirements.

(5) Emergency service facilities: the affected people are separated from the disaster site. After being placed in a relatively safe area, they need the most basic living materials such as medical treatment, food, and drinking water. Therefore, medical and health, commercial facilities, community services, and administrative management in public service facilities should bear the emergency needs at this time.

(6) Emergency support infrastructure: the water supply, electricity supply, and communication in the municipal infrastructure directly serve for emergency support during disasters, and play an important role in post-disaster restoration, resettlement and reconstruction. If the infrastructure can be restored as soon as possible after the disaster, not only can the confidence in reconstruction be established, but also the lives of the people in the disaster area can be restored to normal order in the shortest time.

2.3 Determination of element weight

The Delphi method is used to determine the weight. Based on a total of 111 people including design professionals, experts, government management practitioners tested scoring (original data is omitted), their mean value, variance, and mode are analyzed, as shown in Figure 3 below.

Figure 3 Summary of opinions from the expert questionnaire

(1) Design professionals (31 people)					
	Building quality	Road traffic	Emergency shelter	Emergency service facility	Emergency support infrastructure
Mean value	27.1	21.6	16.7	15.4	19.2
Variance	119.1	31.2	22.9	14.3	23.6
Mode	20	20	15	15	20
(2) Experts (10 people)					

Mean value	27.3	21.6	19.3	14.7	17.1
Variance	72.6	29.9	13.9	14.9	22.2
Mode	20	15	20	15	20
(3) Government management practitioners（70 people）					
Mean value	25.2	19.5	17.5	16.4	21.4
Variance	107.9	23.2	20.2	17.2	26.7
Mode	20	20	15	15	20

T test is used to test whether the mean values of the three types of people's opinions are significantly different. Assume that there is no difference between the scores of the three types of personnel, that is, the mean values are the same. The EXCEL is adopted to perform calculations to obtain the conclusions shown in Figure 4 below. After checking the value figure of the T distribution, it can be seen that the t values among the three groups in Figure 4 are all less than the threshold value, indicating that the hypothesis test can be accepted at the 95% level, that is, the mean values of the three groups are the same. Therefore, the three groups of people have basically the same judgment on the problem, and the components and weight are relatively stable. The average of the three groups can be used as the final weight of the Delphi method, see Figure 5.

Figure 4 T-value analysis results of the significance test of the difference in the mean values of the three groups

T value	Building quality	Road traffic	Emergency shelter	Emergency service facility	Emergency support infrastructure	T test value (n) (95% level)
t_{12}	-0.0048	0	-0.3284	0.1267	0.2361	1.69(39)
t_{13}	0.0941	0.2956	-0.2067	-0.2894	-0.4148	1.66（99）
t_{23}	0.0585	0.2519	0.26742	-0.2899	-0.4744	1.67（68）

Note: t_{12} in the figure *represents the T-test value between the first group of design professionals and the second group of experts. t_{13} in the* figure *represents the T-test value between the first group of design professionals and the third group of government management practitioners. t_{23} in the* figure *represents the T-test value between the second group of experts and the third group of government management practitioners.*

Figure 5 Final weights of expert scoring method

Mean value	Building quality	Traffic	Emergency shelter	Emergency service facility	Emergency infrastructure
Mean	27.1	21.6	16.7	15.4	19.2

value 1					
Mean value 2	27.3	21.6	19.3	14.7	17.1
Mean value 3	25.2	19.5	17.5	16.4	21.4
Grand mean	26.5	20.9	17.8	15.5	19.3

2.4 Element weight subdivision

The weight of subdivision elements can be obtained in the same way, see Figure 6 below.

Figure 6 Element subdivision and weight analysis

Basic elements	Element characteristics	Element subdivision	Control variable	Value standard
Building quality (0.265)	--	--	Building quality (Qa)	The value is set as 3 for higher than the standard; the value is set as 1 for reaching the standard; the value is set as 0 for being substandard
Road traffic (0.209)	Road network density (0.4)	Relationship between traffic and land use	Overall spatial structure (SS)	The value is set as 3 with higher road network density; the value is set as 1 with middle road network density; the value is set as 0 with large road network
	Road width (0.6)	Route selection and surrounding building restrictions	Road width (RW) (0.4)	The value is set as 3 for higher than the standard; the value is set as 1 for reaching the standard; the value is set as 0 for being substandard
			Land function along the road (RL) (0.15)	The value is set as 3 for small flow traffic, 1 for general flow traffic, and 0 for high flow traffic
			Building setbacks along the road	The setbacks is set as 3 for more than 15 meters,

			(RB) (0.3)	as 1 for more than 5 meters, and as 0 for less than 5 meters.
			Building quality along the road (RQ) (0.15)	The value is set as 3 when it is beyond the standard; the value is set as 1 when it is satisfy the standard; the value is set as 0 when it is substandard
Evacuation shelter (0.178)	Accessibility (0.3)	Public facilities layout	Time for taking refuge (ST)	The value is set as 3 for satisfying requirements. The value is set as 1 for not satisfying requirements.
	Effective area (0.3)	Building capacity	Capacity for taking refuge (SC)	The value is set as 3 for satisfying requirements. The value is set as 0 for not satisfying requirements
	Safety (0.4)	Location	Safety of location (SL)	The value is set as 3 for satisfying requirements. The value is set as 0 for not satisfying requirements
Emergency service facilities (0.155)	Medical and health (0.4)	Location and capacity of medical institutions	Medical institution capacity (EH) (0.6)	The value is set as 3 for satisfying requirements. If there is an emergency plan but it does not meet the capacity requirements, set it as 1; if there is no emergency preparation, set it as 0
	Food (0.3)	Location and capacity of commercial facility	Commercial facility capacity (EC) (0.4)	The value is set as 3 for satisfying requirements. If there is a reserve of emergency supplies but the quantity does not meet the requirements, set it as 1; if there is no

	Drinking water (0.3)	;Location and capacity commercial facility		reserve, set it as 0
Emergency support infrastructure （0.193）	Electricity supply (0.3)	Electricity supply system	Safety measures for electricity supply system planning (IP) (0.3)	The value is set as 3 for those with disaster relief safety considerations, 0 for those without such considerations
	Water supply (0.4)	Water supply system	Safety measures for water supply system planning (IW) (0.4)	The value is set as 3 for those with disaster relief safety considerations, 0 for those without such considerations
	Communication (0.3)	Communication system	Safety measures for communication system planning (IC) (0.3)	The value is set as 3 for those with disaster relief safety considerations, 0 for those without such considerations

Source: it is made by the author

Based on the above analysis, a disaster prevention capability model can be obtained, as shown in formula 2.

$$\text{Disaster prevention capability} = 0.26Qa + 0.12SS + 0.05RW + 0.02RL + 0.04RB + 0.02RQ + 0.05ST + 0.05SC + 0.07SL + 0.08EH + 0.06EC + 0.05IP + 0.08IW + 0.05IC \quad (2)$$

3. Assessment method and practice of disaster prevention capability in residential area

3.1 Assessment method of disaster prevention capability

Standard Assessment Guideline Method is used for disaster prevention capability assessment. Figure 6 shows the value standard. The items in Figure 6 are scored one by one by trained professionals who are proficient in the principle of scoring. For example, the scores can be divided into three levels of 0, 1, and 3, and scores are based on the degree of compliance described in the item: 3 means higher than the standard or disaster relief considerations, 1 means that the standard is met, 0 means that the standard is not met or there is no disaster relief consideration. Generally, the more levels are designed, the higher the

requirements for scoring personnel, the greater the risk of error. The score is divided into three levels for easy operation. According to the disaster prevention capability model constructed above, see Formula 2, and the scoring rules, the residential areas are scored. Based on the pre-set assessment criteria, the highest score of the ideal plan can be calculated. In Figure 6, take the highest score for the 14 selected elements as 3, so the full score for disaster prevention capability is 3. The scores are compared with the highest score after disaster prevention capability assessment in the study area, and the level of disaster prevention capability in residential area can be roughly assessed. For example, it can be set: (1) 80% or more, that is, disaster relief capability with a score of 2.4 points or more is at the excellent level and have good disaster prevention capabilities; (2) between 50% and 80%, that is, the disaster prevention capability with a score of 1.5 to 2.4 belongs is at the middle level and has a specific disaster prevention capability; (3) between 30% and 50%, that is, the disaster prevention capability with a score of 0.9 to 1.5 is at the poor level and has a certain disaster prevention capability; (4) less than 30%, that is, the disaster prevention capability with a score less than 0.9 is at the worst level, that is, it does not have the disaster prevention capability.

Usually, in order to improve the credibility of the assessment method, two rounds of assessment are performed. In the first round, two people are selected to assess the disaster prevention capabilities of the same residential area, the assessment is conducted independently. Afterwards, the assessment results are compared and analyzed to find out the difference in scoring, and discuss and correct them. After the first round, the assessment staff reaches an agreement on the assessment standards. The second round is a formal capability assessment, which also adopts the method of double assessment and mutual check. According to experience (He Lei, Dai Shenzhi and Song Yan, 2011), without correction, when the same part of the two scores exceeds 70%, the assessment is considered to be very effective and the assessment results are highly reliable.

This method is suitable for the assessment of disaster prevention capability of mature residential areas and the residential areas that have not yet been implemented and in the planning stage. The variables in the formula are estimated and scored according to the evaluation criteria, and the disaster prevention capabilities, strengths and weaknesses of the assessment objects can be basically known.

3.2 Assessment practice of disaster prevention capabilities in residential areas

The model formula of disaster prevention capability, formula (2), shows that the 14 elements that affect disaster prevention capability are ranked as follows according to the impact weight: building quality (0.26), spatial structure (0.12), medical institution capacity (0.08), emergency water supply (0.08), location safety of evacuation shelter (0.07), emergency commercial facility capacity (0.06), road width (0.05), accessibility of evacuation shelter (0.05), evacuation shelter capacity (0.05), communication system (0.05), electricity

supply system (0.05), buildings setbacks along the road (0.04), land function along the road (0.02), and building quality along the road (0.02). The disaster prevention capabilities can be changed through changing the status of influential factors with larger weights. The following are the main methods to improve disaster prevention capabilities:

(1) Improving the building quality can greatly improve disaster prevention capabilities. The disaster resistance level standard of the building is proposed based on the prediction of the disaster level and disaster scale of the residential area, and the design, construction and maintenance of the building are carried out based on this standard. The overall safety of the residential area is closely related to the safety of each building. Improving the building quality can also effectively reduce the need for emergency refuge and ease the contradiction between supply and demand for refuge systems in residential areas.

(2) The spatial structure of residential areas can improve the efficiency of disaster prevention and evacuation of residents in residential areas. Increase the density of the road network, promote small-scale spaces and a pedestrian environment, improve the closed access control system with only one entrance and exit, connect groups and residential communities with each other, and improve the connection and space sharing between different areas in the community.

(3) The location and capacity of medical institutions is an important force to ensure emergency medical assistance during disasters. The allocation capacity of residential hospitals, health centers, and medical points should be checked according to the emergency medical assistance needs during disasters.

(4) Emergency water supply is the most important infrastructure to sustain life. From the two aspects of drinking water storage and emergency water supply, the safety of emergency water supply is comprehensively improved in terms of location safety, facility reliability, and emergency response capabilities.

(5) The safety of evacuation and refuge location is the basic prerequisite for ensuring evacuation safety. Choose buildings with strong earthquake resistance for evacuation shelters; choose areas with high terrain that are not flooded or buildings with reliable structures; choose places with convenient transportation that are free from bad geological disasters and far away from dangerous sources.

(6) The capacity of emergency commercial facilities includes the storage of important materials such as food and drinking water, which are the most important materials for sustaining life and living after disasters. For residential areas with a certain scale, there should be a stock of materials that can meet the basic needs of residents within 1-3 days after the disaster.

The methods corresponding to the above 6 variables are the main methods, accounting for 61% of the total impact. The remaining 8 variables, due to their smaller weights, are of limited importance compared with the 6 variables, so the variables with smaller weights are ignored.

4. Conclusion

As the most basic component unit of a city, residential area is the 'target area' affected by disasters, the basic unit of disaster prevention and mitigation, and the cell and cornerstone of urban safety and disaster prevention. In the urban disaster prevention planning system ('disaster avoidance -- disaster reduction -- disaster relief '), the residential area, as a micro unit, takes the reduction of material property losses and casualties as the disaster prevention goal, and the reduction of vulnerability and the improvement of disaster relief and emergency response capability as the overall disaster prevention requirements. On this basis, the safety plan elements in residential area are sorted and analyzed, and this paper puts forward that six elements such as the building quality, spatial structure, location and capacity of medical institutions, emergency water supply, safety of evacuation shelter, and emergency commercial facilities greatly affect the disaster prevention capability in residential area, and are the main influencing factors to improve the disaster prevention capability in residential areas. In the planning and design of disaster prevention and mitigation in residential areas, the above six elements are prioritized as strategic measures for planning and improvement, which can effectively improve the disaster prevention capabilities in residential areas.

Meanwhile, a complete research idea for the assessment of disaster prevention capabilities in residential areas is constructed, namely 'basic disaster prevention ideas--disaster prevention goals--element indicators--element weights--assessment methods'. The element indicators are systematic, and the assessment method is simple and easy to operate. It not only contributes to the research on the disaster prevention capability assessment of residential areas in China, but also facilitates the guidance of planning practice. The deficiencies are that the expert scoring method is used to determine the element weight, which is subjective; meanwhile, the disaster prevention capability assessment model has not yet been applied in practice. These aspects will be further study in this paper.

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Identification and Planning of Potential Ventilation Corridors: A Case Study of Wuhu, China

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Abstract
Ventilation corridors have a significant effect on the improvement of urban climate adaptation as well as the improvement of habitat quality. In the context of climate change leading to the frequent occurrence of extremely high temperatures, it is necessary to research urban ventilation corridors to optimise the urban wind environment and thermal comfort. In the past, wind speed measurement and computational fluid dynamics methods have had limitations in their application to large-scale urban spaces. In this study, with Wuhu City as a case study, a geographic information system (GIS)-based method was adopted to design an urban ventilation corridor suitability assessment framework for identifying potential ventilation corridors, which can support the identification and planning of ventilation corridors in large-scale urban planning and design.

Keywords: Urban Wind Environment; Ventilation Corridors; Compensation Space; Urban Heat Island (UHI)

1. Introduction

The world is currently experiencing significant changes characterized mainly by warming. Climate change is one of the most important challenges facing the global community in the 21st century, as it is causing problems such as sea level rise and the frequency of extreme weather events, which in turn are leading to a series of meteorological disasters and will continue to have significant impacts on natural and human systems (IPCC, 2021) The greenhouse gas (GHG) emissions lead to thermal changes in the built-up area. The deterioration of the thermal environment in built-up areas due to greenhouse gas emissions, the heat island effect, and the transformation of green spaces into impervious surfaces have also become one of the major concerns for global sustainable development, and how to cool cities has become a hot topic of research worldwide (Mirabi & Davies, 2022).

The heat island effect is closely related to urbanisation (Su et al., 2012). The problems of insufficient green space, over-concentration of population, and a large number of artificial heat sources all make cities heat islands. China is one of the significant regions in the global urbanisation process; in the rapid urbanisation process, the increase of urban population density and development intensity has led to a rise in the intensity of capacity release within the city. At the same time, the continuous expansion of the area of the urban construction area and the transformation of the land use type have led to a weakening of the ability of the city to communicate with the surrounding natural environment, especially in the urban construction area of the wind blockage by the building complex, the hardening of the urban underlay, industrial waste gas and traffic exhaust emissions, etc., all of which have led to the heat island effect. In particular, the blockage of wind by buildings in urban construction areas, the

hardening of the urban subsurface, and the emission of industrial and traffic exhaust have all had a negative effect on the urban atmospheric environment.
In the context of climate change, the heat island effect has become one of the major concerns of urban planners and designers today. The great potential of ventilation corridors in mitigating the urban heat island effect has been proven to be an effective urban cooling method in planning studies in Japan and Germany (Barlag & Kuttler, 1990; Kagiya & Yasunobu Ashie, 2009).

Ventilation corridors are an essential part of the urban wind environment, and urban canopy ventilation is considered to have great potential for improving urban heat islands. Many regions have incorporated them into their urban planning. To improve thermal comfort in cities, the 2016 Climate Change Adaptation Action Plan for Cities (CCAAPC) of China proposes the creation of urban ventilation corridors to improve the ventilation benefits within cities. Cities such as Shanghai, Beijing, Wuhan, and Nanjing have proposed "ventilation corridor planning" in their urban planning, intending to improve the urban ventilation environment through the study and planning practice of ventilation corridors.

Identifying spaces with ventilation potential is a prerequisite for ventilation corridor planning. To provide a reliable urban ventilation corridor planning method, this study uses Wuhu City as an experimental case to calculate the ventilation potential within the study area. The purpose of this study is to propose a quantitatively calculable method for identifying urban ventilation corridors, to estimate the suitability of ventilation corridors through heat island identification and built environment morphology analysis, and to provide a reference basis for ventilation corridor system planning.

2. Literature Review

The term "urban ventilation corridor" is derived from the German word "Ventilationsbahn", which refers to the channel constructed to improve the air mobility of the city, alleviate the heat island effect, improve the comfort of human beings, introduce fresh, cold and humid air into the urban area, which is an integral part of the urban wind environment. Urban natural ventilation comes from the local circulation system formed by the wind pressure difference and heat pressure difference. Kress carried out studies on air circulation in regional areas and pointed out that the urban ventilation system mainly consists of effective space (Wirkungsraum), compensation space (Ausgleichsraum) and ventilation paths (Luftleitbahn) (Kress, 1979). Ausgleichsraum refers to areas of the city where the wind environment urgently needs improvement, such as high-intensity built-up areas, densely populated areas, etc., and usually also areas with an intense heat island effect. Compensation space refers to areas that provide a source of fresh air, generate cool air, and promote air circulation, usually including broad blue-green spaces such as lakes and urban green spaces. Air-guided channels are air transfer paths that connect the compensation space to the action space. Based on the characteristics of the air flow, these passages can be divided into three categories: ventilation corridors (Ventilationsbahn), fresh air passages (Frischluftbahn), and cold air passages (Kaltluftbahn). Figure 1 demonstrates the relationship between the compensation space, effective space, and ventilation path.

The most commonly used technical approaches in the study of urban ventilation corridor analysis methods are wind speed analysis and computational fluid dynamics (CFD) methods (Ramponi et al., 2015) K. Niachou et al. conducted in wind speed measurements of street

canyons in Athens, Greece, to analyse the influence of urban morphology on airflow, environmental thermal effects (Niachou et al., 2008). The wind speed was measured in the street canyons of Athens, Greece. Because in situ measurements are time- and resource-intensive for data collection and are susceptible to unstable meteorological conditions (Schatzmann & Leitl, 2011), wind tunnels have been introduced to simulate urban wind environments. Previous studies have validated the correlation between building density and mean wind speed using wind tunnel test results (Kubota et al., 2008). The method can scale down the urban space and simulate the airflow in the laboratory by emulating the wind environment's characteristics such as wind speed, direction, and air pressure. This technique is simple, controllable, less susceptible to external environmental disturbances, and capable of continuous observation. However, it is more dependent on equipment and funding (He et al., 2022). Either field measurements or wind tunnel tests require costly experiments, limiting the method's practicality. With the advancement of computer science and technology, the computational fluid dynamics (CFD) method has been widely used in the simulation study of urban wind environments due to its advantages of lower cost, high accuracy, and speed (Ling Chen et al., 2017; Peng et al., 2017). Although CFD methods can simulate wind flow conditions in a small area with a high degree of refinement, they have a high demand for computational resources, and the modelling of CFD methods is too complex for many large-scale urban applications. In recent years, some scholars have used geographic information system (GIS)-based spatial morphology analysis methods to analyse building morphology and assess the urban wind environment using indicators such as surface roughness and building density for the identification of ventilation corridors (Hsieh & Huang, 2016; Peng et al., 2017; Liu et al., 2022).

Considering the limitations of wind speed analysis and CFD methods in large-scale urban space and the advantages of GIS-based wind environment analysis methods in large-scale spatial computation, this study will use GIS-based methods to assess wind environments and identify ventilation corridors at a large scale.

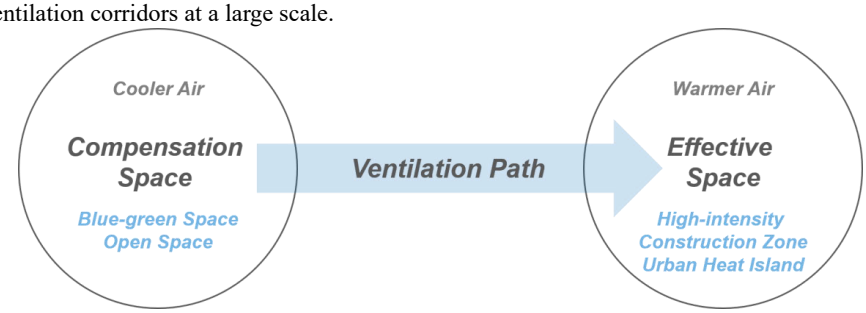

Figure 1. Relationship between compensation space, effective space and ventilation path

3. Materials and Methods

3.1 Study Area

Wuhu City is located in Anhui Province, China, on the lower reaches of the Yangtze River. The study area of this study is located along the Yangtze River in Wuhu City, north of the Qingyi River, about 30 kilometres along the river, with a total area of about 82 square kilometres. The year-round dominant wind direction in the study area is easterly, with an annual maximum wind speed of 18 m/s and an annual average wind speed of 2.8 m/s.

In summer, Wuhu City is controlled by the subtropical high pressure in the western Pacific Ocean, and there is more high-temperature and high-humidity weather. In the summer of 2022, the number of high-temperature warnings (≥35°C) in the area reached 41 days, in which there is a large slice of the high-temperature slice in the northern industrial agglomeration of the study area with a noticeable heat island effect. In terms of cold island areas, more cold island areas are distributed in the study area, including the Yangtze River, mountains, lakes, etc., forming more compensation space. Figure 2 shows the study area of this paper, a wind rose map with wind frequency statistics for different months of the year in the region, and urban heat islands identified by land surface temperature retrieval based on the August 2022 Landsat 9 OLI/TIRS data.

Given the high-temperature problems in the area, it is necessary to evaluate the wind environment in the area, identify and construct potential urban ventilation corridors, harmonise the characteristics of the urban climate environment, and improve the urban air circulation system.

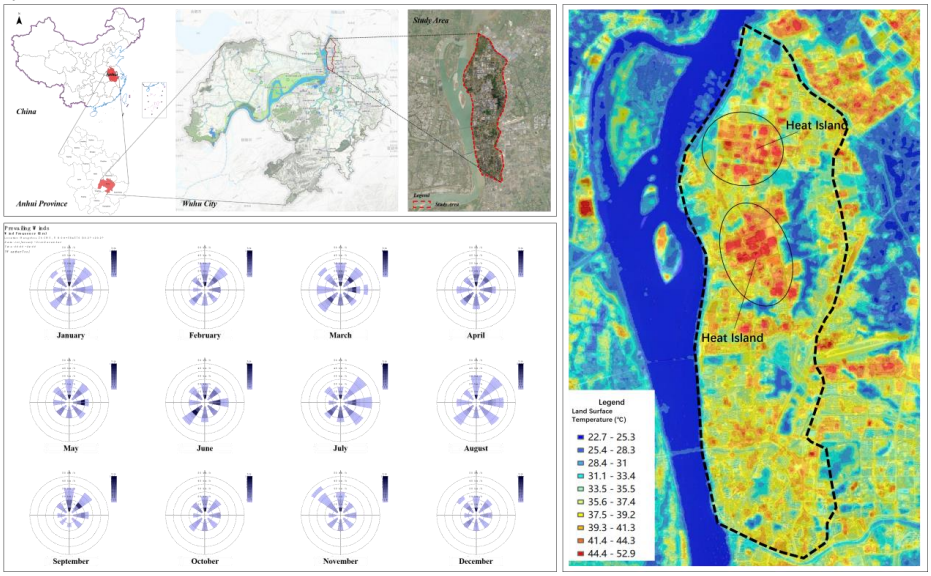

Figure 2. Study area boundaries, wind rose diagram, and land surface temperature

3.2 Data

Data were obtained from various sources, as shown in Table 1. All the data used in this study were calculated with the CGCS2000 coordinate system as recommended by the national government.

Table 1. Data sources and descriptions

Data	Data Source	Year
Landsat 9 OLI/TIRS data	United States Geological Survey (USGS) (https://earthexplorer.usgs.gov)	2022

Land use data (land use type)	Wuhu City Planning and Natural Resources Bureau	2022
Building data (footprint, height)	Wuhu City Planning and Natural Resources Bureau	2022
Road network data	Wuhu City Planning and Natural Resources Bureau	2022

3.3 Methods

This study aims to construct a wind environment assessment method based on a GIS multi-factor overlay to support the identification of ventilation corridors. The framework of the methodology used in this study is shown in Figure 3.

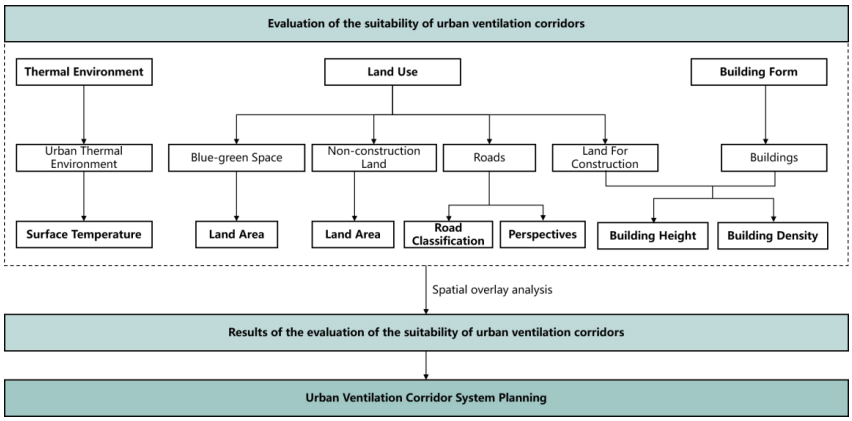

Figure 3. The framework assesses the wind environment and identifies urban ventilation corridors.

This study established a ventilation suitability evaluation method based on spatial superposition analysis, mainly considering the thermal environment, land use, and building form.

3.3.1 Thermal Environment

Land Surface Temperature (LST), a key parameter in the determination of urban heat islands, is the temperature of the Earth's surface as measured by thermal radiation and is one of the most important physical parameters examined in the modelling of land surface processes (Stewart & Kremer, 2022). This study used Landsat 9 OLI/TIRS data to retrieve the surface temperature to evaluate the urban thermal environment. In the analysis process, data from August 2022 were used, severe weather events such as rainy days were excluded, and the steps shown in Figure 4 were followed to calculate land surface temperatures within the study area using the atmospheric correction method and to identify heat island areas in the region.

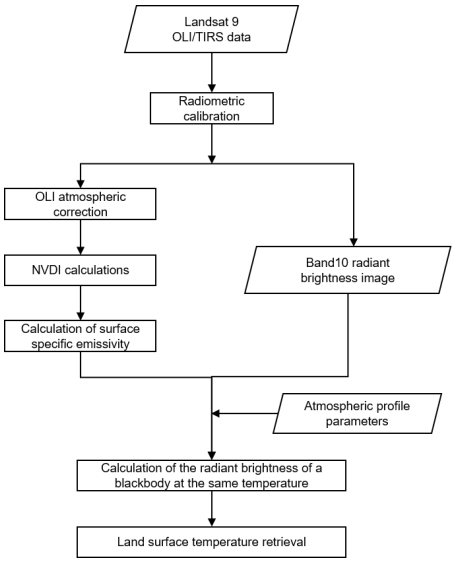

Fig. 4. Workflow of satellite image processing for land surface temperature

3.3.2 Land Use

The form of land use has an essential impact on the urban heat island effect, with different land use types having a heating or cooling effect on air temperature, affecting air movement (Hsieh & Huang, 2016). For example, blue-green space and non-built-up land use have a significant cooling effect and can serve as compensation space for urban ventilation systems; built-up land use acts as a heating effect on air temperature, while roads provide space for air circulation and has the potential to reduce temperature.

In this study, the land use types were divided into four types: blue-green space land, non-construction land, construction land, and roads, where blue-green space land, non-construction land, and construction land were assigned values based on the land area of the parcel, as well as the grade of the road and the angle to the dominant wind direction, which were used to calculate the suitability of the ventilation corridor.

3.3.3 Building Form

Building form affects urban ventilation mainly through building height and windward surface density (Yuan et al., 2014). Buildings are resistant to wind, and the higher the average building height and density in a plot, the more excellent the resistance to airflow. In this study, the average building height and windward surface density in each plot were calculated using building data as an indicator to evaluate the impact of building form on the wind environment.

3.3.4 Overlay Analysis

In this study, the data of three types of thermal environment, land use, and building form, were pre-processed, unified spatial reference coordinate system, resolution, rasterised and graded according to the ventilation potential for suitability evaluation, and the assignment rules are shown in Table 2. Among them, the very strong/strong suitability zone is an important wind

promotion element in the region and has the potential to become an important compensation space and ventilation corridor in the region; the very weak/weak suitability zone is an area with more serious thermal and air pollution problems, and it is a role space that needs to be considered for the construction of ventilation corridors in the future. After completing the assignment, the weighted overlay tool in ArcGIS Pro is used to performe the calculation. Finally, the evaluation results of the suitability of the ventilation corridor in the study area are obtained.

Table 2. Criteria for evaluating the suitability of ventilation corridors

Factor		Value	Suitability scale	Ventilation corridor suitability
Thermal environment (land surface temperature) (℃)		25-38	1	Excellent suitability
		38-40	3	Strong suitability
		40-42	5	Medium suitability
		42-44	7	Weak suitability
		>44	9	Very weak suitability
Blue-green space (waters, green spaces) (ha)		0-30	5	Medium suitability
		30-50	3	Strong suitability
		>50	1	Excellent suitability
Non-construction land (ha)		0-10	7	Weak suitability
		10-30	5	Medium suitability
		>30	3	Strong suitability
Land for construction (building height) (floors)		1-2	3	Strong suitability
		2-5	5	Medium suitability
		5-10	7	Weak suitability
		>10	9	Very weak suitability
Road (angle to prevailing wind direction) (°)	**Expressway**	0°-30°	1	Excellent suitability
		30°-60°	3	Strong suitability
		60°-90°	5	Medium suitability
	Main road	0°-30°	3	Strong suitability
		30°-60°	5	Medium suitability
		60°-90°	7	Weak suitability
	Secondary roads, branch roads	0°-30°	5	Medium suitability
		30°-60°	7	Weak suitability
		60°-90°	9	Very weak suitability

4. Results

The optimisation strategy of the ventilation corridor system in this plan mainly consists of compensation space and ventilation corridors, and the locations of the compensation space and ventilation corridors are determined using the results of the suitability evaluation in combination with the surrounding environment of the study area. The large agricultural and forestry land on the east side of the study area and the Yangtze River on the west side can be regarded as a considerable compensation space outside this ventilation corridor system, where cooler air can be blown by the prevailing easterly winds from the agricultural and forestry land on the east side to the action space within the study area, thus mitigating the impacts of the urban heat island and air pollution and evacuating the warmer air to the Yangtze River to improve the thermal environment in the study area.

The optimised ventilation corridors align with the prevailing wind direction in Wuhu City. This plan also grades the ventilation corridors and proposes the control requirements for urban construction in the areas around the ventilation corridors and recommendations for the width of the ventilation corridors. Figure 5 shows the ten ventilation corridors of the optimised ventilation system. In the first-level ventilation corridor, building height and density in the upwind direction of the city should be controlled as much as possible, and high-rise buildings should be appropriately dispersed to reduce building density and surface roughness. Appropriately increase the construction of open space in the upwind direction, maintain openness, create various forms of open space, appropriately increase the water area, and reasonably create ecological barges. Within the secondary ventilation corridor, the urban road system should be optimised as much as possible, keeping the road direction and the dominant wind direction all the time, improving the regularity of the road network and the number of straight lines to the road network. Improve the road section and design the combination of arterial roads and walking paths; both sides should be set up with a large width of the dense forest belt, planting sparse, low plants, which is conducive to air circulation—appropriate construction of green berms on both sides of the water system to improve airflow rate. Tables 3 and 4 show the compensation space and ventilation corridor in the Optimised ventilation system, respectively.

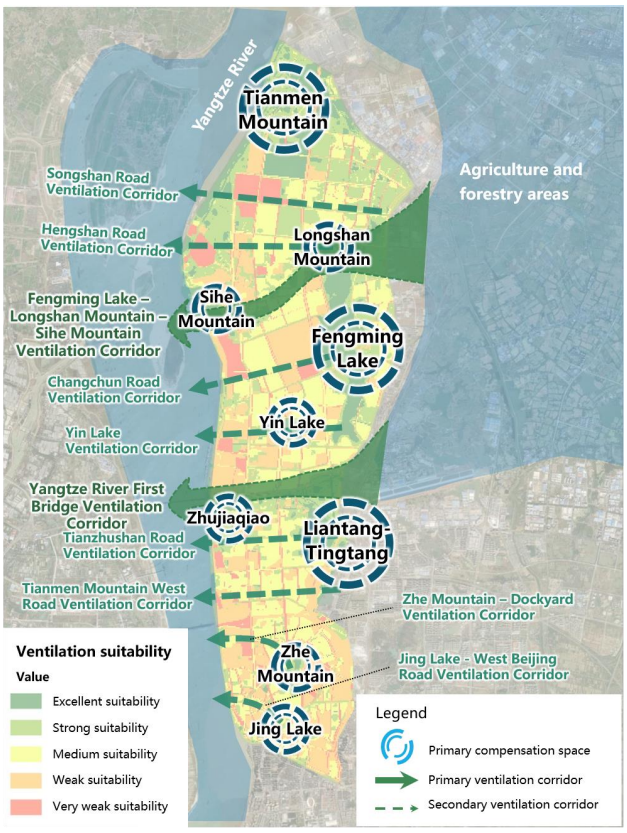

Figure 5. Optimised ventilation system.

Table 3. Compensation space in the optimised ventilation system

Type	Name
Compensation space outside the study area	Yangtze River
	Agriculture and forestry areas
Primary compensation space	Tianmen Mountain
	Fengming Lake
	Longshan mountain
	Sihe Mountain
	Yin Lake

	Liantang-Tingtang
	Zhujiaqiaowei Water Ecological Park
	Zhe Mountain
	Jing Lake

Table 4. Ventilation corridor in the optimised ventilation system

Type	Name	Function	Widths	Guidance for urban construction
Primary ventilation corridor	Fengming Lake – Longshan Mountain – Sihe Mountain Ventilation Corridor	Primary airways improve the quality of the urban atmosphere at the macro-overall level by integrating wind-promoting factors, including large-scale ecological resources such as lakes, forests, and farmland within and near the city, to lower the city's temperature and generate more cool winds for the city.	≥200m	Within the urban primary wind channel, building height and density in the upwind direction of the city should be controlled as far as possible, and high-rise buildings should be dispersed appropriately to reduce the density of buildings and reduce the roughness of the ground surface. Appropriately increase the construction of open space in the upwind direction, maintain openness, create various forms of open space, appropriately increase the water area, and reasonably create ecological barges.
	Yangtze River First Bridge Ventilation Corridor		≥200m	
Secondary ventilation corridor	Songshan Road Ventilation Corridor	The secondary wind channel mainly relies on roads and rivers parallel to or with a small angle to the dominant wind direction as a carrier to establish a secondary wind corridor with compensation space and action space to alleviate thermal and air pollution in local urban areas.	≥50m	Within urban secondary wind corridors, the urban road system should be optimised as much as possible to keep the road aligned with the dominant wind direction all the way and to improve the regularity of the road network and the number of straight lines to the road network. Improve the road cross-section and design roads combining arterial roads and footpaths, which should be flanked by dense forest belts of larger widths and planted with sparse, low-growing plants
	Hengshan Road Ventilation Corridor		≥50m	
	Changchun Road Ventilation Corridor		≥50m	
	Yin Lake Ventilation Corridor		≥50m	

	Tianzhushan Road Ventilation Corridor		≥30m	that are conducive to air circulation. Appropriate green space berms are constructed on both sides of the water system to improve air movement.
	Tianmen Mountain West Road Ventilation Corridor		≥50m	
	Zhe Mountain – Dockyard Ventilation Corridor		≥30m	
	Zhe Mountain – Dockyard Ventilation Corridor		≥30m	

5. Discussion and Conclusion

Ventilation plays an essential role in mitigating the heat island effect and improving air quality, and the evaluation of ventilation potential is a prerequisite for the identification of ventilation corridors. In this paper, by comprehensively considering various factors closely related to urban ventilation, we propose a framework for evaluating urban ventilation corridors based on GIS spatial overlay analysis, which is used to identify areas with ventilation potentials in a large-scale urban space. Based on the evaluation results, we propose a strategy to optimise the urban ventilation corridor system and clarify the ventilation corridors and compensatory spatial layout of the study area, which is inspiring for the study of urban ventilation corridors.

The method adopted in this paper can quickly quantitatively evaluate the ventilation potential of a city using only remote sensing data, land use, and building datasets and optimise the urban ventilation system accordingly. Compared with traditional techniques such as wind speed analysis and CFD, this method shows significant advantages in terms of efficiency and cost. It is well-suited for urban planning and design in large-scale spaces. In addition, we have also applied this method in the conceptual planning project along the Yangtze River in Wuhu City, and we hope that it can provide a convenient and intuitive scientific basis for urban planning decision-makers to promote more effective planning and decision-making.

Nevertheless, many factors affect the urban wind environment, and this study mainly analyses the thermal environment, land use, and building form for computational convenience. However, different types of construction land use have different impacts on the thermal environment, and various land use types should be further differentiated in future studies; meanwhile, the relationship between the orientation and frontal area density of the building form and the prevailing wind direction, as well as the frontal area density of the building, may also have different impacts on the ventilation efficiency. In future research, it is necessary to refine the specifics of the evaluation indicators to achieve a more refined analysis and improve the accuracy of this method.

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Moving forward in uncertainty? A serious game for validating interventions to manage uncertainty in public-private collaboration for sustainable mobility

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Abstract:
Public and private actors who develop mobility innovations in practice often rely on control and reduce strategies when facing uncertainty. Different strategies to deal with uncertainty have been proposed in theory that are more adaptive and robust, such as joint-fact finding and other collaborative governance approaches. Question is how to stimulate actors to use these approaches in practice. This paper has evaluated the effectiveness of an intervention on mindset and synergy, to test the idea that stimulating behavioural conditions can lead to more collaborative responses to uncertainty. This intervention was evaluated in a control and intervention session of a serious game that simulates a multi-actor decision-making process of negotiating about mobility innovations for a sustainable mobility plan. Both sessions were compared in terms of negotiation process and outcome, and strategies to deal with uncertainty. We found that in both sessions actors used collaborative strategies to deal with uncertainty, but in the control session participants were also applying control strategies for their own organization to reduce uncertainty, because of the inhibiting conditions on mindset and synergy. We conclude that combing a psychological perspective with governance approaches for uncertainty is a promising way to experiment with interventions to deal with uncertainty.

Key words: Uncertainty; Risk; Serious Game; Intervention; Decision-making

1. Introduction

In the context of a transition and implementing corresponding socio-technical innovations, public and private actors must collaborate (Ansell & Gash, 2007), especially in the field of transport (Lyons & Davidson, 2016; Martens & van Weelden, 2013). Making choices under uncertainty collaboratively is part of establishing a transition towards a sustainable society (Köhler et al., 2019). Where transition research is 'relatively strong in explaining past transitions and case studies, it seems less strong in designing (practical) interventions' (Zolfagharian et al., 2019, p. 11). Such interventions are necessary though, as actors struggle with finding appropriate responses towards uncertainty, and tend to rely on control strategies via traditional project management approaches, thereby ignoring the unpredictable and unknowable nature of innovations and transitions (Akse et al., 2023) .

In the literature, a broader set of go-alone and concerted strategies for dealing with different types of uncertainty has been proposed (Dewulf & Biesbroek, 2018), ranging from improving information exchange between actors, joint fact-finding, to stimulating trusting relations. The question is how to stimulate actors to use these approaches in practice. Different methodologies have been developed in other domains to stimulate collaboration and moving forward *despite* uncertainty, ranging from psychological interventions regarding judgement and uncertainty (Mussweiler & Posten, 2012) to analytical modelling approaches for constructing adaptive policy pathways (Marchau et al., 2019). Although such methodologies are promising in itself as a way to reflect on the role of uncertainty for individuals and organizations, there is a large challenge to connect these methodologies with actual decision-making practices and find conditions that help implementing them. In other words, there is a gap to apply promising approaches in a behavioural setting that does right to the complexity of an uncertain decision-making processes.

Therefore, we built a non-digital serious game that simulates a decision-making process in a transport context, with the aim of testing a multi-layered intervention. Serious games offer great opportunities to test and play with interventions in a controlled environment (Lukosch et al., 2018; Vervoort et al., 2022). In literature, a serious game is often treated as an intervention with the aim of education and learning (Stanitsas et al., 2019). It can be a form of decision-making support so that organizations can learn about a complex environment (Mayer et al., 2016; Meijer, 2012), or be part of an intervention in the design of the decision-making process without actively intervening in the behaviour of actors (Bekius et al., 2021). In this research, we take a hybrid approach, where we use a serious game as a scientific tool to experiment with an intervention that primes participants in changing their decision-making behaviour throughout the game. The research question this paper wants to answer is: How do conditions regarding mindset and synergy-thinking stimulate or inhibit decision-making practices under uncertainty in a serious game?

2. Theoretical Framework

2.1 Actor behaviour under uncertainty

Multi-actor decision-making for innovations involves two types of uncertainty (Mayer, 2009): system uncertainty, related to the unknown physical and technical state of the system that includes an innovation, and governance uncertainty, related to the social-political issues as a result of the interactions between multiple actors who have diverging and conflicting interests. Uncertainty is not just a characteristic of a system, independent of actors' interpretation of it. However, many studies do consider uncertainty in this way (Jensen & Wu, 2016; Lyons & Marsden, 2019). The consequence of conceptualizing uncertainty in that way is that both actors and scientists look for ways to reduce uncertainty, by getting a better understanding of the

system through gaining more knowledge about that system. Uncertainty is thereby outsourced and externalized by the decision-maker, without reflecting on underlying mechanisms, causes and values and assumptions that support behavioural responses to uncertainty in the form of double-loop or triple-loop learning (Argyris & Schön, 1978; Tosey et al., 2011).

This paper separates therefore an actors' *experience* of uncertainty in the decision-making process and response to it by specific strategies of dealing with uncertainty (Akse et al., 2023). Separating these concepts enables us to pinpoint specific behavioural conditions that stimulate or inhibit specific behavioural responses to uncertainty. In other words, it opens the opportunity for a more intervention-type of thinking in complex decision-making processes, which does right to the *human* aspect of uncertainty and its interpretation by actors in the field. In the design and playing of the serious game, we have developed an intervention that builds on two behavioural building blocks: mindset and synergy. We will theoretically work out these two concepts below.

2.2 Intervention for uncertainty management

2.2.1 Mindset

Mindset plays a crucial role in how individuals and groups perceive and manage uncertainty. The interplay between mindset and uncertainty can significantly impact emotional responses and actions, for example, in the context of information processing, approach to problem-solving, willingness to collaborate, or decision-making (Dweck, 2006).

People with an open mindset, in situations of uncertainty, are more likely to embrace challenges as opportunities (Baas et al., 2011; Silvia et al., 2009). This mindset fosters a more explorative and resilient approach to uncertainty, where the focus is on what can be learned or how one can adapt rather than on the potential for failure. People with an open mindset typically view uncertainty as a puzzle to be solved, which can lead to innovative problem-solving and creative thinking (McCrae, 1987; Williams, 2004). They are more likely to engage with complexity and seek out new information to navigate uncertain situations effectively and collaboratively (Grant & Berry, 2011).

Important to realize, an open mindset is not inherently a stable personality trait; rather, it can be viewed as a dynamic state that can be actively developed and stimulated through various practices and experiences. This view aligns with the broader understanding that many aspects of our personality and behaviour can be influenced by intentional actions and environmental factors (Steg & Vlek, 2009).

Two key approaches to stimulating and cultivating an open mindset are framing and inducing a promotion focus. Framing refers to the way information is presented or structured. The frame that surrounds a set of facts can alter perceptions by highlighting specific aspects, thereby influencing how people interpret, feel about, and react to information (Tversky & Kahneman, 1974).

For instance, framing information in terms of potential gains vs. losses leads to a promotion focus vs. a prevention focus. Promotion vs. prevention focus is known to lead to different thoughts, emotions, and behaviour (Higgins, 1998). The concept of framing is extensively used in psychology, marketing, politics, and media to guide opinion and behaviours in a specific direction (Levin et al., 1998). In the current study, we induced an open mindset and a promotion focus by how we framed the title of the game as well as the role description.

2.2.2 Synergy

In addition, cooperative and synergetic approaches towards dealing with uncertainty can be found in multiple fields of literature. Actor network theory (ANT) (Latour, 2007) points at the synergies that actors can develop, by finding shared solutions for in principle unshared problems. In the interaction with the other, actors can experimentally define how they complement each other's perspective and codevelop solutions that fit those perspectives. This is described in a more normative sense in the works on network management in decision-making processes (De Bruijn & Ten Heuvelhof, 2018; Koppenjan & Klijn, 2004). Moreover, contract design and management literature suggests practical incentivization of synergies via the usage of cooperative approaches (Roumboutsos & Pantelias, 2014), for example through revenue and risk sharing. When uncertainty is coming from actor interactions with possible conflicting goals, experimental cooperation is an enabling condition for trust building and solution finding so that different goals can be part of a shared solution. Adaptive co-management and trust building are thereby key in conditions of uncertainty (Armitage et al., 2009). Collaborative multi-actor approaches emphasize synergetic thinking as a way to deal with uncertainty of innovations, as these synergies can compensate for large uncertainties. Also, actors can embrace synergies as an instrument for designing future systems. In the current study, we induced synergy thinking by how the game was introduced to the players and by adding bonus effects between different innovations.

3. Game Description

To assess the effect of a multi-layered intervention on the decision-making behaviour under uncertainty, we developed a negotiation game in which a government, a public transport company and a start-up must negotiate in multiple rounds to develop a sustainable plan for a city region. The game includes a fictive but realistic setting of dilemmas and dependencies between multiple stakeholders about deciding which innovations will be part of the plan, and under which conditions. The game is open, in a sense that players have a lot of freedom to define these conditions in line with their need to accommodate and prepare for uncertainties that are inherently part of the innovation options and negotiation process. We played the game in an intervention and a control session, to compare how different conditions leads to different decision-making behaviour and outcomes. The intervention on mindset affected the players individually, and the intervention on synergies affected the relationship between the players and the different innovation options. An overview of the game is displayed in Figure 1. We will go into more detail about the scientific set-up and interventions of the game in Section 3.2.

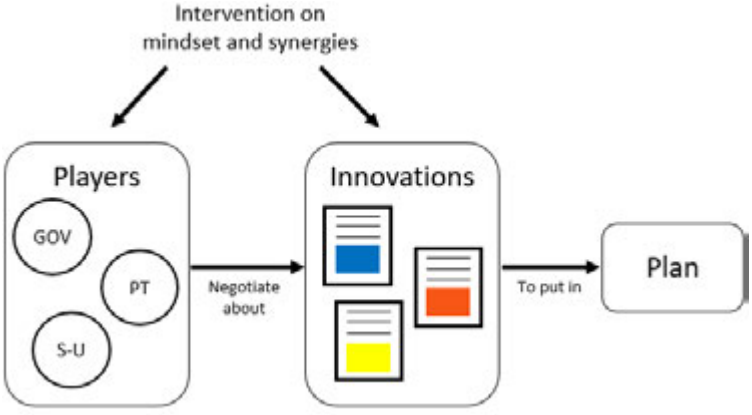


Figure 1: Overview of game, including the intervention. GOV = Government, PT = Public Transport Company, S-U = Start-up

3.1 Outline of game

The game is played in-person in a room, where the local public transport company and start-up have been called by the government to present their innovation options that could be part of the sustainable mobility plan of the government. Eventually, the practical aim of the game is to draft and negotiate a sustainable mobility plan for a city region that works towards zero emission in 2040. Previous research has described several elements that are useful for setting up a game that incorporates uncertainty. For example, Avendano-Uribe et al. (2022) have developed a serious game that allows a local community to play with uncertainty to build resilience. Uncertainty elements built in the game include role-playing cards, different scenarios, disaster dice and conflicting variables. Similarly, Schueller et al. (2020) let participants play a game to assess how uncertainty impacts the processing of information during natural disasters. Leclercq et al. (2023) developed a game-based learning workshop using role-playing activities and increasing self-awareness and reflection on participants' attitude towards uncertainty. van Schaik (2023) played two board games that include multiple roles and measures, aiming to ask participants to identify uncertainties. Other studies use digital tools, in the form of virtual reality (Hajahmadi & Marfia, 2023), or use a co-design approach to develop a game that helps make decisions under uncertainty for an ecological water system (Powell et al., 2021).

The building blocks for our game are the following:

- The transport planning context consists of a city region of about 150.000 inhabitants and is expected to grow by 20% by 2040. There are local diesel trains and buses, and intercity train station.
- Each player has multiple options in its portfolio to put into the sustainable mobility plan. These options have an expected estimated range of investment costs, realization time, emission effect and passenger revenue.
- An independent Assessment Agency provides feedback to the players by presenting the effect of the draft mobility plan regarding emission effect and passenger revenue.

A game session has the following structure:

1. Introduction of the city region, and division of roles between the players. Two participants play one role, and they read their role description and look into their budget and portfolio regarding mobility innovations. The government can pick from land-use measures such as a station renovation, densification, or bus-lanes. The public transport company has more incremental innovation measures in its portfolio such as a data-dashboard, electric buses, or on-demand transport. The start-up had more radical innovations in its portfolio, like mobility hubs, autonomous vehicles, and a drone delivery service system. A summary of the roles is given in Table 1.
2. The first negotiation round starts, and players talk about their measures and preferences
3. After a short individual reflection, players start a second round of negotiation and develop a draft plan with innovation options.
4. The independent Assessment Agency calculates the effect of the draft mobility plan. These numbers are not dependent on the players' plan and are used to put pressure on players to make a more ambitious plan. Also, three scenarios are presented to the players to stress-test their draft plan against.
5. In a final negotiation round, players can change their draft plan based on the calculations and stress-test against the three scenarios. Then, they deliver a final plan and then the game is over.

6. Individual filling in of a post-game survey and plenary de-brief regarding what went well, what could have been better and the role of uncertainty in the game.

Table 1: Players of the game

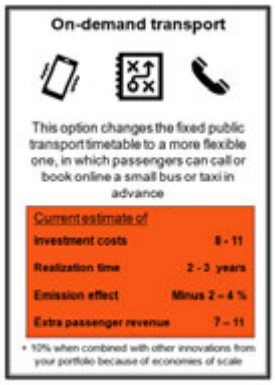
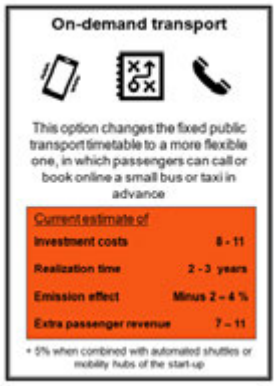
	Government	Public transport company	Start-up
Budget	50	10	5
Playing card typology	Land-use measures and station upgrade	Improving incrementally the existing public transport system	More radical innovations
Range of effect	Possibly large effect, but also high costs	Smaller effects, but lower range difference	Larger effects, but higher range difference

Uncertainty comes into the game in two ways. Firstly, the measures in the portfolio of players do not show exact estimates of the effects of each measure. Moreover, it is unknown what the total number of selected innovations does to the overall emission reduction of the mobility system. These elements refer to system uncertainty in the game. Secondly, in the negotiation rounds players do not know what options are available with other players, or how to value the estimates that other players present to them. Can they indeed rely on the numbers and narratives presented, or is the innovation overhyped? Players have the freedom to use and interpret the numbers to what they think is wise. This means they can also be overly optimistic or just lie to other players. These elements refer to governance uncertainty.

3.2 Scientific set-up of intervention

We developed two versions of the game in the form of a between-subjects design, where a control session is compared with an intervention session. The multi-layered intervention focuses on changing relevant conditions for actors (Rauws, 2017), priming them towards different decision-making behaviours. The conditions in the control session are not neutral, meaning that the difference between both sessions is just the intervention. Rather, we designed the two groups in such a way that the control session worked under inhibiting conditions for collaborative and adaptive decision-making behaviour, and the intervention session worked under stimulating conditions for collaborative and adaptive decision-making behaviour, based on theoretical insights on mindset and synergies as set out in Section 2.2. The intervention consists of two elements: (1) priming a different uncertainty mindset of promotion-focus that stimulates collaboration and (2) emphasizing synergies and design thinking between different types of innovations. An overview of how these concepts have been operationalized for the two different sessions is displayed in Table 2. A different mindset was induced by the title of the game and the given role description to players. A different synergy effect was induced by describing the aim of the game and the innovation bonuses on the playing cards.

Table 2: Operationalization of conditions in control and intervention session

	Operationalization	Control Session	Intervention Session
Mindset	Name of the game	"A safe journey to the future"	"Design the future together"
	Role description (example of government)	Pay attention: • You don't have experience with the start-up • You do not feel much support from the local alderman • You want to reduce the risks as much as possible for your organization	Pay attention: • You have successfully worked together with the start-up • You do feel much support from the local alderman • You would like to explore together to come a robust and sustainable plan
Synergy	Introducing the aim of the game	• Distribute the investment costs • With a focus on an optimum of costs and revenues	• Realize as much benefits as possible • With a focus on the other and a sustainable future
	Playing cards (example of public transport company)		

An important element in the game flow is the so-called 'stress-testing' of the draft plan by players, which involves an examination of how it would perform in different possible futures (Marchau et al., 2019). When a plan is seen to perform less well, it may prompt either a rethink of the plan or consideration whether implementation should be delayed until clearer indications how society is changing, or whether implementation should proceed with the option to scale back if change is unfavourable. Stress-testing is based on the idea of dynamic or adaptive robustness, by making adaption key in the plan formulation (Moallemi et al., 2020). Through monitoring and mid-course corrections, actors keep the system headed towards the original goals while the future unfolds. In the context of our game, we let players stress-test their draft plan against three different scenarios:

- Scenario 1: The 15-minute city has become a prominent paradigm to plan the urban system by
- Scenario 2: Current trends of higher individualized mobility and increasing travel distances by car continue
- Scenario 3: There are lower entry barriers for companies to enter the mobility market, so that there is more competition and flexibility in transport market

The purpose of the stress-testing element in the game is to trigger participants to reflect about the robustness of their plan, and whether the interventions on mindset and synergy influence

participants in the form of choosing for adaptive actions as a response to the three different scenarios.

3.3 Data gathering and analysis

We have played the control and intervention session with a mix of professionals having a background as a practitioner or scientist in the field of transport, mobility, and planning. Each role was played by a team of two persons, so that players had the opportunity to discuss and reflect within their team. To test the game, we piloted the control version of the game in three sessions with master students who had a background in geography and planning. Different authors of the paper facilitated the control and intervention session, but used the same game, session-specified presentation, and a facilitator script.

Research data has been gathered both on a content and process level. Content-wise, the sustainable plan itself has been compared in terms of cohesion. Through observations and transcribing the conversations between players, uncertainty management strategies have been retrieved and compared between the control session and the intervention session. A post-game survey asked questions about the level of uncertainty that players experienced, and the extent to which they collaborated well with other players.

4. Results

4.1 Overall impression

In both the control and intervention session, participants struggled with the uncertainties in the game in the form of unknown estimated effects of the innovations and uncertainties related to interaction with other players. In the de-briefs, participants mentioned about system uncertainty that they 'found it hard to compare two measures with each other, even when there is no different range of effects. How can I negotiate based on that, while I am not entirely sure myself?'. Participants mentioned about governance uncertainty for example that 'especially in the beginning, I was not sure what the government wanted. And I could not see all the cards, for example the parking option was a bit hidden'. Participants appreciated some elements in the game as very realistic, such as the promises made by companies about sustainable effects and the role of the Independent Assessment Agency who presented cost-benefit calculations and emission effects. Because the government had significantly more budget than the other players, they also had a strong say in both mediating and selecting innovations as part of the mobility plan, just as in practice. Some players missed an element to make a balance between long-term and short-term effects of innovations, but this can also be related to the real-life uncertainties of innovations in practice. When comparing the test sessions with planning students with the sessions with work professionals, it was striking to see that the students were highly focused on cost-effectiveness of innovations, calculations, and the division of investments between players. Participants with work experience in control and intervention session, however, acted more vision-led based on the possibilities of innovations, supported by their experience with such innovations in the work-field.

4.2 Control session versus intervention session

We will now analyse the effect of the intervention by comparing the game sessions of the control session with the intervention session, according to two categories: negotiation process and outcome, and strategies to deal with uncertainty.

4.2.1 Negotiation process and outcome

After reading their role and deciding on the strategy to go for, both the governments in the control session and the intervention session started with explaining their goals for the city. In

the control session the government only discussed their goals, and then led the PT company and start-up present their options. Then, the government presented their vision on being a 15-minute city with a strong PT backbone, which meant that that they would go for densification and an upgrade of the train station. Since these options were quite long-term, they were looking for more complementary short-term innovations by the PT company and start-up. The government was open about their budget and asked whether the companies also had money to invest into the plan. The companies did not reply directly but stated that they had some budget but extra investment from the government was necessary. The start-up presented its innovations as short-term solutions, and the PT company presented itself as a reliable partner that could provide door-to-door services in a flexible PT system. The government selected on-demand transport from the PT company as an option that links with densification, and the mobility hubs from the start-up as an option that could function as a switch between the rural areas and inner-city area. In the second negotiation round started, the government still wanted to strengthen the existing PT network, so they selected bus lanes as an option for the plan. The shared scooters option from the start-up was also selected, but only when the scooters were replaced by e-bikes in the mobility hubs. The start-up pushed for its own innovation (autonomous vehicles) though because this option had higher profit estimates. The PT company presented their real-time data dashboard as an innovation option that fitted with the demand-responsive transport option. The bus lanes were also added by the government because that was not expensive. After the calculations by the assessment agency, it became clear that the sustainability goal would not be reached by 2040. Therefore, the government asked for other options so that the goal could be reached. The options presented by the start-up (autonomous shuttles and drones) were rejected by the government because of institutional problems and lack of willingness by politicians, but the electric buses from the PT company were added to the final plan because this option gave a reliable decline of emissions.

In the intervention session, the government had a similar 15-minute vision for the city, based on the densification and train station upgrade. The government was open for options as presented by the companies and mentioned that the transport market was free to join for all without additional investments by the government. Then, the PT company and the start-up started to present their options to the government and emphasized the synergy effects of combining some of their options with other innovations. For example, the mobility on demand option was selected because it had a synergy effect with mobility hubs. And the mobility hubs were firstly selected by the government because it would fit with their vision of the 15-minute city. All players were open about their budgets. Both the PT company and start-up were pre-selecting options that they thought would be most cost-effective and fitting with the sustainability goals of the government. After some calculations made by the government, they thought there would be room for extra investments to achieve their sustainability goals. Therefore, they added shared scooters, digital twins, data analysis and parking tariffs based on the expectation that the overall designed system would have such synergy effects. These synergy benefits would outplay the initial investment costs. After the calculations by the assessment agency, it became clear to the players that more action was necessary but that no investment budget was available anymore. Therefore, a deal was made by the government to add the data dashboard along with the electric buses from the PT company, and the autonomous shuttle along with the bus lanes from the start-up. It was agreed upon that the potential extra benefits because of the expected synergies would be used to cover the extra investment costs of the innovations.

To sum up, the chosen mobility plan in the intervention contained more investments and innovations than the plan in the control session. Although in both sessions all money was spent,

the players in the intervention session agreed upon more positive estimates of costs and benefits than in the control session. Also, they used money from potential future benefits as investment money in the present. Both in the control and intention session, players looked for a balance between land-use measures and mobility measures, as well as combining long-term measures with short-term measures.

4.2.2 Effect of intervention on mindset and synergy

In the control session, players were quite hesitant to share their budget to other players. Only halfway the game, budgets were openly shared. There was quite some uncertainty and competition in the control session between the PT company and the start-up. For example, when presenting their mobility-on-demand system, the PT company said the following about the options presented by the start-up:

"We want to be reliable. I like the scooters [by the start-up], but they can also break easily. With our buses you know that things will not break. Our service is more about the first and last mile, integrated into the PT network."

The competitive language seemed to be a direct consequence of the condition on synergy that was given to the players, namely that there would be a 10 percent bonus for the individual options when combined with other options from their own portfolio. The uncertainty that was there about the options and budgets of both companies was also strategically used by the government was a way to push the companies to make sharper offers, or to challenge a company to think along with the governments' vision. The government acted here as selector and mediator of innovations, by choosing for innovations that fitted with their vision of the 15-minute city. In general, the start-up was struggling in the control session to be a partner because of the condition on mindset that described that the PT company and government did not have any prior experience with the start-up. The effect of this condition can be illustrated by the following discussion on how to distribute the investment costs of the mobility hubs:

Start-up: "If you could provide more investment in the hub as a government, we have more money available to look into something complementary to the hub, for example the digital twin"

Government: "But when we have a more qual investment in the hub, that would make you also committed to deliver these services. Otherwise there could be a tendency that you say, the hub is nice, but we do other things now."

On several moments in the control session, the government did not choose to collaborate with the start-up because 'local politicians did not like it' or because of politicians 'not willing to take a lot of risk' (as described by the conditions on mindset). In the final stage of the game, the start-up did try to sell the autonomous vehicles and drones, but this was rejected because the government expected that it would take too much time and that the innovations were too new. Here, the uncertainty of innovations influencing the short-run made the government choose for the more reliable option of the PT company.

In the intervention session, however, there was almost no competition at all between the three different players. The PT company thought along with the government by pre-selecting options that would fit their goal of sustainability, not out of self-interest. Also, the PT company and the start-up were actively looking for synergies between the different options, so that it would have the largest emission effect for the government. At first, the start-up framed the estimations for its innovation in a positive way, by referring to a maximum effect at a minimum cost. Because

the PT company was honest about the ranges of effects of innovations, the start-up chose to be open about the ranges as well, 'because we have a good-relationship with the government' as described in the intervention conditions on mindset.

Just as in the control session, the government functioned as selector and mediator in the negotiation process of innovations. But, in contrast to the control session, the players were from the beginning open to each other about their innovations, budget and were collaborative in terms of discussing how each innovation would fit with another innovation. This resulted in the end in agreeing upon a deal where potential future profits of the start-up (then: scale-up) and PT company would be used to fill the gap of initial investments in the now. This deal could be made because the government 'trusted on the good experience and expertise of the start-up'.

4.2.3 Strategies to deal with uncertainty

In comparing the control session and intervention session, we can see similar and different patterns of how players dealt with uncertainty. These patterns are displayed in Table 3.

Table 3: Observed strategies to deal with different types of uncertainties in sessions

Strategies in Control Session	Strategies in Intervention Session	For type of uncertainty
Start with a vision that links specific elements together		System and governance
Be open with other players to ask what options they have in their portfolio		Governance
Finding win-win combinations that provide synergy		System
Being closed on what to spent	Being open on what to spent	Governance
Comparing and framing with innovations of competitor	Collaborate and present options together to the government	Governance
Use optimistic scenario of innovation estimates		System
Use the average scenario of innovation estimates		System
Assuring equal investment shares as government for compliance	Willingness to fund innovations that benefit the government	Governance
Saving budget as government as robustness measure	Spending all budget to achieve the sustainable goals	Governance
Choosing based on what is familiar, institutionalized and you have experience with	Choosing based on trust and positive earlier experience	Governance
Choosing the reliable option	Choosing the option with greatest potential effect	System

We found in both sessions that the government had the lead with stating a vision, and asking the companies what they could offer for the sustainable mobility plan. Also, we found that in both sessions the government was looking for synergies, either based on their developed vision (control session) or the synergy cues on the play cards (intervention session). After the initial phase, however, we see different patterns that can be traced back to the different intervention conditions in both sessions. Where in the control session companies were more competitive, players in the intervention session actively worked together as a team. In the control session the government made explicit choices not to collaborate with the start-up based on conditions that describe bad earlier experiences and risk-averse politicians. In the intervention session, the

choice was made by the government to just experiment and trust the start-up to develop its innovations further with co-funded investments.

A final game element to compare the control and intervention session by is the reaction to the stress-testing scenarios as presented by the independent assessment agency. It was striking that in both sessions the government chose to have a 15-minute vision as a basis. It was therefore also concluded by players that this scenario would be no problem in the future. Also for the other two scenarios, players were positive about the robustness of their initial plan and did not make any changes other than adding innovations so that the sustainability goals would be reached. For example, in the intervention session it was mentioned that in the second scenario of higher individualized mobility, there would be more taxes that could be spent on enhancing the public transport system, and that individualized transport such as shared scooters could be scaled up so that demand would be met. The discussion around the measures of responding to different scenarios remained pragmatic, also because of limited time.

5. Discussion

Developing a serious game requires to create a balance between meaning, reality and playfulness for players (Harteveld et al., 2009). In general, participants found the game quite realistic in terms of collaboration dynamics between different actors, and the uncertainties of innovations that were interwoven in the game. Also, participants appreciated the calculations by the assessment agency and treated its outcome as meaningful based on the expectation that a 'true' model lied behind these calculations. The city map and the play-cards were appreciated by the participants as an engaging way to negotiate about the mobility plan. However, participants did mention that in real life different stakeholders would not talk and negotiate as open as was done in the game. In practice, governments are bounded by concessions and laws that forbids them speaking to companies in an informal way as it could lead to an uneven level playing field in terms of knowledge and information. Also, the element of political uncertainty and media dynamics was mentioned as a relevant in real-life decision-making processes that was missing in the game.

The measurement of how large the effect is on decision-making behaviour due to interventions on mindset and synergy is dependent on specific conditions such as the background and experience of players or the facilitator. However, we can still compare the control and intervention session, by viewing the serious game sessions as a form of case study research in a controlled experimental setting. We indeed found patterns that interventions on mindset and synergy lead to more collaborative strategies to deal with uncertainty by actors, as hypothesized in literature in the field of psychology (Baas et al., 2011; Grant & Berry, 2011) and public-private partnerships (Roumboutsos & Pantelias, 2014). These patterns are not occurring uniformly though. Both in the control and intervention session, players displayed the willingness to look for win-win situations and synergies. However, in the control session, inhibiting conditions made players negotiate also in a competitive way with a focus on reducing uncertainty from an individual perspective, whereas this behaviour was almost absent in the intervention session. Players in the control session were willing to negotiate together when it fitted their vision or strategy, and when this was not the case a player used the inhibiting conditions as an (opportunist) argument not to collaborate. In psychological terms, it seems that the inhibiting conditions in the control session led participants to go into a prevention focus (Higgins, 1998), while participants in both the control and intervention session also made choices based on a promotion focus. This promotion focus might be caused by a positive attitude of participants towards adaptivity and finding the best solution in the game. In the post-game survey and de-brief of the control session, participants mentioned that they acted

collaboratively and consensus-finding, while this is only half the story when looking at actual decision-making behaviour in the game. This re-call bias suggests that participants are indeed willing to look for synergies and collaboration (promotion-focus), but not at the moments when this does not fit with their own agenda or strategy (prevention-focus). In other words, they were not willing to tackle the uncertainties together in a co-development style. This had also an effect on the outcome of the game. Where in the control session all investments were neatly covered and distributed over the game, players in the intervention agreed on a plan that was more open and flexible in terms financial coverage.

A critical reviewer of this study could pose that we merely instructed players to behave differently, instead of observing different individual choices due to the intervention conditions we put them in. There are some reflections to make about this point. Firstly, we observed that players acted naturally in the game, and we saw that different frames and role descriptions were not used ad-hoc but in line with players' overall decision-making behaviour. Secondly, participants told in the de-brief that they were not aware of the interventions during the game, which makes it less probable that they merely acted by blunt following the instructions. Finally, the overall aim of the game was to put players into different settings, so that a difference could be measured between these settings. So even when players did pick up on the different instructions and acted accordingly, it would not make the outcomes of this study less valuable because it proves that specific behavioural conditions affect indeed the overall decision-making process and corresponding negotiation outcome.

It is of course the question how these results can be translated to actual decision-making practices, beyond the controlled experimental setting of a serious game. Future research could look into the application of interventions in real and ongoing cases using game-theory (Bekius et al., 2021), combined with psychological theory on mindset (Dweck, 2006). Together, such interventions could form strong behavioural triggers to inhibit responses to uncertainty based on reduce and control, and stimulate response based on collaborate and experiment (Akse et al., Forthcoming).

Another more theoretical direction for future research could investigate finding clearer relationships between stable personal attitudes, local conditions, and the display of promotion and prevention focus while dealing with uncertainty. Also, future research could look into different types of conditions and cues that might help or hinder stakeholders in making robust and adaptive plans. For example, under which conditions does the upfront mentioning of a stress-test stimulate stakeholders to make a more adaptive plan, and when triggers it stakeholders to make a more conservative plan? Further development of experimental settings could be a way forward here.

The serious game sessions were played by practitioners with a background in Dutch mobility planning, which is highly focused on consensus-finding compared to other institutional contexts (Koppenjan & de Jong, 2018). Playing the game with practitioners working in different institutional settings might provide insight in how uncertainty and interventions affect decision-making practices in for example more competitive transport markets. Such participants might have different experiences and attitudes towards uncertainty, which could alter the effectiveness of an intervention on mindset and synergy.

6. Conclusion

This game study was set up to assess the effect of interventions on multi-actor decision-making behaviour related to uncertainties. A game setting simulated the context of a government, public

transport company and a start-up negotiating about innovations to put in a sustainable mobility plan. In this setting, interventions on mindset and synergy were intended to change the behavioural conditions in which actors make decisions under uncertainty. This application of the serious game is novel, as most games on complexity and uncertainty have the aim of learning or decision-making support (Bekius et al., 2021; Leclercq et al., 2023).

We found that in both the control and intervention session, participants were willing to collaborate and look for win-win situations, but that in the control session participants were also applying control strategies for their own organization to reduce uncertainty, because of the inhibiting conditions on mindset and synergy. These responses to uncertainty made the overall negotiation process less collaborative, which led to a less flexible and open mobility plan than in the intervention session. More experimental sessions are necessary however to validate these findings.

The results of this study in a controlled setting can be used for building larger intervention and training programs in ongoing cases, to change actors' mindset, competencies, and adaptive capacity in dealing with uncertainty. Combing a psychological perspective with decision-making and governance approaches for uncertainty has proven to be a fruitful way to experiment with and test the effectiveness of interventions for collaborative approaches to deal with uncertainty.

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Managing coastal risks in the Mediterranean through participatory processes. Preliminary insights from the Metropolitan City of Bari (Southern Italy)

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Abstract
Coastal erosion is a critical issue in the Mediterranean Basin, heavily impacting vital coastal industries like tourism, agriculture, and fishing. Climate change compounds these problems, worsening floods and storms. To counteract the risk of erosion and flood, «hard» engineering-based approaches have been used, often prove ineffective and undesirable effects. Recognising the need for a shift, the international community advocates for Integrated Coastal Zone Management and Nature-based Solutions. Participatory actions involving local communities and stakeholders need to be provided to facilitate collaboration and consensus-building and to enhance peoples' perceptions. Through a case-study analysis in the Metropolitan City of Bari (Italy), this paper tries to understand if policy-makers and stakeholders acknowledge and consider the newly proposed methods for coastal risk management as a potential alternative or supplement.

Keywords
Coastal areas, Risk management, Participatory System Dynamics modelling, Italy

1. Introduction

The Mediterranean Basin faces huge challenges, mainly due to high anthropogenic pressures and its climatic borderline balance (EEA, 2020). It is defined as one of the most critical erosion hotspots in Europe, heavily affecting the main economic industries along the coast (beach tourism, agriculture and fishing activities) (EEA, 2020). Moreover, climate change exacerbates the impacts of other phenomena such as floods and storms (UNEP/MAP and Plan Bleu, 2020). Traditionally, to deal with such complexity and to reduce the vulnerability of the Mediterranean coastal areas, "hard" engineering-based approaches have been used to counteract the risk of erosion and flood (e.g. through the construction of groins and breakwaters). However, such measures have led to ineffective and, most of the time, undesirable effects (Motta Zanin et al., 2023).

As a matter of fact, the necessity to change perspective to manage coastal risks has been recognized by the international debate and new solutions have been identified as alternative or complement solutions (e.g. Nature-based Solutions) (Motta Zanin et al., 2024). Moreover, a more comprehensive and systemic approach, compared to sectoral perspectives, has been designed, namely Integrated Coastal Zone Management (ICZM). A key aspect of the ICZM Protocol refers to the need to define necessary measures to ensure an appropriate involvement of the various stakeholders, in all the phases of formulation and implementation of coastal and strategies, plans and programmes or projects (Turner and Bower, 1999).

For the effectiveness of the ICZM process, participatory actions involving local communities and stakeholders as well as techniques and analysis tools providing information necessary for the follow-up of projects and for decision-making, need to be provided (Motta Zanin et al., 2023). This would allow an improvement of communications and consultation, facilitating collaboration and consensus-building, enhancing stakeholders' and local communities' perceptions of the adopted solutions and, thus, their knowledge and understanding (Slovic, 1987).

Within this frame, this work tries to answer the following key-question:

Are policy-makers and stakeholders acknowledging and considering the newly proposed methods for coastal risk management as potential alternatives or supplements?

To answer the key-question, we selected a case-study in the Mediterranean basin: the Italian Metropolitan City of Bari in Puglia Region (Southern Italy). As the only Metropolitan City in Southern Italy facing the Adriatic Sea, we identified it for two main reasons: (i) the governance system at the metropolitan scale as the most efficacious level for the implementation of solutions for coastal risk management; (ii) the complexity of the City due to its physical, environmental, socio-economic and institutional characteristics.

2. Methodology

To analyse the case-study, we developed a Participatory System Dynamics Model (PSDM), by following the methodology described by Valencia Cotera, Egerer and Máñez Costa (2022). It consists of five incremental work steps (Figure 1) and allows to outline a shared understanding of a problem, within a complex and dynamic system characterised by wicked problems and, most of the time, multiple conflicting interests.

Within this frame, this paper focuses on the preliminary results of the first research phase, based on the first four steps of the process:

01) stakeholder analysis, identifying actors, representing public and private bodies, with different kind of responsibilities (management, regulatory, economic, social and environmental);

02) semi-structured individual interviews, guided by the building of individual mental model maps, to understand each actor's perception of coastal risks. The mental model maps represent the "status-quo" of the coastal area of the Metropolitan City of Bari, in which the social and ecological components of the coast, the main activities and uses, the existing regulatory and planning system, and the existing risks and impacts are correlated (causal links);

03) desktop work, consisting in the analysis of each individual model and the building of the collective preliminary model outlining a general overview of the system by ranking the recurring variables and relationships;

04) building of the group model through a workshop where all actors discuss the variables and causal links of the coastal risks for the Metropolitan City of Bari emerged from the individual interviews.

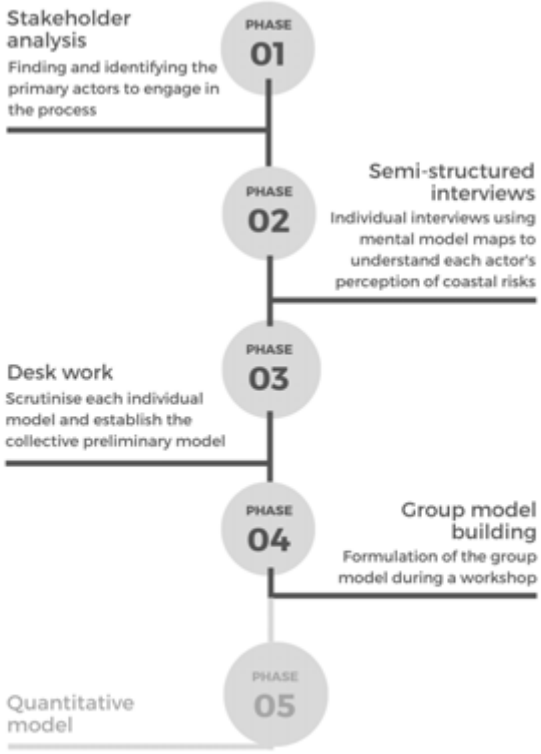

Figure 1 – The process performed to build the Participatory System Dynamics Model (PSDM). Source: Authors' elaboration

3. Framing the case study

The Metropolitan City of Bari is the only one in Southern Italy facing the Adriatic Sea. The coastline is heavily urbanised through medium and large-sized urban settlements (six municipalities including the capital and coastal towns) separated by limited undeveloped areas (Figure 2). The undeveloped zones are sensitive both for landscape and environmental reasons, as they are subject to hydraulic and geomorphological hazards, and for settlement reasons, linked to the pressure of tourist, productive, and commercial interests.

From a hydro-geomorphological perspective, the territory's structure comprises rocky terraces, gradually descending parallel to the coastline. The surface hydrography consists of incisions and river-karst valleys, called "lame", developed in the predominantly limestone or calcarenite bedrock. Due to the permeability of the carbonate substrate, the "lame" have an episodic hydrological regime, with flood events occurring during significant rainfall. The catchment basins of the "lame" form a fan-shaped surface with its apex roughly corresponding to the settlement of Bari (Borri and Calace, 2017).

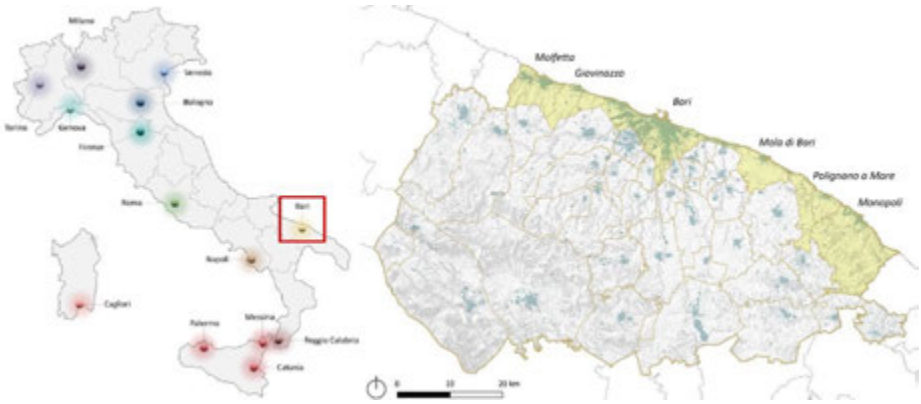

Figure 2 – Location of the case study (left); distribution of coastal municipalities in the Metropolitan City of Bari (right). Source: authors' elaboration

In addition to their hydraulic function, the "lame" today represent the main elements of naturalness along the metropolitan coast, as well as the ecological connectors between the sea and the hinterland. As described by the Territorial Landscape Plan of Puglia Region (2015), they host vegetational and faunistic habitats that have adapted well to changing environmental conditions. Along the Bari coast, there are few other natural areas, mostly located in peri-urban agricultural areas, while wetlands have disappeared.

Despite the high degree of artificialisation of the metropolitan coast, the seabed holds significant natural value, so much so that it is protected as Special Conservation Areas of the Natura 2000 Network. Indeed, the biocenosis of finely calibrated sands and the Poseidonia oceanica seagrass are of strategic importance for maintaining marine biodiversity (Regional Territorial Landscape Plan, 2015).

In general, the coastal morphology of Bari lacks articulations, except for those detailed ones due to localised erosive processes caused by karstification and marine action. The coast is predominantly characterised by low rocky formations (44.55%) with a rather homogeneous trend (Figure 3) (Regional Coastal Plan, 2012). Indeed, marine abrasion platforms gradually slope towards the sea and end with nearly vertical walls, typically not exceeding 1.5 meters in height. These surfaces have variable depths (about 10 meters) with widespread karst corrosion features such as caves, small basins, and coves. There are also stretches of high rocky coastline (23.42%) with cliffs of varying slopes, with elevations not exceeding 12 meters (Regional Coastal Plan, 2012).

The first settlements of the main centres aligned along the coast (Molfetta, Giovinazzo, Mola di Bari, Polignano a Mare, and Monopoli) with their related anthropic works (33%) were born in the coves of the rocky coast. There are also some stretches of sandy coastline (4.6%) or pebbly (0.97%), fed by weather and marine movements or by collapses of coastal banks: sandy beaches at the foot of the rocky coast within coves and small natural recesses or artificial beaches created through sand deposition; sandy stretches near the mouths of the "lame" (Regional Coastal Plan, 2012).

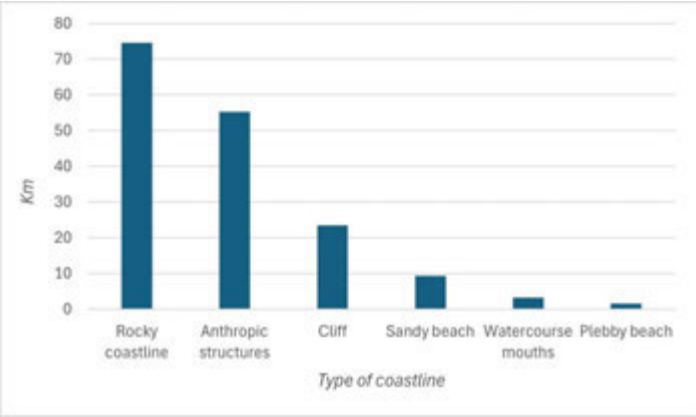

Figure 3 - Coastal morphology of the Metropolitan city of Bari. Source: authors' elaboration from data of Regional Coastal Plan, 2012

Considering the type of coastline, erosion of the sandy coast is only in a few stretches, mostly in the territory of Molfetta and Monopoli, while stretches of coast characterised by cliffs are at risk of landslides and collapses. Conversely, the orographic and geomorphological conditions of the territory produce significant hydraulic hazard phenomena that have repercussions on sediment deposition at the mouths of the "lame," as well as risks for existing urban developments (Mossa, 2010; Bisantino et al., 2016).

The Metropolitan City of Bari represents a unique settlement pattern resulting from a slow process of polycentric and articulated urbanisation, characterised by a strong "radial" dependence between smaller centres and the capital (Borri and Calace, 2017) and especially between inland centres and coastal municipalities of medium to large size (Figure 4).

Indeed, on the metropolitan coast, there are six medium to large-sized municipalities: Molfetta with 57,245 inhabitants, Giovinazzo with 19,232 inhabitants, Bari with its coastal areas with 316,212 inhabitants, Mola di Bari with 24,323 inhabitants, Polignano a Mare with 17,464 inhabitants, and Monopoli with 47,847 inhabitants (ISTAT, 2024). The urban load of these municipalities entails a dense network of water distribution with seven final outlets of wastewater directly into the sea. The strong settlement pressure has also been influenced by the dense network of road and rail infrastructure that characterises a clear separation between the coast and the hinterland.

Harbour infrastructures are another determining factor of anthropic impacts, as they generate large flows of goods and people. Indeed, on the metropolitan coast, there are 11 ports of various categories, which testify to old traditions related to fishing and trade, and new uses related to tourism, recreational boating, and water sports: one of international economic importance (Bari), one of national economic importance (Molfetta), eight of regional and interregional economic importance (Giovinazzo, the coastal areas of Bari, Mola di Bari, and Monopoli), and one tourist (Polignano a Mare) (Law No. 84/1994 "Regulating port organisation and activities"). Transformations of coastal areas for the construction of ports and docks often have not adequately assessed the induced effects on meteomarine equilibria, leading to significant alteration of sediment transport. In fact, the major harbour infrastructures (Molfetta to the north, Bari in the centre, Monopoli to the south) constitute the boundaries of the physiographic units[1] of the metropolitan coast.

[1] Physiographic Units are stretches of coastline where natural features or anthropogenic works do not allow the entry and/or exit of solid transport, due to wave motion and littoral currents.

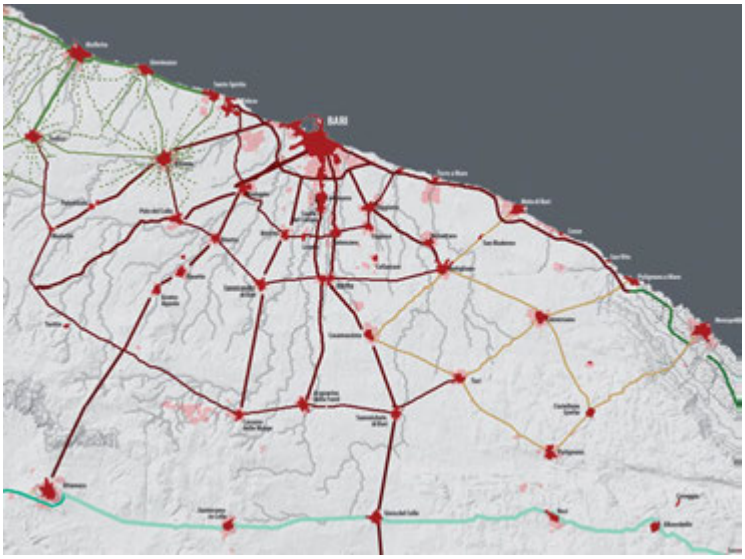

Figure 4 - Distribution of urban settlements of the Metropolitan City of Bari. Source: Territorial Landscape Plan of Puglia Region, extract from document 3.2.6

The stretches of coastline enclosed between urban centres have undergone significant transformations since the 1960s to promote local beach tourism, not only for residents but also for the population coming from inland centres. This has led to a strong privatisation of coastal zones through the construction of accommodation facilities, beach resorts, and seasonal holiday homes in agricultural areas and near the "lame", often in conflict with municipal urban planning instruments and hydrogeological structure plans. The dispersion of settlements along the coast has produced numerous impacts in terms of both use and accessibility and hydrogeological risk. In the last 10 years, tourist flows have grown considerably with visitors from both national and international territories (Potito and Quercia 2023), also thanks to the enhancement of historic centres and elements of the historical-cultural heritage scattered in peri-urban areas, and to the regeneration and creation of new public coastal spaces (public beaches, areas equipped for water sports, reuse of disused industrial buildings, etc.) (Calace et al. 2020).
Indeed, all coastal municipalities of the metropolitan city are implementing policies to enhance the coast while attempting to manage critical issues and impacts. From the analysis of policies and planning of municipal administrations, both common themes and objectives emerge, linked to environmental dynamics and the enhancement of urban identity related to fishing and trade, as well as specific aspects characterising individual territories: water pollution caused by sewage discharge and industrial waste disposal (Molfetta and Giovinazzo); saline contamination of agricultural soils (Giovinazzo and Monopoli); accessibility and use issues linked to high beach tourism pressure (Polignano a Mare and Monopoli); enhancement of areas that have resisted urban sprawl, rich in heritage stratifications and still linked to agricultural activities (Bari and Polignano a Mare); valorisation of different coastal urban identities (Bari) (Calace et al. 2020).

3.1 The governance system of the Metropolitan City of Bari

We have considered the case study of the Metropolitan City of Bari, because the governance system at the metropolitan scale could be the most efficacious level for the implementation of solutions for coastal risk management. The Metropolitan level of government, established in Italy with Law No. 56/2014, has competences for the governance of a vast area and for the promotion and coordination of socio-economic development. The statutory objectives of the metropolitan level can promote the implementation of integrated actions for the reduction of anthropogenic pressure on the coast, risk mitigation, and the enhancement and sustainable development of territories. So far, to date, the Bari system still struggles to practice true governance, understood as adaptive forms of multilevel and multi-actor collaboration in which actors, driven by divergent interests, interact to formulate and achieve common objectives (Torfing et al., 2012), in a 'trading zone' that allows for partial innovations attributable to strategies even in conflict with each other (Balducci, 2013). Instead, a highly planned yet fragmented system emerges, with multiple sectors and levels of governance that find it difficult to interact synergistically (Figure 5).

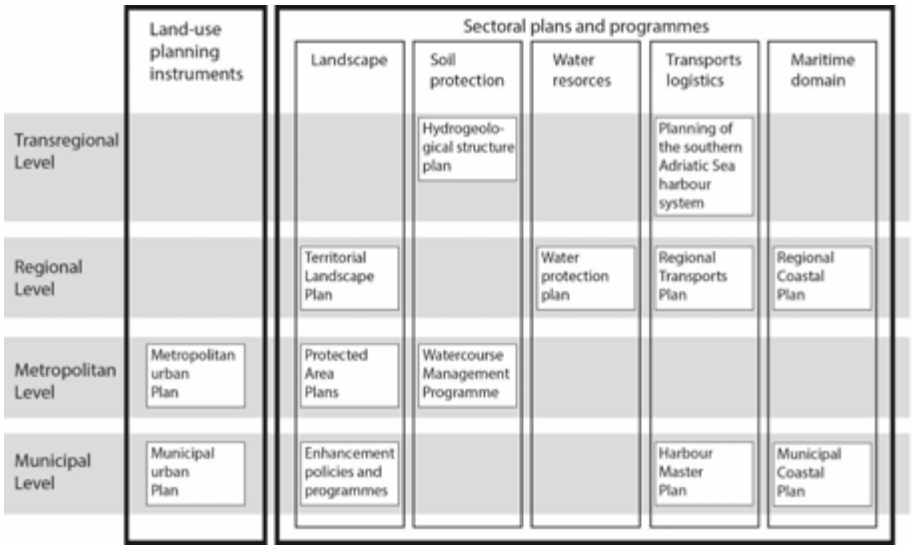

Figure 5 - Planning and programming tools for coastal management. Source: author's elaboration

The Hydrogeological Structure Plan, which came into effect in 2005, has a prescriptive content that establishes admissible interventions in areas prone to hydraulic and geomorphological hazards but does not provide project management guidelines. On the other hand, the Water Protection Plan, which came into effect in 2009, has a forward-thinking policy for wastewater discharges into the sea, foreseeing the relocation of discharges and promoting water reuse policies.

Port planning, according to national Law No. 56/2014, is the responsibility of municipalities or supra-regional authorities depending on the rank of the harbour, involving actions to expand port infrastructure and redevelop port-city interaction areas.

The Regional Coastal Plan, which came into effect in 2012, outlined the framework of coastal sensitivities and criticalities and defined the main choices for coastal management, in line with environmental and landscape constraints. Management rules must be further developed at the municipal level with Municipal Coastal Plans and only concern the strip of maritime public property, often very narrow due to erosion phenomena. These plans have very limited

competencies (coastal recovery and zoning of concessions for bathing establishments, fishing, trade, water sports) and are inadequate compared to the complexity and intensity of environmental and landscape dynamics.
The Regional Territorial Landscape Plan (RTLP), which came into effect in 2015, is now the only reference for an integrated coastal management approach. It adopts the concept of the 'coastal zone' as a transition area between sea-coast-hinterland encompassing cities, rural areas, infrastructure, and protected areas. The RTLP pursues the objectives of enhancing and redeveloping natural and anthropic elements, enhancing the resilience of the coastal ecotone, and safeguarding and enhancing undeveloped areas.
Urban planning and territorial planning instruments operate at the municipal and metropolitan levels. All municipalities still have very dated urban plans (from the 1970s-1990s) that envisaged intense urbanisation for residential, industrial, commercial, and tourist purposes but are promoting numerous projects for waterfront and public space redevelopment through ministerial funding (European Regional Development Fund and The National Recovery and Resilience Plan). Instead, the Strategic Plan for the Metropolitan City of Bari, still under development, proposes 11 strategic actions including the "Metropolitan Waterfront and Marine Economies" action. It assumes the following objectives: (i) coastal consolidation and enhancement of the entire Bari metropolitan area coastline; (ii) enhancement of the natural landscape characteristics to make it more attractive; (iii) the waterfront as an identity element for communities and an economic and social engine for territorial growth. At present, these objectives have not yet resulted in an organic programming of measures and actions for the territories and do not provide concrete answers for climate change. Nevertheless, these objectives can help municipalities align their planning and programming instruments, increasing the effectiveness of individual interventions on the coast.

3.2 Setting the PSDM process for the Metropolitan City of Bari

To set the Participatory System Dynamics Model process, we started by identifying the key actors to be involved (Phase 1). First, we defined a list of stakeholders including representatives of public bodies (at the regional, sub-regional, metropolitan and local scale), of economic activities (agriculture, tourism, fishing) and of NGOs (Table 1).
Our main goal was to include different typologies of actors with different responsibilities in managing the coastal area of the Metropolitan City of Bari (management, regulatory, economic, social, tourism and environmental). Moreover, we used the snow-ball sampling method to strengthen the stakeholders identification and reduce the chances of leaving out important parties.

Table 1 – Selected actors for the Participatory System Dynamics Model process in the Metropolitan City of Bari

Institution	Typology	Type of responsibility	Scale
Acquedotto Pugliese S.p.a.	Investee Company	Management	Regional
Puglia Region – Landscape protection and enhancement	Public	Regulatory	Regional
Puglia Region – Coastal and harbor public domain	Public	Regulatory	Regional
Puglia Region – Parks and biodiversity protection	Public	Regulatory	Regional

Apulian Water Authority	Public	Regulatory, management	Regional
Regional Agency for environmental prevention and protection - ARPA	Public	Regulatory	Regional
Basin Authority	Public	Regulatory	Sub-regional
Port Authority	Public	Management, regulatory	Sub-regional
Terre D'Apulia Reclamation Consortium	Public	Management, regulatory	Sub-regional
Superintendence of archeology and landscape	Public	Regulatory	Metropolitan
Metropolitan City of Bari - Environment	Public	Regulatory	Metropolitan
Municipality of Bari – Urban planning and development	Public	Regulatory	Local
Association of beach concessionaires	Trade association	Economy	Local
Coldiretti agriculture Association	Trade association	Economy	Local
I Gabbiani di Costa Ripagnola Association	NGO	Environment, social	Local
Litorali	NGO	Environment	Local
Pugliarte Association	NGO	Social, tourism	Local
ASD Lo Stroppo Association	NGO	Economy, social	Local
Mola di Bari Fisherman association	Trade association	Economy	Local
Confagricoltura Bari	Trade association	Economy	Local
Confcommercio Bari	Trade association	Economy	Local
Puglia Promozione	Public body	Economy, tourism	Metropolitan

To prepare Phase 2, consisting in the individual semi-structured interviews, we set a guide of questions divided in four main topics (Figure 6): i) definition of the socio-ecological system; ii) identification of the main activities and uses on the coast; iii) identification of the socio-economic rules/control on the coast; iv) existing threats and impacts on the coast.

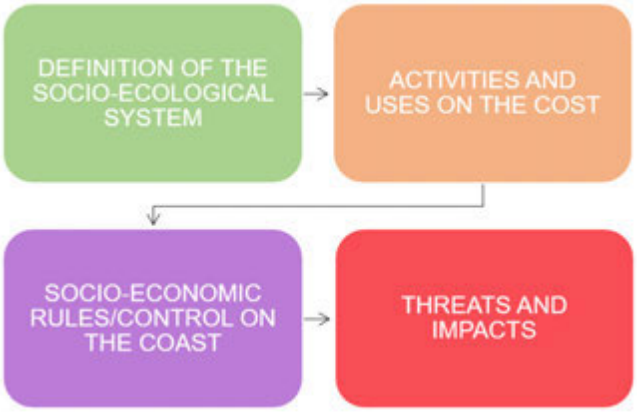

Figure 6 – Structure of the individual semi-structured interviews. Source: author's elaboration

The individual interviews are conducted to build individual qualitative mental models. Each model is represented as a Fuzzy Cognitive Map (FCM), composed of oriented graphs with feedbacks, which consist of nodes (or concepts), being the variables, and weighted arcs (or connections) (van Vliet, Kok and Veldkamp, 2010). During the interview each participant is directly involved in the creation of the individual model by following the structure described in Figure 6. This phase helps to refine the perception of each stakeholder to represent their personal perspectives and to deepen the understanding of the issue and prepare for Phase 3.
Phase 3 consists in a desk analysis, necessary to build a preliminary qualitative model (PQM) based on the information gathered from the individual interviews. As stated in Valencia Cotera, Egerer and Máñez Costa (2022), this phase has the aims of i) forming a broad understanding of the system's behaviour and ii) compiling a comprehensive summary of stakeholder perceptions. In this phase, all components emerged from the Individual mental models are analysed and ordered. Only variables present in all individual models are considered and boundary conditions are set by classifying the components and relationships into tiers (Table 2).

Table 2 – Classification of components and relationships into Tiers

COMPONENTS	**TIMES MENTIONED (%)**
C-Tier 1	>50
C-Tier 2	25-50
C-Tier 3	<25
RELATIONSHIPS	**TIMES MENTIONED (%)**
R-Tier 1	>75
R-Tier 2	50-75
R-Tier 3	25-50
R-Tier 4	<25

We consider only components of C-Tier 1 and C-Tier 2 and relationships of R-Tier 1, R-Tier 2 and R-Tier 3. By incorporating only the components mentioned by the majority of stakeholders, we are able to build a basic framework to capture the collective perception of the system.
The last Phase consists in the Group Model Building (GMB), through a Workshop with the participation of all actors identified in Phase 1. During the Workshop and with the guidance

and moderation of two facilitators, participants discuss and decide the main components to place in the model, following the same structure used for the Individual interviews (Phase 2). The facilitators guide the workshop by taking into consideration the elements that emerged from the preliminary model to bring out any aspects that are overlooked. However, facilitators do not show the preliminary model to the participants because it could modify stakeholders' feelings and create bias and framing effects.

4. Results and discussion

The Participatory System Dynamics Model developed for the Metropolitan City of Bari helps us to understand if policy-makers and stakeholders acknowledge and consider the newly proposed methods for coastal risk management as potential alternatives or supplements.

First, we deliberately decided not to give a definition to the extent of the coastal area of the Metropolitan City of Bari to the actors involved, as we wanted to comprehend their own understanding of the system.

In fact, from the preliminary qualitative model (Figure 7) built in Phase 3 we realise that actors do not perceive the coast as a sea-coast-inland transitional zone as defined by the Regional Territorial Landscape Plan. They mention only the coastline and no reference is given to the relationships with the system of the ephemeral rivers "lame" and the inner territory of Murgia.

Moreover, most of the participants give much attention to the predominance of beach establishments used for bathing by residents and tourists and less recognition is given to residential, agriculture, fishing and harbour activities. The touristic use of the coast, and mainly the management of the state property by beach concessionaires, is recognised to be cause of beach privatisation and consequently to anthropic pressures leading to an increase of hydro-geomorphological risk and coastal erosion. The coexistence of these activities results in land consumption, high water footprint, large amounts of solid waste, and pollution of marine waters, impacting seagrass and the attractiveness of beaches for bathing.

However, the presence of poseidonia is recognized only as a waste that produce pollution. Such aspect highlights the low level of actors' knowledge on the importance that poseidonia could have as a Nature-based solution for coastal protection, manly to reduce flooding and erosion risk. As a matter of fact, the PQM lacks in components related also to the presence of "hard" engineering-based solutions to counteract the risk of erosion and flood such as groins and breakwaters. Another aspect not emerging from the model is climate change and its negative impacts. This could be due to the fact that climate change is seen as a global issue that is not reflected on a local scale.

The actors perceive coastal erosion as a main issue for the Metropolitan City of Bari as directly caused by anthropic pressure (harbour activities, beaches privatisation, tourism).

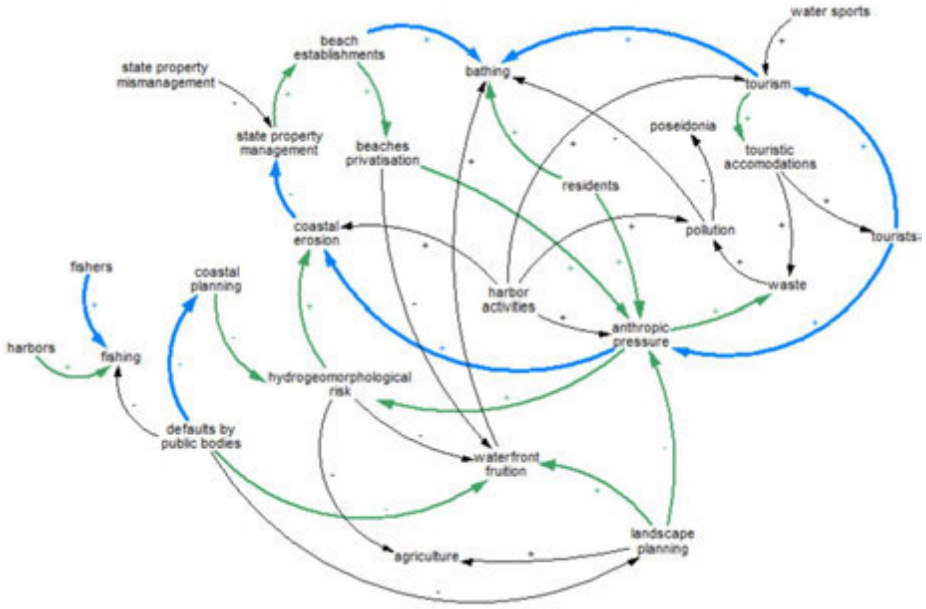

Figure 7 – The preliminary qualitative model - PQM (Phase 3) built from the analysis of the individual interviews (Phase 2) with the presence of C-Tier 1 components. The arrows' thickness represent the Tier level, R-Tier 1 with low effect relationships in black, R-Tier 2 with considerable effect in green and R-Tier 3 with strong effect in blue. The "+" and "-" indicate the positive or negative effect related to the cause. Source: author's elaboration

The strong perception of the problem is linked to episodes of collapses and landslides along the predominantly rocky coast, jeopardising the viability of economic activities regulated by state property management. Participants identify bathing and tourism as both a problem and activities at risk due to difficulties in management, routine maintenance, and coastal supervision. Hydrogeological risk is also perceived as one of the main issues along the coast, especially as actors recall past flood events that caused severe damage to settlements and populations. This risk is mainly attributed to urbanisation in flood-prone areas and widespread soil sealing, resulting in challenges for waterfront enjoyment and agricultural production.

Landscape planning, with relation to the Regional Territorial Landscape Plan, is recognised to be a relevant instrument to counteract anthropic pressures and to allow a better fruition of the waterfront. On the contrary, the fruition of the waterfront is perceived as hindered by defaults of public bodies. In particular, this deficiency leads to problems related to the difficulty of implementing coastal planning at the local scale.

This is in line with the reality, as no municipality in the Metropolitan City has a current Municipal Coastal Plan. Furthermore, participants widely share dissatisfaction with the current planning systems, which are too fragmented and sectoral. The complexity of regulations and defaults by public bodies cause many problems in the management choices of coastal uses (fishing, ports, bathing), interfering with coastal redevelopment scenarios promoted by landscape planning.

During the workshop, participants ignored the emerged themes from the Preliminary Qualitative Model (PQM) to enable an objective and unbiased formulation of the Group Model Building (GMB).

From the Group Model (Figure 8) built during the Workshop with all actors involved in Phase 2, we can say that most of the components and relationships deriving from the PQM are confirmed. In this phase, the actors have deepened the correlations between uses, impacts, role and plans, highlighting the following aspects.

Figure 8 – The group model – GMB (Phase 4) built during the Workshop with the actors involved in Phase 2. Source: author's elaboration

The actors have undoubtedly produced a more organic vision of anthropic pressures, linked not only to sea-related tourism and urban centres in general, but also to infrastructure, industrial areas, settlement sprawling and agriculture. In particular, they pointed out that settlement expansion is the main cause of land consumption, with direct repercussions on coastal erosion, hydro-geomorphological risks and sediment management, and that urbanisation results in the reduction of birdlife and coastal habitats. The actors also deepened the impacts caused by agriculture: (i) extraction of groundwater for agriculture causes saline intrusion into the underground aquifer and its depletion, to the disadvantage of agricultural production; (ii) agricultural discharges into the sea that require the implementation of water protection plan policies and measures related to the reuse of purified wastewater and waste treatment efficiency systems.

The topic of the state property management, already extensively emphasised in the PQM, was further explored for the following issues: (i) the need to improve the management of water discharges because they change the balance of the poseidonia, causing it to be deposited on beaches and making it difficult to manage biomass; (ii) the need to improve coastal planning through integration with landscape planning (protection of the biodiversity of lame and archaeological assets) and a more correct distribution of uses, because supporting services for the fruition (mobility and parking) cause impacts on the environment and landscape.

5. Concluding remarks

The initial findings deriving from the Participatory System Dynamics Model process set for the Metropolitan City of Bari indicate that decision-makers and stakeholders do not perceive the

complexity of the coastal zone as a sea-coast-inland transitional zone. Although hydro-geomorphological hazards, and coastal erosion in particular, are mentioned, there is no reference to approaches to manage them. Moreover, there is no recognition of climate change as the primary cause of risks and pressures on their coastal areas. This perception is conditioned by the vision of the existing problems related to the equilibrium of the coastal system and may be influenced by the absence of detailed predictive scenarios.

In the meantime, they are aware about the risk of erosion and of pollution caused by the urbanistic transformations, both caused by the "hard" engineering-based approaches used for the last decades, and by the future impacts caused by the touristic, residential and commercial development.

Furthermore, actors view Nature-based Solutions positively in an abstract sense, but they may not be applicable in highly anthropised contexts with significant socio-economic conflicts. Especially stakeholders at the regional level, with regulatory and management responsibilities, demonstrate knowledge of Nature-based Solutions, including those projected to circular resource management. However, they do not consider them applicable for several reasons: (i) the economic-settlement development interests of an already highly populated territory that does not allow for short-term relocation hypotheses; (ii) the difficulty of intervening in the adaptation or replacement of existing infrastructure, networks and facilities; (iii) and the coexistence of too many sector planning tools along the coast, with sometimes conflicting interests, which do not allow for the experimentation of innovative and forward-looking management solutions.

To overcome the approach of resolving specific conflicts in the short and medium term, a comprehensive framework is necessary. This framework should combine methods, data sources, and theories, detailed climate change scenarios to address the partial perception of stakeholders and change perspective to manage coastal risks.

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Flood Risk Management in the Face of Climate Change: Strategic Spatial Planning for Integrating River Basin Management and Residual Risk

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Abstract

In response to the impacts of climate change, the increasing risk of flooding has traditionally been addressed by identifying flood-prone areas using floodplain maps to regulate land development. However, the interconnected dynamics of runoff in the river basin and levee effect have highlighted the potential threats posed by residual flood risk. Consequently, this paper integrates residual risks and flood source areas into flood risk management within the river basin. Utilising the SOBEK model, this study simulates three flood scenarios—without levees, with existing levees, and with failed levees—to conduct flood hazard analysis and flood source-to-impact analysis. Based on these findings, this paper proposes land use management strategies aimed at enhancing water resilience through strategic spatial planning in the face of climate change.

Keywords: flood risk management, spatial planning, residual risk, flood source area, SOBEK model

1. Introduction

As climate change escalates, the frequency and severity of extreme rainfall events are increasing significantly. Taiwan's extensive and mountainous terrain, characterised by steep slopes and fast-flowing rivers, presents significant challenges for water retention, often resulting in frequent flooding. Traditionally, flood threats like these have been mitigated through structural flood control measures designed to protect urban areas. However, research into the "levee effect" indicates that reliance on structural flood control in flood-prone areas can foster a false sense of security among governmental bodies and local communities. This misplaced confidence may cultivate an illusion of enduring immunity from flooding, thereby accelerating development within floodplains and consequently amplifying long-term flood risks (Di Baldassarre et al., 2018; Ding et al., 2023). Moreover, as climate change intensifies, not only do the frequency and intensity of extreme rainfall events increase, but the existing standards of flood protection facilities also reach their limits, failing to entirely eliminate flood risk (Associated Programme on Flood Management, 2017). Incidents surpassing these thresholds may result in levee overtopping or breaches, representing significant residual flood risks (Serra-Llobet et al., 2022). In light of this, there has been an increased focus on the importance of non-structural measures in flood risk management. The Intergovernmental Panel on Climate Change (IPCC) in its Sixth Assessment Report advocates a holistic approach that integrates both structural and non-structural measures in managing flood-prone zones. Serra-Llobet et al. (2022) emphasise the effectiveness of regulatory flood maps in reducing exposure and vulnerability by either prohibiting or limiting development in high-risk areas.

In the context of disaster management, it is emphasised that disaster mitigation can be achieved through spatial planning, thus minimising flood risk (Hartmann, Slavíková, and Wilkinson, 2022). In the integration of spatial planning and flood risk management, flood hazard analysis often utilises flood maps as a basis for risk assessment in land management policies for flood-prone areas. However, these maps are only the final output of hydrological modelling, which

leads to the formation of flood-prone areas not only due to natural topographic factors, but also as a result of human development, which is a significant driver of flooding. Changes in land use due to development reduce the infiltration capacity of the soil, thereby increasing surface runoff and peak flood volumes (O'Donnell and Thorne, 2020). Furthermore, when considering the spatial scale of entire river basins, there are flood risk externalities within the system: land development changes in upstream areas are likely to increase flood threats downstream, demonstrating the spatial interconnectivity between flood source areas and flood impact areas (Seher and Löschner, 2018; Chang, H.-S., & Hsueh, P.-R., 2023).

In conclusion, traditional spatial planning has predominantly focused on identifying flood-prone areas using flood maps. However, this approach frequently overlooks the residual flood risk associated with levee failures and the equitable distribution of runoff within comprehensive river basin management. Consequently, this paper aims to address the limitations of considering only flood-prone areas in flood risk assessment. It examines the variances in flood hazard levels both with and without levees and explores the residual risks should these defences fail. Additionally, this study integrates river basin management to reassess the spatial correlations between flood source areas and flood impact areas, aiming to develop strategic spatial planning to meet the challenges posed by climate change.

Initially, this study will establish three flood simulation scenarios: without levees, with existing levees, and with failed levees. Subsequently, through flood hazard analysis, it will generate flood hazard maps for each scenario, considering changes in flood spatial distribution and land use. This process will also entail the creation of a Composite flood risk zone map that categorises areas into high, medium, and low flood risk zones. Moreover, a flood source-to-impact analysis will chart the spatial distributions of flood sources areas and flood impact areas within the river basin for each scenario. Based on these variations in spatial distribution under each scenario, a comprehensive flood source area map will be developed.

Following this, the study will develop land use management strategies predicated on varying flood risk levels and outline responsibilities for flood management in primary flood source areas. These measures are crucial for flood risk management strategies in response to the challenges posed by climate change. Ultimately, this paper will simulate four flood risk management scenarios: no change, a land use management policy based on flood risk zones, flood responsibility in primary flood source areas, and a combination of land use management policy and flood responsibilities. The study will evaluate changes in flood risks across these scenarios and devise strategic spatial planning based on flood risk assessment.

2. Methodology

To explore the residual flood risk associated with levee failure and the spatial relationship between flood source areas and impact areas within the river basin management, this study will employ the SOBEK model as the flood simulation software. The SOBEK model, jointly developed by Taiwan's Water Resources Agency and the Dutch company WL | Delft Hydraulic, is also the model used for creating the current flood inundation maps in Taiwan. As shown in Figure 1, the research will establish three flood simulation scenarios: without levees, with existing levees, and with failed levees (Figure 1a). It will then conduct a flood hazard analysis and produce a composite flood source and impact analysis a flood source-to-impact analysis (Figure 1c). The study will formulate land use management strategies based on different flood risk zone levels identified in the Composite flood risk zone map, and assign flood responsibility in the primary flood source areas depicted in the composite flood source area map, as part of the main flood risk management strategies in response to climate change challenges (Figure 1d).

Finally, the study will simulate and compare the outcomes under four flood risk management strategies scenarios: no change, a land use management policy based on flood risk zones, flood responsibility in primary flood source areas, and a combination of land use management policy and flood responsibilities (Figure 1e). It will assess the more effective flood risk management strategies.

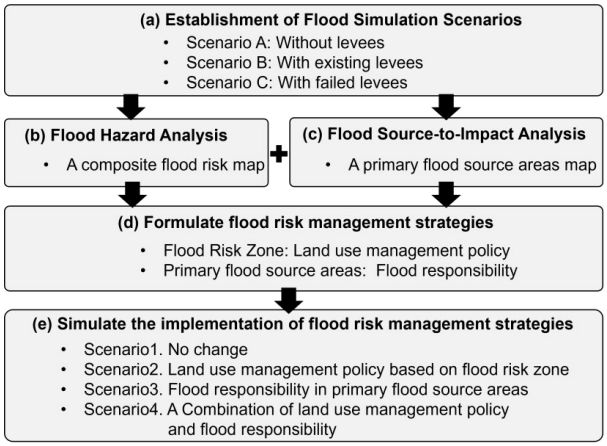

Figure 1. Research framework

2.1 Establishment of Flood Simulation Scenarios

This study will establish three flood simulation scenarios as shown in Figure 2, to explore the variations in flood hazard levels and the spatial distribution of flood source areas and flood impact areas with and without flood defence infrastructure, as well as under conditions of defence failure. Scenario A "Without levees" assesses the flooding situation under a 200-year return period rainfall scenario without any flood control infrastructure, representing the "inherent flood risk" of the area. Scenario B "With existing levees" evaluates the flooding situation under the current flood defence standards for a 200-year return period, representing the "existing flood risk" of the area. Scenario C "With failed levees" assesses the flooding situation when levees are overtopped, exceeding the 200-year return period flood defence standards, with climate change or extreme rainfall events used as the simulation rainfall scenarios, representing the "residual flood risk" of the area.

The outcomes of scenario A "Without levees" and B "With existing levees" will reflect the changes in the spatial distribution of flood risks with and without flood defence infrastructure, identifying areas where flood hazard levels are inherently high despite reduced flooding due to the construction of defences. The outcomes of scenario B "With existing levees" and C "With failed levees" will reflect the flood threats posed by levee failure under future climate change rainfall scenarios or extreme rainfall events, highlighting areas where residual flood risks are overlooked due to the protection afforded by flood defences.

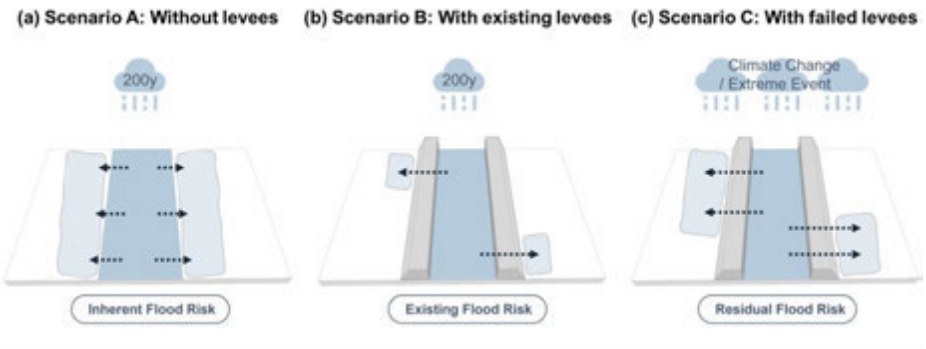

Figure 2. Flood Simulation Scene Setup

2.2 Flood Hazard Analysis

As shown in Figure 3, this study utilises the SOBEK model to simulate three flood scenario settings and conducts flood hazard analysis to explore the variations in flooding under conditions with and without levees, as well as in cases of levee failure. Initially, three flood hazard maps will be generated: one for without levees, one for existing levees, and one for failed levees (Figure 3a). Scenario A "Without levees" reflects the inherent flood risk based on topography without any flood control measures, showcasing areas with high flood hazard due to natural geographical factors. Scenario B "With existing levees" illustrates the existing flood risks under the current 200-year return period flood protection standards, where flooding still occurs. Scenario C "With failed levees" displays the residual risks in the event of levee overtopping during future climate change-driven rainfall or extreme rainfall events, highlighting areas with potential flood threats.

Subsequently, an overlay analysis of the flood hazard maps from the three scenarios will be conducted (Figure 3b). This analysis will particularly focus on comparing scenario A "Without levees" and B "With existing levees" to identify areas where flood situations have decreased due to the construction of levees but still possess inherent high flood hazard. It will also compare scenario B "With existing levees" and C "With failed levees" to pinpoint areas at risk of flooding beyond the protection standards during climate change-induced or extreme rainfall events. Lastly, by overlaying information on land use map, current land use status, and future development plans, a Composite flood risk zone map will be drawn (Figure 3c). This map will categorise areas into high, medium, and low flood risk zones, serving as a foundation for formulating spatial flood risk management strategies.

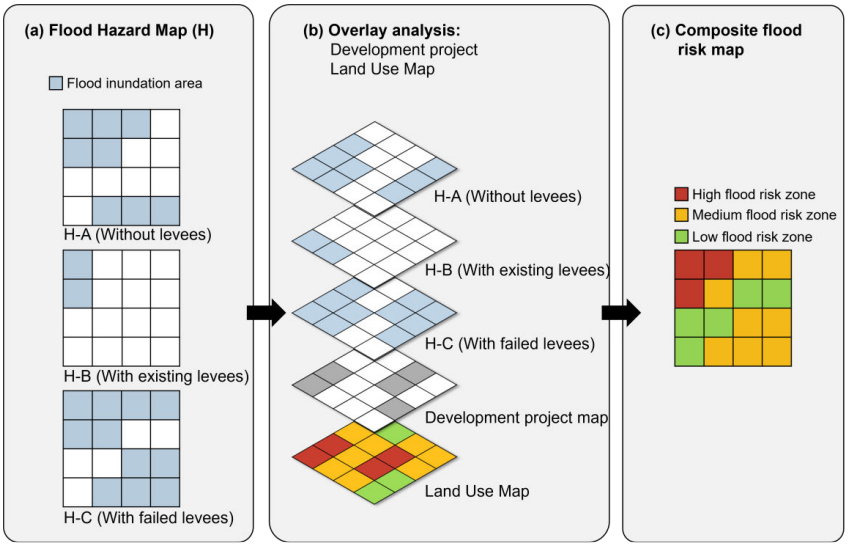

Figure 3. Flood hazard analysis research design

2.3 Flood Source-to-Impact Analysis

Considering the interconnected impact of surface runoff within river basin, it is challenging to distinctly delineate flood source areas from impact areas due to the mutual influences of runoff across upstream, midstream, and downstream regions. This study will employ the Flood Source-to-Impact Analysis (Vercruysse et al., 2019; Chang, H.-S., & Hsueh, P.-R., 2023) as illustrated in Figure 4, to re-examine the flood volumes generated by flood source areas and the spatial distribution of impact areas within the river basin.

(i) Divide Calculation Grid: Grids are delineated based on regional topography and land use;

(ii) Baseline Rainfall Scenario (BS): Simulates surface runoff under a baseline rainfall scenario with uniform rainfall across all grids, resulting in a flood depth (Fd_{BS}^{R}) ;

(iii) Grid i Rainfall Scenario (i): Sets zero rainfall for a specific grid 'i' (meaning no rainfall in grid 'i') while maintaining uniform rainfall across the remaining grids to simulate surface runoff, resulting in a flood depth (Fd_{i}^{R}). This step is repeated sequentially for each grid treated as grid 'i';

(iv) Flood Source Identification: Compares the Baseline Rainfall Scenario with the Grid i Rainfall Scenario. The difference in surface runoff distribution between the two scenarios $(F_i = Fd_{BS}^{R} - Fd_{i}^{R})$, identifies the contribution of grid 'i' to flood generation in other grid units.

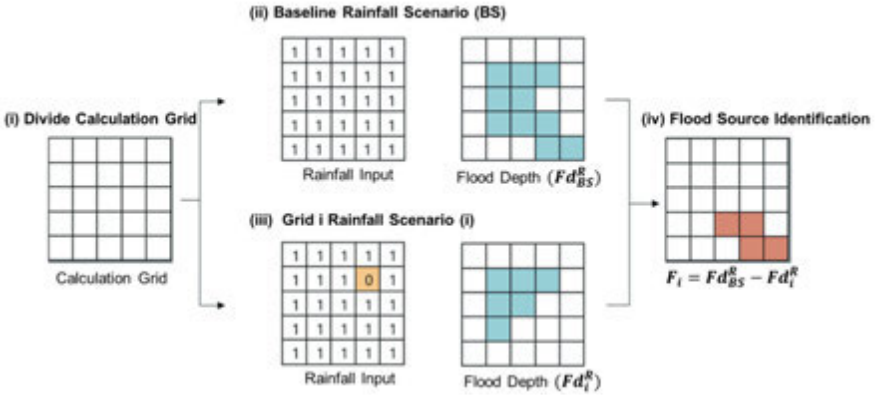

Figure 4. Illustration of Flood Source-to-Impact Analysis
Source: Vercruysse et al., (2019); Chang, H.-S., & Hsueh, P.-R., (2023)

As illustrated in Figure 5, this research has established three flood simulation scenarios for conducting flood source-to-impact analysis, resulting in the production of three maps of flood source and impact areas under conditions of without levees, with existing levees, and with failed levees (Figure 5a). Subsequently, an overlay analysis of these three maps will be performed to compare the flood source areas and flood impact areas across the scenarios. This analysis assesses the changes in the spatial distribution of flood source and impact areas under conditions with and without levees and in various rainfall scenarios. Additionally, this analysis includes overlaying data on land use map and land development map (Figure 5b) to identify the main and undeveloped flood source locations. Finally, a composite flood source area map will be created (Figure 5c), which will serve as the basis for formulating responsibilities for flood responsibility in primary flood source areas.

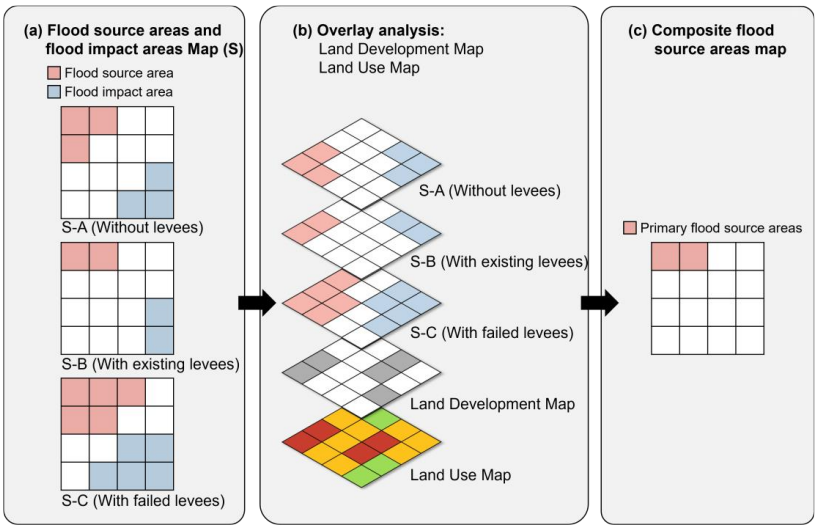

Figure 5. Flood Source-to-Impact Analysis research design

2.4 Formulate Flood Risk Management Strategies

The Composite flood risk zone map considers areas facing potential flood threats during climate change rainfall scenario or extreme rainfall events; the composite flood source area map identifies primary flood source areas likely to develop in the future. To implement strategic spatial planning based on flood risk, this study will formulate appropriate land management strategies for different flood risk zones: high flood risk areas will be designated as prohibited zones (to prevent new development), medium flood risk areas as restricted zones (allowing new developments but with specified development intensities and required flood mitigation measures), and low flood risk areas as development zones (encouraging concentrated new developments). Additionally, principal flood source areas will be assigned responsibilities for managing the excess runoff, which involves implementing measures to mitigate flooding impacts, thus ensuring equity in managing flood risks in the river basin management. Consequently, this research adopts land use policy for flood risk zone and responsibilities for flood source areas as crucial strategies in spatial flood risk management.

2.5 Simulate the Implementation of Flood Risk Management Strategies

To investigate the variations in flood risk under different flood risk management strategies, this study establishes four flood management strategy scenarios: Scenario 1 "No change" which retains current flood management practices; Scenario 2 "Land use management policy based on flood risk zone," prohibits development in high flood risk zones and restricts development intensity in medium flood risk zones while implementing flood mitigation measures; Scenario 3 " Flood responsibility in primary flood source areas," involves setting flood mitigation measures in primary flood source areas, taking responsibility for excess runoff; Scenario 4 " A Combination of land use management policy and flood responsibility " integrates flood risk zones with flood responsibilities under river basin management. The SOBEK model is used to simulate flooding under these four flood risk management scenarios, comparing changes in flood risk across scenarios to assess the most effective flood risk management strategies in response to flood threats under climate change.

3. Results

This study utilises the SOBEK model to simulate three flood scenarios: without levees, with existing levees, and with failed levees, and conducts flood hazard analysis to simulate flooding for each scenario. This approach offers a more comprehensive inclusion of land flood hazard levels prior to levee construction, as well as considers areas facing potential flood threats from climate change-driven rainfall scenarios or extreme rainfall events. It also considers land use and future major development plans to produce a Composite flood risk zone map, which categorizes areas into high, medium, and low flood risk zones. Additionally, through flood source-to-impact analysis, the spatial relationship between flood source and impact areas within the river basin is re-examined, with consideration of land use and land development to produce a composite flood source area map, identifying primary flood source areas responsible for excessive runoff.

Furthermore, based on the Composite flood risk zone map, the study formulates appropriate land use management strategies to guide suitable land use, preventing high-density development in areas of high flood risk to minimize potential loss of life and economic damage. Preliminary strategies include prohibiting new developments in high flood risk areas, restricting development and implementing flood mitigation measures in medium flood risk areas, and promoting intensive development in low flood risk areas. According to the composite flood

source area map, primary flood source areas should take flood responsibilities, due to their excessive runoff contributing to flooding in impacted areas. Finally, the study simulates flooding under four flood risk management strategy scenarios, assessing the impact of flood risk zones and flood responsibilities, and formulates strategic spatial planning responsive to climate change, effectively reducing flood hazards and equitably distributing excessive runoff.

4. Conclusion

This paper is grounded in a spatial planning perspective, aiming to overcome the constraints imposed by traditional flood inundation maps used for land management in flood-prone areas. It assesses alterations in flood hazard levels under scenarios with and without levees, and in the event of levee failures, redefining the spatial dynamics between flood source areas and flood impact areas from the perspective of river basin management. Three flood simulation scenarios—without levees, with existing levees, and with failed levees—have been established using the SOBEK model for flood simulation. Initially, this research analyses changes in the spatial distribution of flood hazard levels through flood hazard analysis. It identifies areas at potential flood risk, culminating in a Composite flood risk zone map that categorises regions into high, medium, and low flood risk zones. Moreover, flood source-to-impact analysis investigates spatial variations between flood sources and affected areas across these scenarios, resulting in a composite flood source area map that pinpoints primary flood origins. Concurrently, flood risk management strategies are developed based on land use considerations. New developments are prohibited in high flood risk zones; development is constrained, and flood mitigation measures are mandated in medium flood risk zones; responsibilities for managing excess runoff are allocated in primary flood source areas to address the equitable distribution of runoff. This study also evaluates variations in flood risk among different flood risk management strategies.

In conclusion, in response to the severe threats and uncertainties posed by climate change, this research integrates residual flood risks and the spatial relationships between flood sources areas and flood impact areas into comprehensive flood risk management. It advocates for strategic spatial planning based on land flood risk and water management responsibilities. From a land-use management perspective, this strategy aims to prohibit development in high-risk areas, guide appropriate spatial development, and ensure fairness in river basin management by assigning flood responsibility to flood source areas. The objective is to harmonise land development imperatives with flood risk management, thereby establishing a resilient spatial planning framework that is responsive to climate change.

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Urban Resilience in EU Cities: Insights from Ukrainian Citizens with an Understanding of War Risks

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Abstract

This paper considers into urban resilience by drawing insights from Ukrainian citizens who have firsthand experience with the risks of war, aiming to provide practical lessons and examples to enhance urban adaptability and preparedness. Their unique perspective enriches the discourse on urban resilience in EU cities, shedding light on the challenges faced in the aftermath of conflict. The narrative begins by highlighting the stark realities experienced by Ukrainian citizens due to the lack of preparedness in their cities, setting the stage for an exploration of resilience issues post-conflict. Key areas of concern include energy system resilience, with real examples emphasizing vulnerabilities and the need for EU cities to fortify their energy infrastructure. This paper contributes to academic discourse while offering pragmatic lessons to inform policies and practices, fostering resilient, compassionate, and inclusive cities ready to face future uncertainties.

1.Introduction

In the face of urbanization and globalization, the resilience of cities has become a paramount concern. As urban environments evolve and face various challenges, from climate change to socio-political unrest, understanding and bolstering urban resilience is imperative for ensuring the safety, stability, and well-being of urban populations. The authors consider the realm of urban resilience through a unique lens, drawing insights from Ukrainian citizens who have firsthand experience navigating the complexities of conflict and its aftermath. The backdrop against which this exploration unfolds is Ukraine, a nation that has grappled with the devastating impacts of war in recent years. Through the eyes of its citizens, we gain invaluable perspectives on the realities of urban resilience in the midst of crisis. The aim of this research is twofold: to illuminate the challenges faced by Ukrainian cities during the conflict and to extract practical lessons and tangible examples that can inform and empower urban resilience efforts, particularly within the European Union (EU).

The journey begins by immersing ourselves in the stark realities confronted by Ukrainian citizens as they contend with the ravages of war. In Ukrainian cities, where the prevailing sentiment was often one of disbelief in the possibility of conflict, the unanticipated and unprecedented challenges underscored the critical importance of preparedness. This introductory narrative lays the foundation for a comprehensive examination of resilience problems encountered ongoing-conflict, with a specific focus on three key dimensions: the energy system, transportation, and the provision of bomb shelters.

Within the energy system, disruptions wrought by conflict reveal vulnerabilities that demand attention. Real-life examples gleaned from the experiences of Ukrainian citizens shed light on the strains placed on energy infrastructure and the urgent need for reevaluation and fortification of energy resilience strategies in EU cities.

The provision of bomb shelters emerges as a crucial but often overlooked aspect of urban resilience. Drawing on the experiences of Ukrainian citizens, the importance of robust and accessible shelter systems is underscored, prompting EU cities to assess and enhance their own shelter infrastructure to

ensure the safety and well-being of their populations during emergencies (Deepak, 2022; UNESCO, 2023; Olcese, 2024).

The insights garnered from Ukrainian experiences serve not only as a reflection of past challenges but also as a beacon guiding future resilience efforts. By examining tangible challenges and practical solutions, this paper aims to prompt a reevaluation of urban planning paradigms, emphasizing the imperative of proactive preparedness and dispelling notions of implausibility regarding conflict. Ultimately, the lessons gleaned from Ukrainian cities contribute not only to academic discourse but also to the development of policies and practices that foster cities resilient in the face of uncertainty, compassionate in their response, inclusive in their design, and well-equipped to navigate the complexities of the future.

2.Aim of the paper

The paper aims to provide EU cities with a robust framework for enhancing their resilience to conflicts and other uncertainties, ensuring the safety, stability, and well-being of their residents. The insights from Ukrainian citizens serve as a valuable resource, offering a unique perspective that enriches the discourse on urban resilience and highlights the necessity of comprehensive and forward-thinking planning in the face of potential crises.

3.Overall situation with Ukrainian cities

The full-scale war in Ukraine is one of the most brutal in recent decades. The last time Europe saw such destruction was in the 1990s, when fighting broke out in Yugoslavia. Despite the absurdity of war in the 21st century, russian troops continue to target civilians and commit war crimes.

According to estimates, as of the beginning of 2023, the russian army has launched about 5,000 missiles and 3,500 air strikes against Ukraine. The invaders launched almost 1000 more strikes using kamikaze drones. These figures do not include shelling from artillery and multiple launch rocket systems (Visit Ukraine Today, 2023).

Base on investigation of the Kyiv Schools of Economics (Kyiv School of Economics, 2024), the total documented damages inflicted upon Ukraine's infrastructure due to Russia's full-scale invasion stand at a staggering $155 billion, inclusive of the destruction caused by the explosion of the Kakhovka Hydroelectric Power Station dam in June 2023. This assessment, derived from the "Russia Will Pay" project conducted by the KSE Institute team, in collaboration with various ministries including the Ministry for Communities, Territories and Infrastructure Development, the Ministry of Health, and the Ministry of Economy, as well as the National Bank of Ukraine, reflects a grim reality of devastation and loss. The escalation in the overall damage is attributed to the widespread destruction across various sectors, including housing, industry, energy, education, and healthcare. Housing, in particular, bears the brunt of the devastation, with nearly 250,000 buildings damaged or destroyed, amounting to an estimated direct loss of $58.9 billion.

Infrastructure damage has reached $36.8 billion, while direct losses in industry and businesses stand at $13.1 billion. The destruction of numerous enterprises, both private and state-owned, underscores the severe economic repercussions of the conflict. The energy sector alone has incurred direct damages of up to $9 billion, exacerbating the challenges in restoring vital services to affected areas (fig.1-2).

Total estimate of infrastructure damage by industry in monetary terms, as of January, 2024

Property type	Damage, $ billion
Housing	58,9
Infrastructure	36,8
Assets of enterprises, industry	13,1
Energy	9,0
Agriculture and land resources	8,7
Education	6,8
Utilities	4,5
Forests	4,5
Transport	3,1
Healthcare	3,1
Trade	2,6
Culture, sport, tourism	2,4
Administrative buildings	0,5
Digital infrastructure	0,5
Social sphere	0,2
Financial sector	0,04
Total	**154,9**
Ecology*	16,4

*Environmental damages are calculated as damages from air emissions and are not direct damages of real estate or other assets of Ukraine

Figure 1. Total estimate of infrastructure damage by industry in monetary terms (January 2024)

Figure 2. Damaged and destroyed infrastructure objects of Ukraine total

Here are some key points illustrating the extent of destruction caused during the conflict:

1. **Kyiv.** Russian missile attacks have targeted civilian areas in and around Kyiv, the capital of Ukraine. An apartment block was hit by a Russian missile, resulting in significant destruction (fig.3).

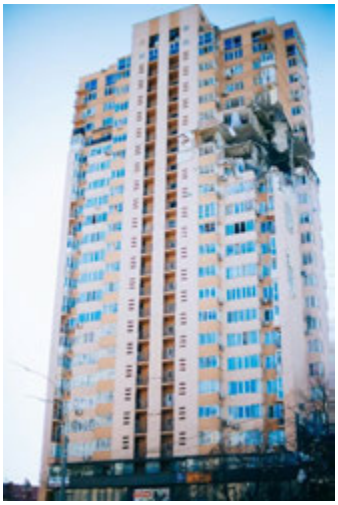

Figure 3. A destroyed house in Kyiv
(Photo retrieved from: https://unsplash.com/)

2. The city of **Irpin**, located northwest of Kyiv, has also suffered severe damage due to artillery and air strikes. Residential areas have been almost completely destroyed.

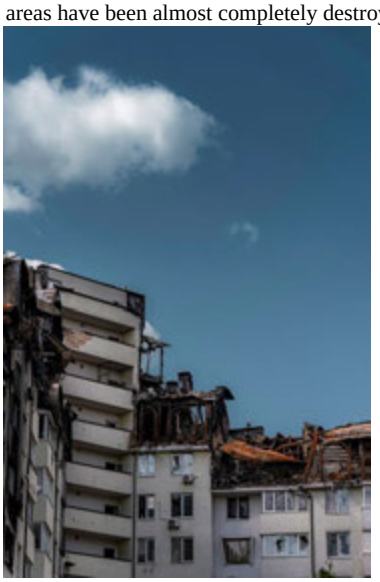

Figure 4. A destroyed house in Irpin
(Photo retrieved from: https://unsplash.com/)

3. **Kharkiv**, Ukraine's second-largest city, has been intensely bombarded by Russian forces, causing significant damage to its center.

Figure 5. People Hiding from Bombing at a Metro Station, Kharkiv, Ukraine (Retrieved from: https://www.pexels.com)

4. In **Borodyanka**, a town northwest of Kyiv, Russian airstrikes have destroyed several residential buildings, leaving the area in ruins.

Figure 6. Destroyed house in Borodyanka (Retrieved from: https://www.pexels.com)

5. **Chernihiv**, northeast of Kyiv, has faced heavy shelling, resulting in casualties and damage to schools and residential buildings

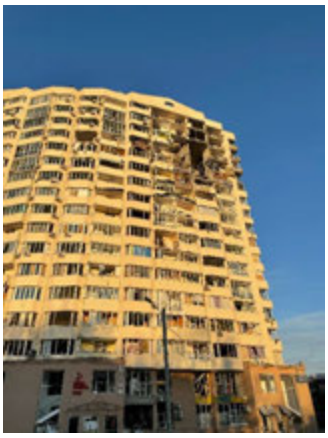

Figure 7. Destroyed house in Chernihiv
(Retrieved from: https://unsplash.com/)

4.Residents insights about the war risks

There was interviewed representatives from such cities as Kyiv, Irpin, Cherkasy, Kharkiv, Gysin. Understanding the firsthand experiences of citizens living through war-torn regions provides invaluable insights for bolstering urban resilience strategies in EU cities. The challenges faced by Ukrainian residents during times of conflict shed light on critical areas that demand attention for enhancing preparedness and adaptability in urban environments.

1.Security Challenges Faced During the War. Ukrainian citizens encountered significant security challenges, particularly during the early stages of conflict:

- Lack of air raid alarms during initial missile activity left residents vulnerable to potential strikes, highlighting the need for reliable early warning systems in urban areas.
- Residents grappled with the unknown locations of bomb shelters, resorting to improvised hiding spots and facing heightened anxiety due to the lack of clear guidance from authorities.
- The absence of clear directives or programs from governmental bodies exacerbated residents' sense of insecurity and contributed to confusion regarding safety protocols.

2.Mobility Challenges During the War. Mobility became a critical issue for residents navigating the urban landscape amidst conflict:

- Residents faced difficulties accessing distant bomb shelters during air raid alerts.
- Suspension of public transportation compounding mobility challenges and leaving many without viable shelter options.
- Shortage of fuel at gas stations especially in the first year of the war made it difficult to use personal vehicles.

3.Energy-related Issues Encountered. The war brought about disruptions to energy infrastructure, posing significant challenges to daily life:

- Attacks on energy infrastructure led to widespread power outages, impacting essential services such as cooking and elevator access.
- Scheduled power outages necessitated residents to adapt their routines, while darkened streets and non-functional traffic lights heightened safety concerns and necessitated careful route planning.

4. Recommendations for Enhancing City Resilience. Insights gleaned from the experiences of Ukrainian citizens offer valuable guidance for bolstering urban resilience in EU cities:

- Implementing autonomous energy systems, ensuring widespread access to bomb shelters, and relocating critical facilities away from densely populated areas.
- Establishing stockpiles of essential supplies and creating emergency response bases to facilitate swift aid distribution during crises.

- Equipping households in industrial areas with chemical protection gear to mitigate potential industrial accidents.
- Installing comprehensive air raid alarm systems to provide prompt and clear alerts to all residents, enhancing overall safety and preparedness.
- Improving governmental transparency and communication to empower residents to make informed decisions during crises, thereby fostering a sense of security and trust in authorities.

5.Discussion

Incorporating insights from Ukrainian citizens into urban planning and resilience initiatives can significantly fortify EU cities against the uncertainties of conflict, ensuring the safety and well-being of their residents. This comprehensive approach involves several key strategies, which are essential for creating urban environments that are both resilient and adaptable in the face of potential crises.

First, enhancing infrastructure resilience is crucial. Cities should invest in renewable energy sources and backup power systems, such as solar panels, wind turbines, and local battery storage systems, to maintain essential services during disruptions. Additionally, constructing robust bomb shelters in all new buildings, and retrofitting existing structures to include accessible and well-equipped shelters, can significantly enhance civilian safety.

Improving mobility solutions is another vital component. Developing resilient public transportation networks that remain operational during emergencies, such as using fuel-efficient or electric vehicles with backup power sources, can ensure that residents can reach safe locations swiftly. Designing transit stops and routes to include protective structures that can serve as temporary shelters during attacks will also help safeguard commuters.

Strengthening communication and information systems is critical. Implementing advanced air raid and disaster alert systems that provide clear, real-time information to residents is essential. Integrating these systems with mobile apps and public broadcasts ensures widespread awareness. Governments must establish clear, consistent communication channels to provide residents with accurate information and actionable guidance during crises. Regular updates and preparedness drills can foster trust and readiness.

Emergency preparedness and response must also be prioritized. Creating reserves of food, water, medical supplies, and other essentials in strategic locations throughout the city will ensure quick access during emergencies. Conducting regular emergency response training for both officials and residents can improve overall preparedness and resilience. Educational programs should focus on survival skills, first aid, and the use of emergency shelters.

Community engagement and inclusivity play a significant role in urban resilience. Building strong community networks can enhance collective resilience. Initiatives that encourage neighborly support and cooperation can create a more unified and resilient populace. Ensuring that urban planning processes include input from a diverse range of community members, especially those who have experienced conflict, can lead to more comprehensive and effective resilience strategies.

Industrial and environmental safety should not be overlooked. Establishing stringent safety measures for industrial zones, including regular inspections and emergency response plans, can mitigate risks associated with industrial accidents. Protecting and managing urban green spaces and water resources can enhance resilience to both man-made and natural disasters, providing critical resources and refuge areas during emergencies.

By integrating these strategies into urban resilience frameworks, EU cities can better withstand the impacts of conflict and create safer, more adaptive, and supportive environments for their residents. These measures ensure that cities are not only prepared for emergencies but are also places where communities can thrive despite the challenges posed by uncertain times.

6.Conclusion

The insights gained from Ukrainian citizens who have endured the ravages of war offer invaluable lessons for enhancing urban resilience in EU cities. This paper has highlighted the urgent need for cities to be prepared for the uncertainties of conflict by focusing on several critical areas:

infrastructure resilience, mobility solutions, communication systems, emergency preparedness, community engagement, and industrial and environmental safety.

By prioritizing the development of autonomous energy systems, EU cities can ensure the continuity of essential services during disruptions, reducing their dependency on centralized power grids and increasing their overall resilience. Constructing robust bomb shelters and retrofitting existing structures to include accessible and well-equipped shelters will significantly enhance civilian safety during emergencies.

Improving mobility solutions, such as developing resilient public transportation networks and designing protective transit stops, ensures that residents can swiftly and safely reach secure locations during crises. Strengthening communication systems through advanced air raid and disaster alert mechanisms, coupled with clear and consistent information from authorities, can empower residents to make informed decisions and foster a sense of security and trust.

Emergency preparedness and response are vital components of urban resilience. Establishing stockpiles of essential supplies and conducting regular training for both officials and residents can enhance overall preparedness. Educational programs focused on survival skills and first aid are crucial for ensuring that the population is well-equipped to handle emergencies.

Community engagement and inclusivity are also essential. Building strong community networks and ensuring that urban planning processes include input from diverse community members, particularly those with firsthand experience of conflict, can lead to more comprehensive and effective resilience strategies. Inclusive planning fosters social cohesion and resilience, making cities more unified and prepared for adversity.

Finally, ensuring industrial and environmental safety through stringent safety measures, regular inspections, and the protection of urban green spaces and water resources can mitigate risks and provide critical resources during emergencies. These measures can contribute to the overall well-being of residents and enhance the city's ability to withstand both man-made and natural disasters.

Incorporating these strategies into urban resilience frameworks can enable EU cities to better withstand the impacts of conflict and create safer, more adaptive, and supportive environments for their residents. The experiences of Ukrainian citizens can serve as a valuable guide, demonstrating the importance of proactive preparedness and the need to dispel notions of implausibility regarding conflict. From these insights, EU cities can develop robust, resilient, and inclusive urban environments that are well-equipped to navigate the complexities of the future, fostering a culture of preparedness and adaptability.

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How far do decision-makers see? A spatiotemporal investigation of flood risk governance in a French Alps city

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Abstract

At the confluence of two rivers, the Grenoble Metropolitan area of France is a fabric of municipalities surrounded by Alpine massifs. Despite the absence of a major flood since 1859, flood risks persist, further amplified by climate uncertainties. We investigated how institutional structures manage these evolving risks. From previous research using Q-methodology, we found tensions related to spatial and jurisdictional aspects of flood risk management. To gain a deeper understanding of the temporal aspects not apparent from the Q-method study, we conducted a thematic analysis of seven interviews of study participants who hold managerial positions. Even though the interviewees were well aware of flood history and climate change, regulatory and policy mechanisms often impede the mobilisation of a long-term view into flood risk management strategies.

Keywords: flood risk governance; policy myopia; institutional inertia; thematic analysis; France

1 Introduction

Urban planning presents various "wicked" problems that are complex, multifaceted, and pervasive throughout socio-ecological systems (Rittel and Webber, 1973). Managing these problems is challenging as they involve multiple interrelated and co-evolving processes with no single best solution. Similarly, stormwater and flood risk management are wicked problems that operate within the context of evolving hydro-social systems, both constrained by and co-evolving with existing socio-cultural settings, land use patterns, governance structures, and infrastructures (Holling, 1973; Armitage *et al.*, 2009; Montanari *et al.*, 2013; Hommes, Hoogesteger and Boelens, 2022; Arik, 2024). Most water infrastructure and policies in developed areas are rooted in the concept of 'stationarity,' which uses the past hydrological regime to determine the envelope of variability for current and future water management decisions. In the face of increased uncertainties related to climate change, the assumption that hydro-climate systems exist in a fixed envelope of variability risks implementing inadequate infrastructure planning and water management strategies (Milly *et al.*, 2008; Sivapalan and Blöschl, 2015; Nair and Howlett, 2017). However, better capturing the uncertainty posed by evolving hydro-climate systems remains a major science and policy challenge. As a result, well-tested engineering methods based on stationarity remain prevalent in water infrastructure planning and management approaches (Brown, 2005; Harries and Penning-Rowsell, 2011; Milly *et al.*, 2015; Meng *et al.*, 2022; Robert, Quercy and Schleyer-Lindenmann, 2023).

To better meet the pace of evolving climate challenges, the concept of 'path dependency' helps conceptualise how the past shapes possible futures through current societal structures and systems (Haasnoot *et al.*, 2013, 2020; Bruley *et al.*, 2021). In other words, existing societal

structures can limit future pathways for adaptation to changing risks and climate uncertainties, even if there are known strategies to reduce risks. Some scholars explain the persistence of these societal structures in terms of reproduction, equating it to 'social inertia' by suggesting that institutions reproduce themselves over time, which causes self-reinforcing dynamic that resists directional changes even if the status quo is maladaptive (Mahoney, 2000; Barnett *et al.*, 2015). These pathways add a layer of complexity to managing flood risk as they can be hard to predict and can hinder the implementation of climate-adaptive flood risk management strategies even when they are known or have a contingency of supporters who work in flood risk management.

Therefore, the range of implementable climate change adaptation actions depends on the alignment of implementable strategies, scientific knowledge, governance processes, infrastructure lifecycles, and political and social will. Our study investigates whether the institutional structures match the spatial and time scales necessary to manage evolving flood risks. We focused on the Grenoble metropolitan area of France, where we interviewed 62 specialists who are members of an advisory committee in flood risk management. For this, we used Q-methodology paired with semi-structured interviews. The Q-method helped identify issues related to the jurisdictional mismatch in the scale of risk prevention and crisis management (Arik *et al.*, 2023). As jurisdictions are socially constructed, it makes sense that tensions related to spatial scaling would emerge from the study of perspectives. However, a temporal perspective of flood risk management did not emerge from the Q-method study. To go deeper into the temporal aspects, we conducted an exploratory analysis for this paper focusing on the interviews of seven study participants with managerial positions representing diverse perspectives, prompted by retrospective and prospective questions. We investigated how they learn from Grenoble's history of flooding and incorporate climate change knowledge into their decision-making.

2 Background and methodological notes

2.1 Setting the scene

This study was conducted in the Grenoble-Alps Metropolitan area (Grenoble-Alpes Métropole, GAM) of France, a region with a rich historical context in flood risk management. With a population just short of 450,000 (INSEE, 2022), this medium-sized metropolitan administrative entity governs an agglomeration of 49 individual municipalities. While each municipality has its own mayor and public officials, the agglomeration provides an inter-municipality governance structure to facilitate cohesion across planning efforts and public services. Notably, within the last ten years, all water-related responsibilities were transferred under the purview of GAM, and the municipalities no longer have the power to act, except for sanitation. GAM comprises a flat and densely developed valley, surrounded by less urbanised regions situated at the foothills of the surrounding mountains. Over a hundred steep torrents descend from these mountain massifs, flowing into two major rivers—the Isère and Drac Rivers, which converge in the City of Grenoble. The urbanisation of the valley was significantly influenced by the flooding regime of these merging rivers and surrounding torrents. A period of disastrous floods from 1600 to 1859 prompted major engineering efforts to curtail the flooding (Cœur, 2003). Consequently, since 1859, the valley has not experienced a major regional flood. However, the region experiences regular localised flooding, landslides, and torrential flows along the periphery, and the risk of catastrophic flooding remains a concern for the region (Creutin et al.,

2022). Alongside these flood events, the concentration of flood risk oversight and responsibility has evolved over centuries from hyper-decentralized to hyper-centralized and levels in between (Renou, Brochet and Creutin, 2020). Currently, GAM oversees most flood management and financing, but certain responsibilities are distributed across different levels of government, requiring cooperation. Table 1 provides an overview of key actors in flood risk governance in the region.

Table 1. Relevant flood risk management actors and their roles, represented on the committee for the management of aquatic environments and flood protection, CoMAPI.

Actors	**Flood Risk Governance Roles**
GAM (Grenoble Alps Metropolis)	GAM is the intercommunal government structure that governs 49 municipalities, including the City of Grenoble. Through the GEMAPI law enacted in 2018, GAM is responsible for aquatic environment management and flood prevention, particularly the smaller waterways not under the purview of SYMBHI. Through GEMAPI, GAM also collects a tax to fund these efforts and organises the CoMAPI, a committee of actors (as described in this table) who play an advisory role in aquatic environment management and flood prevention decisions.
SYMBHI (Joint Association of the Isère River Basin)	SYMBHI is the public body responsible for the planning and management of the South Isère River and Drac River basins, and it plays a key role in waterway management and flood risk prevention for the major rivers.
Regional agencies of the State	These include the water agency, the forestry agency, and the health department, among others. The health department has a prominent role in crisis management, especially for significant events.
Municipalities	Each of the 49 municipalities within GAM has an autonomous government, including a mayor and a town hall. The mayors are responsible for crisis management and coordination in the event of local flooding but do not carry direct responsibility for flood risk management.
Riparian landowners and riparian landowner unions (ASAs)	Riparian landowners are legally responsible for managing their streambanks. Historically, they transferred this role to riparian landowner unions, which collected fees and could access the stream reaches for management activities. Many of these unions have been eliminated in the region, but riparian landowners remain responsible for maintaining their streambanks.
Other stakeholders and associations	These include, for example, the electricity company (EDF) that manages hydroelectric dams in the basin and associations concerned with biodiversity or recreation.

2.2 Q-method and beyond

Studying wicked problems has multiple modes of entry and requires drawing wieldy boundaries around an inherently complex system (Holling, 2001; Hou, Li and Song, 2022). Because of the complex nature of wicked problems, mixed-methods approaches offer a means to look at multiple aspects of a problem (Mertens, 2015). Q-methodology (QM) is a mixed method increasingly used to study subjectivity related to complex issues (Dziopa and Ahern, 2011;

Zabala, Sandbrook and Mukherjee, 2018; Dieteren *et al.*, 2023). Using data reduction techniques, QM enables researchers to understand complex, multi-dimensional issues through a digestible set of perspectives. For this paper, we outline the findings of a QM study we conducted (Arik *et al.*, 2023) and how we take the study further through a thematic analysis of interviews.

2.2.1 Q-method insights reveal local-level gaps in hazard management

The Q-method uses an "inverse factor analysis" to study the associations between peoples' viewpoints rather than grouping people according to their characteristics (Stephenson, 1936, 1977). This is carried out by asking several participants ("P-set") to individually react and rank a set of stimuli ("Q-sample") relative to one another according to a semi-normal grid ("Q-sort"). Generally, the Q-sample is a set of non-provable statements pertinent to a particular subject. Principle component analysis or data reduction techniques are then used to identify similar perspectives from the Q-sorts. Several studies have mobilised QM to identify differing perspectives on flood risk governance or stormwater management (Cousins, 2017a, 2017b; Rittelmeyer, 2020; Arik, 2022; Tafel *et al.*, 2022). As a part of this study, we used QM to uncover tensions within the governance of flood risk in GAM; the full description of this part of the study is published in Arik et al. (2023). Briefly, the study included 32 statements, of which we asked participants to sort according to a semi-normal grid ranging from -5 (strongly disagree) to +5 (strongly agree). In total, we had 62 participants and collected 55 sorted sets of statements from members of CoMAPI or similarly affiliated flood risk management specialists.

Our study revealed three different perspectives (see Figure 1). The first group we identified as "Hydro-experts" tended to have a global 'point-of-view' and a specialised background in flood management. In this case, the expression 'point-of-view' can be understood verbatim as it refers to a characteristic that structures the overall perspective and flood risk management in GAM generally. The second and third groups represented participants connected to flood risk management at a local jurisdictional scale, dubbed the "Hydro-generalists" and "Hydro-operators." The Hydro-generalists were typically elected officials of periphery municipalities responsible for crisis management. They were concerned that blame would fall on the mayor for any unattended management of flooding hazards, even if stream management is not their responsibility. The Hydro-operators were local technicians who worked on everyday management issues, particularly current or formally associated professionals of an ASA, which are being phased out within the institutional space. Both of these latter groups observed a similar management gap of smaller streams under the jurisdiction of GAM caused by the administrative complexification of access to private land in cases where private landowners are not maintaining streambanks on their property.

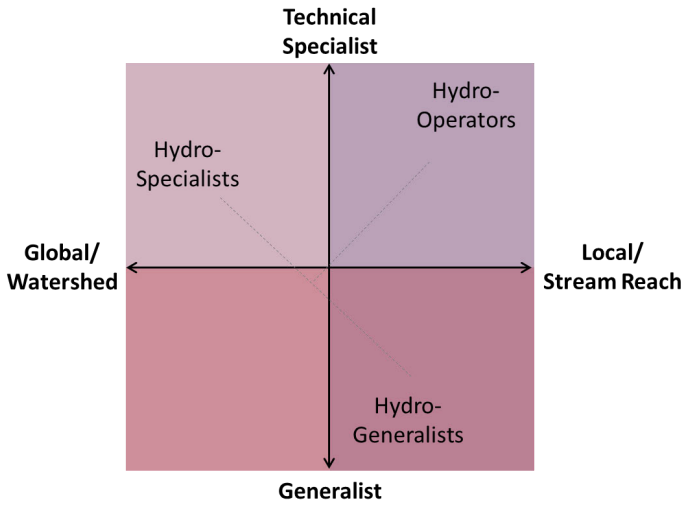

Figure 1. Orthogonal characteristics of the three perspectives identified through the Q-method. The hydro-specialist perspective of flood risk management is that of a technical specialist with a global or watershed view, the hydro-operator perspective is also that of a technical specialist but with a more stream-level view, and the hydro-generalist perspective is a generalist with an on-the-ground point-of-view.

While QM does not determine the percentages of a sample population that ascribe to a particular viewpoint, we found it striking in our analysis that a great majority of participants correlated with the Hydro-expert perspective. Our findings, therefore, revealed a large unity among the flood risk management actors of the region. However, we also noted differences in ideas between the Hydro-experts and the latter two groups, which represents friction along the 'fringe' of the body of CoMAPI actors. This raises a question of the right balance between the scale of governance and the orchestration of roles and responsibilities within an integrated flood risk management architecture under GAM. The separation of these groups reflects real or perceived insufficiency of measures in the institutional arrangement to address management issues affecting local municipalities. Efficiencies might be found at the jurisdictional scale of GAM in terms of watershed management, harmonisation in planning, and strategic investments in projects and infrastructure. However, these efficiencies need not come at the cost of incorporating issues that arise in a local context and likely require better institutional mechanisms to connect management scales from the bottom up.

2.2.2 Going deeper through interviews

While the QM study revealed friction related to the jurisdictional mismatch in the scale of roles and responsibilities between actors in charge of flood risk management and crisis management, it revealed little about the temporal aspect. To explore this further, we conducted a thematic analysis of semi-structured interviews. For this qualitative analysis, we first identified participants with current or former decision-making or policy-influencing roles in flood risk management at the scale of GAM or the greater watershed (ca. 20, based on their titles and our knowledge of their roles). Since many participants fit this profile, we used the principal

component correlations to select a more manageable sample of seven participants representing a range of views, including five representing the Hydro-experts (out of 44) and one each from the Hydro-operators and Hydro-generalists (out of 3, respectively). Specifically, we visualised the correlation values of the first six principal components (PCs) using Chernoff faces (Chernoff, 1973; Wolf, 2019), which captured 82% of the explained variance. From the facial plots, we selected a sample of participants aimed to capture a wide range of views based on their 'facial characteristics.' We explain the Chernoff faces and our selection more in Appendix A.

During the interviews, we asked a range of questions relating to the QM study statements, the participant's experience with floods and risk management, the impacts of climate change, and the evolution and needs in risk management. For this paper, we were particularly interested in the following questions asked of interviewees:

- What are your sources of information about climate change and its impacts? Do you take climate change into account in your flood management-related work? In what way(s)?
- Have your views of flood management evolved [during your career]? Do you think flood management practices, in general, have evolved [particularly in what you have witnessed during your career]?
- What do you believe is necessary to bring all the different actors within GAM to the table to work together on flood risk management? Or do you see obstacles in what already exists?

Note that the interviews were conducted in French, and relevant material was translated for this paper. The interviewees for the thematic analysis included a director associated with GAM, a president of a biodiversity association, a city resiliency leader, a mayor and a vice mayor of different municipalities, an environmental service lead for a State agency, and a former president of an ASA. All of the interviewees were well-experienced and represented a diversity of backgrounds.

3 (A)synchronicity in the temporal outlook on flood risk management

While the Q-method allowed us to identify misalignment in the jurisdictional scaling of flood risk management and crisis management, the interviews gave us insight into the misalignment of temporal aspects of management. Several aspects of temporality were revealed through the interviews, with most interviewees thinking multi-decades into the past and future to describe how that affects their daily functions or the set of flood risk management problems to tackle.

3.1 Policy myopia: A problem too abstract

Not surprisingly, climate change was well-accepted as a critical problem in flood risk management. However, no one admitted climate change was well-mobilised in flood risk management. However, some pointed to efforts, especially personal, toward learning and integrating climate change knowledge in their work. For example, this interviewee talks about the inability to take into account potential climate change impacts because of current regulations:

> [Climate change is] on the radar, and every time we work, we say "yes!" But we don't know [how to include it in our work] because the regulations don't necessarily include it...In concrete terms, the sizing of projects is based on [the flood risk prevention plan]. So even if we're worried […the project] may be undersized […], in reality, we give authorisation based on regulations that don't necessarily take [climate change] into account. – *city resilience program leader*

Similarly, another interviewee references a comparable lack of regulation and guidelines, and adds what they are doing personally to understand the subject better:

> [About the basin's master plan for water development and management] there are about ten pages of broad principles, but there's nothing else: No instructions from any ministry on the subject. No technical notes. No regulatory reflection. So, professionally speaking, apart from a few technical days organised by the Rivière Rhône-Alpes Auvergne Association or things like that, there's nothing. Then, from a personal point of view, I seek information myself. I'm thinking about taking on a trainee or a part-time employee to set up a method to suggest modelling [based on IPCC projections] without necessarily imposing it on project managers. – *state agency head of environmental services*

Nair and Howlett (2017) aptly refer to the concept of 'policy myopia,' where long-term uncertainty is not adequately incorporated because short-term certainty is better known and understood. This myopia may contribute to or reinforce the institutional and cultural inertia that upholds the status quo, even when flood risk managers see the importance of taking a longer-term view.

Reflecting on the past was, in some ways, easier for interviewees because of lived and learned experiences. One interviewee suggested that experiencing or seeing major climate change-related flood disasters has served to increase awareness and can change perceptions strategies needed for better flood risk management:

> Our colleagues in planning today are much more aware than they were 10 years ago […] At one point, the departments, or rather the various players, were somewhat in denial about the risk. I also think well-known tragic events may have changed their perception, like [Cyclone] Xynthia and what happened in Germany last year [2021]. – *metropolitan director of environment and public services*

The same interviewee also pointed out that an ironic barrier to improved flood risk management in GAM is the lack of recent disastrous flood events. Similar to the concept of the 'dike paradox' (Vinet, 2008; Haer *et al.*, 2020)—an expression capturing the irony of flood protection infrastructure encouraging development in flood-prone areas—the interviewee suggests a lack of historical memory of flooding leads to a sense of security, creating an absence of risk culture:

> You might find it strange, but I think the biggest obstacle we have, locally, is that the last [major] flood was in 1859, which is not on the scale of human memory. When there are recurrent floods, the knowledge of the risk is maintained, and no one questions the

> wisdom of taking any measures...people don't realise that rivers can be devastating here. – *metropolitan director of environment and public services*

These ideas suggest that even with technical knowledge of climate change impacts or historic flooding, a long-term view can become too abstract without proper support structures or mechanisms to incorporate this knowledge. In other words, technical and scientific knowledge of long-term flood risks will likely be underutilised when it exists within social, political, and institutional structures that favour the certainty of a short-term view. Some interviewees alluded to elected officials either helping or hindering climate change adaptation, however, there was a sense that the lack of ability to mobilise adaptation strategies was beyond their control.

3.2 Systems Inertia: A (frustratingly) slow evolution toward (hopefully) better

The interviewees' outlook often reflected expressed or muted emotions when recognising their professional role within a larger system beyond their control. On one hand, they found it frustrating when they perceived inaction or slow change. On the other hand, most could also identify positive outcomes that gave them a certain level of hope, which seemingly motivates their continued work:

> It's complicated [and slow]. But we're getting there. Well, [more like] we're going. When you see the people who work on floods in local authorities, syndicates, etc., there are many young, super-trained, super-savvy people […] Among the technical-administrative intermediaries, I find that the overall level is super good with really committed people who believe in [climate resilience] and think transversally, horizontally. However, action takes time because [there is] a heritage, an inertia. But, yes, it's changing in the right direction. – *city resilience program leader*

In this sense, as with the concept of path dependency, a long, sometimes invisible, history can have a huge impact on the current possible trajectories. Like the law of physics, Mahoney (2000) describes social inertia as processes that are set into motion towards a particular outcome that stay in motion and continue to track that outcome. Many processes embedded within social-infrastructural systems add to inertia, thus creating a perception of slow and incremental change and tension in the aspects of time incongruency. On the one hand, there is a stagnant viscosity to the reality, while on the other, there is an accelerating desire for change.

3.2.1 Technical limitations to adaptation: Do what can be done, where it can be done

Several case studies explore the concept of inertia as an impediment to climate adaptation action. One common finding is the persistence of traditional engineered approaches in institutional cultures and development regimes of territories (Harries and Penning-Rowsell, 2011; Meng *et al.*, 2022; Robert, Quercy and Schleyer-Lindenmann, 2023). In GAM, there was a similar sentiment expressed by some interviewees that the urban fabric cannot easily accommodate changes:

> The problem we're facing isn't that we don't know what needs to be done; it's that we're intervening in a city that's already built up, and the main problem is that the rivers have been corseted; they don't have enough space. Now we have to make do, or more that it's

> complicated to give them more room to roam. The Isère Amont [upstream restoration project] is typically about giving space back to the river. Although the structures are very man-made, they still reflect the idea that you have to let the water spread out so that it doesn't cause as much damage downstream. – *metropolitan director of environment and public services*

Another technical obstacle that slows progress relates to the sheer magnitude of expenditures needed for even minor adjustments to water or wastewater infrastructure networks. These infrastructure assets have a value on the order of magnitude of multi-billion euros and have been built over centuries. Therefore, as one interviewee explains, spending €10 million a year on water or wastewater infrastructure improvements touches only about 1% of the infrastructure. Thus, climate resiliency actions—as interpreted by several interviewees—need to include efforts to 'live with flooding' or reduce its destructive capability when there is an event. For example, ensuring that ground-level floors are floodable in exposed areas. Additionally, elevating less 'fixed' infrastructure, such as telecom equipment and cables, can help reduce vulnerability.

Many interviewees referred to the problem of surface artificialisation adding to the flood risk. There was a widespread agreement that "pouring concrete" needs to stop, and the cities need to de-artificialise or re-permeabilise developed areas. Several interviewees connected the idea to concepts of being "more ecological" or "green." Specifically, one interviewee had a tightly integrated view of managing climate and biodiversity. In urban areas, creating greater opportunities for biodiversity while improving climate resilience:

> We're working with our partners to integrate biodiversity; to create a city where nature is part of the design, such as de-impermeabilising (sic) and buildings with native plant garden programs to make them better adapted to climate change. – *local chapter president of a national environmental protection association*

As this same interviewee pointed out, climate change impacts also create technical limitations in managing mountain spaces for either flood risk management or biodiversity. For example, climate change impacts in the mountains, including changing snow altitude, changes in snowfall timing, increased fire impacts, and higher temperatures, are already putting certain species at risk and impacting flood risk. However, no further mitigation can be done at some point, whether it is species loss or hydrological changes.

3.2.2 Institutional stagnation: Bureaucratic delay and knowledge loss

Across the board, interviewees expressed a general 'slowness' in implementing flood risk management projects or strategies, with one interviewee alluding to a tanker needing to turn. Often, scales referenced in terms of waiting to 'get something done' are on the order of decades. This institutional slowness was rightfully a source of frustration for the interviewees. While it is undeniable that institutions are incorporating climate resilient flood risk management practices at a slower rate than managers would like to see and the rapid pace of climate change. However, what is unclear from the interview discussion is how much of the slowness is a tactic to either kill a project or avoid public or political scrutiny. Some interviewees directly pointed to a "political blockage" to implementing projects or better strategies:

> Something that might work on the technical side can be completely swept away because the two elected representatives are tense. We [on the technical side] don't feel it too much because we're dealing with a subject that's quite well agreed upon […] In a lot of departments, sometimes they've worked for six months setting up a project and then at the last minute, it's scratched. When it comes to collaboration […] the political issues must be ironed out. – *city resilience program leader*

In another example, an interviewee recounted a sediment removal project with the State and indicated being dismissed when they suggested that the amount of sediment removed was insufficient for getting ahead of a problem:

> It's annoying because we don't go any further than the existing problem. In other words, we're not going to solve the problem. We're going to wait and see. – *former president of an ASA*

Regarding collaboration on flood risk management, CoMAPI is supposed to serve that role for GAM, with GAM as the coordinator. However, several interviewees expressed dissatisfaction with the role that CoMAPI plays, suggesting that its role is somewhat ineffective in consulting, knowledge mobilisation, and collaboration. For example, this interviewee specifically talks about the CoMAPI meetings:

> I get the impression that the meetings are much more focused on sharing information than consulting actors. What is lacking and what, in my opinion, is difficult to implement are real consultation committees between the various parties responsible, i.e., the municipalities, GAM, and the State. – *former president of an ASA*

An issue that seemed to be circulating among several interviewees with more local roles, and similar to what we found in the QM study, was the idea that GAM is not organising well with the municipalities to incorporate on-the-ground realities into their flood risk management responses:

> For me, GAM needs to step up and better involve the municipalities. Because [municipalities are] the first point of contact locally. Also, everything passes through a municipality, local knowledge and so on. – *mayor of a municipality*

Another interviewee elaborates on the history of this relating to the transfer of responsibilities from the ASAs to GAM, resulting in a loss of information and confusion about roles and responsibilities:

> Flood protection disappeared when the responsibility was transferred to [GAM…] For a long time, people thought [GAM] would [maintain the streams and torrents]. Whereas that is not the case […] As a result, the owners no longer know where they stand when there's a problem or who they should call. There's a loss of communication, a loss of information. Yes, a very significant loss of information because I sincerely believe that homeowners no longer know who's looking after what. – *former president of an ASA*

While CoMAPI offers an important structure for collaboration, there seem to be aspects that could be improved to address these issues raised. However, the question is, at what cost? This interviewee aptly describes the reality that effective collaboration requires time, and time is costly:

> When [collaboration] works, you can't see it, but it takes up a huge amount of time. Organisations don't think about coordination time. For me, it's more of a global thing: If we want people to work together, we need to make it something we can quantify and pay for. – *city resilience program leader*

On the one hand, the frustration over the slow pace of implementing projects and acting toward climate-resilient strategies was palpable among the interviewees. There was an across-the-board agreement that better collaboration is needed (partly prompted by an interview question), especially to have more holistic management of flood risk and to mobilise on-the-ground knowledge. However, the time outlays of such solutions are rarely considered. In other words, effective collaboration also requires a significant investment of time (Renou *et al.*, 2024), and although it might lead to better management outcomes and is needed to address certain issues, spending more time on collaboration would be unlikely to assuage the perceptions and criticisms about slow implementation.

3.2.3 The movement of ideas: Optimism in turnover

While thinking about present-day obstacles might have prompted a sense of frustration for the interviewees, asking them to reflect on the changes they have seen during their careers tended to expose an optimism in the ability to actually enact some of the changes that they would like to see toward climate resilience and better connecting flood risk management to environmental management.

> From what I've seen, there's been a generational shift. With the 'resilience label'—which you can criticise—I saw a shift from those who said, "We'll be able to prevent it" to those who said, "In fact, it's going to happen." And that, for me, really changed the perspective and the way we acted. – *city resilience program leader*

However, from the experiences recounted, there seem to be many layers of interconnected processes, some of which have changed and others which have not. The above quote refers many to ideational shifts, which they then describe as "percolating slowly" into how flood risk management is handled even though the generational shift was "noticeable." This was similar to another interviewee:

> We have a rich history in the Isère, but a lot has changed in 10 years. However, my perception of the issues and my technical perception have changed relatively little. In other words, I'm convinced we must include as much [environmental management] as possible in our policies. – *state agency head of environmental services*

Even those who are impressed by the changes (generally, the younger interviewees) admit that much of the technical knowledge has remained the same for the last 20-30 years. The

descriptions indicate the significant role that political and social values play in flood risk management, even when it is viewed as a technocratic exercise.

However, not all changes within the evolution of flood risk management were viewed as positive. For example, one interviewee talks about some of the changes and events they've witnessed during their career as clearly climate change-related. At the same time, at other times, they have been unconvinced about whether an event was linked to climate change or lack of maintenance. They give a specific example of when they were younger, there were road maintenance workers; now, they do not exist, and they see that the drainage backs up quickly leading to flooding. These issues relate to the previous section, the loss of information, and the lack of a mechanism to mobilise on-the-ground issues to the level of GAM. While the evolution that most interviewees referenced relates to institutionalising widely accepted concepts, such as holistic and integrated management, it is important to realise that this change in the institutional structure has also led to the loss of other institutional structures that served a critical function.

4 Conclusion

In this paper, we investigated the spatiotemporal aspects of flood risk governance to understand the alignment (or misalignment) of spatial and time scales needed to continue to manage evolving flood risks. Our study took place in the Grenoble metropolitan area of France, where we explored how flood risk managers considered spatial and temporal scales in their work missions. The investigation was conducted in two parts. The first uncovered scaling issues using the Q-method, which helped identify tensions related to scaling management actions and jurisdictional boundaries. Overall, this highlighted the need for better knowledge mobilisation between actors at the local and watershed level, and better distribution of roles between risk management and crisis management. A deeper exploration via seven interviews of policy influencers of diverse backgrounds highlighted some of the ways in which temporality comes into play (or not) in flood risk management. Our analysis suggests a misalignment between policy actions and long-term objectives. This misalignment is exacerbated by myopic policy decisions, which favour short-term certainty even if technical solutions are known. The study also highlighted the persistent issue of systems inertia, where technical limitations, slow institutional responses, and ideational stagnation often impede progress towards more climate-resilient flood risk management. Despite these challenges, the interviewees were generally hopeful for the future as they recounted changes seen during their careers with shifts in thinking and adopting new approaches.

Drawing lessons from the findings, there is a subtle recognition of the importance of investing in the less tangible aspects of flood risk management such as relationships and knowledge mobilisation, instead of solely focusing on material or institutional structures. Often, seeking an alignment of spatial aspects in flood risk management can dominate the dialogue when the alignment of temporal aspects is also critical, even though aspects of time add more uncertainty to already challenging management issues. This raises the crucial question of how 'time' can be integrated as a more common factor in the collective retrospective and prospective views of flood risk management as an approach to better adapting to wicked problems.

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Appendix A

As a visual aid for selecting the seven participants for this study, we used a plot of Chernoff faces. Figure A1 shows the facial outputs according to the first six PCs and the seven selected participants. Chernoff's faces are a method to visualise multivariate data in a form that is more relatable for the human mind than graphical plots and can be used as an aid in discrimination analysis, for example. Chernoff faces use the PC correlation values to modify facial characteristics. For example, we associated PC1 with head shape, meaning Q-sorts with the highest PC1 correlation values show larger, blockier faces. Meanwhile, low correlation values show smaller, rounder faces. Using Chernoff faces to visualise the Q-sort data provided us with a more objective way to select interviews for this exploratory study rather than selecting based on our prior interactions or connections to the participants. For example, of the participants that

fit the profile, we tried to ensure that there was a range of nose sizes to capture the range of views comprising PC5.

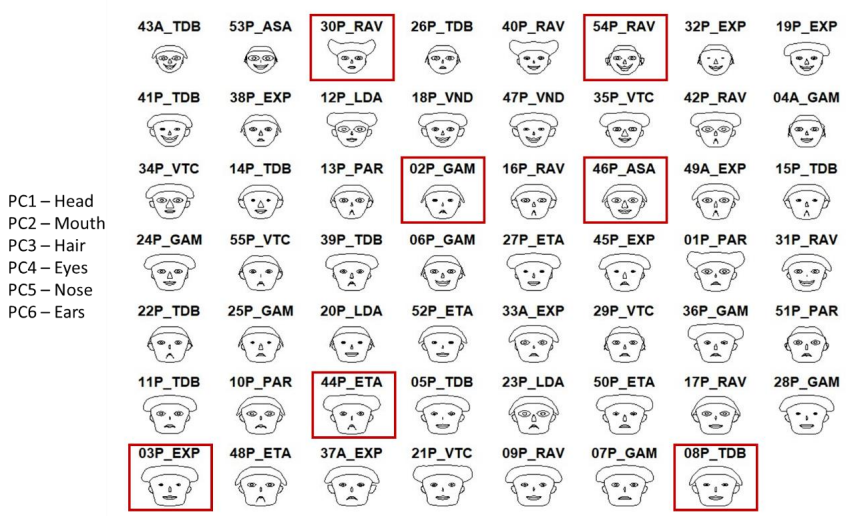

Figure A1. Mapping of Chernoff faces based on the correlation values to the first six principle components. For this paper, faces highlighted are participants selected to investigate the temporal aspect of flood risk management.

RISK MANAGEMENT FOR URBAN HERITAGE: THE CASE OF IZMIR

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Abstract

Risk management for cultural heritage is a significant issue in conservation and management studies. The Convention Concerning the Protection of the World Cultural and Natural Heritage states that ensuring a good state of conservation of the property is a requirement for inscription on the World Heritage List. This paper aims to develop a preliminary site-specific methodology for the urban heritage, the case of historic centre of Izmir, which is the management site of the Historical Port City of Izmir in the Tentative List from 2020. Although risks are diversified, the scope of this paper is limited to physical risks affecting the spatial environment. The site-specific methodological approach is constituted based on key sources of ICCROM and UNESCO and adopted for the urban heritage of Izmir.

Keywords: Risk Management, Cultural Heritage, Historic Centre, Izmir, Historical Port City of Izmir

1. Introduction

"Cultural heritage is always at risk" states Stovel (1998, p.17) in *Risk Preparedness: A Management Manual for World Cultural Heritage*, one of the earliest noted sources in risk management for cultural heritage. Stovel (1998) explains principles including importance of advance and integrated planning not just for buildings but also for associated context and landscapes, adopting preparedness requirements compatible with conservation principles, and inclusion of users in the process of planning. He draws a planning framework as preparedness, response and recovery phases for the risks of fire, earthquakes and related disasters, flooding, armed conflict, and other hazards.

Managing Cultural World Heritage (2013) is a significant resource manual, mentioning risk preparedness is one of the key considerations for the management system. In the context of risk management, *Managing Disaster Risks for World Heritage* (2010) is the specific resource manual published by UNESCO. The manual states that disaster risk management (hereafter DRM) should be an integral part of a site management plan and linked to local, regional, and national management systems. DRM plan is designed to eliminate or mitigate negative impacts of disasters on heritage values, which is outlined in statement of Outstanding Universal Value (OUV). The DMR plan is consisted of three phases, namely before, during, and after disasters (Figure 1). For each phase, the manual determines relevant studies to be followed.

With a similar approach, *A Guide to Risk Management of Cultural Heritage* (2016), prepared by ICCROM, Government of Canada, Canadian Institute, provides a scientific model and methodology for risk elimination and assessment for cultural heritage. Risk Management is a future oriented and continuous study, which has six main steps: context, identify, analyse, evaluate, treat, and monitor (Figure 2).

For the case of Izmir, there are several noted sources. *The Provincial Disaster Reduction Plan (called IRAP in Turkish)* is prepared by Izmir Governorship Provincial Disaster and Emergency Directorate in 2021. For the whole province, earthquake and tsunami, landslide and rockfall, flooding, industrial facility accidents and CBRN events, fire, disasters due to meteorological events and climate change, medical geological disasters and pandemic diseases are assessed, evaluated and mitigation strategies are presented.

The Historical Port City of Izmir Site Management Plan (2022-2027) defines the heritage sites with diversified values, historical background, social and economic structure, current management system and other relevant plans on the site. The plan with a vision of "The port and trade city of the eastern mediterranean, the beautiful Izmir's multi-layered cultural heritage created by the effect of co-existence will be conserved, sustained and promoted" introduces guiding policies, sets goals and an action plan. The Goal 5, "Risk management of the historical port city of Izmir will be activated", describes necessary actions to be taken regarding both physical aspects and social and economic issues in risk management.

The recent project, *Developing Risk Management in the Historical Port City of Izmir*, aims to develop a study methodology specific to the site with the participation of relevant stakeholders. This ongoing study is also in line with this paper, which is constituted based on the research question of *how to develop a methodologic approach for risk management for the historic centre, specifically for the case of urban heritage of Izmir*. Hence, the study focuses on before any disaster event, risk preparedness and mitigation activities that deal with hazards affecting the built environment, which are earthquake, flood, fire, landslide and rockfall. Although, social and economic risks are significant aspects of the Site Management Plan, they are not in the scope of this study.

For this purpose, based on the main steps clarified in the key sources published by UNESCO and ICOMOS, a case study is conducted. Specific data for the case of urban heritage of Izmir are gathered from diverse sources, mainly the key sources mentioned previously. The data are analysed and evaluated with thematic maps prepared via CAD (drawing) software. Afterwards, preliminary strategies for risk identification, reduction, monitoring and revision processes are determined.

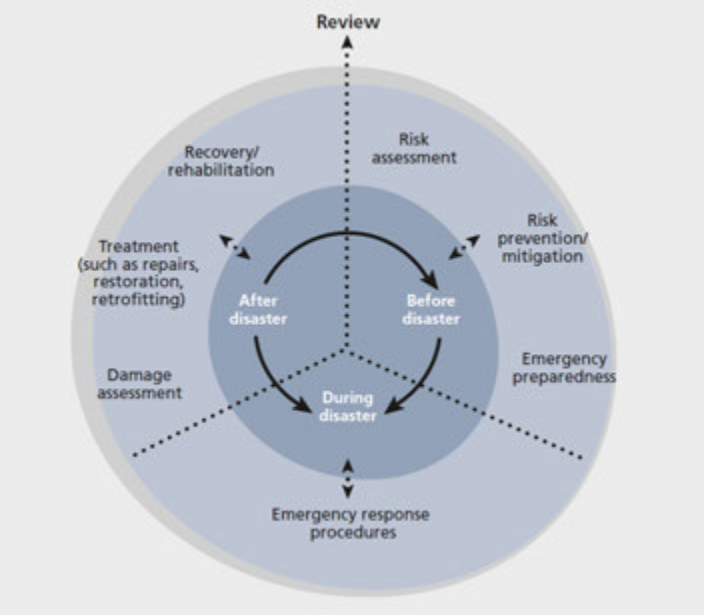

Figure 1: Disaster Risk Management Cycle
(Source: Managing Disaster Risks for World Heritage, 2010, p. 13)

Figure 2: Risk Management Cycle
(Source: A Guide to Risk Management of Cultural Heritage, 2016; p.15)

2. Scope and Context

Izmir, located on the Aegean coastal area of Türkiye has been a significant settlement and cultural hub in the Mediterranean Basin since Neolithic ages. The story of the Historical Port City Izmir is consisting of three different areas and diverse periods of Izmir, one of which are the oldest Izmir established in Yeşilova and Yassıtepe mounds from Neolithic period, secondly as Old Smyrna, during the next period called Hellenistic, and the third Izmir as the historic urban centre living around 2500 years (Figure 3).

Cultural significance of the Historical Port City of Izmir mainly based on its location on Bornova plain near to the Gulf of Izmir, interaction with the sea and trading activities in the Mediterranean basin with diversified routes throughout the history. Meles River on the eastern site of the management area, the Gulf of Izmir on the west, and Pagos Hill on the eastern south are natural edges of the historic urban centre.

Figure 3: Historical Port City of Izmir

The site has been conserved and managed based on conservation master plans and the Historic Port City of Izmir Site Management Plan (2022-2027), and faces various hazards such as earthquakes, fires, floods, landslides, and climate change, as well as social and economic risks. Under the Goal 5 of the management plan, specific targets, and actions are determined to eliminate, mitigate, and adopt these risks.

This study is in line with the site management plan but focuses on the historic urban centre and physical risks affecting the spatial environment. To clarify the scope and context of the study, values and cultural characteristics of place, present state of conservation, and stakeholder participation strategy are explained as follows.

2.1. Values and Cultural Characteristics

The historic centre of Izmir is a multilayered heritage and continues its formation. The city was established on the layers of Smyrna Ancient City of Hellenistic times, later formed as a traditional Ottoman city with a bazaar, afterwards as a modern city with national architectural elements, and today as a living heritage place with diverse cultural values. The historic urban centre has diverse cultural characteristics and can be conceptualised in different character areas (Figure 4):

1. Coastal Areas: This area gives the main characteristic of a port city, the coastal site as an interaction place of historic city centre and the gulf. The pier was constructed in the Ottoman period and significantly increased trading activities and led to modernization of the city. The rectangular narrow parcels facing to the gulf presents a modern urban layout. A modern port system, a customs house, ferry terminal, bank, commercial and residential buildings give characteristic of the area. Between Pasaport Ferry Terminal and Konak-Pier custom house, the original pier line of the Ottoman times has survived today.

2. Mimar Kemalettin Modern Bazaar: Covering the architectural elements of Ottoman Period, the area is a commercial zone of modernization period. Buildings with corner towers, corner entrances, window layouts changing in each floor, horizontal and vertical window mouldings, tile panels, reliefs and carved ornament motifs, and wide eaves (Aslanoğlu, 1980) are typical features of the area. The stock exchange building, old Greek National Bank, Kardiçalı Khan are among characteristic buildings in the place.

3. The Historic Kemeraltı Bazaar: This Ottoman bazaar is one of the biggest bazaars in the world, covering an area approximately 270 hectares. The bazaar was constructed with the infilling process of the ancient inner harbour between 16th and 19th centuries (Beyru, 1992). The urban morphology of the bazaar, composed of commercial parcels and gated khans in the narrow and long streets leading to the pier area, is largely preserved today. The five mosques, which are named as Hisar, Kemeraltı, Şadırvanaltı, Kestane Pazarı and Başdurak are located in Anafartalar Street, which is the main axes presenting shoreline of the ancient harbour.

   Trading activity, both from sea and land routes shaped the urban fabric. For instance, fevkani mosques were constructed to accommodate commercial activities, and khans were designed to provide storage, accommodation, also passageways between streets. Unlike the typical foundation-based approach seen in other Ottoman settlements, the khans in the bazaar were erected through a collaborative effort among merchants, reflecting a unique social model in this vibrant trading hub. Public squares, khans, passages, bazaars, and business centres, mosques, synagogues, hotels, hammams, sebils, and shadirvans, are among cultural heritage components of the living bazaar.

4. Public Administrative Facilities: Konak Square is the historic administrative centre of Izmir. The square and coastal shore are located on the infilled area, which was an ancient harbour in the 16th century. The Clock Tower, the Governor's Office, Izmir

Metropolitan Municipality Area[1], and Yalı Mosque, all together compose the administrative node. Close to the square, Elhamra Cinema and National Library, Gureba-i Muslimin Hospital and Beyler Streets are located, which contributed to public facilities of the area.

5. Trade, Production, and Storage areas of Kestelli: Adjusted to the Historic Kemeraltı Bazaar, the area covers trade, small production, and storage uses. The building typology is also similar to the historic bazaar.

6. Residential Quarter of İsmet İnönü Street: The residential quarter adjusted to historic Kemeraltı Bazaar. Two-storey Izmir houses with a basement, staired street in İsmet İnönü, mansions with decorated façade and interiors are significant features. These residential quarters functioned as houses for those working in Kemeraltı Bazaar. Mosques, churches, synagogues, hammams, sebils, shadirvans, and fountains are components of the residential areas.

7. Residential Quarter of Damlacık: The area is a vista point on the upper elevation. The area has a residential characteristic with limited registered buildings, close to the open green area of Cicipark.

8. Basmane Train Station and Environs: Basmane Train Station and environs is a gateway and transit point, connecting the city with its hinterland and welcoming people coming to the bazaar via railway or caravan in the past. Nearby, there are hotel regions, where Izmir houses were transformed into accommodation facilities. Basmane Train Station, hotels along hotels street, and train station warehouses behind the station gives general characteristics of the area.

9. Residential Quarter of Basmane: Basmane quarter at the east of İki Çeşmelik street is the main residential quarter of the historic city. In the past, mainly the Turkish population and Jewish population were settled in this area. Dead ended street and organic pattern, two storey Izmir houses, and a few conserved *cortijo* houses (shared housing units for collective living, built by Jewish people in the Ottoman time) are characteristic spatial organisation of the area.

10. Components of Smyrna Ancient City: The historic urban centre is a multilayered cultural heritage and Smyrna Ancient City gives the overall ancient layer. Smyrna Acropolis, Smyrna Agora, Smyrna Theatre, Harbour Bath, and the ancient residential area Altınpark are seen in todays' living heritage place. Some parts of trade pathways are also still visible. The modern İki Çeşmelik street and the Roman road is the cardo maximus, while Anafartalar street is decumanus maximus in Roman period. Although the wideness of these street changed in time, the route and several remains have been conserved. Significantly, Caravan Bridge on Meles River has been conserved with its form and still sustains its function.

[1] Izmir Metropolitan Municipality building was located in this area previously. However, the building was damaged due to the 2020 Aegean Sea earthquake and demolished in 2023. The metropolitan municipality announced plans to build a monumental metropolitan building in this area, based on an architecture project competition. (https://sehirmeclisleriyarismasi.Izmir.bel.tr/yarismanin-amaci.html, Access in 31.03.2024)

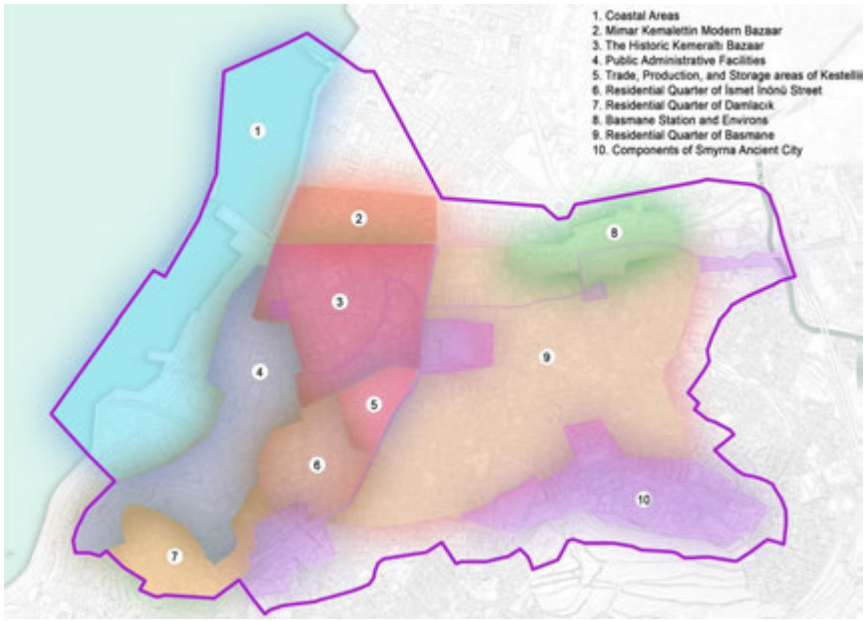

Figure 4: Values and Characteristics of Historic Centre

2.2. State of Conservation

The historic centre of Izmir is also determined as a management site in the legal framework. The management site is 372.40 hectares and is composed of diverse categories of conservation areas, which are Urban Conservation Areas, Historical Conservation Areas, Archaeological Sites, Natural Sites and Urban Archaeological Sites. Almost half of the management site is registered as Urban + 3rd Degree Archaeological Conservation Area (Table 1, Figure 5).

Table 1: Conservation Areas in Management Site (prepared based on source: The Historical Port City of Izmir Site Management Plan, 2022, p. 30-31)

Conservation Areas	Size (ha)
Urban + 3rd Degree Archaeological Conservation Area	167.10
Urban Conservation Areas	8.34
Historical Conservation Areas	80.59
Archaeological Conservation Areas	38.86
Natural Conservation Areas	8.98

Besides, there are 1730 registered cultural properties, including 1153 examples of civil architecture, 371 industrial and commercial buildings, 60 religious buildings, 59 cultural buildings, 52 administrative buildings, 13 archaeological remains, 7 water structures, 4 cemeteries, 4 monuments, 3 military buildings, 2 streets, and the Port Bath-Gymnasium structure. Moreover, the Historic Kemeraltı Bazaar covers 13.1 hectares of urban and archaeological conservation sites and includes 403 registered cultural assets.

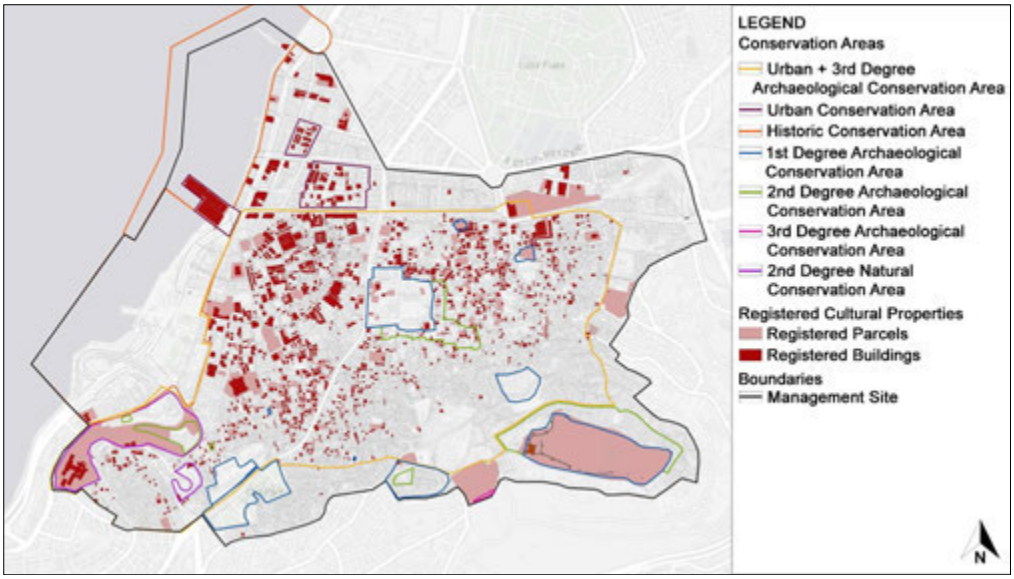

Figure 5: Conservation Areas and Registered Buildings
(prepared based on source: The Historical Port City of Izmir Site Management Plan, 2022)

2.3. Stakeholders

The stakeholders are categorised as public authorities of central and local governments, universities, professional chambers, NGOs, local community, authorised public-private partnership, and private sectors serving public services.

Public institutions hold the main responsibility in conservation and management. Universities in Izmir province are significant actors to improve knowledge about the site and conduct research on the site. Professional chambers both represent professions' perspective and monitor activities on the site for the public. Non-governmental organisations mainly comprise trade unions and sustain communication among tradesmen, both owners and renters of shops. Authorised public private partnership conducts projects mainly on restoration of buildings with other partners. Several companies provide public service of electricity at local level.

For disaster risk management, public authorities, NGOs, companies providing public services, and authorised public private partnership are determined as stakeholders who are to be worked in collaboration, provide advisory, and required data including statistical information. Universities and professional chambers are defined as stakeholders who provide advisory. Local communities are main users of the site, including headmen, tradesmen, and visitors. All stakeholders are also responsible for informing the public and involve in risk management studies (Table 2).

Table 2: Main Stakeholders in Risk Management and Participation Strategy

Institution		Key Duties	Strategy
Public Authorities	İzmir Governorship	Provincial Civil Supervisor	Collaboration, Advisory and Data
	İzmir Provincial Directorate of Disaster and Emergency	Disaster management planning, general coordination on emergency situations	
	Izmir Provincial Directorate of Environment and Urbanization	Built environment, urbanization	
	İzmir Provincial Directorate of Culture and Tourism	Conservation of cultural heritage	
	İzmir No. 1 Cultural Properties Conservation Regional Board	Conservation of cultural heritage	
	Directorate of Smyrna Ancient City Excavation	Conservation and scientific research	
	İzmir Development Agency	Financial support, local development	
	2nd Regional Directorate of Turkish State Meteorological Service	Weather forecast, notice	
	İzmir Metropolitan Municipality	Provincial public services	
	Izmir Provincial Police Department	Rescue in emergency	
	Provincial Gendarmerie Command	Rescue in emergency	
	Konak Municipality	District public services	
Universities	Dokuz Eylül University	Scientific research	Advisory
	Ege University		
	İzmir Institute of Technology		
	İzmir Katip Çelebi University		
	İzmir Democracy University		
	Yaşar University		
Professional Chambers	UCTEA Izmir Provincial Coordination Board	Public monitoring and information	Advisory
	Chamber of Architects İzmir Branch		
	Chamber of Landscape Architects İzmir Branch		
	Chamber of Geological Engineers İzmir Branch		
	Chamber of City Planners İzmir Branch		
NGOs	Union of Chambers of Tradesmen and Craftsmen of İzmir	Trading activities	Collaboration, Advisory and Data
	İzmir Historical Kemeraltı Tradesmen Association		
PPP	Historical Kemeraltı Construction Investment Trade. Inc. (TARKEM)	Conservation and restoration	
Public Service Companies	GDZ Electricity Distribution Joint Stock Company	Public service	
	Türkiye Electricity Transmission Inc. 3rd Regional Directorate	Public service	
	Türkiye Electricity Distribution Inc. 12th Regional Directorate	Public service	

3. Identifying Risks and Presenting Mitigation Actions

The historic centre of Izmir is both susceptible and exposed to the risks of earthquake and tsunami, landslide and rockfall, fire, and flood. To identify risks, statistical data of past disasters and emergency response preparedness on the site at present are analysed. The frequency of disasters is also indicated.

3.1. Earthquake and Tsunami

The Gulf of Izmir and its surroundings are full of intense fault lines; thus this region is identified as "magnificent seismological area" (MTA, 2005). According to Earthquake Hazard Map of Türkiye, prepared by AFAD in 2018, Izmir provincial area is located in the red zones with a high probability of earthquake hazard prevails (Figure 6), experiencing earthquakes with the magnitude of 6, in every ten years (Uluğ, 2017).

The fault lines which potentially affect the centre of Izmir are the Karşıyaka fault line of 35 km (Çiğli-Bostanlı-Karşıyaka Bornova) at the north and the Izmir fault line of 40 km (Güzelbahçe-Narlıdere-Balçova-Izmir centre) at the south. Besides, Gülbahçe (Karaburun fault), Uzunada, Seferihisar (from Gulf of Sığacık to Güzelbahçe) and Tuzla (from west of Kuşadası Bay to Orhanlı-Gaziemir-Izmir centre) fault lines have potentially effects on the city. Each fault line is considered to have a possibility of creating an earthquake with 5-6 magnitude (Izmir Metropolitan Municipality, 2020).

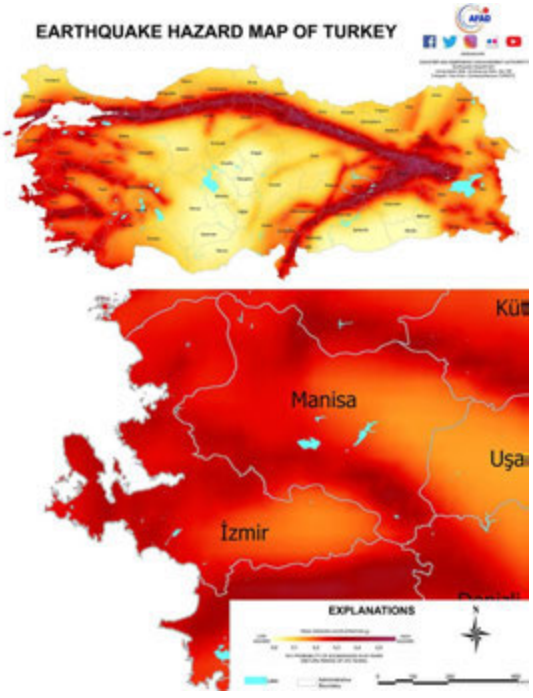

Figure 6: Earthquake Hazard Map of Türkiye and Detail of Izmir
(illustrated based on the source: AFAD, 2018)

The ground condition is also significant for settlements where earthquake seismic waves can be felt and highly affected. Depending on the general tectonic structure of the Aegean Region, the Gulf of Izmir and its surroundings are located in a depression zone where the opening regime still continues. Hence, the region is under the influence of faults, some of which that cannot be monitored from the surface may cause earthquakes. The coastal areas, where mostly settled, are composed of young sedimentary alluviums (İzmir Metropolitan Municipality, 2018).

The Historic Kemeraltı Bazaar and environs were formed with the filling of the inner harbour of ancient times, which was a process spanning 400 years (Beyru, 2011). Different periods infilling processes with alluviums, from antiquity to the 19th century not only changed the urban morphology but also cause more vulnerable ground conditions.

The carrying capacity of these areas is quite weak, magnifying seismic waves several times above normal. More critically, the ground might have high liquefication probability, creating very adverse conditions for the settlements (Uluğ, 2017). Earthquakes trigger soil layers, causing to softening and loss of strength. Similarly, liquefaction is the loss of the bearing feature of the ground due to dynamic effects. Liquefaction events in soil are mostly observed in water-saturated coarse-grained soils, such as coastal areas (İzmir Metropolitan Municipality, 2018).

Although detailed surveys are needed to identify ground conditions, assessments based on previous studies (İzmir Metropolitan Municipality, 2018) shows that the historic city centre of Izmir is located on risky ground, and high and middle probability of liquefaction (Figure 7).

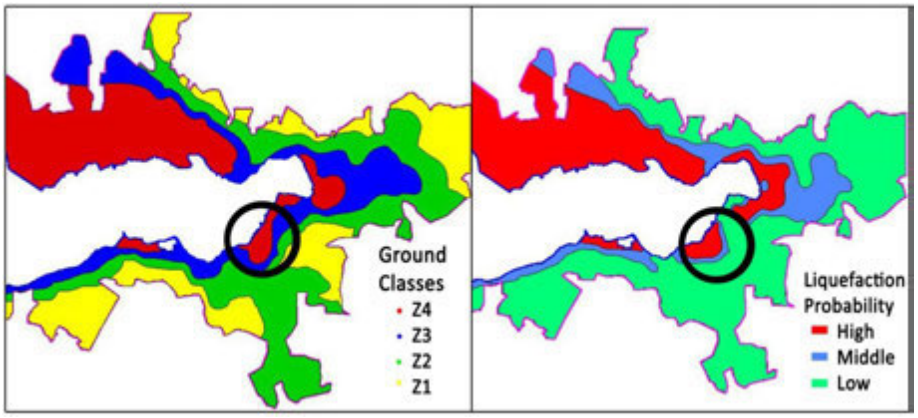

Figure 7: Ground Classes and Liquefaction Probability
(illustrated based on source: Izmir Metropolitan Municipality, 2018)

The major earthquake events that occurred since the 1900s and affected Izmir are analysed (Table 3). It is seen that earthquake events occurred around Aegean Sea, Karaburun-Chios, Lesbos-Doğanbey-Sisam affect Izmir. When the magnitude of the earthquake was around 5, buildings were damaged. While the magnitude is around 6, it causes mainly casualties and the collapse of buildings. Also, tsunami events occurred as secondary hazards when the magnitude was higher than 6.5, around the coastal areas of rivers or Aegean Sea in 1955 and 2020 (MTA, 2005; MTA, 2020; Izmir Governorship Provincial Disaster and Emergency Directorate, 2021; AFAD, 2024).

It is also known that settlements at the coastal zone of Aegean Sea and Eastern Mediterranean Sea are located at the riskiest areas regarding tsunami, mainly due to Hellenic and Cyprus subduction zones. For instance, the 2020 dated Aegean Sea Earthquake was followed by a tsunami at south of Izmir, reaching 200 meters distance according to witnesses. Historically, a tsunami with magnitude of 5 occurred on the coast of Izmir. Tsunami waves up to 5 metres high may reach to the southern part of Türkiye, which also affects Izmir (Izmir Governorship Provincial Disaster and Emergency Directorate, 2021).

Since, there are 44 earthquake monitoring stations in Izmir (İzmir Governorship Provincial Disaster and Emergency Directorate, 2021). Seismic Microzonation studies are ongoing by the Izmir Metropolitan Municipality to determine exact locations of fault lines (Izmir Metropolitan Municipality, 2023).

Table 3: Major Earthquake Events in and around Izmir in last hundred years
(prepared by the authors based on MTA 2005 and 2020; Izmir Governorship Provincial Disaster and Emergency Directorate, 2021; AFAD, 2024)

Date	Time (UT)	Latitude (N)	Longitude (E)	Depth (km)	Intensity (Io)	Magnitude (M)	Note
19/01/1909	04.57	38	26.5	60	IX	6	**Foça Earthquake** Centre: Around Güzelhisar, Menemen and Foça districts Casualties: 8 people died. Collapse of 700 houses, damage to 1000 houses
31/01/1928	00.29	38.18	27.8	10	VIII	6.5	**Torbalı Earthquake** Centre: Junction of Little Meander and İzmir K-G hole Casualties: 50 people died, may injured. Collapse of 2000 houses, and huge damage on buildings, collapse on the top of Clock Tower, some seaside areas had slid into the sea by 20 meters.
22/09/1939	00.36	39.07	26.94	10	VIII IX	6.6	**Dikili Earthquake** Centre: Between Dikili and Lesbos Casualties: 41 people died, 68 injured. Collapse of 1000 houses.
23/07/1949	15.03	38.57	26.29	10	VIII VII X	6.6	**Karaburun Earthquake** Casualties: 7 people died. Collapse or damage of 2200 houses in Karaburun-Çeşme peninsula

(Table 3 continues)

Date	Time (UT)	Latitude (N)	Longitude (E)	Depth (km)	Intensity (Io)	Magnitude (M)	Note
02/05/1953	05.41	38.48	26.57	40	VII VIII	5	**Karaburun Earthquake** Centre: North of Karaburun peninsula Casualties: Damage on around 300 houses
16/07/1955	07.07	37.65	27.26	40	VIII	6.8	**Söke-Balat Earthquake** Centre: Aegean Sea Casualties: 2 people died. Collapse of 300 houses, damage on many buildings and minarets of mosques in İzmir Secondary hazard: Overflows in the Gediz and Büyük Menderes rivers.
19/06/1966	17.55	38.55	27.35	9	VI	4.8	**Menemen Earthquake** Casualties: Damage around 100 houses
06/04/1969	03.49	38.47	26.41	16	VIII VII	5.9	**Karaburun Earthquake** Centre: Sea near to Karaburun Casualties: Damage to 443 buildings in Çeşme and Chios
01/02/1974	00.01	38.55	27.22	24	VII	5.3	**İzmir Earthquake** Centre: 15 km away from Izmir Casualties: 2 people died, 7 injured. Huge damage on 47 houses in city centre, Karşıyaka and Alsancak.
16/12/1977	07.37	38.41	27.19	24	VIII	5.5	**İzmir Earthquake** Casualties: 20 people injured. Collapse of several buildings in İzmir, damage on several buildings in Buca, Alsancak, Hatay, Karşıyaka, Bornova, Gültepe and Tepecik districts.
14/06/1979	11.44	38.79	26.57	15	VII	5.7	**Karaburun Earthquake** Centre: Aegean Sea. Casualties: 1 people injured. Collapse of 2 houses, damage on several buildings in Alsancak.
06/11/1992	22.08	38.16	26.99	17	VII	5.7	**Doğanbey Earthquake** Centre: Around Doğanbey district. Casualties: Damage to 60 buildings.
28/01/1994	18.45	38.69	27.49	5	VII	5.2	**Manisa Earthquake** Casualties: Damage to 60 buildings.
24/05/1994	05.05	38.66	26.54	17	VII	5	**Karaburun Earthquake** Casualties: Damage to 10 buildings.

(Table 3 continues)

Date	Time (UT)	Latitude (N)	Longitude (E)	Depth (km)	Intensity (Io)	Magnitude (M)	Note
10/04/2003	03.40	38.26	26.83	16	VII	5.6	**Urla Earthquake** Centre: Between Urla and Seferihisar Casualties: Damage to several buildings
17/10/2005	5.45				VII	5.7	**Urla-Seferihisar Earthquake**
	09:46					5.9	
	12:55					5.6	
20/10/2005	21:40				-	5.9	**Urla-Seferihisar Earthquake**
11/11/2010	21:08				-	5	**Selçuk Earthquake**
12/06/2017	15:28				VI	6.2	**Aegean Sea Earthquake**
17/06/2017	19:50				-	5.3	**Aegean Sea Earthquake**
22/06/2017	02:48				-	5	**Aegean Sea Earthquake**
30/10/2020	14.51	37.88	26.77	6-15	V VI	6.6	**Aegean Sea Earthquake** Centre: 8 km north of Sisam Island Casualties: 114 people died, 1035 people injured. Collapse of 16 buildings in Bayraklı district, damage to 973 buildings. Secondary hazards: Tsunami in coastal areas of Gulf of Sığacık (Seferihisar-İzmir) and Samos Island.
01/02/2021	08:46				IV	5.1	**Aegean Sea, Karaburun Earthquake**
14/08/2021	03:24	37.96	27.17	6.47		5	**Aegean Sea, Kuşadası Earthquake**
31/08/2022	13:10	26.80	37.58	7.03		5.1	**Aegean Sea, Söke Earthquake**
01/02/2021	08:46 11:35	26.11 26.07	38.98 38.94	20.69 17.62		5.1	**Aegean Sea, Karaburun Earthquake**
30/11/2021	07:00	26.14	37.72	3.97		5.1	**Aegean Sea, Çeşme Earthquake**

3.2. Landslide and Rockfall

Landslide hazard is seen around the southern part of Kadifekale's slopes, and rockfall is seen northwest of management area boundaries in Kocakapı district. Landslide and rockfall risks are related to geological formation of soil, geological features, and also effects of water, flooding and earthquakes.

Eastern part of Meles River is covered with clayey marl and tuff, and Neogene limestone on the top, and slopes of Pagos hill is covered with andesite (Figures 8, 9, and 11). Gecekondu buildings are located in these areas in general. The steep slope is also damaged due to water from surrounding houses. Thus, Kadifekale and its surroundings were declared as "Disaster Exposure Area" due to landslide risk and should be afforested with the decisions of the Council of Ministers in 1977, 1981, 1998, 2003, and 2013 in order to prevent the landslide risk (Figure 10) (Izmir Governorship Provincial Disaster and Emergency Directorate, 2022).

The area in Kocakapı district is andesite, and rockfall event occurred at nearby outcropped clay schist, where rainwater causes degradation of clay shales and steep cliffs to slide. This area was declared as a "Disaster Exposure Area" due to rockfall with the decisions of the Council of Ministers in 1981 (Figure 10) (Izmir Governorhip Provincial Disaster and Emergency Directorate, 2018).

The landslide hazard is driven by earthquakes or rainfall. The landslide susceptibility shows that southwest of the historic urban centre is under moderate and high degree of landslide susceptibility, while Kadifekale and its southern part are under susceptibility degree (Figure 8).

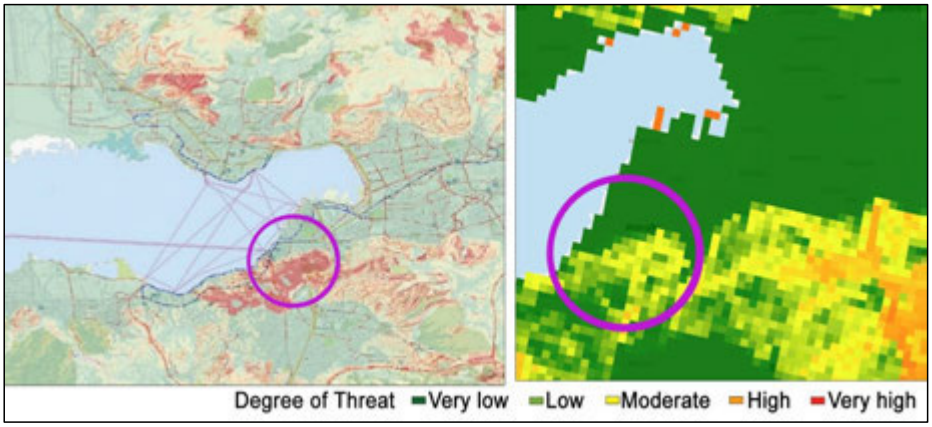

Figure 8: Resilience to Landslide (illustrated based on sources at left: Izmir Governorship Provincial Disaster and Emergency Directorate, 2021,p. 137; at right Ministry of Environment, Urbanization, and Climate Change, 2023)

According to Izmir Metropolitan Municipality Fire Department statistics, emergency rescue studies for landslide events were conducted in Sakarya neighbourhood in 2023, and Ülkü and Sakarya neighbourhoods in 2021 for the years between 2019 and 2023.

For mitigation, Kadifekale Urban Renewal Project was conducted in the Disaster Exposure Area of 42 hectares, at southern slopes part of Kadifekale, in the early 2000s. With the decision of the Izmir Metropolitan Municipality Council dated 20/07/2006, expropriation studies were conducted, and buildings were demolished. Then this area was afforested (Mutlu Kılıç & Göksu, 2018). Public engagement and social studies are still ongoing, conducted by the municipality.

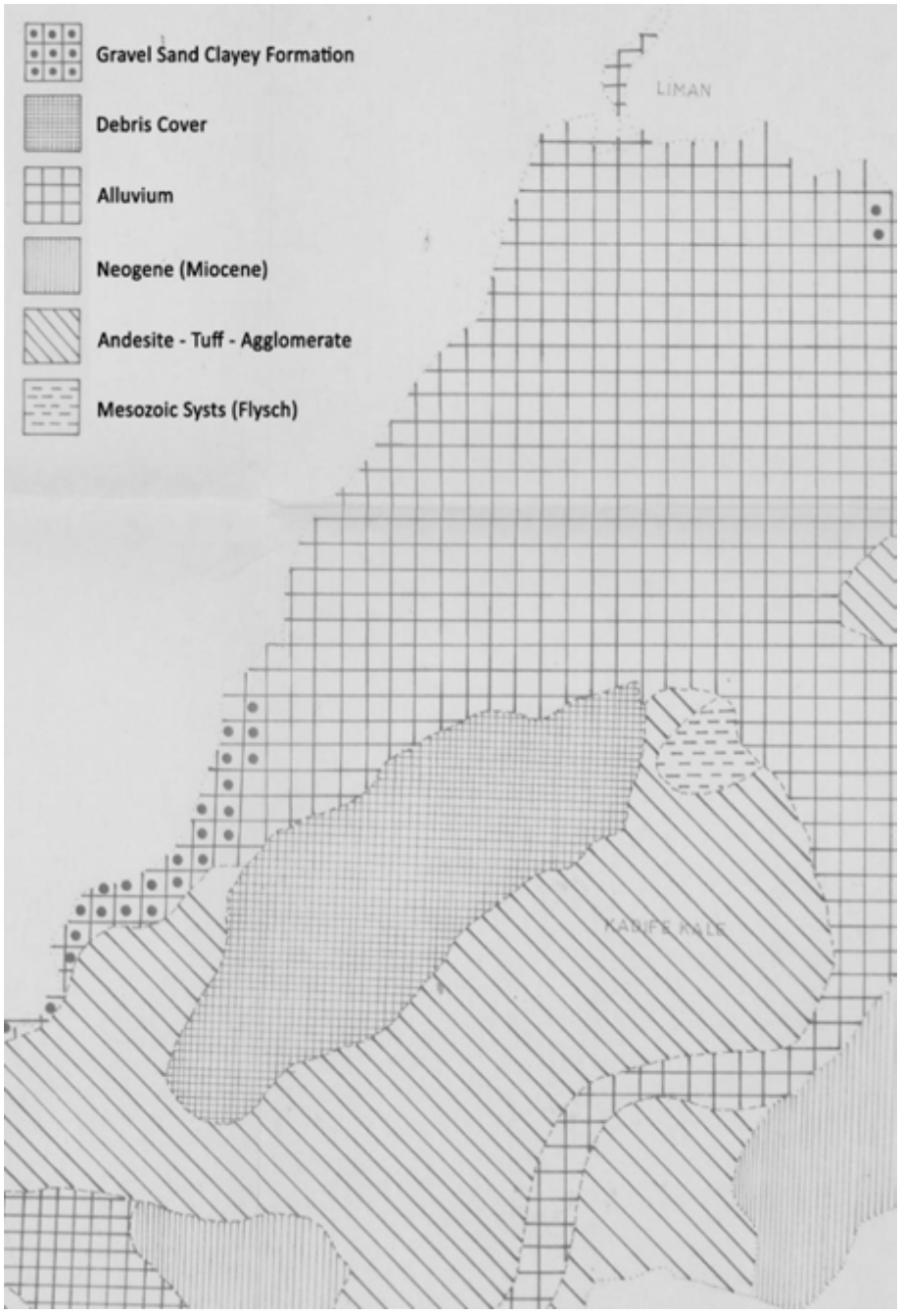

Figure 9: Geological Structure (scaled 1/20000) (edited by authors based on the source Geologist Mehmet Taşdemiroğlu Report, Izmir Metropolitan Municipality Archives, 1962)

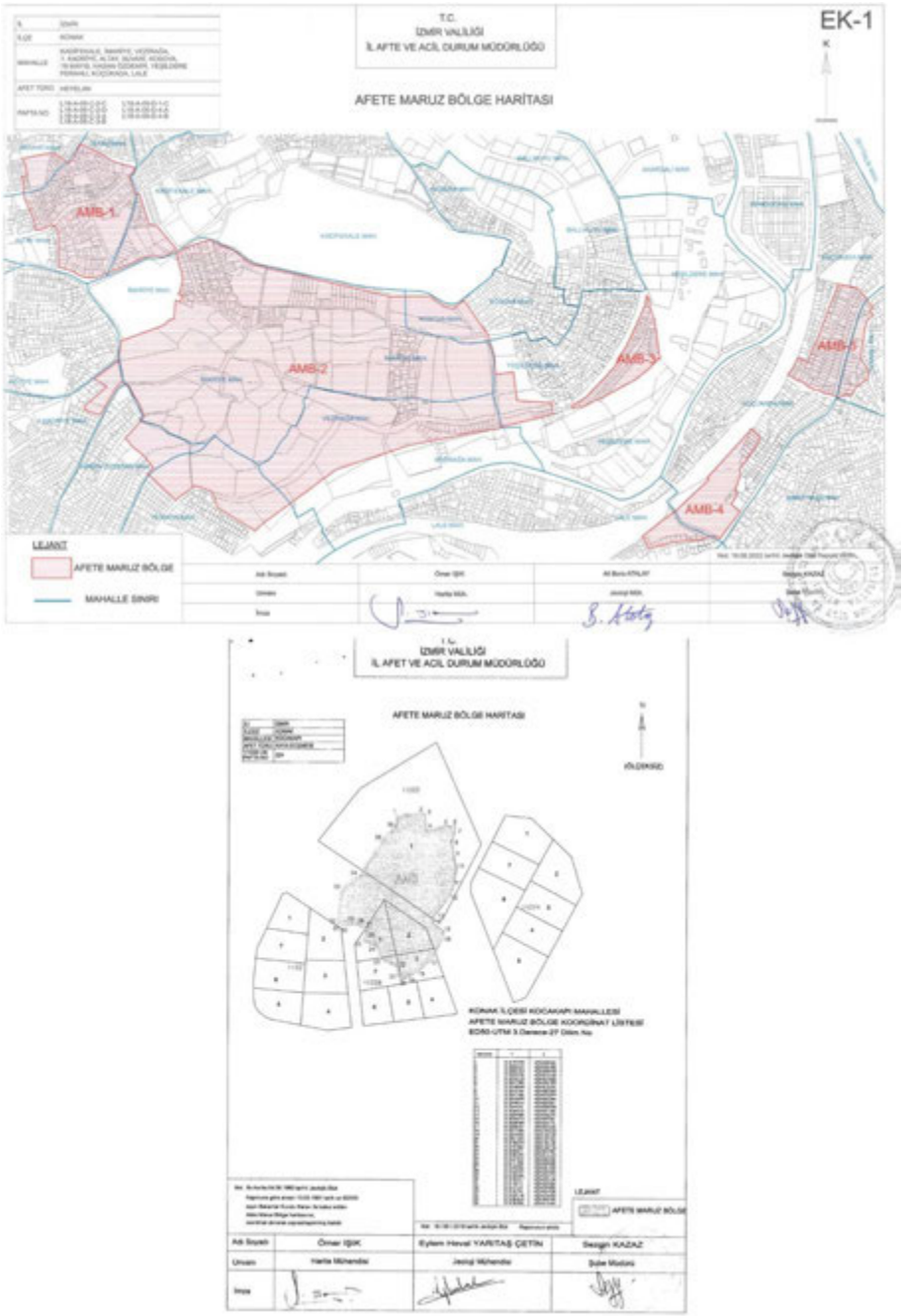

Figure 10: Disaster Exposure Areas in Kadifekale (above) and Kocakapı (below) (Source: Izmir Governorhip Provincial Disaster and Emergency Directorate, 2018, p.22; 2022, p.12)

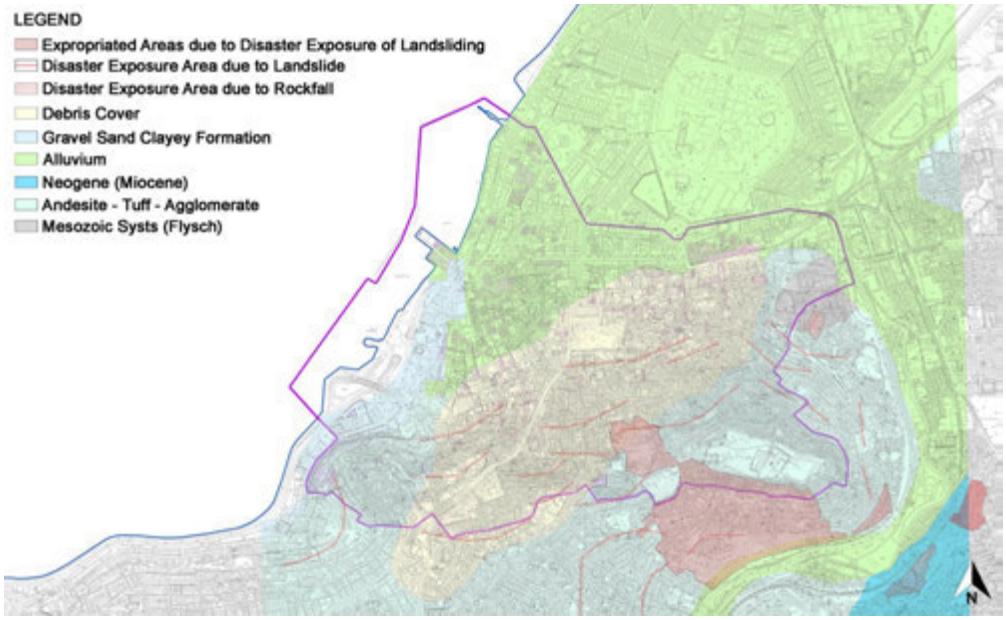

Figure 11: Geological Structure and Disaster Exposure Areas

3.3. Fire

Historic city centre of Izmir has suffered fire events in its history many times. One of the most significant fire events occurred in 1922, which caused around 300 hectares of the city to burn.

According to Izmir Metropolitan Municipality Fire Department statistics, around a thousand fire events in total were fought in the management site between 2018 and 2023 (Figures 12 and 13). Fire events mostly occurred in buildings, garbage areas, workplaces, transformers, and electrical infrastructure respectively. The fire events occurred in buildings, mostly housing units and abandoned buildings. It is also known from the site observations that old and inadequate electrical infrastructure in the buildings causes fire events.

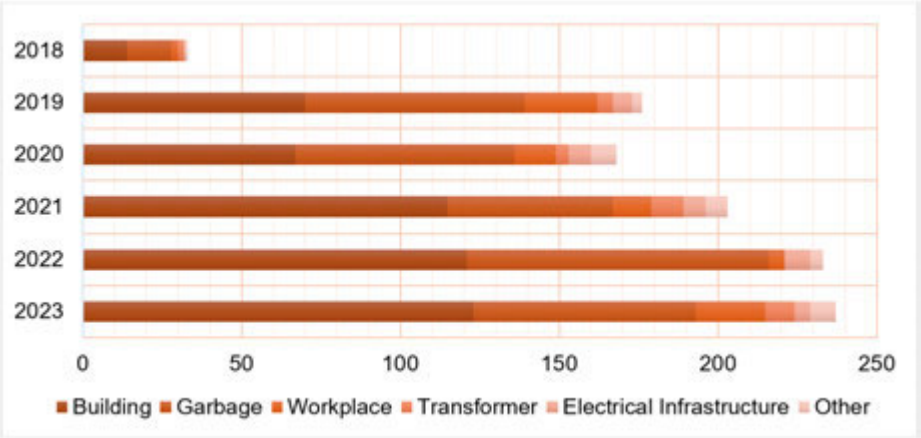

Figure 12: Fire Events in the Historic City centre of Izmir Between 2018 and 2023 (produced based on the source National Smart City Open Data System, 2024)

Izmir Metropolitan Municipality Fire Department statistics show that there are 57 hydrants, and 9 of them are also near to the fire cabinet. Most of the hydrant and fire cabinets are around the Historic Kemeraltı Bazaar, Mimar Kemalettin Modern Bazaar, and public buildings. It is seen that there are limited hydrants, especially in the Basmane residential area.

Figure 13: Fire Events and Response Equipment

3.4. Flood

Enclosing the historic city centre, Meles River is located in Küçük Menderes River Basin. It is known that especially the Meles River has overflowed since antiquity. Heavy rain with the effects of climate change, hydrogeological features, uneven urbanisation, land cover change with impermeable surfaces and damages on natural vegetation are several causes of flooding (Ministry of Agriculture and Forestry, 2019).

Küçük Menderes River Basin Flood Management Plan identifies that Meles River is risky and determines 500-, 100-, and 50-years recurrent flooding models. In the Q 500 model, the historic city centre would be partly affected. In total 3.855 people, which is 3% of the district population, would be affected including Alsancak region for 2018. It is projected that the population would increase to 4.150 by 2025. Also, economic damage would be around 10-225.000 TL around the historic city centre. The plan also determines six vulnerability factors for cultural heritage and flooding risk (Table 4).

Table 4: Disaster Vulnerability Factors for Cultural Heritage at Flooding Risk (Source: Küçük Menderes River Basin Flood Management Plan, 2019, p.323)

Vulnerability Factors	Details
Topography	• Current altitude (Altitude) • Surface water flow paths
Slope	• Upstream source of flood • flood susceptibility
Building Density	• Land value per tread (ground surface) • Land use
Distance from Riverbed	• Distance of the area at risk of flood from the riverbed
Drainage System and Soil Type	• Vulnerable population and critical infrastructure facilities • Soil drainage • Soil moisture • Soil appearance within fragile ecosystem balance • Soil composition
Distance from Road	• Distance of cultural property from the road

Konak district with the Meles River is considered risky since flood impact areas may affect low lands and ground floors of several buildings. According to models Q10, Q50, Q100, and Q500, the Meles River overflowed three times in 1976, 2000, and 2011 between 1962 and 2010 (İzmir Governorship Provincial Disaster and Emergency Directorate, 2021). Hence, overflowing occurred three times in 50 years.

Besides, it is known that periodic heavy rains cause floods on several scales especially in the Historic Kemeraltı Bazaar. According to Izmir Metropolitan Municipality Fire Department statistics, 433 flooding events and water withdrawal interventions were conducted in the management site between the middle of 2019 and 2023. In total, 275 flooding events were intervened, while 124 small scale, 29 larger scale, and 5 middle scale water withdrawal interventions were conducted in the time period (Figure 14 and 15). The highest interventions to flooding events occurred in different times, mostly in September in 2020, in January and February in 2021, in October in 2022, and in October and December in 2023.

The past flooding event in the figure 14 indicates that flooding events occurred in line with dry stream beds. Besides, land cover is mostly impermeable concreate materials that make

infiltration of rainwater difficult in the historic centre, except from open green areas and Mimar Kemalettin Modern Bazaar. The change of land cover in time, from permeable surface to impermeable ones such as asphalt or concreate, drove the impacts of flooding.

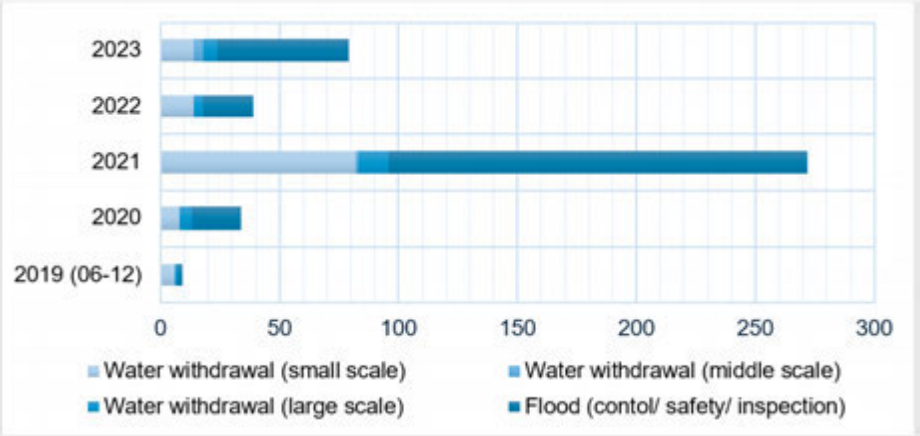

Figure 14: Fire Events in the Historic City centre of Izmir Between 2019 and 2023 (produced based on the source Izmir Metropolitan Municipality Fire Department statistics, 2024)

Today, effective studies are carried out on the risk of flooding and inundation. In order to prevent flood disasters in the area, Early Warning Meteorology Radars and Automatic Meteorology Measurement Stations were established in the city. The Enclosure Infrastructure Project carried out by the Izmir Metropolitan Municipality regarding this risk element is considered as an essential step to eliminate the risk.

With the project, it is aimed to improve the drinking water and wastewater infrastructure network in the region. The First Stage Belt Infrastructure Project aims to discharge rainwater that causes flooding in Kemeraltı area from high elevations during heavy rains, and a pumping station is also being built. Within the scope of these works, it is aimed to renew the drinking water and wastewater network in Fevzipaşa Boulevard, Gaziosmanpaşa Boulevard and Eşrefpaşa Street and to strengthen the existing infrastructure in the region (as cited in Nizamoğlu et al., 2022).

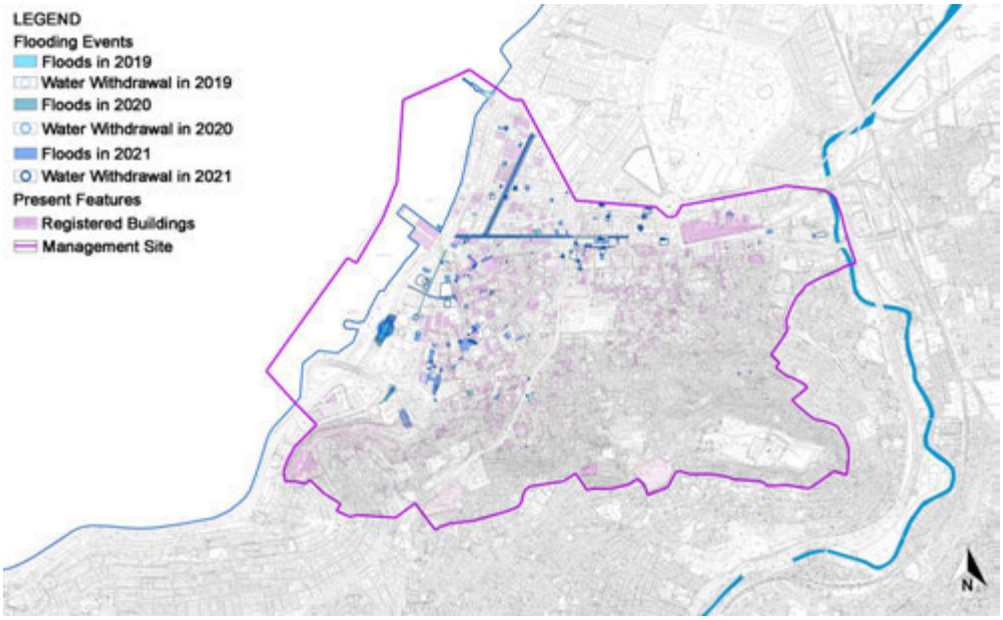

Figure 15: Flood Events and Water Withdrawal Interventions

4. Risk Analysis and Evaluation

The main steps for analysis and evaluation determined in *A Guide to Risk Management of Cultural Heritage* (2016) are followed regarding the risks affecting the built environment.

The analysing step is conducted based on a matrix that shows expected occurrence about how often these hazards may occur, and impact about loss of value (Table 5). In the ABC scales, letter A represents the frequency of the disaster event or rate of occurrence of a damaging process, letter B shows expected loss of value in each item of a heritage asset, and letter C indicates how much the heritage asset value is affected; in other words, how significant is the part of heritage asset affected by the risk. And the combination of the letters A, B, and C is the magnitude of risk (Pedersoli Jr. & Antomarchi, 2016).

Table 5: ABC Method Table (Source: Pedersoli Jr. & Antomarchi, 2016; p. 64, 65, 70)

A-Score	How often does the event occur? (years)	B-Score	Fraction of value lost in each item	Word guidelines	C-Score	% of the value of the heritage asset	World guidelines
5	~ 1	5	100 %	Total or almost total loss of value in each affected item	5	100 %	All or most of the heritage asset value is affected
4.5	~ 3	4.5	30 %		4.5	30 %	
4	~ 10	4	10 %	Large	4	10 %	Large fraction
3.5	~ 30	3.5	3 %		3.5	3 %	
3	~ 100	3	1 %	Small	3	1 %	Small fraction
2.5	~ 300	2.5	0.3 %		2.5	0.3 %	
2	~ 1000	2	0.1 %	Tiny	2	0.1 %	Tiny fraction
1.5	~ 3000	1.5	0.03 %		1.5	0.03 %	
1	~ 1000	1	0.01 %	Trace	1	0.01 %	Trace fraction
0.5	~ 30000	0.5	0.003 %		0.5	0.003 %	

The occurrence is categorised as rare events, which occur less often than about once every 100 years, common events, which occur many times per century, and cumulative process, which occur continuously and frequently. Besides, level of priority and magnitude (level) of risk (hereafter MR) are determined for evaluation. The scale of MR values classified based on the priority, which is catastrophic ($13.5 \leq MR \leq 15$), extreme ($13 \leq MR \leq 11.5$), high ($11 \leq MR \leq 9.5$), medium ($9 \leq MR \leq 7.5$), and low priority ($7 \leq MR \leq 5$).

For the case of urban heritage of Izmir, risk analysis and evaluation are conducted based on present features of the site and past disasters (Table 6). For earthquake risk, it is known that 157 earthquake events with a magnitude higher than 3.5 occurred in Izmir and surroundings from 1900 to 2015 April. A total of 38 earthquakes with magnitudes around 4-5, 15

earthquakes with magnitudes around 5-6, and 3 earthquakes with magnitudes above 6 occurred in the region (İzmir Governorship Provincial Disaster and Emergency Directorate, 2021). Earthquakes occur frequently, while earthquakes with magnitudes higher than 6 likely occur every 38 years. Earthquakes can be determined as common events and A score is given as 3.5.

Although the exact route of the fault lines is not known due to Seismic Microzonation studies are not finished yet, present maps of AFAD illustrate that the Izmir fault line is crossing through the management site. The effect of an earthquake would be diversified according to distance from the fault line. Hence, potential effects for three zones are hypothetically drawn, which are the first affected zone in 150 meters from the fault line, the second zone in 500 meters distance, and the third zone in 1000 meters distance (Figure 16).

The liquefaction risk is illustrated (Figure 17) based on infilling interventions throughout history. The oldest infilled area is considered as having less risks since the area would be more stabilised when compared to the recent infilled areas. Hence, ground stabilities are ranked from safest to the most liquefaction risk as, not intervened areas as the most stabilised, followed by the first infilled areas of Kemeraltı Bazaar, then second period infilled areas in the years between 1400-1850, the third period infilled areas between 1850-1905, and lastly infilled areas between 1905-1997. The third and fourth periods infilled areas are having the most liquefaction risk in coastal areas.

In this sense, a possible earthquake would affect almost all of the site, while coastal areas are more vulnerable due to liquefaction risk. Besides, the historic earthquakes shows that earthquakes in Izmir and environs affects the site. Thus, the B scale is given as 5. Since almost all parts of the heritage would be negatively and directly affected by the earthquake, C score is also determined 5. As a result, MR of earthquake is 13.5, which is a catastrophic priority.

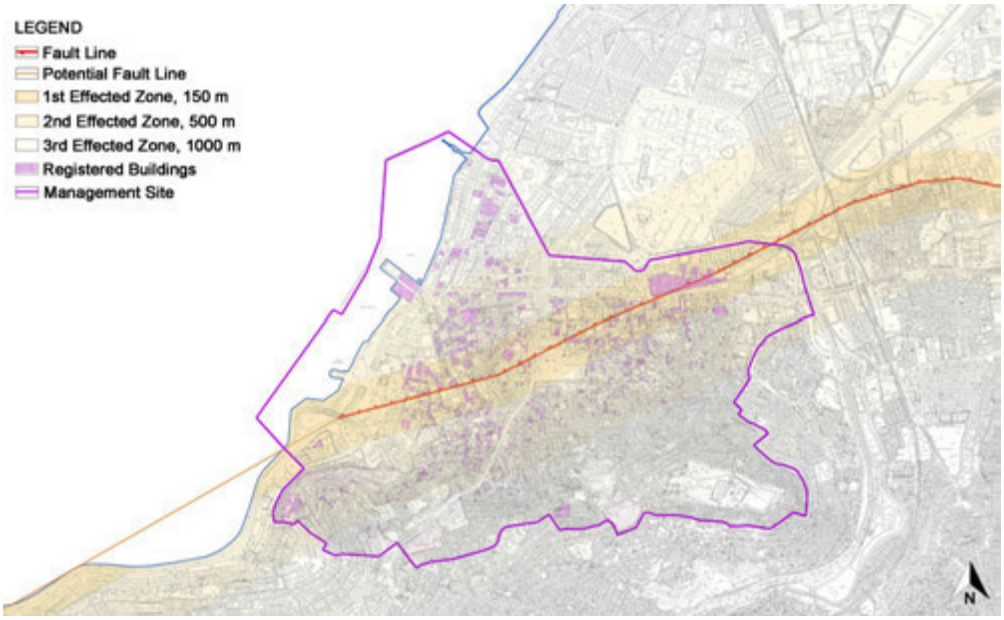

Figure 16: Active Fault Lines in Izmir and Environs

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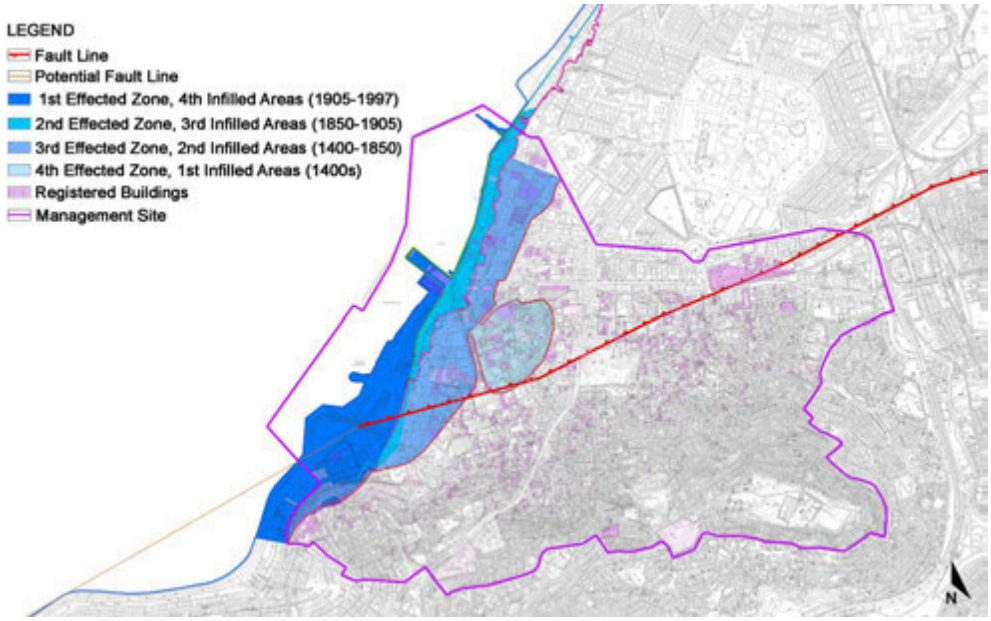

Figure 17: Ground Classes and Liquefaction Probability

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Tsunami events rarely occurred after earthquakes, most at the southern part of Izmir, not ever occurring around the historic urban centre. Hence, the frequency of tsunami around the historic centre is considered as once in every 300 years and A score as 2.5. Although, Disaster Risk Reduction Plan for the Izmir Province (2021) perceives that 500 meters from the coastal area could be affected by tsunami, a hypothetical map is drawn to show maximum reaching areas of sea level rise (Figure 18).

For this, both infilled areas and topographic conditions are taken into consideration. It is perceived that higher slopes and high-rise buildings at coastal areas would limit the sea to reach inner parts, while Kemeraltı Bazaar area and its northern part would be more affected. The damage would be in between small and large, B score is given as 3.5. Mostly Kemeraltı Bazaar and coastal zones would be affected, which is a small but valuable part of the whole site. And the C score is given as 3. In total, MR value is 9, which is a medium priority to response.

Although there is limited data available for landslides and rockfalls, three landslides were responded to by the Fire Department of the municipality in five years. With this data, the occurrence frequency of landslide and rockfall events can be thought as once or twice a year. Hence, landslide and rockfall for the site are cumulative processes and A score is 3.5. Landslide and rockfall may affect a small part of a heritage item, and B score is to be 3. Also, a tiny fraction of the historic city would be affected, and C score would be 2. In total, the MR of landslide would be 8.5, which is a medium priority.

Both fires and floods occur several times every year. Fire and flood are thought as cumulative processes, and A scores for both are 5. Since fires are more destructive than floods, causing irreversible damage to heritage items, B score of fire is given as 4. The fraction of loss in flooding would be in between large and small, and B score is given 3.5. Hence, MR score for fire is 13 and for flood is 12.5, having extreme priority.

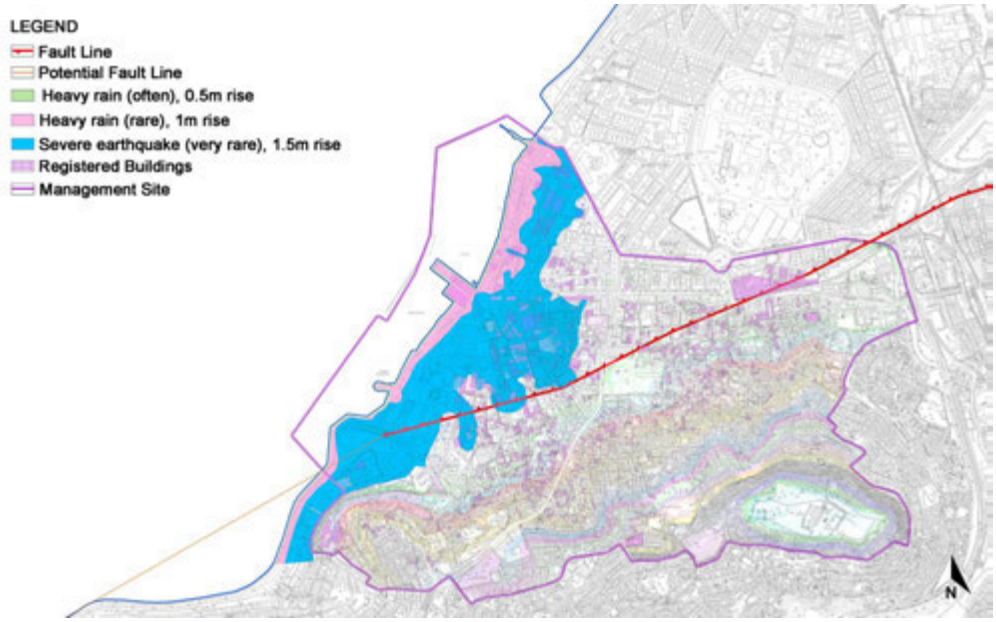

Figure 18: Probability of Sea Level Rise

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Table 6: Evaluation of Risks for the case on Urban Heritage of Izmir

	A (How often does the event occur?)	B (fraction of value lost in each effected item)	C (% of value of the heritage asset)	MR (A+B+C)	Level of priority
Earthquake (M ~ 6)	3.5	5	5	13.5	Catastrophic priority
Tsunami	2.5	3.5	3	9	Medium priority
Landslide and Rockfall	3.5	3	2	8.5	Medium priority
Fire	5	4	4	13	Extreme priority
Flood	5	3.5	4	12.5	Extreme priority

The scenario can also be varied according to uncertainty of the event. For this sense, magnitude of the risk can be presented in three values, regarding most likely, low estimate, and high estimate of the relevant scores.

Scenarios for possible disasters:

- Most Likely Scenario: The earthquake with a magnitude of over 6, caused by the Izmir fault, caused to collapse of high-rise buildings and unauthorised structures in Kemeraltı Bazaar and its surroundings, and the destruction of some of the cultural assets and the permanent damage of some of them due to both the earthquake and the destruction of other structures.

- High Estimate Scenario: The fire, which occurred due to a leak in a registered building with an outdated electrical infrastructure in the historic Kemeraltı bazaar, caused the roof to burn and the adjacent buildings to be damaged.

- High Estimate Scenario: After the severe earthquake, fire incidents occurred as a result of the collapse of high-rise buildings and buildings with excessive air conditioning and irregular power lines in the Historical Kemeraltı Bazaar, the closure of roads made the intervention difficult, and the roofs and interiors of registered buildings were permanently damaged.

- High Estimate Scenario: Extreme weather events and sudden rains driven by climate change caused the Gulf of Izmir to overflow, damage on the Clock Tower and its surroundings, submergence of the ground floors of shops, fires due to electricity leakage in some buildings, and permanent damage in some buildings.

- Low Estimate Scenario: After the severe earthquake, the sea overflowed, causing the buildings in the historical city centre to collapse and get damaged, Konak Square and its surroundings were flooded, and the Izmir Clock Tower and the coastline got damaged.

- Low Estimate Scenario: The sea flooding that occurred after the severe earthquake, combined with the irregular electrical infrastructure problem, caused fires to break out

in Kemeraltı Bazaar, high-rise buildings collapsed, and cultural assets got damaged, and coastal buildings suffered permanent damage as a result of floods and fires.

A specific vulnerability analysis methodologic framework for the urban heritage of Izmir is defined based on vulnerability criteria and analyses for identified risks (Table 7 and Figure 19). The vulnerability criteria are determined for all risks, earthquake, tsunami, landslide, fire, and flood. Based on value and cultural characteristics of determined zones, a matrix is drawn for evaluation.

Accordingly, (3) the historic Kemeraltı Bazaar is the most vulnerable place regarding overall risks, which is followed by (4) public administrative facilities, (5) trade, production, and storage areas of Kestelli, (1) coastal are, and (9) residential quarter of Basmane.

Regarding vulnerability criteria for all risks, (9) residential quarter of Basmane is the most vulnerable place which has low accessibility of roads, less open green areas, and limited emergency response equipment. The zones of (1) coastal areas and (4) public administration facilities are the most vulnerable to earthquake risk, which are followed by (3) the Historic Kemeraltı Bazaar and (2) Mimar Kemalettin Modern Bazaar. These places are vulnerable due to spatial pattern, building density, liquefaction risk, ground condition with some effects of infilling interventions as well as proximity to fault line and ground condition.

Tsunami is mainly a risk for (1) coastal areas, while landslides threaten mostly (10) components of Smyrna Ancient City, which is Kadifekale and surroundings. Fire risk is high in (3) the historic Kemeraltı Bazaar, and (5) trade, production, and storage areas of Kestelli. These places are close to uses that drive fire risk, such as small workshops or easily flammable products. Due to the uses of shops, streets are problematic for accessibility. Moreover, the lighting system is mostly improper with disorganised cables and lamps.

Flooding is a most widespread threat for the historic centre, affecting most of the zones. Only, (10) components of Smyrna Ancient City and (2) Mimar Kemalettin Modern Bazaar are more resilient compared to other zones. Since the characteristic zones are mostly covered by concrete materials, infrastructural and spatial organisational problems are driven by proximity to coastal line and height from sea level, flooding becomes a more and more significant risk for the historic centre.

Table 7: Vulnerability Analyses for the Case of Urban Heritage of Izmir

	1. Coastal Areas	2. Mimar Kemalettin Modern Bazaar	3. The Historic Kemeraltı Bazaar	4. Public Administrative Facilities	5. Trade, Production, and Storage areas of Kestelli	6. Residential Quarter of İsmet Inonu Street	7. Residential Quarter of Damlacık	8. Basmane Station and Environs	9. Residential Quarter of Basmane	10.Components of Smyrna Ancient City
For All Risks										
Accessibility of Roads (Culde sacs, Narrow Roads, Steets with stairs: 3, Parking & Occupation: 2, Open&Traffic problems: 1)	1	1	3	2	2	3	2	1	3	2
Proximity to Main Roads (Far: 3, Moderate: 2, Close: 1)	1	1	1	1	1	1	1	1	2	2
Proximity to Open Green Areas (Gathering Areas) (Far: 3, Moderate: 2, Close: 1)	1	2	1	1	3	2	1	1	3	1
Density of Users (High: 3, Moderate: 2, Low: 1)	3	3	3	3	2	1	2	3	2	1
Proximity to Emergency Response Equipment (Far: 3, Moderate: 2, Close: 1)	2	1	1	1	2	3	2	1	3	1
Heritage Information and Documentation (Not available: 3, Partly available: 2, Available: 1)	1	2	2	2	2	2	1	2	2	1
Total	9	10	11	10	12	12	9	9	15	8
Earthquake										
Spatial pattern (Adjoining: 3, Composition of adjoining & discrete orders: 2, Discrete: 1)	3	3	3	3	3	3	2	2	3	1
Building Density (High: 3, Moderate: 2, Low: 1)	3	2	2	3	2	2	2	3	2	1
Proximity to Fault Line Close: 3, Moderate: 2, Far: 1)	2	2	3	3	2	2	2	3	1	1
Liquefaction Risk (High: 3, Moderate: 2, Low: 1, Not: 0)	3	2	1	2	0	0	0	0	0	0
Ground Condition (Alluvium/ Infilled/Gravel sand Clayey Formation: 3, Debris Cover: 2, Andesite-Tuff-Agglomerate: 1).	3	2.5	3	3	2	2	1.5	2.5	1.5	1.5
Total	14	11.5	12	14	9	9	7.5	10.5	7.5	4.5
Tsunami										
Proximity to sea & Topographic Features	3	0	2	1	0	0	0	0	0	0

(Table 7 continues)

	1. Coastal Areas	2. Mimar Kemalettin Modern Bazaar	3. The Historic Kemeraltı Bazaar	4. Public Administrative	5. Trade, Production, and Storage areas of	6. Residential Quarter of İsmet	7. Residential Quarter of Damlacık	8. Basmane Station and Environs	9. Residential Quarter of Basmane	10.Components of Smyrna Ancient City
Landslide										
Proximity to Disaster Exposure Area (Close:3,Moderate:2,Far:1,NA: 0)	0	0	0	0	0	0	0	0	1	3
Fire										
Proximity to fire risk uses (Close: 3, Moderate: 2, Far: 1)	0	2	3	2	3	2	1	2	1	1
Obstacles for Responses on Street (High:3, Moderate:2, Low:1, NA:0)	1	1	3	2	2	0	0	0	0	0
Proximity to hydrant/ fire cabinet (Close: 1, Moderate: 2, Far: 3)	2	1	1	1	2	3	2	1	3	1
Oder of Lightening System (Improper:3, Partly p.: 2, Proper: 1)	1	1	3	2	2	1	2	1	1	1
Total	4	5	10	7	9	6	5	4	5	3
Flood										
Spatial organization (Problematic: 3, Moderate: 2, Organized: 1, NA:0 - regarding building entrance below street, concreate & open areas, adjoining & discrete)	1	1	3	2	3	1	2	2	2	0
Land Cover (Concrete: 3, Permeable Surface: 2, Green: 1)	1	2	3	3	3	3	3	3	3	2
Road (Tunnels & Underground passes: 3, Partly asphalt: 2, pedestrian pathways: 1, Natural: 0)	3	1	2	2	2	1	3	2	2	1
Infrastructure (Old: 3, Moderate: 2, Renewed:1, Not Required: 0)	1	1	1	1	2	3	2	2	3	0
Ground Condition (Alluvium/ Infilled/Gravel sand Clayey Formation: 3, Debris Cover: 2, Andesite-Tuff-Agglomerate: 1).	3	2.5	3	3	2	2	1.5	2.5	1.5	1.5
Proximity to Coastal Line (Close: 3, Moderate: 2, Far: 1)	3	2	2	2	3	3	3	3	3	2
Height Above Sea Level (Low:3,Moderate:2,Higher slopes:1)	3	2	3	3	2	2	1	1	1	2
Total	15	11.5	17	16	17	15	15.5	15.5	15.5	8.5
Grand Total	45	38	52	48	47	42	37	39	44	27

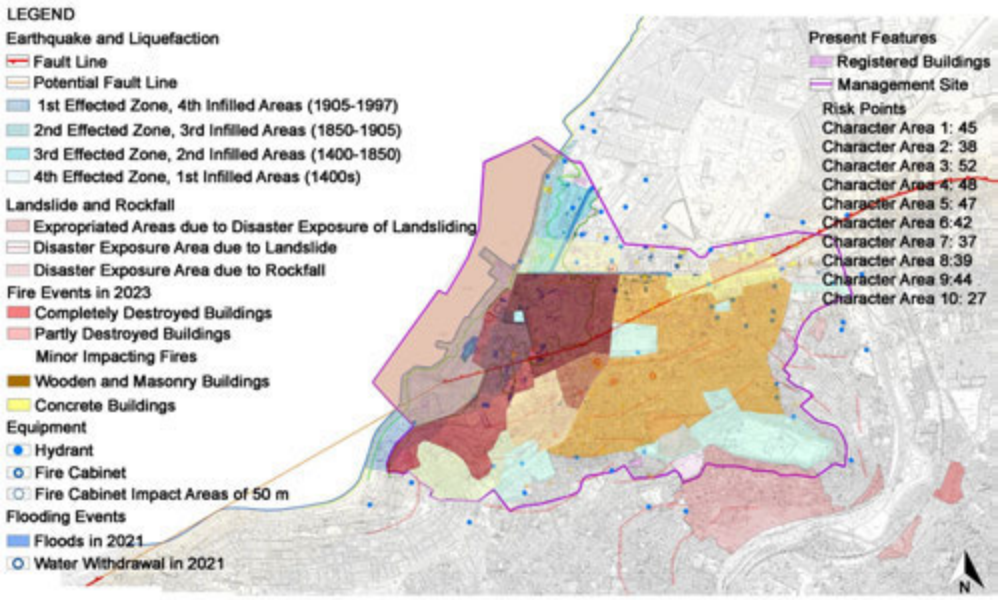

Figure 19: Synthesis of Risk Analyses

5. Proposals for Improvement of Risk Treatment Strategies

According to analyses and evaluations, preliminary strategies for elimination, adaptation or mitigation risks are determined in regard to cultural values of the site.

For all risks:

- To increase accessibility within the historic centre, parking problems and occupation of small shops in the streets are to be prevented in the historic Kemeraltı Bazaar.
- Small compatible vehicles and transportation facilities are to be utilised for residential quarters of İsmet İnönü Street and Basmane.
- Emergency response equipment including early warning system, emergency buttons, and monitoring cameras sensitive to heat, as well as hydrants and fire cabinets are to be increased in number and upgraded in technologic quality.
- Emergency gathering areas are to be developed. Several buildings are to be functioned as emergency gathering points, especially in trade, production, and storage areas of Kestelli and residential quarter of Basmane.
- As determined in the Site Management Plan, heritage information and documentation must be sustained, detailed inventory of buildings and cultural characteristic zones are to be regularly updated and data is to be secured.
- Specified studies to increase public awareness on precautions before disasters, behaviours during disasters, and recovery processes after disasters are to be conducted.
- Periodical training is to be organised for capacity building of public authorities on how to respond during and after disaster events.

For earthquake and tsunami risk:

- Prevention and mitigation strategies are to be developed and reviewed based on seismic microzonation studies.
- Spatial plans including conservation plans and master plans are executed fully. Building densities must be audited by relevant public authorities to be appropriate with the plan decisions.
- Emergency monitoring systems are to be placed in the coastal areas to monitor sea level rise, gather data periodically and sustain information for future estimations and planning studies.

Landslide and Rock Fall:

- Specific interventions must be taken in the Disaster Exposure Areas around Kadifekale. Housing areas are to be expropriated and afforestation studies are to be conducted by the public authorities in cooperation with relevant stakeholders. Since these are radical interventions, public participation and involvement of locals and residents should be ensured. Spatial interventions should sustain social and economic empowerment strategies, in this manner, social inclusion policies should be determined and implemented sensitively regarding diversified cultural backgrounds of locals.
- Kocakapı neighbourhood and other areas close to Meles River should be monitored regarding rockfall risks. Similar interventions like expropriation and public participation in Kadifekale should be taken for the disaster exposure area due to rockfall.

Fire:

- Trade of fireproof products in the historic Kemeraltı Bazaar is to be encouraged.

- Small shops and workshops in the historic Kemeraltı Bazaar and trade, production, and storage areas of Kestelli are to be regularly audited by the relevant authorities.
- Street shelters are to be designed with an appropriate height from the street, fireproof materials, and compatible with the cultural heritage.
- More hydrants are to be placed in residential quarters of İsmet İnönü Street and Basmane.
- Lightening systems in the historic Kemeraltı Bazaar, public administrative facilities, trade, production, and storage areas of Kestelli, and residential quarter of Damlacık are to be reviewed. Besides, old electricity infrastructure of the buildings is to be detected and renewed in the historic centre.

Flood:

- Küçük Menderes River Basin Flood Management Plan determines measures for Meles River as pre-disaster period, which are building a canal with retaining walls (masonry and concrete materials) and improvement of bridges and transition structures on the river between 2020-2024. For the basin scale several measures are determined, such as introducing green roof, plant rain ditch, permeable pavement, permeable asphalt, rain tank, bioretention and infiltration ponds. These measures are to be evaluated and adopted for the historic centre in regard of compatibility to cultural heritage values.
- Since land cover change significantly drives flooding risk, permeable surfaces are to be used in the historic centre, concrete surfaces can be preferred only in main roads.
- Some buildings have remained below street level due to infrastructure studies. These inappropriate interventions must be reversed.
- Old infrastructure facilities such as water collection channels in residential quarters of İsmet İnönü Street and Basmane are to be renewed. The cultural layers of the past must be taken into account in the renewal studies.
- Intervention including expropriation can be taken to create open green axes according to dry stream beds. Continuity of open green areas should be sustained within the historic centre.

6. Proposals for Monitoring and Revision Processes

The main responsible stakeholders for implementation, monitoring, and revision of risk treatment strategies are public authorities. The whole process of risk management is to be conducted with collaboration of universities, professional chambers, NGOs, PPP, and public service companies. Main strategies for monitoring and revision processes are determined:

- A database to collect data about risk management strategies is to be established by the relevant public authorities. This database is also utilised to collect data and documentation of past disasters.
- A risk management working group consisting of experts from public authorities, academics from universities, representatives of professional chambers, NGOs, PPP, and public service companies is to be constituted.
- Main duty of the risk management working group is periodically collecting actual data and monitoring processes within their corresponding authority.
- A risk management monitoring board is to be constituted with involvement of senior representatives of the whole stakeholders.
- The working group and monitoring board together would evaluate the progress and obstacles faced during the processes of implementation and monitoring. Also, new emerging threats either due to risk management strategies or unpredicted events are to

be discussed. Required regulatory actions are to be taken with consolidations of stakeholders.

7. Conclusion

This study presents an example of a preliminarily risk management process for urban heritage sites, suggesting a methodology to open new discussions for further studies. This paper is an attempt to encourage conducting an integrated risk management plan with participation of the stakeholders, based on detailed surveys to identify risks, including specified parts such as action programmes with responsible authorities and allocated resources, monitoring indicators, and evaluation forms.

Risk identification, analyses, and evaluation, as well as strategies for risk reduction, monitoring, and evaluation are determined in a general perspective which should be further studied and expanded. Studies not just in the scale of area but also in the building scale should be conducted. The impacts of different hazards influencing one another and threats occur due to the dynamics of the place, such as adjacent order, adjoint electricity infrastructure, narrow roads with low accessibility, should be taken into consideration. Based on more detailed analysis, more specified strategies for mitigation and adaptation should be determined.

Cultural heritage places are threatened by many factors, either due to human induced factors or natural factors. It is significant to take actions effectively and comprehensively regarding human, technical, and financial resources. Pre-disaster risk studies are fundamental to eliminate risks on cultural heritage and decrease costs of recovery and rehabilitation after disasters. The overall aim is to be the conservation of urban heritage, which are significant to humanity, as of public interest for today's and future generations and beyond.

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Saturation as urban crisis.
Understanding Anthropocene from two flooded cities of the Global South

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Abstract (up to 125 words)
The paper proposes to shed light on the articulation of global processes typical of urban trajectories in southern cities and crises at the local scale, based on a comparative analysis in two cities frequently affected by floods, Dakar (Senegal) and San José (Costa Rica). In doing so, the paper aims to clarify the notions of 'crisis' and 'disaster' in urban contexts in the Anthropocene by linking them to that of 'saturation'. We highlight three results. First, using flooding as an example, saturation sheds light on the processes that shape cities and their disasters. Second, saturation highlights the specific ways in which water interacts with urban environments. Finally, the findings touch on the capacity of actors to cope with these crises.

Key words: city, floods, crises, Anthropocene, saturation

Full text

1. Thinking crisis through a process of saturation in the Anthropocene

The crisis refers to a state of uncertainty often linked to an exceptional, accidental but disruptive event that shakes the ordinary up and reduces the time available for decision-making (Godard et al., 2002). The event can be a natural or technological disaster that has happened and damages assets. It can also be an anticipated event that has not yet happen, but that leads actors to take decisions under stress. It might be crisis without an actual event (Tazieff, 1977). The notion is directly related to the capacity of the decision-making process to deal with the extraordinary beyond all fields of expertise or knowledge (Gilbert, 2007; Rey-Thibault, 2022). Some authors will distinguish crisis from rupture, the latter leading to a whole other path, as in the former, the organisational structures are not completely questioned afterwards (Guilhou and Lagadec, 2002). In urban environments, the literature highlights how the concentration of populations and problems, the interconnectedness of networks and overlapping systems of governance can lead to thresholds being crossed (Robert 2012). The notion is related to the suddenness of a probable disruption, implying changes in the ordinary functioning of organisations.

Complementing this work, this paper aims to clarify the notion of crisis and disaster in urban contexts on the basis of the Anthropocene by linking it to that of ‘saturation’. The aim is to integrate more systematically the crises that have been neglected by much of the work on the urban and disaster studies, which have focused on exceptional events and leaving aside crisis related to long terms process of accumulation. Within the literature, notions such as the *neglected disasters* (Wisner and Gaillard, 2009) or the *small disasters* (Gaillard et al., 2014) have pointed this long-term crisis. The first category refers to disasters which, because of their less exceptional and long-term nature (such as drought, environmental degradation and

poverty), attract less public and media attention. The second refers to small-scale events that affect a certain type of population on a daily basis and therefore do not evoke earth-shattering responses (Gaillard et al., 2014). More recently, the notion of slow disaster emphasises this long-term *process* by which disaster happen, beyond the event (Knowles, 2020). By amalgaming the notions of "creeping disaster" (Rosenthal, 1998) and "slow violence" (Nixon, 2013), it also points toward the necessity to understand the properties of affecting elements, that are not entirely social construction but also material entities with their own dynamic, to understand disasters. In the context of the Anthropocene, the notions of small, neglected and slow disasters become particularly enlightening. Following these paths, we aim, to shed light on the links between crisis as stated events, and crisis as long-term disasters as the Anthropocene is also the time of "concatenation of both slow- and quick onset events" (Steffen et al., 2021, p. 162). By doing so, we question what has been approached differently in the literature. We also put into perspective the "normal" situation, often characterized by the fragility much more than stability.

Now, the time of the Anthropocene corresponds to a time of critical events, and of uncertainty as to their intensity (Reghezza-Zitt, 2019), but through other related concepts developed by the social sciences, such as 'capitalocene' (Moore, 2017) or 'accumulocène' (Fressoz, 2020), the Anthropocene gives the opportunity to rethink lifestyles, economic activities and their material emanations deployed at least since the end of the 19th century, which are the material expressions of the anthropogenic geological transformation (Fressoz, 2020). From this perspective, the Anthropocene is also the time for dealing with the materiality that the human species has moved, extracted, burned and agglomerated, and finally inherited in the long term, and with which it must contend in a changing climate. From an Anthropocene perspective, a crisis is not just seen as an exceptional moment, an event, or a catastrophe, as a break with what already exists (Sierra, Gustiaux and Leclercq, 2020). It is not only a one-off disturbance leading to specific practices for dealing with it that are likely to evolve over time (Gueben-Venière and November, 2020). The crises can also be seen as processes of accumulation and transformation of matter, social practices and techniques which allows to consider the (temporal and spatial) continuities between crises. In the context of floods in the urban South, we refer to this process as a process of saturation.

In chemistry, the notion of saturation refers to "the limit of a substance's ability to dissolve or absorb another". In hydrology, it refers to "the state of a medium [...] whose interstitial voids are completely filled with water"[1]. In its current sense, the concept is used to describe a historical process of accumulation, densification and intensification, leading to a point of discharge by the medium in question, or transformation of the latter (in this case a substance). It seems to us that this notion can be useful for thinking about disasters linked to urban flooding in the Anthropocene for two reasons. First, the notion of saturation emphasises the process rather than the event: to say that a system, substance or environment is saturated is to point toward the historical and material depth of its state. The process of saturation leads to a tipping point at which a gentle return to 'normal' is difficult when not impossible. In this respect, the temporalities involved in the saturation process reflect both the history of the 'forcing' factors that changed environments, and the particular state in which it finds itself at the saturation point: characterised by great (permanent) instability, or by the tipping point into another state. This particular state is the second aspect of the concept that interests us. At the point of saturation, the properties of agents, social forms and relationships are, or could, transformed depending of the intensity of the pressure, the relationships between actors, and their history. We will see that,

[1] Centre National de Ressources Textuelles, 26-07-2023, « Saturation », https://www.cnrtl.fr/definition/saturation

in the case of urban environment, these transformations are far from mechanic processes but include different interactions implying weather, geo-urban landscapes, and ways of leaving and governing these landscapes.

Thus, although the Anthropocene has undoubtedly radicalised the questioning by offering a common spatial and temporal scale, that of the planet, to numerous studies interested in the environment, climate change, forms of pollution and disasters (Bonneuil and Fressoz, 2013). However, the articulation of these scales with those constructed and investigated for a long time by social and environmental scientists remains problematic (Clark, Szerzinsky, 2021). This paper takes the saturation process as a way to investigate urban environments that are both site specific geo-ecological settings, and a global assemblage that produce their own vulnerability (Tsing, 2015).

Moreover, thinking of human collectives as geological forces (Clark, Szerzinski, 2021) implies articulating an approach to the environment as a social construct to another that see the material limits of geo-ecosystems (Charbonnier, 2017). In order to do this, saturation appears to be a boundary terms capable of characterising these socionatural milieu that have thus 'entered' the Anthropocene and their disruptions. Using the case of flooding in two cities in the South, Dakar and San José, we will attempt to show what the 'saturation' of these environments poses as a specific problem, and how it impacts the traditional analysis of disasters in urban environments.

2. A comparative approach of two flooded cities from the South

One of the challenges posed by the Anthropocene lies in the global nature of a phenomenon whose effects are nevertheless unevenly distributed in time, space and between social groups. In addition, by forcibly or voluntarily bringing all social, political and 'natural' formations into a single space-time characterised by global crisis, the concept has been accused of reproducing the colonial gesture of recalibrating the world on the scale of a Western perception and knowledge regime of its disruptions (Davies, Todd, 2017). Clearly situated in the field of the humanities and social sciences, but at the same time careful to put forward 'other' perspectives, at once situated but capable of complementing, amending or contradicting 'the' global theory, our approach consists of understanding global transformations through comparison, by situating these transformations, in the city and in the South, through ethnography method (Robinson, 2022). The table 1 shows the method declined in different qualitative data collection strategy in each research.

Table 1. Qualitative methods

Method	Dakar	San José
Semi-structured interviews	59 (Inhabitants, Local/national practitioners, private actors, ONG, public authorities)	52 (31 inhabitant, 16 practitioners, and 5 private experts)

Immersive observations resulting in notebooks	Total of 2 years living in Dakar between 2015 and 2019 *(work with community organisation, following of large scale mitigation projects and municipal mitigation efforts, several month living with municipal flood manager in an impacted neighborhood…)*	In total 3 years living in San José between 2014 and 2018 *(e.g. observation of public lectures on risk management for public actors and of trainings for citizen participation in risk management; city walks; participation in a citizen early warning system).*
Analyses of documents and archives	Documentation of several mitigation projects. Press review: 600 press articles from 1987 to 2009	Archives of local risk management committees; of the Municipality of San José and of the Ministry of environment. Press review: 51 press articles from 1944 to 2015.

This approach seems to us to have a twofold interest. The first is heuristic. By comparing situations specific to two urban contexts separated by thousands of kilometres and an ocean, the comparison reveals similarities and differences that are particularly interesting for understanding the dynamics of 'global' phenomena, and for tracing their contours. Thus, the fact that this comparison contrasts two thesis fields (Guevara Viquez, 2020; Leclercq, 2020), carried out by their authors at roughly the same time and using similar methods and questions, not only provides information about their common scientific background, but also provides tools for delimiting, naming, grouping or separating phenomena and categories whose scope sometimes remains relatively vague (Candea, 2016).

Secondly, by situating ourselves in the South and seeking to define what the city as a material, social and political environment produces and reveals in terms of socionatural disturbances, this comparison responds both to long-standing calls in urban studies (Robinson, 2006), sustainability studies (Horlings et al., 2020), and more recent calls in Anthropocene studies (Yusoff, 2018), to give an equivalent place in theory to subaltern sites and actors. To do this, we sought to establish equivalences and *a posteriori* comparisons between phenomena and experiences that we approached through qualitative methods in working-class neighbourhoods of Dakar and San José, two cities affected by flooding that is both recurrent and directly linked to their forms of urban planning.

3. Results

3.1 Urban landscape formation: waterscapes in global encounters

The Anthropocene, with the advent of extreme events, rising water levels and droughts, poses problems of water surplus and shortage. We propose to approach the problems of surplus water, accumulation and stagnation, generating floods in cities, which are multiplying, generating specific forms of 'urban waterscapes' (Goh, 2019), modes of inhabiting, and calling for expertise and public responses (Leclercq, 2020; Guevara-Viquez, 2020). Theses crises results from the accumulation in time and space of practices and techniques aiming to modify, control, orient the behaviours of water. This process of accumulation redefines the temporality of the crisis, not as a moment or an event, but as a material thickness that transforms watersheds.

3.1.1 Terraforming the niayes in the Cape Verde peninsula

On the Cape Verde peninsula, the hydrographic network has been characterised since the Quaternary by the presence of lakes or wetlands, regularly of permanently under water, in the foothills of the sand dunes due to an outcropping water table (Fall, 1986). This network, known as the "niayes", is modified by alternating wind regimes and the accumulation of fluvial sands that shape the dune formations, as well as by the interaction between marine currents and the groundwater network fed by rainfall. Highly dependent on the climate, these particular ecological formations are also very fertile, and provided the Lebus who settled on the peninsula from the fifteenth century with a terrain that was both suitable for cultivation and for resisting the Cayor armies from the 1790s onwards (Sylla, 1992). In 1857, colonial settlers bought land on the tip of the peninsula and developed the Dakar colonial city, which became the capital of French West Africa in 1902 and concentrated most of the country's commercial and industrial activities, attracting a very large population in search of work. Typical of the spatial forms of colonial exploitation, this polarisation led to the rapid expansion of the city across the entire peninsula, reshaping the landscape of the niayes.

Continuing the "sanitation" work begun in metropolitan France, which stemmed from the hygienist movement and involved draining wetlands and "containing" urban fertile lands (Fournier, 2007; Morera and Morgan, 2019), the French colonists drained the "marigots" at the tip of the peninsula. These operations, carried out from the end of the 19th century onwards, were in some cases combined with the installation of wastewater and rainwater drainage networks (Faye, 2017). However, the meagre investments made at the time were never enough to make up for the lack or inadequacy of collective facilities in the vast majority of the urban area. These changes to the hydrographic network were also combined with ongoing drainage work to transform wetlands into market gardens, used by the settlers to separate the French neighbourhoods from the indigenous ones, but also by the Lebus and even by new arrivals from French West Africa as the capital expanded and demanded food.

The expansion of the colonial city was very different from the colonial dream. From the Lebus villages, in the interstices of the colonial city and on its margins, a large number of neighbourhoods developed, described as “irregular”, escaping the cadastre and the water and energy networks (Faye, 2017). Accused of contributing to the spread of disease and of 'cluttering up' the urban landscape, their inhabitants were evicted from their homes, sometimes in exchange for building plots located far from the urban centre. This approach was taken up again after independence for urban planning reasons, leading to the expansion of Pikine and Guediawaye, in the north and east of the peninsula. From the 1950s to the end of the 1980s, the servicing of plots of land allocated for building purposes often included a minimal sewerage network, with residents having to connect to it themselves or install individual sewerage systems. These new centralities systematically gave rise to the production of a new "irregular" town on its flanks and along the roads in a context of exponential population growth throughout 20th century. The drought of the 1970s and 1980s in the Sahel had a decisive impact on the urbanisation of the niayes. By contributing to the drying up of certain wetlands, the latter provided fertile ground for regular and irregular urban expansion, and thus prepared the way for some of the flooding that occurred in the 1990s and 2000s, after the drought ended and the rainfall pattern changed (Chagnaud *et al.*, 2022). During this period, the suburban districts started to regularly suffer from stagnant water that displaced entire neighbourhoods, led to a phenomenal rise of hydric and vectorial illnesses, and to major disturbances of social life (school closures etc.). But because it was affecting *waa banlieue*, considered as marginal people, this phenomenon was not considered as a public problem (Leclercq, 2019). It is only during the 2000’s, when the rise of water table level and the soil sealing coefficient reached a

certain level, that the entire agglomeration started to floods, and that the State authorities and international donors began to handle it.

3.1.2 Piping watercourses, soil sealing, and floods in San José

San José's structuring role in the urban development of the so-called Central Valley starts in the middle of the 19th century, and in particular from the end of the 19th century related to the development of coffee farming (Carvajal Alvarado and Vargas Cullel, 1983). Commercial activities linked to the agro-export model were concentrated in San José (Quesada Avendaño, 2011). Later, as in many Latin American capitals, the phenomenon of metropolisation starting in the 1950's is reflected in the tertiarization of the productive apparatus, the disappearance of land used for agriculture and the development of the property market and speculation (Dureau et al., 2006; Hall, 1976). The population of the urban-metropolitan area rose from 322,823 in 1950, to 1,105,679 in 1981. Despite the existence of planning instruments, these urbanisation trends continued after 1980, with horizontal urban expansion, without any increase in density, in areas with complex topographies (Hardy, 2005). In the course of this transformation process, the canals built to irrigate the coffee-growing fields became drainage canals for urban water.

San José's sewage system was built at the end of the 19th century (Quesada Avendaño, 2011). Several canals and streams formerly used for agricultural activities were then covered over to become part of the sewerage system (Alvarado Rojas, 2014).

Wealthy neighbourhoods were the first to benefit from the installation of the changes. The working-class districts had to wait a few decades to be connected. (Quesada Avendaño, 2011). The urbanisation process that created the metropolitan area between 1940 and 1970 reproduced these trends and adapted to the coffee strategy In this process, property developers invade protected areas, underestimate the flow of watercourses and even erase them by levelling the land to build streets and houses on their original axis (DRENACA, 1977).

This process of piping is punctuated by the phenomenon of flooding, which is gradually becoming associated with a problem of urban development (Guevara Viquez, 2020), and not exclusively as problem only related to poor areas (Guevara Viquez, 2019). The floods of the late 1960s and early 1970s marked a turning point. The municipality of San José commissioned the DRENACA study, drawn up in 1977, which was supposed to result in infrastructure works to increase the drainage.

Along with this process of transformation of basins, city actors tend to forget the watercourses. Mapping of the stormwater network in San José is almost non-existent, even though the lack of information on technical networks is a major challenge for their management in a context of climate change (Denis, Florentin 2022). The managers know only 30% of the network, which is currently being re-registered (Guevara Viquez, 2020). Most rivers and streams are channelled and buried, hidden by buildings. When they are not covered, the watercourses are lined by walls and their beds become very narrow, particularly at bridges, which function like dams during rainfall (Morales Soto, 2012).

Thus, the two cases show the historical accumulation of people, techniques and practices that shape landscapes from wetlands and agricultural lands to two-sided urban "waterproof" area in order to feed the demand of local and global shifting political economy. These processes transform the hydrographic basins into a new entity. The challenge of the Anthropocene is to rediscover urban waterscapes as they are, i.e. urban watersheds made of underground sewer-rivers, working-class swamp districts, polluted streams and urban flood plains. These processes

challenge the hydrological knowledge as well as the sociological one needed to deal with the flood crisis. In the South, where hygienist movement and the related process of city canalization has often merged with precarious urbanization, partial urban planning and public services (Bierschenk and Olivier de Sardan, 2014), this allow us to better understand the ways by which some groups and people are becoming vulnerable to different flood manifestations.

3. 2 Saturation shaping the living spaces

3.2.1 Living in a changing hydrographic basin: from slow to flash floods in San José

This process of transformation can be illustrated at the level of Barrio Luján, a working-class neighbourhood in the old town centre in the south-east of San José. Its development began in the 1920s and intensified in the 1950s. The socio-economic profile of current residents corresponds to craftsmen, blue-collar workers and small shopkeepers with an intermediate level of general qualification[2]. It is a neighbourhood heavily affected by flooding from the *Ocloro*, whose basin has been 100% sealed with the urbanisation process in San José (Guevara Viquez, 2020). This river is 6.85 km long and has a catchment area of 6.196 km². Its flow behaviour and the changes to its bed can be likened to "quebradas", a type of "gully", an element of the hydrographic system that operates particularly during heavy rainfall (Metzger and Peltre, 1996), with rapid, even violent overflows. The transformation and coverage of the riverbed at the scale of the neighbourhood is associated to the expansion of a dairy factory from 1950 to the 2000's, when most of its activities where displaced to the west of the Vallee.

The flooding in Barrio Luján is accentuated by the process of urban sprawl. Many of the residents we met grew up in the district between 1950 and 1970. Their stories take us back to the San José of another era, dotted with fields of fruit trees and pasture, over which the river slowly overflowed without affecting the houses. This overflowing was to the north and not to the south, unlike today:

> Bernardo: Let's just say that what was flooding was the little square over there […] on the other side of the river. And all that [the land near the river] was full of vegetation, where we used to play at the time [...] Let's say the river overflowed but there was plenty of room. [B. Barrio Luján, June 2017]

Heavily affected by the floods of the early 1970s, the district was included in the DRENACA works. The work took until the 1990s to complete. The measures involved covering part of the River Ocloro and building a secondary canal to divert excess water upstream from Barrio Luján. As long as it reduces the impact of overflows, work on the sewerage system is a popular option:

> Flooding was continuing and we heard that they were doing a project called DRENACA […] We could see the difference: it rained and the river hardly overflowed [Beth, Barrio Luján, who moved to the neighbourhood in the 1980s].

Thus, over the course of the twentieth century, the development of the sewerage system in San José was shaped by crises and recurring floods. While the network is being deployed to reduce overflows, it also shapes today's flooding, as we will see in the last part of this paper. The construction and extension of the sewage system has a feedback effect on the crises affecting the city today (Coates, 2022).

[2] Data collected in February 2017 from the National Institute of Statistics and Census (INEC).

3.2.2 Accumulation, stagnation, progression of the floods and of the water networks in the suburbs of Dakar

In the municipality of Djiddah Thiaroye Kao, raised in the 1960's and 1970's from the Pikine resettlement neighbourhood onwards in the suburbs of Dakar, the first floods started at the end of the 1980's. At this time, ancient cultivated "bas-fonds" transformed into houses and courtyards during the drought period, started to fill up again forcing people to live their house during the rainy season. This phenomenon gained in force and intensity during the 1990's, leading the government to consider a first resettlement plan in 1994, that was never achieved because of the opposition of certain households (some of them had already been displaced during the 1960's because of the "clearance" of Dakar "slums"). That "return" of the rains eventually combined with a periodic rise of the level of watertable (Ndao, 2015) - because of the rainfall intensification and beside its general trend decline - led to a very different flood dynamic than the San Jose one. Here, the problem was not the sudden and violent manifestation of water, rather than its progressive accumulation and progression, leading to the progressive abandonment of house, or to the backfilling of others. This dynamic eventually intensified after 2004 and the stop of the pumping of the groundwater-table for the alimentation of Dakar with potable water for sanitary justifications (Leclercq, 2017), leading to its rise, one of the major flooding event at the agglomeration scale, and the intensification of neighbourhood's socio-material transformation.

> M. Diop: It started in Leona in 2005. The floods were a bit far away. But it came year after year, it came up towards us. [...] And so it was in 2009 that we [our school] were flooded. The water was almost 1 metre high. [...] So we closed the school, we stopped our activities, and it was only in 2011 that we started again. But from 2009 to 2011, there was nowhere to go. The neighbourhood was overrun... [...]
>
> Romain: Did that have an impact on your students?
>
> M. Diop: Oh yes! We lost a lot of pupils, a lot! They left. So yes, it had an impact on us. We've lost almost 60% of our pupils. [...] Here now, the population is practically poor... With the flooding, the level of poverty in the town has increased even further. [...] You know, let's talk about the consequences. The abandoned houses. The families who abandoned their homes had the means to do so, so they went and rented somewhere else. Now poor families live in these houses.
> *M. Diop - Headmaster of the Léona Franco-Arab school, interview conducted the 27 june 2016 in one of the classrooms.*

2005 was a major outbreak for the entire agglomeration, leading to the forced resettlement of thousands of people during several month (several years for some of them) and to the launch of the first national urban adaptation policy. The point of this paper is not to get back to this policy building process that have been described elsewhere (Schaer, Thiam and Nygaard, 2018; Bottazzi, Winkler and Ifejika Speranza, 2019; Leclercq, 2019, 2023), but to point out the overarching processes that gather our two different cases. As in San Jose, the main response of the public authorities, national and international, had relied on the channelization, and eventually the displacement of flooded affected people. After 2010, the State and the World Bank started a major drainage infrastructure project, that is still undergoing, following the watersheds tops and depressions in order to cover the whole suburban area. But here again, that channelization did not operate in a fixed environment. All along the last two decades, Dakar was also the object of major road infrastructures and pavements projects (Melly, 2017), some of them directly related to the needs of water evacuation through the new drainage networks.

As this way of producing the “out of water” city was expending, inhabitants started to not only backfill and seal their own houses, but also entire roads and neighbourhoods. Far from disappearing, the floods now displace through waterproof roads and sealed neighbourhoods from the top of the dunes to their feet, sometime until the sea, and sometime until the next low lying point where they remain trapped.

In our work, saturation directly refer to the bifid process of channelization on one hand – that had been conducted first as a way to build a “sanitized” city for the wealthier and the dominants – and of overflow, stagnation, choking, accumulation on the other – when the entanglement with very unequal socio-material landscapes produces different types of floods. If the channelization could have been a very specificity of the urban form since ages and in very different contexts (Chwałczyk, 2020), what make it different from the 1950’s in some cities of the Global South is that it interacts with a fast and very large process of groups and land transformation, and in a context of huge power imbalance within the city production. The urban demographic explosion, the polarisation of national economies within few city centres, the generalization of grading and levelling, of concrete, cars and the associate infrastructures, and the inequalities reflects into the material production and setting of the city, confronted with very different hydroscapes. What’s interesting here, is that besides these different hydroscapes and, at the end, different urban-hydroscapes flooded in different ways, the same solutions are used, producing the same horizons of an “out of water” city. Defining a process as well as a situation, the saturation/saturated city appears to be produced and reproduced through this power imbalance, that define and redefine who is affected and in what extend.

3. 3 Saturation and power reconfigurations: living on the edge

The notion of 'saturation' offers an opportunity to think both about the limited “capacities” (Tousignant, 2018) of actors living in an uncertain environment, regularly submitted to variable crisis. The question is not really how to transform the environment to stop the flood, but who, where and how the flood will affect (Chahim, 2022). The uncertain nature of water manifestation in saturated urban watersheds is thus pointing toward the different capacities to deal with different behaviours of water at different urban scales.

In saturated urban environments, the attempts of individuals and groups to protect themselves from flooding almost systematically have an impact on the exposure of their neighbours. In the suburbs of Dakar, the backfilling of one house often leads to flooding of the neighbouring other, while abandoning another can lead to the formation of a water accumulation point, degrading the neighbourhood symbolically (the empty space quickly becomes a dumping ground) and concretely (water rises by capillary action in the walls of neighbouring houses, Leclercq, 2022). The ability to take action, on one's house, street, neighbourhood or any other part of the urban space, then depends on the ability to mobilise money, matter, relationships, or to produce and direct public action, making it possible to be on the "right" scale - i.e. the scale that determines the flow, infiltration or stagnation of water within the space to be "protected from water" - using the "right" method - i.e. the method that is best suited to the behaviour of the water that we wish to avoid. However, the scale and method are far from obvious; on the contrary, they are the subject of active research punctuated by trial and error (Leclercq, 2019; 2017) and are intrinsically political.

Whether at local or city level, acting collectively on pumping out a low point (Leclercq, 2019), or on draining an entire catchment area (Leclercq, 2023), produces 'winners' and 'losers' of the city out of water. When a parastatal agency involving the Senegalese government and the World Bank redefined the master drainage plan for Dakar on the scale of the city's catchment area,

they chose to fight the accumulation of water by favouring its "natural" flow, determined in part by the topography of the Cape Verde peninsula, and at the same time evicting the inhabitants located along the route of these flows. When neighbourhood organisations succeed in mobilising international NGOs and institutions to resume pumping a water table that has become too high, thereby flooding part of the suburbs (Leclercq, 2017), they make some of the flooded neighbourhoods more or less liveable, and in so doing act on the forms of exposure that structure them. In a saturated hydro-urban catchment area, the ability to mobilise more than human forces - run-off, infiltration and water storage capacities - and to modify the environment in order to do so, depends on urban actors ressources (Clark, Szerzinski, 2020). Behind exposure to risk or access to resources lie infrastructures, forms of urban planning and institutions that organise the production and maintenance of a city that produces its own exposure to flooding (Chahim, 2022), and over which certain individuals, groups, and not others have the capacity to act.

In San José, we see these power imbalances in handling the flooding between the historical responses of the dairy products factory in Barrio Lujan, the current responses of the new real estate actor in the neighbourhood, and the inhabitants' responses. Because the phenomenon is long-standing, and the work to reduce it is spread over time, residents have learned to live with it. In the landscape of the district, one can see the handcrafted devices visible in the facades of the houses: the inhabitants erect small walls, concrete or zinc barriers to prevent the entry of water in their houses. When it happens in the streets, flood is undermined, inhabitants live with it, even though they remain isolated. Residents also have permanent watch strategies (Gueben-Venière, November, 2020): they observe the clouds in the distance, listen to the force of the rain or torrent and decide to act accordingly (Guevara Viquez, 2023; 2019). When the artisanal barriers are breached and the water enters the houses, the residents mobilise to demand a response from the public authorities and from the neighbourhood's main employer, the dairy products factory that stayed in Barrio Lujan for over 50 years, which was also affected by the floods. Archives of minutes of meetings between representatives of the neighbourhood and the factory show the discussions of the various nuisances that the factory could generate during the 1990's. Although the company claims to be a victim of flooding[3], its response to it (to dig canals) gives a glimpse of the resources it can mobilise to deal with the situation, thereby reassuring local residents and easing tensions in the exchanges. Furthermore, the modification of the riverbed was one of the topics of debate back then as it was during the fieldwork: *"Listen, the assistant of the Municipality says to me "but the thing is that you put yourself in the river's natural field of expansion" and me "Damn! We got into the land of the river!", until I said "no", and I started to say "no, madam! Look at this, this, and this!*". Inhabitants associate the riverbed modification to the floods and hold the factory responsible for it.

Today, these power imbalances concern the use of the part of the riverbank land sold by the factory, which is currently empty and functions as a riverplain zone. A project of three residential towers is to be carried in the area. In order to develop it, the real estate company has to carry out works to increase the river's drainage capacity, widening the riverbed and encroaching on the protection zone[4]. The latter was not respected when the factory buildings were still standing. Since their demolition, this protection zone has been the subject of debate at the Ministry of the Environment, pitting the local residents, the company and the local authority, which supports the project, against each other (Guevara Viquez, 2020).

[3] One example is the minutes of 10 July 1995.
[4] A ten-metre protective strip along the riverbed that should not be built Law 7575 ("Ley forestal") of 1996.

Far from being only a question of "money", "coordination", "under-equipment" or "resilience", as emphasized by a post-positivist approach of the disaster supported by donors, authorities and a vast majority of engineers and scientists, the floods in those cities challenge the capacity of the channel system itself to evacuate water in an unequal and distributed maintenance regime (Pontille and Denis, 2017), and within a context of self-urbanism (Chiodelli and Grazioli, 2021) and fragmentation of public action (Lavigne Delville, 2017). As the statistic data would eventually show, it is not the deprivation and exposition that generate floods, but its articulation with economic growth and huge urban development projects that characterize a lot of cities of the Global South (Rentschler *et al.*, 2023).

4. Discussion and conclusions

Based on a situated approach, the paper sheds lights on the articulation of global processes typical of the urban paths in Southern cities and local scales. Through the notion of saturation, we show the processes of accumulation of expertise, practices and their materiality around the idea of channelization that, in interaction with hydroscapes marked by a particular pattern of urbanization, generate floods in two cities. In doing so, we propose to point out the temporal and spatial continuities between crises in the context of the Anthropocene. Following Knowles, we believe that these distinctions in time and place are "its self a form of politics, a politics of disaster amnesia, cutting effects from causes, and from futures" (2020, p. 203). Through 'saturation', we call to open the scope to approach crisis and disasters in the Anthropocene.

The common features we raised are however deploying on very different geo-ecological landscapes and timeframes.

In Dakar, the confluence of the city, the *niayes* geological formation and the monsoon regime generates problematic floods due to the slow progression, the stagnation, and the transformation of water, leading to abandonment of houses and epidemic problems. In San José, the process of metropolisation encounter the inter-tropical regime and the morphology of the micro-basins in an intra-montane valley lead to rapid and violent flooding. In contrast with the Dakar case, the problem seems to be the accumulation and the velocity of water. In both cases, however, saturation of the soil and of the networks seems to result from a waterproof-canalised urban planning model that imprinted its path, even if not realised, to the whole watershed.

Second, the comparison reveals a time lag in the public problematisation of the phenomenon. In San José, flooding became a topic of discussion in the 1960s, whereas in Dakar it was not until the early 2000s that the issue was publicly acknowledged, despite the fact that the suburbs suffered from floods since the early 1990's (Leclercq, 2020). This pre-San José approach to flooding might lead one to believe that the problem would have very different temporal characteristics today. What we can see, however, is that the problem is recurrent and persistent, sometime in the same neighbourhoods, sometime displacing from one neighbourhood to another, always taking the form of an unpredictable but persistent threat that targeting specific communities. This "on the edge" situation seems to be a characteristic of the saturated urban landscapes, pointing toward the unequal exposition to this very temporality. As pointed out by various authors using different frames (Nixon, 2013 ; Chahim, 2022), the Anthropocene is here not referring only to the great divide between North and South, but also to shifting temporalities within the cities and the neighbourhoods that put some of their inhabitants at risks more than others, redefining inequalities through this question : who is able to handle the hydro-forces within saturated urban watershed ?

In spite of differences, in both cases we see classic infrastructural responses aiming to tame and channel water, but also to "catch up" the vulnerable city that expanse quickly, both spatially and in term of population growing. If the water channels are considered as a necessity, both by hydrologists, urban planners and inhabitants facing floods, it also reflects a "bottleneck" in urban public policies and their capacity to change in these contexts (Melly, 2017). However, we saw that in saturated contexts, the different capacities to deal with the water forces has consequences at every scales, and that this power imbalance is the main driver of the reconfiguration of environmental inequalities. In this context, it become crucial to open the black box of water infrastructure in order to ask who is defining, controlling, managing them, how to reach and maintain "at the good scale", and is this solution the best suited for reducing environmental inequalities at the city scale (Leclercq, 2022).

The limited capacity for public action in the Global South doubles environmental inequalities in the Anthropocene, as the question of power becomes central. Large-scale action depends on resources, but also on the ability of actors to mobilise and exert pressure at different levels (private, local or national). The article thus highlights the importance of addressing the Anthropocene and the challenges posed by climate change not only by strengthening the infrastructure itself, but also by adopting situated approaches. The stakes are high in terms of knowledge of these hydro-urban basins, new urban environments (Hardy, 2005), in order to act in a changing context. Social science approaches can shed light on the long and spatial temporality of material saturation, capturing situated practices, including those of local residents, and thus facilitating the formulation of appropriate solutions beyond the exceptional event.

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Bridging the gap between resilience research and resilience planning in conflict contexts. Application of a federated urban resilience Model toward rapid recovery and sustainable development.

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Abstract
The proliferation of global crises, such as climate and war-related issues, underscores the need for resilience assessment in urban systems to restore balance and achieve sustainable development. Despite extensive resilience research, a gap remains in adopting a common concept and effectively integrating resilience assessment into operational planning. This gap is especially critical in conflict contexts requiring rapid recovery. This paper aims to identify causes behind this gap and suggests integrating a federated urban resilience model into digital platforms. Focused on the case of Ukrainian cities, the preliminary findings from a cooperation project between the HafenCity University Hamburg and the German Corporation for International Cooperation (GIZ) GmbH, aim to enhance planning approaches for rapid recovery and sustainable urban growth, applicable to various crisis-affected contexts.

Keywords: urban resilience, digital tools, rapid recovery, conflict, Ukraine.

1. Introduction

Urban Systems are becoming ever more complex. As urban centres are becoming denser and population growth is dramatically shifting to urban areas, the frequency of natural and anthropogenic disasters in cities seems to be correlatively increasing (Council & Hov, 2013; Hoffmann, n.d.). The consequences of unexpected disaster events also evidence higher economic impact on its governments (Mohr et al.,2022). The planning of cities must devise new approaches, as well as agile and rapid means of planning for long-term solutions in view of the uncertainty of such events. Traditional planning comes to the limits of its capacities to deal with such circumstances.

In the context of rapid urban planning strategies, particularly in the adaptation to natural or man-made disasters (such as cities recovering from climate-related flooding or enduring war conflict) resilience frameworks emerge as crucial solutions. They optimize variables like uncertainty, which comes with risk and unexpected threats (OECD, 2019; Folke, 2016). Nevertheless, despite the existence of numerous models and frameworks, the integration of resilience-based strategies into operational instruments for urban planning has not been consolidated. Existing instruments for resilience assessment are mostly intended for higher level of policy and governance, but not fully integrated yet into the strategic planning practice at the local level. (Krishnan et al., 2023; Sharifi & Yamagata, 2018).

Based on a preliminary literature review and the empirical work carried out during an ongoing project in the context of Ukraine´s rapid recovery during and in a post-war situation, the first objective of this paper is to show the significance of integrating urban resilience assessment methods into the practical realm of strategic spatial planning. A secondary objective of this paper is to open a space for further exploration and debate towards reducing the identified gap between theoretical resilience frameworks and practical urban planning tools. An essential aspect to explore is the identification of current obstacles hindering the effective incorporation of urban resilience assessments into digital spatial platforms. The discussion section argues how digital tools can potentially address this gap and contribute to both rapid recovery and sustainable growth in conflict contexts. The outcome of this contribution should extend toward further research and implementation measures which should provide insights towards innovative integration and adaptation of urban resilience models into spatial planning practices and instruments, enhancing their utility in the realm of rapid urban planning strategies.

2. Theoretical Framework

2.1. Challenges faced by urban planning

As cities expand and evolve, the myriad of components that they hold are becoming increasingly intertwined and dynamically influential upon each other. Dynamic analyses have proven necessary to assess urban challenges from a scientific perspective, i.e. city-science and complexities of flows and networks (Batty, 2012), in opposition to a static and fragmented perspective which would otherwise focus merely on isolated parameters of the urban morphology, such as its physical characteristics. From the perspective of urban planning strategies, innovative approaches must be adopted to identify the source of urban challenges and understand the connections between its triggering parameters. Not only transdisciplinary perspectives (holistic approach, system thinking, adaptive governance) are enough to prepare for the formulation of solutions, but also innovative instruments to dissect the problems and their causes are urgently demanded.

In this sense, understanding cities as complex and adaptive systems allows to better recognize the interdependent relations of flows, material, and relationships inherent to cities (Alberti, 2016; Batty, 2009; Bettencourt, 2021; Ortman et al., 2020). The complex character of cities stresses the concentration and interdependencies of assets, systems, functions, flow, and population. Moreover, hazards and risks to which urban areas are exposed, have shown greater impact upon occurrence. For instance, in the cases of natural disasters such as the Haiti Earthquake (2010), the Sichuan earthquake (2008), Cyclone Nargis (2008), the European heat wave (2003) (Dickson, et al., 2012), or anthropogenic disasters such as the COVID-19 pandemic (2019) or the recurrence of armed-conflicts in such areas as Ukraine, Afghanistan or the Middle East, have led to devastating consequences not only on the physical, but also economic, environmental, and socio-psychological levels, especially for urban dwellers.

The correlation between the growing trend of global urbanization and the levels of risk and vulnerability in urban environments still demands further research (Leichenko & O'Brien, 2008; Cutter, 2021). In combination with the notion of hazard, understanding *threat* is an important part of the equation. Agents capable of triggering a potential hazard can be linked to a specific situation. From a complex-systems approach, resilience and by extension concepts such as risk, threat, and vulnerability share common patterns and interrelations. A city, as a dynamic network of interconnected activities and resources (e.g. human, natural, and built environment) can therefore be more vulnerable to any given risk or threat, triggering hazardous situations. Given the higher risks cities face, risk analysis has become more of a common practice, adopted not only by financial or cyber-security sectors but also by insurers advising the governance sector at higher levels. From this risk assessment practice, certain frameworks have also gained relevance within the field of spatial planning. Furthermore, these concepts and frameworks have been applied and transferred to other specific complex-systems fields of study such as cybersecurity, insurance and governance (World Economic Forum, 2022; Rangu, et al, 2024; Alibasic, et al, 2017). Such existing workflows can potentially offer a relatable scheme capable of serving as a reference amongst to-be proposed resilience frameworks for urban planning.

Endeavours on developing urban resilience frameworks resulted in several thorough efforts from different agencies, mainly governmental and of international development. Such frameworks (for instance, City Resilience Framework by 100RC; UN-Habitat City Resilience Profiling Tool, Resilient Cities Scorecard, by IBM and AECOM; City Resilience Index by ARUP and Rockefeller Foundation; Urban Resilience Indicators by the European Commission's joint Research Center; among others) often require complex metrics for rigid standards, making it difficult to rapidly operationalize such frameworks or provide guidance to further planning and projects (Datola, et al. 2022; Figueiredo, et al, 2018; Meerow, et al, 2016; Da Silva, 2013; Jabareen, 2013). Hence, a flexible tool adaptable to each specific case, data availability, and local expertise might prove useful to be operationalized for planning strategies under scenarios of uncertainty.

2.2. Considerations of urban resilience concepts for planning

Resilience comes into play as a relevant concept for planning, as it can inform how ready a system is to face a given risk and react towards recovery (Ribeiro and Goncalves, 2019; Datola, 2023). Within the specific context of urban systems, urban resilience is a crucial measure towards the achievement of sustainable development (Li et al., 2014; Meerow et al., 2016). It contributes to a better understanding of the interdependencies and trade-offs of the various urban sub-systems constituents of any city, including infrastructure, social networks, economic

structures, and environmental factors (Derrible et al., 2023; Chelleri, 2012). It also considers risk assessments to draw adaptation and mitigation measures. It aids in the balance between the redundancy and efficiency of a system´s resources. Urban Resilience can drive towards long-term sustainability, by withstanding shocks and maintaining stable urban environments over time.

The advantage of urban resilience, as Goldschalk (2003) notes, is that it is not a state bound to specific patterns or urban form. It offers flexibility to respond to each specific urban condition, and by doing so, fostering creative thinking to achieve it. Such quality opens a wide range for adaptability in the approaches that each of its frameworks addresses. Furthermore, through the awareness of the complex, dynamic, and open nature of urban systems, the need for a holistic, integrated and yet flexible (i.e. easy to adapt to each individual urban and disaster situation) approach to achieve urban resilience is acknowledged when understood in this way.

Nevertheless, how are resilience measures effectively integrated into the common workflows of planning approaches at more local levels of cities is still cumbersome in many cases. Measures can be planned for, in view of known risks faced by cities, but when uncertainty is also a determining factor, and the functional network of cities has become not only more complex but also vulnerable, solutions are more difficult to be devised. Interdependencies among correlating factors, and their cascading effects upon impact are still hard to identify and even measure (Cimellaro et al., 2019).

2.3. Artificial disasters in conflict contexts

Cities facing post-shock damage and subsequent reconstruction must carry out innovative policy and planning approaches in the midst of critical situations (e.g. emergent but fragmented plans, sudden inflows of aid, weak legislation, unregistered displaced people, scarcity of resources, unstable economy) all against the need for rapid recovery. Added to the complexity of this task, is that of coordinating activities across multiple levels of governance, understanding which measures are carried out at the national level and at the local level. Once again, resilience is a pertinent approach, as it is based on a conception of urban contexts as a composition of sub-systems within a larger system (Folke, 2016; Chelleri, 2012). This approach opens the scope of addressing challenges in the midst of rapid recovery, with considerations of time and scale dependencies, and allows the segregated understanding of parts of a system, in order to devise effective solutions for specific situations.

Differences between natural and artificial disasters.

It is, however, important to mark the distinction between two determining factors: the type of disaster and the context of the situation. The type of disaster affecting an urban system can be natural _e.g. earthquakes, flash floods, volcanic eruptions_ or they can be anthropogenic _e.g. an industrial leak of pollutants or the failure of an entire city´s electrical grid system due to lack of maintenance. Both types of disasters can have specific causes, but its impact on an urban system´s failure might be more dependent on the system´s conditions at the moment of impact. An urban system can also be broken down into two relevant context situations, when it comes to assessing resilience: stable or unstable. A significant distinction can be made on how disasters would affect an urban system, depending whether this finds itself in a stable (peaceful) condition or in a more vulnerable (conflict) condition (Fig. 1). Further knowledge on this topic,

collected from empirical cases, should shed insight on new and relevant parameters to take under consideration for an adapted resilience framework for urban planning measures. The definition of an urban resilience model which considers this differentiation could inform more about the different impacts of disasters, understand their behaviour according to this distinction of the urban system (stable or unstable) and the way they unfold and their path of cascading effects differently.

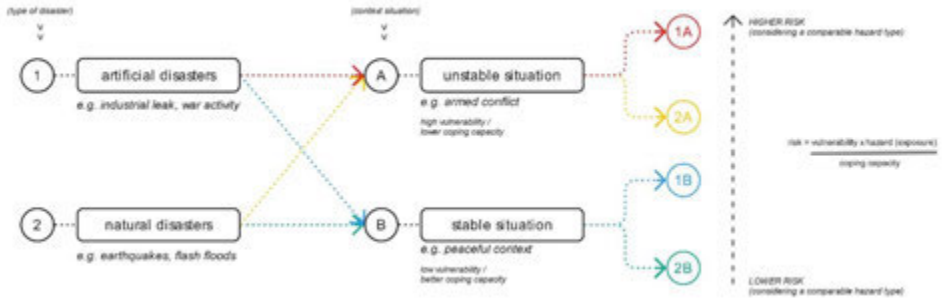

Fig. 1. Scenarios of Resilience assessment based on type of disaster combined with its context situation (authors, 2024).

The relationship between resilience and conflict.

Studies have coincided in the strong correlation between resilience and armed conflict (McCandless & Onbargi, 2023). However, this correlation has been identified in more studies from the perspective of disasters causing conflict, rather than in the opposite direction, when it comes to cause and effect contexts (Elfversson & Höglund, 2023; Rosvold, 2023). More extensive research has been conducted from the perspective of understanding how vulnerable areas impacted by disaster (e.g. climate-related) have a higher tendency of dealing afterwards with escalating conflict, in other words, how disaster consequently shapes conflict (Fig. 2).

On the other hand, when it comes to research on how areas already undergoing conflict are dealing with its low resilience capacities, less research is found and nevertheless it is still heavily demanded (McCandless & Onbargi, 2023; Rosvold, 2023). This refers, in opposition to the previous case, to the specific case of conflict triggering negatively the level of risk of disaster in a given situation, affecting a system's resilience. This first assessment collected from the available literature overview sheds light on the importance of exploring further what pre-existing conditions of areas undergoing conflict should be registered and acknowledged into a resilience framework for recovery planning.

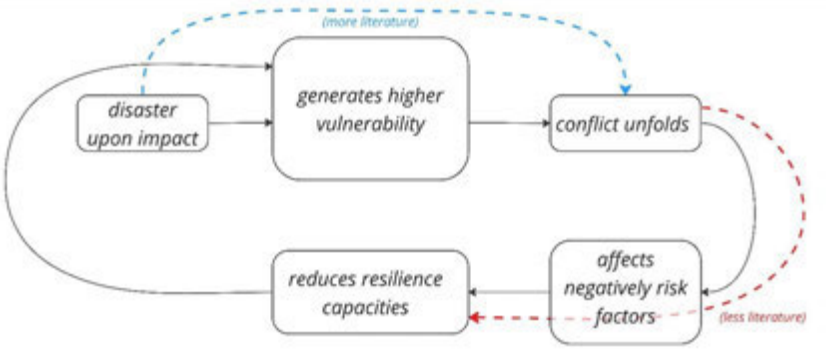

Fig. 2. Correlation between disaster and conflict and its coverage in literature (authors, 2024).

The case of Ukraine.

The case of Ukraine is a fitting case to explore these two correlating situations. One of the most pressing challenges in the current situation for Ukrainian cities is the accelerating criticality of space after assessing damage coverage in the country, caused by ecosystems erosion, bomb-mining, leakage of industrial substances after explosion or scattered military debris. It has intensified the challenge for planning across different actors and levels. Policy-makers and planners, along with central governments and local administrations, must define priorities when the country is in urgent reconstructive demand of housing allocation, without compromising other land use demands, such as those of economic or environmental nature, agricultural activity or protection of natural ecosystems (Shnaider et al., 2024).

Another example is the volatile numbers of internally displaced people (IDP) in Ukraine since the beginning of the war. The ongoing conflict has generated additional pressure on already vulnerable areas within the country, due to the constant shift in the numbers of the registered population within each city. Registration and up-to-date record keeping of IDPs is difficult to maintain track of, in view of the constant attacks (World Bank et al., 2022), and planning for an uncertain population number is cumbersome.
A third development brought on by the war situation has been the massive influx of financial aid received by the country. This has been identified by some as an unforeseen reaction which in turn might accelerate, in the long term, unprecedented urban development or even the integration of the country into the EU (Fiott, 2023; Ukraine's Path Towards EU Accession, n.d.). From the field of international strategic support this can be seen as a case of "silver linings" opportunities (Grant et al., 2023). For this to produce a successful outcome, strategic plans and measures must be realigned to be able to achieve both goals, i.e. focusing on fast reconstruction and deep transformation of the country (Rozmaritsyna, 2023).

3. Digital Tools for Urban Resilience

In view of the exposed need to reconsider planning strategies for rapid recovery scenarios and to draw multi-dimensional capacities of planning processes and instruments, it seems relevant to seek for solutions that can address a better understanding of cascading effects upon impact and interdependencies between parts of an affected urban system, under each context. Digital tools can help to model and understand complex, dynamic systems, as they can speed up planning processes by enhancing access to relevant data, synthesizing knowledge needed for

planning and decision-making. This may accelerate the generation of new output data, in the form of analysis for concrete planning activities (e.g. citizen participation, satellite image analysis, automated design assessment) facilitating agile and iterative evaluations, such as scenario comparison, design and check or rapid urban design prototyping (Noennig et al., 2023). Integrating digitalisation to urban resilience framework should be considered as a relevant option for accelerating these needed analysis, iteration, and decision-making activities toward more transparency in the restoration of a balanced urban system after a disruption.

The current findings from our ongoing research, within the framework of a cooperation project in Ukraine supported by the German Corporation for International Cooperation (GIZ) GmbH, address the identified need to incorporate digital tools into a proposed urban resilience framework for the case of Ukraine´s rapid reconstruction planning strategies. Our research has been based on a mixed approach between literature review on the theoretical background on resilience and urban systems, and also empirical knowledge collected through different sources, i.e. workshop sessions with members of the local authorities from different cities in Ukraine, webinars with NGOs working on site since 2022, the collected knowledge on site on behalf of the GIZ as our funding partner in this project, and collaborating researchers, both from Ukraine and externals, currently carrying out as well implementation projects in the country.

In this sense, the specific research-based activities in our project focus on defining the necessary components in a federated model for urban resilience, adaptable to Ukraine. One of the preliminary reflections from this process is that certain urban-related characteristics arising from the specific situation of conflict are still to be integrated into such a federated urban resilience model. Examples of these conflict-generated characteristics are e.g. shelters, massively displaced population or aggravated land-use distribution. Others are still to be outlined.

From the set of frameworks analysed, the similarities in the hierarchical organisations of dimension, sub-dimensions, components, and indicators were identified (Fig. 3). On this basis, a simplified set of four dimensions constitute the first step of the framework. Considering the specific situation of conflict, the relevant dimension distributions are social, economic, institutional, and physical. The natural ecosystem is included into the physical dimension of the urban system, as a fitting measure from other frameworks, to better cluster common components with overlapping characteristics, i.e. environmentally protected areas, public space, water bodies.

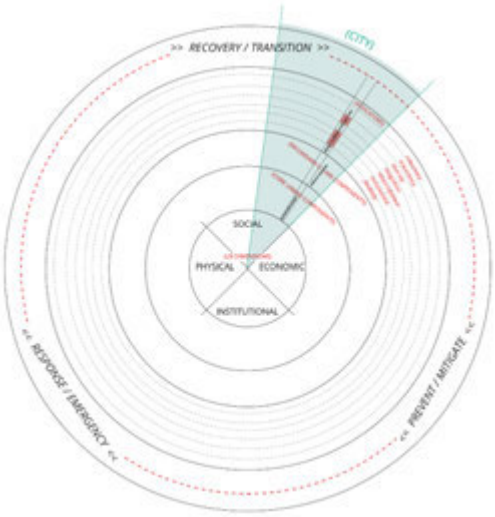

Fig. 3. Diagrammatic Chart of the proposed UR federated model scheme for the Ukraine Case (authors, 2024).

Considering the Cities Resilience Index (Rockefeller Foundation & ARUP in Da Silva, J., 2013) as one of the most adaptable references in terms of its composed set of indicators for resilience assessment, a further step in clustering components under each dimension is assumed to group sub-components in a system and better classify indicators and metrics. The final step of this process will be to identify at the indicators level of the proposed diagrammatic chart (Fig. 4) an additional set of indicators capable of measuring the new and needed urban characteristics, endogenous of an urban system undergoing conflict situations. These should be located within the proposed diagram, within fitting components and its host urban dimension.

4. Discussion

The upcoming phase of the ongoing research project will test the federated model for the urban resilience assessment in Ukrainian cities, with the objective of collecting learnings and insights on the following formulated research-related inquiries:

- On the topic of urban conflict: The outcome of the implementation of the proposed federated UR model should contribute to further identification of conflict-intrinsic urban parameters, and the need to measure their effect through newly proposed indicators. This should provide insights on how conflict, different from natural disasters, incorporates different variables, such as anthropogenic action and reaction, and to what extent these can condition the possibility of achieving a resilient urban system.

- On the topic of vulnerability and uncertainty during conflict: Based on the previous argument, it can also be discussed in what way resilience models should not be generalized and framed equally for contexts in peace and those in conflict, when facing any kind of unexpected disaster.
- On the paradox of urgency versus feasibility*:* It is in those areas with utmost urgency where the availability of up-to-date and reliable data is most difficult to be collected. From the

empirical work regarding resilience assessment to be carried out in the Ukrainian context, it is expected that a series of recommendations can be collected, in the form of learnings on how to deal with this paradox which hinders the faster take-up of digital tools for the realm of planning. The topic of overcoming urgent demands under scenarios of high uncertainty is, in any case, relevant for further study.

- On the impact of implementing digital tools for planning to address crises: Can digital and spatial tools implemented to contribute to the assessment of UR, indeed achieve faster iteration and formulation of more rapid responses in planning? The proposed model must be validated with the necessary actors, e.g. planners, authorities, citizens and regulators, in real-context scenarios, in order to address this question.

5. Conclusions

With the increasing complexity of urban systems, driven by rapid urban growth, densification, and population shifts, the risks to which cities are exposed become ever more relevant to address, encompassing challenges that combine multiple urban dimensions simultaneously. Hence, the importance and relevance of resilience frameworks that can inform about the interdependencies and adapt to each particular urban circumstance seem necessary. Furthermore, in an integrated manner, such frameworks can lead to planning strategies not only to lay out projects but also to monitor and steer its progress. The integrative character would not only be limited to planning experts but also serve as a platform to inform, collaboratively assess, and plan among various stakeholders.

Digital tools collect enough qualities to potentially address this gap by enhancing visualization, multiple scenarios validation, and quantitative deliberation of outputs which should facilitate decision-making for rapid reconstructive planning. It is nevertheless still necessary to carry out further research and validation through implementation projects to adapt a fitting urban resilience model (a federated model) into understandable digital platforms, which can ultimately address the needs of contexts in conflict, those facing not only climate-related disasters, but also artificial disasters. The critical need to incorporate novel urban resilience models and methods into strategic spatial planning is underscored.

The longer-term transference of the outcome of this research into operational activities toward more effective rapid planning for urban reconstruction could also be potentially supported by the assessment of other similar cases of contexts facing conflict, recovery and reconstruction, such as Israel, Palestine or Afghanistan.

Further research should help understand what is temporary and what remains (planned and built infrastructure, for example) when addressing fast recovery *versus* sustainable growth in a post-conflict context. The integration of digital tools supported by a validated resilience model which allow the formulation of more accurate decisions can potentially address two important challenges faced by planning in the coming years, meaning which solutions are designed for fast recovery and which are designed for long-term sustainable development.

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The necessity of new interconnections in multiple ecosystems in the Northeast Italian region between natural hazards and a desired new ecology

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Abstract

Just under 100,000 inhabitants live in the Bassa Pianura Friulana (Lower Friulian Plain), Italy, an area spanning a complex system of artificial and natural infrastructures, located at the northernmost point of the Adriatic Sea and bordered by a vast lagoon. During the summer season, the 130-kilometre coastline hosts over 3 million tourists. At multiple scales, the hydrographic system faces increasing anthropogenic pressures and is hierarchically structured, which may not align effectively with the efficient functioning of the territory. Consequently, the area is persistently exposed to risks from unexpected climatic events, resulting in significant imbalances such as floods, droughts, and storm surges. Artificial water management networks, however, do not fully mitigate the operational challenges of the territory.
This article initiates a discussion on research efforts, exploring tools, projects, and potential solutions to enhance the resilience and adaptability of artificial territories in response to transformations in both coastal and inland urban areas. The research aims to identify and highlight the conflicts between human and natural spaces, drawing on insights from Urban Political Ecology studies rather than a design-driven approach as often seen in landscape urbanism.

Keywords: climate change, planning transition, blue & green infrastructure.

1. Introduction: climatic emergencies

Several recent investigations provide compelling evidence that the boundaries of climate change and biosphere integrity are entering a phase of increasing and interconnected risks. Influential research analyses current phenomena - climate conditions and temperature trends - identifying a threshold of 2.7°C global warming, which will be exceeded during the 21st century unless substantial emission reductions are implemented. Only under these conditions could air quality improvements be achieved, potentially reversing temperature trends after approximately 20 years, with positive effects on various climatic factors over extended periods (Brondizio et al., 2019; IPCC, 2023; Pörtner et al., 2022).
Since the early 2000s, the worsening systemic changes have directly contributed to nearly a doubling of global disasters, predominantly driven by climate change. Approximately 90% of these events are hydro-meteorological in nature, while the deadliest catastrophes stem from geophysical events.[1] The urgent nature of the matter is also emphasised by the United Nations,

[1] If countries do not implement a prevention approach that incorporates risk reduction into decision-making in all sectors, the number of global disasters is likely to increase significantly each year, from 400 in 2015 to 540 in 2030. This would represent a 40% increase. In the past two decades, for example, earthquakes and tsunamis have been

which in recent years has intensified efforts to guide climate-vulnerable countries in adopting Disaster Risk Reduction protocols (Albrito P., 2023). Shifting conditions and persistent climatic imbalance are pushing planet Earth beyond the safe operating space for humanity. Six of the nine boundaries related to climate and Earth system changes have been violated, underscoring the need to evaluate the impacts of anthropogenic factors on the Earth system within a complex systemic framework. Currently, anthropogenic disruptions to the environment – such as climate change, biodiversity loss, and pollution – are often addressed as isolated issues. This approach ignores the nonlinear interactions and resulting aggregate effects on the overall state of Earth system (Richardson et al., 2023). Extreme weather conditions and adverse atmospheric phenomena are becoming increasingly frequent, exerting a greater impact on daily life, undermining economies, and exacerbating social inequalities [Beck, 1986; 1992; Secchi, 2014]. Time appears insufficient to alter the trajectory of current, uncontrolled development, which is increasingly dependent on the exploitation of natural resources, despite the need for implementing measures to counter worsening conditions. (Heynen, Swyngedouw, 2003). Adverse environmental events and related risks are becoming more and more impactful. For these reasons they need to get comprehensive regulatory frameworks. Compliance with legislation, a commitment to sustainable development programmes through concrete actions aimed at strengthening territorial resilience, and an awareness of the delayed response by public institutions in addressing the climate emergency are essential conditions for tackling the current fragility of territories without further delay. At the national level, Italy is implementing measures that contribute to the enactment of European policies on environmental protection and on adaptation and mitigation strategies in response to climate change. [2]

2. Contexts of ongoing research: iNEST Spoke 4 [3]

responsible for 58% of casualties, causing huge economic losses; in 2022 alone, estimated losses as covered by insurance were around $120 billion [UNDRR, 2020].

[2] Here the list of the Italian government's measures aimed at achieving the European Agenda's climate neutrality goals by 2050: National Strategy for Adaptation to Climate Change (SNAC), which is the act expressly directed to address adaptation at the national level and was issued by the Ministry of Ecological Transition in 2015; Long-term Low-GHG Emission Development Strategies (2021); Plan for Ecological Transition - PTE (2022), which constitutes a National Plan for Adaptation to Climate Change as a tool for coordinating and updating a range of environmental policies, including those on climate change mitigation and adaptation. There are other relevant national acts on climate change adaptation with cross-cutting or sectoral character, including: Cultural Heritage and Landscape Code (2004); Environment Consolidation Act (2006); National Strategy for Sustainable Development (2017); Civil Protection Code (2018); Protect Italy Plan 2019-2021 (2018); Climate Decree (2019), which introduced provisions aimed, primarily, at defining a national strategic policy for combating climate change and improving air quality; National Plan for Hydrogeological Risk Mitigation (2019); National Integrated Energy and Climate Plan (NIPEC); National Plan for Recovery and Resilience - NRP, submitted under the Recovery and Resilience Device under the Next Generation EU (2021); National Plan for Prevention of Heat Effects on Health - Guidelines for Prevention (2019); PP9 Environment, Climate and Health Program - PNP 2020-2025 (2019); National Forestry Strategy (2022); National Biodiversity Strategy 2030 (2022); National Strategy for Sustainable Development 2022 (2023); Guidelines for Climate Audit of Infrastructure Projects in Italy 2021-2027 (2023).

[3] iNEST – Interconnected Nord-Est Innovation Ecosystem model is based on the extensive use of information and communication technologies and digitization, and aims at the development of innovative technologies for people's well-being and the dissemination of culture and economic and entrepreneurial growth. The research was co-founded by European Union – Next Generation EU, grant no. ECS00000043 – CUP J43C22000320006, Piano Nazionale di Ripresa e Resilienza (PNRR - IT), Mission 4 "Education and Research", Component 2, Investment 1.5, Interconnected Nord-Est Innovation (iNEST) Ecosystem, Spoke 4 (https://www.consorzioinest.it/en/city-architecture-and-sustainable-design-2/). In this context, the study being developed by the group of urban planners

iNEST is a consortium based on the extensive use of information and communication technologies and digitization, and aims at the development of innovative technologies for people's well-being and the dissemination of culture and economic and entrepreneurial growth. The research was co-founded by European Union - Next Generation EU. The research iNEST - Spoke 4 has as its object of study is the inter-regional territorial system of Triveneto: the macro-region of northeastern Italy, consisting of Friuli-Venezia Giulia (FVG), Veneto and Trentino Alto-Adige, being a key area for the Italian economy among the richest, with 12% of people,14% of GNP, and 20% of Italian exports (iNEST, 2023). The research team of the Department of Engineering and Architecture (DIA) of the University of Trieste, identified the territory of the Bassa Pianura Friulana (Lower Friulian Plain) as a case study (Figure 1), better defined as a pilot project task. It serves as a pivot between the whole project and its testing.

Figure 1: Low Friulian Plain in the context of Italy.
Source: the authors.

The Lower Friulian Plain serves as a sensitive indicator of physical changes resulting from anthropogenic transformations of the environment and ongoing shifts in climatic conditions, which generate risk situations linked to the increased frequency of extreme meteorological events (ARPA FVG, 2023). Its unique geographical position lies in being a low-lying coastal area facing the northernmost saltwater basin of the Mediterranean Sea, making it directly exposed to fluctuations in sea levels. The small urban centre of Marano Lagunare (45°46′ N; 13°10′ E; 2 m a.s.l.), situated on the shores of its namesake lagoon, is an ideal reference point for this situation. Additionally, the Lower Friulian Plain is characterised by the interplay between the advancing sea along a discontinuous coastline interrupted by lagoons, and an

affiliated with the Department of Engineering and Architecture at the University of Trieste (DIA) for the Spoke 4 - City, Architecture, Sustainable design, research topic 1 e 2. In particular, 11 'Ecosystems' projects were financed in Italy, for a total amount of 1.3 billion euros. These are networks of state and non-state universities, public research institutes, territorial public bodies, other highly qualified and internationally recognised public and private entities. Each Ecosystem intervenes in areas of technological specialisation consistent with the industrial and research vocations of the reference territory, both regional and supra-regional, in order to promote and strengthen the collaboration between research institutes, the production system and territorial institutions. iNEST refers to the Triveneto territory, and is divided into 9 'Spokes', i.e. specific thematic networks. Leader partner of Spoke 4 is the Iuav University of Venice. Active partners in the research are CORILA; CRESME and the affiliated Universities: University of Padua, University of Udine and University of Trieste - Department of Architecture and Engineering (DIA), where, as far as research topics 1 and 2 are concerned, the research unit referring to urban and territorial studies is co-ordinated by E. Marchigiani and sees the participation of S. Basso, P. Cigalotto, M. D'Ambros, T. Frausin.

extensive inland water system comprising rivers with varying seasonal flows and a dense network of irrigation canals that support an extensive agricultural economy.
Approximately 100,000 residents live permanently in this area, and in the summer season, its 130 kilometres of coastline attract over 3 million tourists. The exposure to risks from extreme meteorological events and anthropogenic pressures can lead to significant disruptions in the broad, everyday use of this territory (Figure 2).

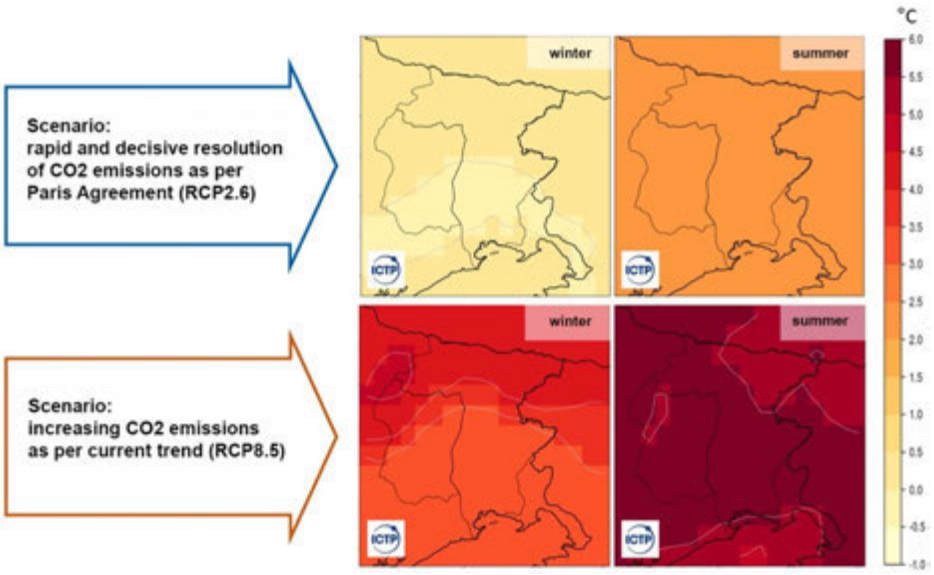


Figure 2: Increase in average temperatures in Friuli Venezia Giulia Region
at the end of the century under two different scenarios (2071-2100).
Source: ARPA FVG Regional Agency, 2018.

3. "Networks" and "ecologies" in the Lower Friulian Plain. Territorial functioning at various scales

The Lower Friulian Plain coincides with a vast intermunicipal territory (754 sq. km, 97,856 inhabitants; ISTAT, 01.01.2023) that corresponds to an extensive inter-
municipal territory encompassing 34 municipalities and situated between the Tagliamento River to the west – one of the main rivers of northern Italy – and the Isonzo River to the east; the Adriatic Sea to the south; and to the north the first inhabited strip
of a low wetland intersected by a line of resurgent waters. The profile between land and water presents a low coastline and a double overlook of a lagoon and marine environment. The coasts

present sandy beaches from marine and fluvial deposition, sloping into the shallow waters of the Upper Adriatic and heavily anthropized at the coastal urban centres of Lignano and Grado. Overall, the lagoon system covers about 16 q km (length 32 km; average width 5 km). It is possible to interpret the structure of this territory through a dual perspective. One approach describes the area in terms of "networks." The other, in a complementary fashion, uses the concept of "ecology" to characterise this territory. Here, we employ the term "ecology" not in a strictly scientific sense, but rather as a descriptive method, akin to the usage adopted by Reyner Banham in the past. [4] Furthermore, as a compelling interpretative metaphor for the complexity of urban habitats, natural ecosystems, and their interconnections, it is essential to clarify that the term "ecology," as applied in this phase of analysis of settlement systems in the Low Friulian Plain, does not imply an ecological interpretation of the natural environment of human beings. It is, however, valuable to refer to Richard T. T. Forman, who has recently explored the concept of Urban Ecology in a way that helps refine the understanding of "ecology" and the approach of "ecological reading" proposed here. [5]

The network system primarily defines the Low Friulian Plain and is structured through four main networks: the *mobility network*, the *environmental net*work, the *energy network*, and the *water network*. The *mobility network* is defined by a complex infrastructure system with different densities. In the east-west direction, major roads and rail routes — forming one of Europe's infrastructural corridors — connect tourist and industrial hubs along the coast. In the north-south direction, there is a more intricately layered local network close to the rivers. Running parallel to the Trieste-Venice route and along the Stella and Cormor rivers is an extensive network of rural roads supporting the slow-paced road network.

The environmental network is defined by the Marano and Grado lagoons and the remnants of lowland forests, which serve as key nodes within a network of protected areas classified under the EU Natura 2000 legislation. Rivers and canals act as potential ecological corridors that extend inland, taking on the character of linear parks (e.g.: Parco dello Stella). The *energy network* defines a territory that is transitioning from being a consumer of externally produced energy to an active player in clean energy self-production. This shift is driven by the rapid expansion of photovoltaic fields, supported by private initiatives, alongside biogas facilities and

[4] Borrowed from the context of natural science disciplines, the term "ecology" has long been part of the vocabulary of urbanism and planning and is used to observe, read and interpret space and place. In particular, the direct, learned, and innovative reference is to the word "ecology" used by Reyner Banham when describing the city of Los Angeles in 1971. In Banham's famous text, "ecology" is understood as a product of the interaction between physical features of a place, environmental elements, climate and forms of living, between physical and cultural landscapes. Banham understands and uses reading for ecologies by considering the different fabrics and structures of an urban setting as a whole. What the author introduces is the idea of considering settlement systems in relation to their own "ecology" that identifies them by inherent socio-spatial characteristics: that is, within a geographical, social and historical context. Reading by ecologies in this sense stands as a method of study and at the same time "an open scheme, suitable for heterogeneous observation and heterogeneous subjects" (Vidler A. in Banham, 2009: XXVIII). It restores the characters and conformation of places according to the perspective of their possible evolution. Reflection focus on the overall configuration of the observed settlement systems. The ecological study presupposes the recognition of possible spatial units, Banham would say.

[5] In Forman's definition, "Urban ecology studies the interactions of organism, built structures, and the physical environment, where people are connected. (...) Built structures are a key to urban ecology. Organism-environment interactions are simple ecology, whereas inserting buildings and roads into the interactions transforms the subject to urban ecology" [Forman T. T., 2014: 3-4]. This assumption moves from the hypothesis that settlement systems are describable as different spatial type mosaics where flows and movements through the mosaic create a dynamic system - again to refer to Forman. (Forman, 2014: 4) and to emphasize the effectiveness and importance of proceeding according to an interpretation and reading by 'ecologies'.

hydroelectric intakes. The *water network* in the Low Friulian Plain is characterised by a scarcity of aqueducts, replaced largely by artesian wells, which are frequently associated with private users.

The extraction from aquifers for residential, industrial, and agricultural purposes is widespread and substantial, leading to increased waste and growing challenges in resource management. The sewage disposal network is connected to a system of wastewater treatment plants, which come under strain during the summer. From a morphological perspective, when observed from a distance, the networks overlap within a framework of complex and diverse structures, shaping the configuration of a sprawling, low-density urban landscape. Within this spatial organization of the territory, reticular system of urban patterns lacking clear geometric order are discernible, featuring clusters of varying sizes that are mostly disconnected from main linking routes (Secchi, 1995).

The "ecologies" of the Low Friulian Plain are conceptually understood as territorial areas where settlement structures are complementary and interdependent, in relation to infrastructure systems and natural elements – the blue and green networks – to which they are linked. As mentioned, this definition is metaphorical, and here it is evoked with a renewed interpretation. The aim is to ascribe to the term "ecologies" a meaning as epistemologically robust as possible. In this context, an "ecological reading" highlights and explores the potential to advance the study of settlement systems by introducing the necessity of adopting new descriptive frameworks. These frameworks would enable a deeper understanding of territorial structures, addressing future interpretative and design challenges. In this context, within the territory, it is possible to describe various intersecting and overlapping territorial ecologies, layered upon one another with multiple points of conflict, understood as "critical frameworks" that draw attention to the interactions between human and non-human agents across different scales, the dynamic relationships between the biosphere, ecosystems, populations, and communities, and their vulnerabilities (Centis et al. 2024). These interactions make the Low Friulian Plain a distinctive case study for exploring the dynamics of a coastal territory, which here extends beyond a conventional urban waterfront to encompass a vast, evolving landscape. From the inland to the coastline, some "ecologies" are recognized: (i) the "productive cities of the European corridor" formed from a large-scale comb-like infrastructure (motorway and railway) of European significance, which connects to the industrial port area of Porto Nogaro. This area is traversed by substantial international commercial flows that extend seaward along the intercontinental routes of the Adriatic; (ii) the "inhabited street" aligned with State Road 14, along which lies a string of service centres and dispersed recent developments that have lost their historical connection with the ancient waterways system. However, these areas remain threatened by opposing phenomena of flooding and the risks associated with the increasing emerging of heat islands in urban context; (iii) the "city on water" which consists of small-scale territorial infrastructures linked to subsistence economies, particularly those associated with inland waters. These include landing stages with minimal facilities designed to accommodate small boats, areas for fishing and lagoon activities, small docks, fishing ponds, and traditional lagoon huts (known as *casoni*). Within the complex interaction between freshwater and saltwater, it becomes crucial to address the relationship between water infrastructure and the inhabited system structure; (iv) "leisure and tourism city" economically based on temporary tourist accommodation in coastal resorts, large-scale tourist camping village, and cultural attraction urban centres (e.g., Aquileia), all of which are threatened by storm surges and rising sea levels. In the background of this portrayal, shaped by interconnected and overlapping ecological systems, one can distinguish the rural settlements and the scattered isolated farmhouses of land

reclamation, largely abandoned and reduced almost to ruins, fallen into disrepair. The conflicts between the various ecologies are concentrated at the land-water interface, along the perimeter surrounding the lagoon, which constitutes a fragile area, radically transformed over the past century and subject to a range of diverse risks.

4. Lower Friulian Plain: the hydraulic machine and blue nets of a high-risk artificial territory

The Lower Friulian Plain represents the northernmost land of the Mediterranean, bordered by a body of saline water and directly exposed to fluctuations in sea level, with varying altitudinal levels. Until the mid-19th century, the landscape was defined by extensive floodplain forests and permanent meadows, [6] which have since been reduced to isolated fragments of natural habitats. Over time, the Lower Friulian Plain has been altered through the drainage of marshes, rivers and streams forced within their own embankments, the construction of canal infrastructure, and, lastly, the practice of agriculture. This has led to a comprehensive and systematic regulation of surface waters and the reshaping of these territories. A new spatial configuration was gradually consolidated, largely through significant land reclamation projects, predominantly carried out during the 20th century. [7] The aim was to make the land agriculturally productive and to strongly structure the territory, reshaping the landscape forms and imposing a new rationalised design of the land composed of a limited number of elements and materials (Feruglio, 1926; Feruglio, Mori, Soresi, 1931).

A system of agricultural enterprises with medium- to large-scale cultivated fields thus characterised the new configuration of the natural and productive open space system, leading to the development of an economy based on intensive monoculture (Felcher, Strazzolin, 2019; Zilli, 2019).

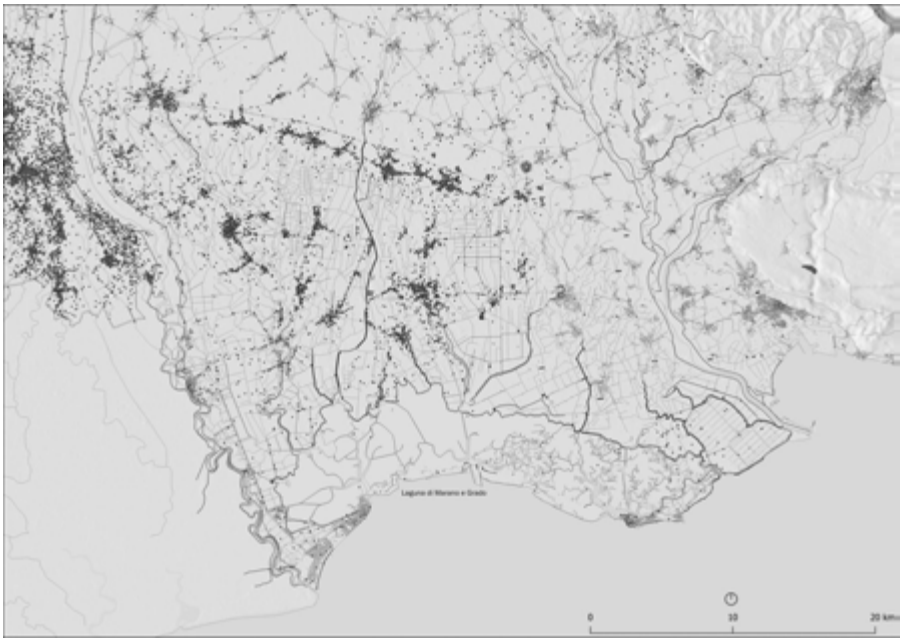
In the management of the territory, the priority has always been the collection of water to control its flow, initially slow and natural, then regulated and distributed in a rationalised manner through irrigation and reclamation works on an ever-increasing scale. The natural order of the past wetland environments has been disrupted and reduced to an artificial order, tending to separate the natural environment from the anthropogenic and agricultural space.

Today, the defining yet almost imperceptible characteristics of this territory are its topography and an extensive, strategically distributed network of mechanical water-pumping stations. The relatively uniform elevation ranges from approximately 10 metres above sea level in the spring zone, gradually descending southward to reach levels around zero hydrometric elevation. In the peri-lagoonal area, the terrain of the Low Friulian Plain falls below sea level. Currently, the Pianura Friulana Land Reclamation Consortium (Consorzio di bonifica Pianura Friulana) is one of the principal monitors and managers of this territory. It oversees coastal defence embankments and conducts maintenance operations across nearly the entire lagoonal boundary, which spans 80 kilometres, along with an additional 500 kilometres of embankments along

[6] From a comparison of Anton Von Zach's Kriegskarte (1798-1805) and Giuseppe Malvolti's Map of Friuli (1818), it is possible to see how wooded areas and stable meadows begin to shrink in extent.

[7] The reclamation of this territory is an ancient fact. In the past, its conformation was modified by natural phenomena (river floods, coastal deposits and bradyseismic movements) and as result of actions to drain swampy lands and marshes. The first systematic and most important operations can be traced back to the interventions made by the Republic of Venice from the 16th century onward.

major rivers flowing in the consortium's jurisdiction. [8] In total, the area under management extends over 78,277 hectares – representing approximately one-tenth of the entire surface of the Friuli Venezia Giulia Region – subjected to constant monitoring and safeguarding measures. [9] Based on the type of water runoff flowing across the area, the Consortium's territory is divided into zones of natural drainage, alternating drainage, and mechanical drainage. [10] In the circum-lagoonal area, 23,700 hectares correspond to depressed zones; here, water must be constantly removed and mechanically lifted by pumps, [11] as the land is situated below mean sea level or below the average hydraulic head of the main watercourses that naturally drain the territory, and, in any case, below the maximum tidal level (CPBF, 2021; Felcher & Strazzolin, 2019; Tosoratti, 1997) (Figure 3). In the second half of the 20th century, the prevailing development paradigm fostered an expansion of the territory, which now reveals an insufficient degree of infrastructure and spatial configurations required to enhance its efficiency and manage its resources effectively, particularly concerning water usage, agricultural land, and the growth of residential settlements. Describing the soil of this territory as a sort of "hydraulic machine", capable of managing water use and drainage with high efficiency, brings to light a paradox. To understand this, it is essential to consider the extensive network of pumps distributed mainly in peri-lagoonal areas,



[8] Example of this are the embankments along the entire lagoon front between the Tagliamento River and the Isonzo River raised to a height of 3 meters above mean sea level after the 1966 flood.
[9] The Consortium also controls the High Plain area above the resurgence line, which covers an additional 123,127 hectares.
[10] Natural and mechanical drainage channels cover a total of 2,228 km.
[11] On the territory of the Lower Friulian Plain there are 33 water-water plants with a discharge capacity of 163 m3/s and a consumption of about 5 million kWh/year; irrigation plants consume 16 million kWh/year.

Figure 3: Built-up areas, hydrographic network, embankments,
water wells, reported water pumps, aqueducts of the Lower Friulian Plain.
Source: the authors with Cristian Crovatto, 2024.

which keep the Low Friulian Plain dry by discharging water into rivers and the sea, preventing potential flooding. Added to this are the increasing demands for potable water for domestic, agricultural, and industrial uses, with substantial extraction from the groundwater table, which risks progressive depletion. [12] Moreover, the water supply and sewage networks require evaluation, as parts need modernisation and are insufficiently deployed to serve the entire urbanised area, particularly with significant gaps in the peri-lagoonal zones. [13]

This paradox becomes evident when observing that, despite extensive infrastructural development, the Low Friulian Plain is inadequately equipped to handle water emergencies (Zini, 2011; Bendoricchio, 2024). The critical environmental conditions are further exacerbated by widespread subsidence and saline intrusion, which are poorly monitored phenomena. [14] One longstanding risk in this region, now intensified by climate change, is river flooding. Hydraulically, this area presents distinctive characteristics (Figure 4).

[12] The left Tagliamento zone is in semi-equilibrium quantitatively because withdrawals are theoretically offset by recharge; however, the drawdown of water to the right Tagliamento zone depletes the quantities available on the left.

[13] The CAFC Spa - Acque del Friuli is in the process of drafting an Aqueduct System Interconnection Masterplan that envisages future scenarios of the aqueduct system in the FVG Region and Eastern Veneto, identifying interconnections and future sources of supply to the system in order to increase the degree of resilience of the entire FVG aqueduct system, and as a single model for monitoring intake works and drafting Water Safety Plans.

[14] Both phenomena are not extensively monitored: there are no updated large-scale data to formulate aions to counteract their effects.

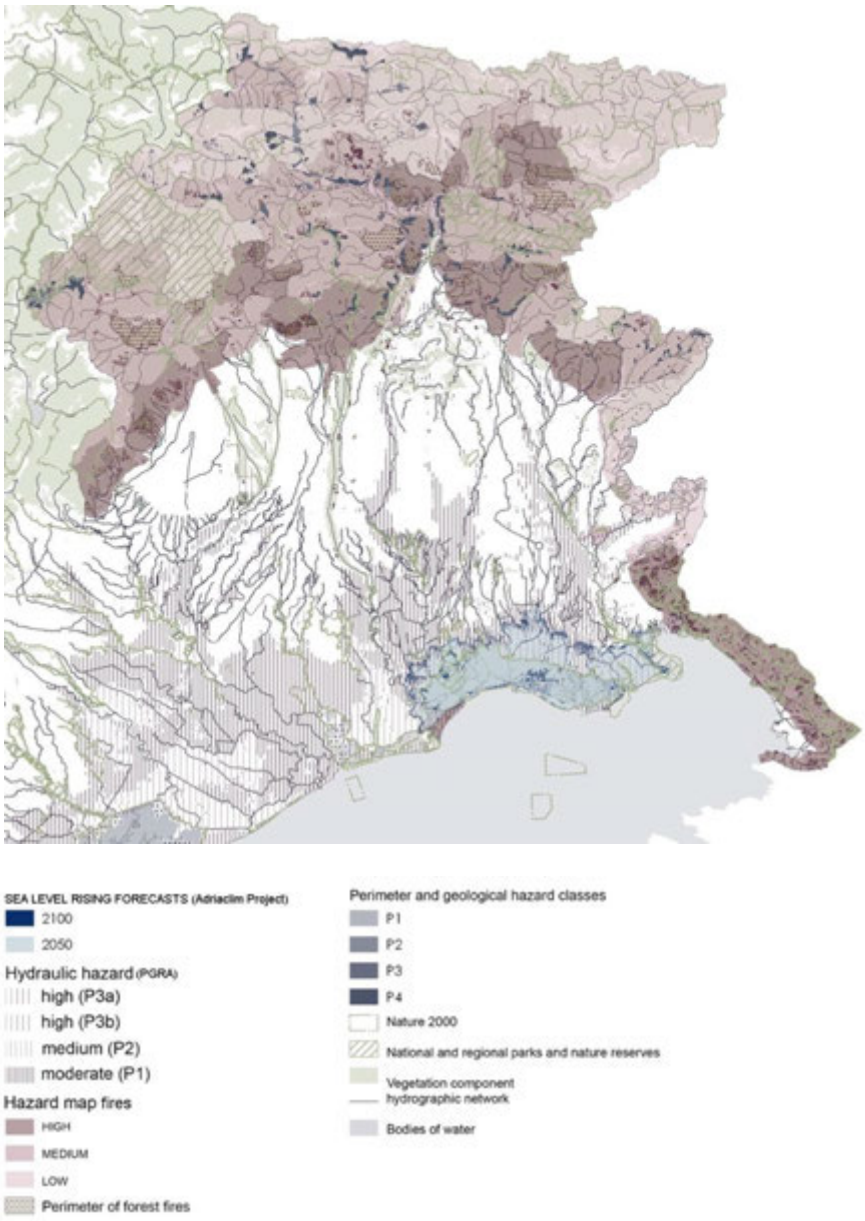


Figure 4: Vulnerabilities in Friuli Venezia Giulia Region.
Source: the authors with Eleonora Ceschin, 2024.

The short distance between the Alps and the sea, high rainfall in mountainous areas, the torrent-like nature of rivers with sudden surges, and the presence of spring-fed rivers have historically led to recurrent flooding issues, exacerbated by current climatic change. Coexisting with risk

has been a long-term feature of lowland territories. The canalisation and embankment works on rivers, predominantly found in these areas, do not provide an adequate solution to problems rooted in the past, nor can they effectively address the increasing risks anticipated in the future. The reduction of river flows due to hydroelectric diversion and other extractive uses appears to have indirectly caused the raising of riverbeds, increasing flood risks during extreme events. In the predominantly artificial hydraulic network of the upper and lower plains, there is ongoing debate to restore and to rewild segments of the "blue network" as an alternative to the construction of "grey infrastructure" solutions, such as flood detention basins. From the perspective of climate neutrality, devising alternative configurations for this territory entails rethinking territorial hierarchies, beginning with the establishment of new spatial relationships between environmental and anthropogenic components within a framework of expansive open spaces (Secchi, 1989). This approach must also acknowledge the current 'environmental phase' of land reclamation (Duca, 2003), which calls for a renewed dialogue with the agricultural landscape.

5. Across the River and Into the Trees: the uses of soil, ecological network and risks

Forests, meadows, rivers, and the lagoon were once the components of a lush, silvo-pastoral environment that characterised the plains below the spring line. The lowland forests, primarily oak woodlands, extended across the intermediate zone, forming
integral elements of a socio-economic system that spanned thousands of hectares until the First World War. Other woodlands occupied the spring belt and riverbanks, with sediment deposits gradually shaping the plains. To the north of the forests lay a belt of wet meadows, springs, and marshes; to the south was the shifting boundary with the lagoon. As recently as 1850, 58% of the circum-lagoonal area was covered by pastures, forests, and marshlands, with only 28% devoted to arable land. Large tracts of communal land allowed an organisation of isolated rural villages within a landscape half cultivated and half uncultivated. The abolition of rights over communal land disrupted this social balance, reducing many community members from land-users to rural proletariat. Simultaneously, by the late 19th century, a class of medium and large landowners and agribusinesses emerged, initiating a transformation of the landscape. With the construction of water pumps along the peri-lagoonal belt from the late 1920s onwards, many transitional wetland areas were reclaimed, while northern zones remained marshy. The hydraulic reclamation planned between the two World Wars was partially completed only after 1950. Meadows and forests disappeared, along with
marshlands, pastures, and ponds that once constituted a complex transitional environment between the open lagoon and cultivated highlands. The current landscape (Figure 5) reflects an industrialised agricultural environment of low ecological value, where only a few remnants of isolated lowland forests remain. Rivers have been channelled, and peri-lagoonal embankments demarcate the lagoon. Some protected areas (Natura 2000 Network) at river mouths preserve isolated sites of great

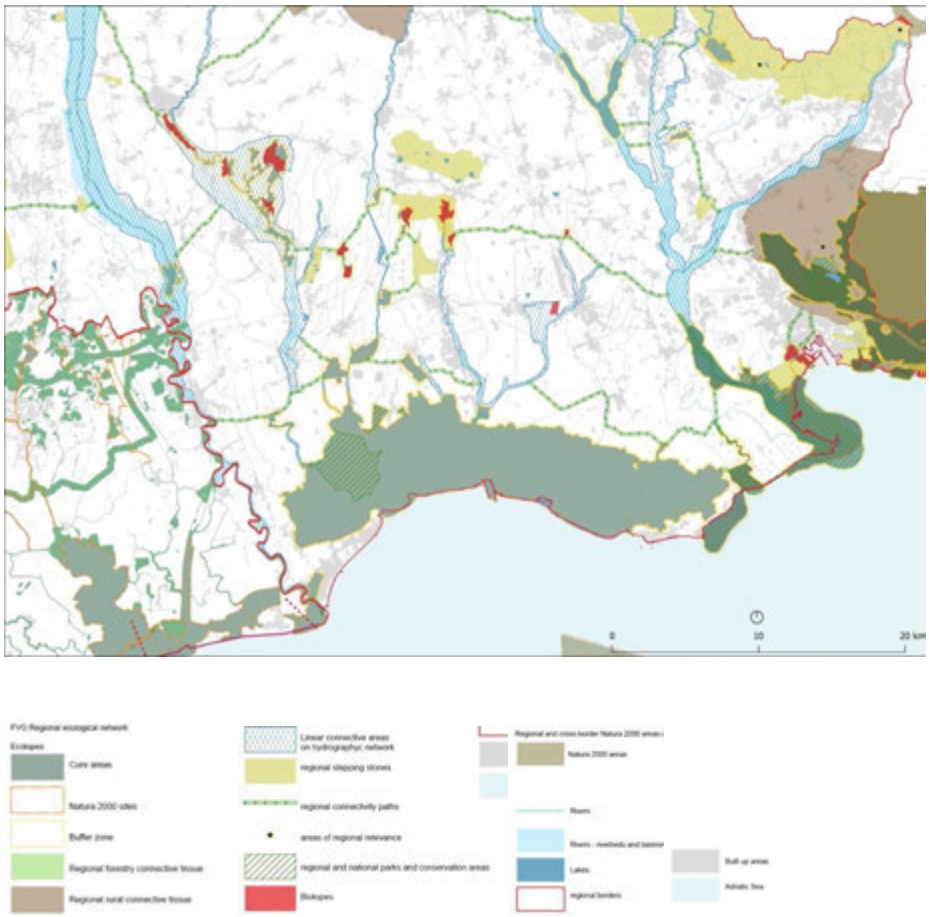


Figure 5: Ecological network of Lower Friulian Plain from the Project of Regional Landscape Plan, 2018. Source: the authors with Eleonora Ceschin and Cristian Crovatto, (elaboration of IRDAT data), 2024.

ecological richness. In recent years, projects have been initiated to strengthen and restore a more extensive ecological network and to reconnect forests, rivers, and the lagoon. A persistent risk, now heightened by climate change, is river flooding, a unique hydraulic challenge in this region. In the same way, Nature-Based Solutions (NBS) are being considered, for example, to address the risks of declining pollinator populations and biodiversity loss, a particularly serious issue in the highly simplified landscape of the Low Friulian Plain dominated by intensive agriculture. Some projects propose solutions involving the restoration and enhancement of landscape heterogeneity and the development of ecological networks of multifunctional natural and semi-natural areas, including forested zones.

6. Networks and ecologies at risk

"Networks" and "ecologies" – describe in paragraph 3 – are subject to severe challenges and increasing risks, with varied implications depending on the morphology and resilience of the affected areas (Figure 6). It is essential to examine the impacts of changes in both natural and human-modified environments in diverse contexts, primarily driven by climate change. A key objective of the ongoing research is to identify the specific impacts and, consequently, the necessary mitigation or adaptation measures to be implemented. While this section does not detail that aspect of the work, it is possible to highlight the most critical issues and project domains within which to construct a framework for reflection on a macro scale of the territory, to guide future work and suggest further avenues for investigation. At present, three key issues can

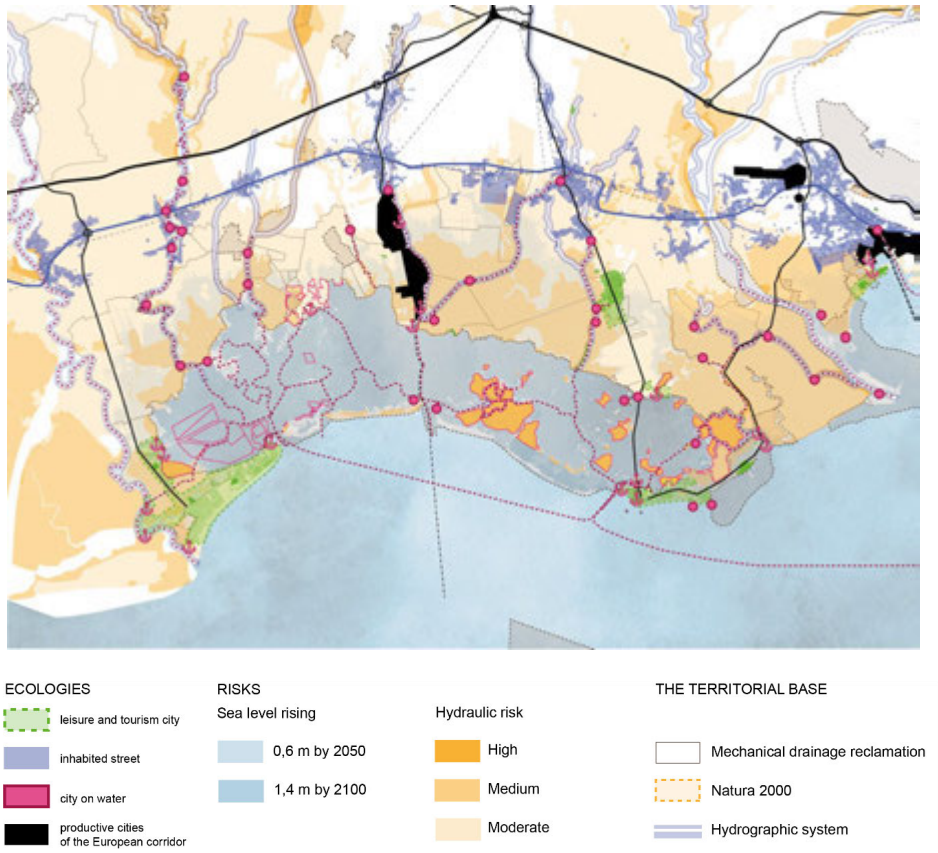


Figure 6: Ecologies, risks, hydraulic hazard (PGRA), Sea level rising forecasts (Adriaclim Project), network of the Lower Friulian Plain (Project of Regional Landscape Plan, 2018).
Source: the authors with Eleonora Ceschin and Cristian Crovatto, 2024.

be considered, without prioritising their order, to structure the perspective: 1) sea-level rise, 2) water abundance and scarcity, and 3) rising temperatures. These are among the most significant

macro-level issues directly affecting the Lower Friulian Plain. Together, these factors contribute to increased risk levels, and their combined impact implies a deterioration in living conditions across different contexts. In particular, the risks associated with rising mean sea levels primarily affect the "leisure and tourist city" and the "waterfront city." These two "ecologies" are impacted differently due to their direct exposure to tidal variability. For instance, on the coast, seasonal storm surges are becoming increasingly frequent, directly impacting urban centres like Lignano and Grado. The western coastal zone, characterised by sandy terrain, offers limited protection to urbanised areas, at the cost of erosion and the need for continual seasonal beach replenishment. [15] To the east, situated on an island, nearly all of Grado's urban area is inevitably exposed to the cyclical effects of tides (Bezzi et al., 2021). On one hand, water scarcity is intrinsically linked to these areas, largely due to the high seasonal influx of tourists, which significantly increases potable water consumption during the summer, concentrating demand during a short period compared to the rest of the year. During the summer season, the number of tourists stays averages over 3 million, primarily concentrated in the two main seaside centres of Lignano and Grado. On the other hand, the abundance of water resulting from heavy downpours predominantly challenges urbanised areas with higher levels of soil impermeability. The peri-lagoonal area, extending towards the hinterland, is also subject to potential flood risks due to the pronounced altimetric depression that characterises it. Continuous embankments protect one-third of the Low Friulian Plain from the average sea level, which is approximately 2 metres above the zero sea level mark. To ensure continuous protection against water intrusion and backflow, there are also 33 pumping stations [16] that enable this extensive territory to remain dry. A network of 2,228 km of natural and mechanical drainage channels further supports its proper functioning. The productive cities within the "European corridor" and the service and residential centres defining the ecology of the "inhabited road" appear to be more protected from the aforementioned emergencies. While not immune to the risks of water accumulation and drought, they are better equipped; unlike the peri-lagoonal areas, which are less serviced, this part of the plain benefits from a more extensive potable water distribution network. Rising temperatures and the resulting formation of heat islands affect the urbanised areas across all the described ecologies, with the greatest impact where proximity to natural areas is limited or where urban greenery is scarce. It can be said that the inner zones—aligned with the ecologies of the "productive cities" within the "European corridor" and the "inhabited road"—where urban mobility is highest due to extensive infrastructure, experience a higher concentration of heat islands as average seasonal temperatures increase.

7. Conclusion

As environmental degradation intensifies and climate change becomes a result of this worsening condition, it is imperative to reconsider environmental networks, especially in coastal regions. Certain issues emerge as evaluation markers in ongoing research, underscoring the need to develop hypotheses that go beyond mere concepts. There is an urgent need to rethink the relationship between humans and the environment, not as a matter of separation, but by

[15] Studies by the Region FVG have estimated the amount of sand needed for seasonal nourishment of the shoreline at 70,000 cubic meters, which grows to 200,000 cubic meters following storm surges). Con-causing the reduction of the sandy shoreline cordon is the confluence of the mouth of the Tagliamento River, which affects a large area, increasing the risks due also of possible freshwater flooding.

[16] The discharge capacity of the water pumps is 163 m3/s. Their consumption is about 5 Million kWh/year.

seeking strategies that foster improved coexistence. This includes exploring new frameworks that complement the concept of networks, such as the mosaic, kaleidoscope, or pluriverse (di Campli, Gabbianelli, 2022). The research is oriented towards a project concept based on relationships between different ecologies, practices, and forms of inhabitation. This presents an opportunity
to rethink networks in relation to climate change by considering at-risk zones as potential new core areas, expanding spaces of naturality. A significant advantage lies in the potential to integrate biodiversity considerations across all areas of planning, rather than confining them solely to green and blue networks. Connecting different areas within the territory to build landscapes does not necessarily require spatial continuity, but rather complex, multi-layered design approaches capable of establishing multidisciplinary, multi-scalar relationships. The spatial challenge is to activate biodiversity and new settlement forms across various ecologies: in industrial areas, residential zones, standardised areas, and particularly in agricultural regions. A priority, on one hand, is to redefine spaces for experimentation where urban and territorial projects can be re-evaluated, initiating a collective debate supported by design explorations and prototype formulations. As Viganò (2023, p.145) notes, "the design of the transition requires changes that we are not politically and economically equipped to implement and legislate." On the other hand, there is a need to develop shared visions and projects across different levels of public administration and multidisciplinary expertise, capable of designing across multiple scales rather than in a fragmented manner. The EU's missions provide clear guidance, offering a new approach to addressing some of Europe's most significant challenges. In this regard, Friuli Venezia Giulia stands out, being one of the few Italian regions to join the first of the five missions, "Adaptation to Climate Change," with the objective of achieving climate resilience by 2030, promoting innovative solutions for climate adaptation, and supporting cities and communities in building a more resilient society.
Planning must manage the coexistence of differences (worlds, species, social groups, etc.) rather than their separation. To this end, the Friuli Venezia Giulia Region established the "Technical-Scientific Working Group on Climate" in 2022. In the case of the Low Friulian Plain, attention is focused on at-risk areas, with 75.2% of the territory vulnerable to flood or sea-level rise risks. The emphasis is on a project centred around the reorganisation of water resources across various scales. For instance, the concept of *a net zero water territory* should become a shared objective, not only for the Low Friulian Plain. In this context, viewing all at-risk areas as project opportunities allows new themes to be incorporated into territorial planning efforts.

Attributions

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Track 18: Actor Constellations

ACTOR CONSTELLATIONS - Public, private and third-sector actors in planning processes

Chairs:

- Martine Drozdz, Ecole des Ponts ParisTech
- Stefanie Dühr, University of South Australia
- Sila Ceren Varis Husar, Slovenská technická univerzita v Bratislave

Keywords: *planning agencies, consultants, public participation, power relations, urban politics, local democracy, planning knowledges*

Public sector planning agencies are today operating in a shared power world. Declining capacities (and with it often declining in-house expertise) in the public sector have contributed to the rise of private sector consultants playing an increasingly significant role in plan-making and development assessment processes. At the same time, community groups and associations have become more concerned with changes to their urban environments, sometimes resulting in opposition movements that may significantly delay the implementation of urban development projects.

In this track, we are interested in the relationship between these different groups of planning actors and how their interactions are shaping planning decisions and urban development outcomes. We invite conceptual and empirical contributions that shed light on the sometimes conflicting and sometimes cooperative relationships between these actors. Contributions that deal with the current practices around how information and knowledge are produced and used by different actors in planning processes are welcome. In this track, we are keen to discuss the implications of the changing landscape of planning actors on the approach to managing urban planning processes and on the distribution of power between different actors in determining urban development outcomes.

Governance

Innovations in Semi-Formal Tools and Multi-actor Cooperation for Urban Design Governance: The Practice of City Chief Designer System in China

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Abstract: Urban design governance is the process of state-sanctioned intervention in the means and processes of designing the built environment in order to shape both processes and outcomes in a defined public interest, advocating for the establishment of a system of actions and decisions composed of diverse entities. The current development trajectory of Chinese cities has shifted from a period of rapid growth to a phase of high-quality development focusing on stock space, and urban design as a mode of planning and control has received more and more attention. A new form of urban design governance has emerged in key areas of development in some mega-cities—the City Chief Designer system. The City Chief Designer system serves as a semi-formal governance tool, bridging the gap between the hard-power governance of government authority and the soft-power governance of non-governmental organizations. This study divides the development of City Chief Designer system into three stages: the implicit development period, the establishment of the mechanism period, and the optimization and adjustment period. It summarizes the practical role of the system in driving the effectiveness of urban design operations, and investigates the interactive relationships among diverse participants. The study dissects the role of the system as a semi-formal design governance tool, analyzes power shifts and institutional reforms, and discusses the problems of the system, aiming to provide insights for optimizing the governance system of future urban design.

Key Words: Historical institutionalism; Urban design governance; Semi-Formal Tools; Multi-actor cooperation; City Chief Designer system

1 Introduction

By 2023, China's urbanization rate had reached 66.16%. The continued rapid urban development has also brought about a series of new problems and challenges, including inefficient resource utilization, environmental pollution, and loss of regional culture. Currently, China's urban construction is transitioning to high-quality development. Urban design, as a professional means of providing higher-quality urban living environments and public services (Wang and Liang, 2024), has received significant attention in recent years for its ability to meet the demands of high-quality development in the new era. The "Guidelines for Urban Design in Territorial Spatial Planning" issued in 2021 pointed out that "urban design is an important component of the territorial spatial planning system, a vital support for high-quality development of territorial spatial planning, and runs through the entire process of territorial

spatial planning, construction, and management."

At the same time, improving the urban governance system, enhancing urban governance capabilities, and increasing urban quality and competitiveness are trends in urban development. Urban design governance, as an important aspect of improving urban governance capabilities, has gradually attracted attention. Coordinating planning, construction, and management is an important manifestation of the modernization of the urban governance system and governance capabilities. In recent years, various regions in China have carried out a large number of urban design practices, but they face many challenges during the implementation phase, including the ineffective resolution of discrepancies between the implementation of urban design at the meso- and micro-levels and the existing institutional framework.

The position of City Chief Urban Designer represents an important innovative exploration for China in promoting high-quality urban development and transitioning urban design governance. A systematic study from this perspective can provide an intuitive understanding of the semi-formal tools and the composition and relationships of multiple stakeholders in China's urban design governance.

2 Governance turn of urban design in China

2.1 Traditional urban design

The concepts and methods of modern urban design were introduced to China at the end of the last century. Traditional urban development primarily relied on regulatory planning as the main control method, and urban design mainly followed architectural traditions, with morphological design directly affecting urban spatial forms.

2.2 Urban design regulation

Due to the involvement of a series of public interest motivations in urban design, state intervention has become increasingly widespread, and the depth and manner of state intervention have also been continuously changing. The normative guidance approach, which is too extensive and lacks targeted regulatory planning as a control method, has brought about problems such as resource waste, infringement of public interests, and environmental pollution. Urban design is considered to be able to optimize these issues, and its importance as a public policy has begun to emphasize the implementation of design control based on public spaces (Wang and Liang, 2024). During this period, a series of urban design transmission mechanisms such as technical guidelines and additional regulations emerged. The principles of urban design were incorporated into local urban planning technical management regulations or directly into regulatory planning. As technical management regulations and regulatory planning are the statutory basis for local scheme review and management, the incorporated urban design principles also have a certain legal effect, guiding and controlling specific development and construction activities to a certain extent. However, this model faces implementation issues

such as technical formalization and blurred lines between rigidity and flexibility in urban design control, and its effectiveness is not as expected.

2.3 Urban design governance

The current role of the Chinese government is shifting from directly intervening in economic and social affairs to providing public services, formulating rules, and maintaining fairness as regulators. It emphasizes government efficiency and responsibility, promotes public-private cooperation, enhances transparency and public participation, and is undergoing a transformation from management to governance. National recognized interventions are implemented in the methods and processes of built environment design to ensure that the design process and results better serve the public interest, and it is recognized that the process of design governance should be continuous and permeate through all stages of a project from inception to completion.

In response to the difficulties in coordinating interests, vague evaluation standards, inadequate technical responses, and difficulty in grasping intervention intensity in the urban design operation process, the renowned British urban design scholar Matthew Carmona proposed the concept of "design governance" in 2016. Design governance is the application and extension of governance concepts in the field of urban design, providing references for the development of transitional period urban design in China (Feng, 2021). Urban design governance is the process of state-sanctioned intervention in the means and processes of designing the built environment in order to shape both processes and outcomes in a defined public interest (Carmona, 2016). This concept advocates for establishing an action and decision-making system composed of diverse actors such as experts, investors, and citizens around the government, and optimizing the urban design operation process through formal and informal governance tools (Zhu and Tang, 2019). Essentially, it explores the basic principles of state intervention in urban design.

2.4 Semi-formal urban design tools

In the field of public policy research, government tools refer to various instruments, methods, and actions adopted by decision-makers to guide environmental and organizational actors in achieving specific policy outcomes. Since the 1990s, the rise of neoliberalism has led to a proliferation of available government tools, with tools or means to address public policy issues rapidly spreading. Some scholars have used typological approaches to study and classify existing government tools (Hood, 1983; McDonnell and Elmore, 1987; Schneider and Ingram, 1990; Salamon, 2000; Lascoumes and Le Gales, 2007). Schuster proposed five categories that could represent the "implementation of government urban design policies," namely operations, regulations, incentives, establishment, and information (Schuster， 1997). Based on this, Carmona categorizes design governance tools into formal and informal. Traditional formal design governance is primarily led by government departments, utilizing formal government tools such as laws, regulations, technical standards, and public policies to intervene in urban

material environments through planning and design, thereby ensuring that the design process and results align with the public interest. It is a "hard" governance approach relying on government power. Informal design governance tools represent methods used by third-party organizations, other than the government and the public, to indirectly participate in the urban design process. These methods lie between "traditional" design management and "private" corporate management, lacking legal safeguards and constraints. They constitute a "soft" governance approach intervening in the design and implementation process of the built environment. (Table 1)

Since urban design implementation in China is integrated into the planning management process, it possesses most attributes of formal design governance. However, due to the government's not necessarily possessing the strong professional capabilities required for urban design, and the relatively low level of development of non-governmental institutions in China, there exists a "semi-formal" design governance state (Wang, 2022). The government commissions professional technical organizations or teams to complement formal design governance, authorizing non-governmental department teams or organizations as leading actors in the multi-stakeholder governance network, and employing a mix of formal and informal design governance tools for design intervention. Semi-formal design governance practices currently emerging include the Chief Urban Designer system, community planner system, etc.

Table 1 Characteristics of formal, semi-formal, and informal design governance tools

	Governance entities	**Governance tools**	**Governance approaches**
Formal design governance	Government planning management departments take the lead.	Primarily utilizes formal tools such as laws, regulations, technical standards, departmental regulations, and administrative permits.	Relies on the power-based "hard" governance approach.
Semi-formal design governance	Non-governmental public institutions, but government-funded.	Combines formal and informal design governance tools.	A "flexible" governance approach between "hard" and "soft".
Informal design governance	Non-governmental organizations or citizen groups.	Primarily relies on informal governance resources and tools such as research and advocacy.	A "soft" governance approach relying on informal resources.

3 The Connotation and evolution of the City Chief Designer System

3.1 The connotation of the City Chief Designer System

The City Chief Designer system originated from the need to address the temporal and spatial separation issues in urban design formulation and implementation. Similar practices include the collaborative system of architects in the United States, coordinated architects in

France, expert advisory teams in Germany, and chief supervising designers in Japan. The City Chief Designer system entails local governments hiring experts and their planning and design teams to serve as regional city chief designers. These designers, commissioned by the government, leverage their professional technical expertise to provide services such as technical coordination, professional consultation, and technical review during the urban design and implementation processes in designated areas. This ensures that public interests are not infringed upon and that designs are effectively implemented. Essentially, this system serves as a flexible supplement under the rigid top-down control regime of government management departments. It aims to promote effective coordination between management and technology through institutional improvements, thereby better safeguarding core elements such as public interests, exhibiting characteristics of semi-formal design governance tools.

3.2 The evolution of the City Chief Designer System

This study takes historical institutionalism as its analytical perspective and divides the development of the Chief Urban Designer system in China into three stages: the implicit development period, the establishment of the mechanism period, and the optimization and adjustment period.

3.2.1 The implicit development period (Before 2018)

The development goals of cities, and even the phased development goals of cities, are continuously being adjusted, and the implementation paths face a series of choices, which is an important test for the subsequent services of urban design. For some key development areas of cities, the involvement of local planning and design teams is often long-term and may involve many different projects. The goals and orientations of planning and design also evolve continuously. For example, in the Shenzhen Bay Super Headquarters Base in Shenzhen, the Shenzhen branch of the China Urban Planning and Design Institute has been involved in a series of projects including protection and development planning, conceptual planning, and urban design over nearly twenty years. It witnessed the evolution of its positioning from a single "coastal urban residential area" (2001) to a compound "coastal cultural and business centre" (2004), and then to a "super headquarters base" (2007) (Figure 1). Although there is no specific employment contract for this long-term tracking of planning and design, the planning and design team effectively plays the role of city chief designers in overall planning and coordination for the region. The service usually accompanies dynamic planning and design work, including from planning intent to design blueprint, and then to the process of implementation construction (Wang, et al, 2022).

Figure 1 Changes in the Shenzhen Bay Super Headquarters Base Scheme Over Twenty Years

3.2.2 The establishment of the mechanism period (From 2018 to present)

In 2018, the Urban Planning and Land Resources Commission of Shenzhen Municipality issued the "Shenzhen Key Area Chief Urban Designer Trial Measures " (hereinafter referred to as the "Trial Measures"), establishing the City Chief Designer system in key areas and proposing relevant requirements for selection, service, and management, aiming to strengthen the planning, design, construction, and management standards of urban key areas through institutional establishment. Subsequently, Zhengzhou, Wuhan, and Foshan have successively promulgated implementation measures for the City Chief Designer system, and Longgang District of Shenzhen has formulated the more detailed "Implementation Rules for the City Chief Designer System in Longgang District" by referring to the "Trial Measures" of Shenzhen Municipality and combining with the actual situation of Longgang District. Meanwhile, the City Chief Designer system has been practiced in various regions, typical examples include the Shenzhen Bay Super Headquarters Base and the International Convention and Exhibition Centre in Shenzhen, the International Financial City and Pazhou West Area in Guangzhou, and

the West Bank Media Harbor, Expo B Zone, and Hongqiao Business Centre in Shanghai. These practices aim to improve the overall development and construction quality of regions by employing City Chief Designer teams mainly composed of planning and design units. However, there are significant differences in specific work content and practices among these practices.

Due to the lack of unified institutional documents issued by higher authorities, there are significant differences in the exploration and institutional provisions of the City Chief Designer system in key areas across different regions, mainly reflected in the service targets, work content, and whether the land has been granted (Table 2).

Table 2 Relevant institutional documents and requirements of the City Chief Designer system in key areas across different regions

City Name	**Document Name**	**Release Date**	**Main Content**	**City Chief Designer Responsibilities**	**Service Period**	**Whether participation in relevant design bidding and competitions is permitted**
Shenzhen	Shenzhen Key Area Chief Urban Designer Trial Measures	2018	Implement the City Chief Designer system in key areas throughout the city, determine selection and management tasks	Provide technical coordination, professional consultation, and technical review services to construction management departments	3 years	Yes, but the scale of buildings undertaken should not exceed 15% of the total planned new construction in the area
Zhengzhou	Zhengzhou Key Area Chief Urban Designer Trial Measures	2021	Employ City Chief Designer in 32 core blocks and other key development areas of the city, determine selection, service, and management requirements	Provide administrative decision-making assistance to planning and construction competent authorities, including technical coordination, professional consultation, and technical review services	3 years	Yes

Wuhan	Wuhan Key Functional Area City Chief Designer System	2021	Implement the City Chief Designer system in 14 key functional areas, the City Chief Designer team will provide long-term urban design guidance and technical support for project proposals	——	——	——
Longgang District of Shenzhen	Implementation Rules for the City Chief Designer System in Longgang District	2021	Applicable to major planning studies, technical standards issuance, and project construction implementation in the district. Determine responsibilities, work content, requirements, and processes, and propose evaluation criteria for the Chief Designer team	Regional-level planning coordination, core control area planning control transmission, and project-level quality improvement	3 years	Yes, registration is required
Foshan	Foshan Key Area Chief Designer Trial Measures	2022	In key areas determined by administrative agencies based on the city's development priorities and the distribution of construction projects, determine selection and management tasks	Provide decision-making consultation to relevant functional departments, including technical coordination, professional consultation, and technical review services	2 years	Yes, but the scale of buildings undertaken should not exceed 15% of the total planned new construction in the area

3.2.3 The optimization and adjustment period (From now on)

China's urban development has transitioned from the traditional period of incremental

growth to an era of stock development, where large-scale new projects are becoming increasingly scarce, and urban renewal is becoming the mainstream of future urban development in China. Although the origin of the City Chief Designer system and its current stage primarily apply to large-scale new construction projects, its important role in effectively implementing planning and design intentions, safeguarding public interests, and improving regional quality remains significant in urban renewal projects. While maintaining its characteristic advantages, how to make adjustments to better adapt to the needs of projects in the era of urban renewal is an important challenge that the City Chief Designer system will face in the future.

Furthermore, contracts for City Chief Designer typically involve large amounts of money (for example, the contract amount for the City Chief Designer of the Shenzhen Bay Super Headquarters Base, with a planned land area of 1.17 square kilometres, is 58 million yuan, whereas the contract amount for the overall planning of Shenzhen Municipality is only 31.57 million yuan). However, in recent years, local finances across the country have gradually tightened, making it difficult to support such large expenditures. History has shown that when resources are scarce, politically expedient measures may overlook the significant role played by design governance tools. Therefore, how to optimize the development of the City Chief Designer system in the context of limited local government financial resources in the future becomes crucial.

4 The multi-actor cooperation of City Chief Designer System and the existing issues

4.1 Participating actors and their main roles

The work of the City Chief Designer system spans the entire process of project planning, construction, management, and operation, involving complex coordination among multiple stakeholders and disciplines. Due to the lack of unified technical and implementation standards for the City Chief Designer system, there are significant differences in exploration and innovation across regions, leading to diverse compositions of participating actors. However, the main actors typically include government entities, City Chief Designer teams, construction unit, land developers, land design units, and the public (Figure 2).

Taking the participation of actors in the City Chief Designer system at the Shenzhen Bay Super Headquarters Base as an example, government entities include the Housing and Construction Bureau of Shenzhen Municipality, key projects management office in Bao'an District and so on. The composition of the City Chief Designer team includes a Development and Construction Command, responsible for decision-making and approval; an office within the municipal planning and construction management department, responsible for coordinating administrative tasks among various relevant departments; Shenzhen Investment Holdings Co., Ltd., responsible for all public construction and operations; and the City Chief Designer team, responsible for coordinating technical teams from different design units, comprehensive transportation teams, municipal teams, landscape teams, and other professional teams,

effectively integrating the results of multiple disciplines to achieve the best overall outcome. Land developers include 15 companies such as OPPO, JD.com, China Merchants Bank, Vanke, and Tanyin, etc., while land design units include 11 companies such as Foster, GMP, and Zaha Hadid Architects, etc. It can be seen that the implementation of the City Chief Designer system in key urban areas involves such a wide range of stakeholders and a large scope of work complexity.

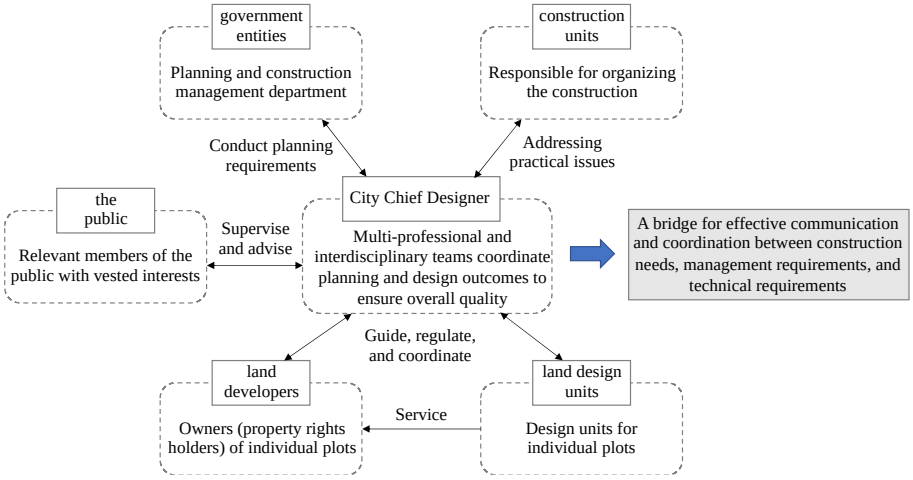

Figure 2 Participating subjects and their relationships

4.2 Existing issues

4.2.1 Unclear boundaries

As the City Chief Designer system is still in the early exploration stage, there is limited and insufficient in-depth research regarding its conceptual boundaries, work boundaries, and the flexibility boundaries of control. This lack of clarity has led to numerous problems in the actual implementation.

Regarding work boundaries, although the implementation methods in various regions have roughly defined the work content of the City Chief Designer, local governments often expect the City Chief Designer to address all issues in project development and construction after hiring them. Moreover, they hope that the City Chief Designer can devote all their time to the project. However, many aspects of the project are not within the expertise of the City Chief Designer, and the City Chief Designer team usually handles many other projects simultaneously. These issues arise due to the lack of clearly defined work boundaries.

Regarding flexibility boundaries, compared to regulatory planning, the control elements of the City Chief Designer system have greater flexibility. This characteristic of design control

is both a feature of design guidance and a conflict focal point in the scheme review process. Excessive control by the City Chief Designer may affect the creativity of landowners and design units, leading to homogenization of design schemes. However, insufficient control may be exploited by developers, compromising public interests and public spaces. Therefore, the lack of clarity in the flexibility boundaries of City Chief Designer control will lead to many problems, which is one of the key issues that need to be addressed in the current system optimization.

4.2.2 Difficulty in coordinating various actors

On the one hand, the institutional factors determine the close relationship between the City Chief Designer and the government, which puts this system in a dilemma to some extent. The City Chief Designer is very susceptible to the influence of government departments in the decision-making process, making them appear weak. Although the City Chief Designer seems to have considerable power, they are still part of the government's design department and receive funding from the government, which at least partially restricts their independence. The decisions of the City Chief Designer may be interfered with by the decisions of the management department, and the hiring party hope that the City Chief Designer is an independent third-party technical entity, but it is difficult to achieve in reality without considering the intentions of the higher authorities.

On the other hand, due to the complexity of the interests of multiple stakeholders, various actors may hinder the decisions of the City Chief Designer. For example, architects may perform poorly in scheme reviews, government decisions may be influenced, other design institutions may not support due to competitive relationships, and developers may feel that their autonomy is diminished. These stakeholders may oppose the City Chief Designer. system and the decisions made by City Chief Designers due to considerations of their own interests.

5 Conclusions

The transition from a single decision-maker to collaboration, from top-down power relations to interactive power relations, and from static management to dynamic and continuous governance make the City Chief Designer system an important innovative exploration for China to promote high-quality urban development and transition in urban design governance. The pursuit of better design by the City Chief Designer system is not limited to the narrow aesthetic level but involves comprehensive considerations of functionality, sustainability, economic feasibility, social equity, and more. The City Chief Designer system has established a mechanism that enables the needs of various fields and departments to be better coordinated, leading to better decision-making, promotion of key project implementation, efficiency improvement, and quality enhancement. However, as the City Chief Designer system is still in its early stages of establishment, many complex issues exist in terms of both system and implementation, requiring further optimization to meet the needs of development. This article takes the City Chief Designer system as a starting point, introduces the concept of design

governance, analyses the connotation of China's urban design governance transition, semi-formal governance tools, and the composition and role of participating actors, hoping to lay the foundation for further exploration of China's design governance and the development direction of future urban design governance.

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Conceptualising the urban transformative capacity of underprivileged neighbourhoods for realising just energy transitions

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Abstract

Positive Energy Districts (PEDs) are put forward as a building block to facilitate the transition towards climate-neutral cities and sustainable energy systems. While PEDs are pivotal for realising climate objectives, the concept is difficult to apply in existing, underprivileged neighbourhoods, because it underestimates social and political dimensions of neighbourhood energy transitions, and therefore risks to perpetuate or even exacerbate energy injustices. This research uses a spatially-sensitive approach to scrutinise energy injustices and rethink vulnerability stigmas. Drawing on the concept of urban transformative capacity, the paper develops a four-track approach focusing on collective-inclusive visioning, collective actions, institutional-community co-evolution and socio-technical innovation to foster collective agency. This framework serves as a basis for further case-study research aimed at achieving just urban transformations.

Keywords: underprivileged neighbourhoods, Positive Energy Districts, urban transformative capacity, place-based, collective agency.

1. Introduction

Transforming the energy system fairly and inclusively is a vital challenge in the face of the climate crisis. Positive Energy Districts (PEDs) are put forward to transition towards climate-neutral European cities and energy transitions. They are promoted as crucial building blocks to realise the UN Sustainable Development Goals, the European Green Deal objectives, the Mission on Carbon-Neutral and Smart Cities, and to implement the Renovation Wave

(European Commission, no date). Positive Energy Districts are defined as energy-efficient and energy-flexible urban areas or groups of connected buildings which produce net zero greenhouse gas emissions and actively manage an annual local or regional surplus production of renewable energy (JPI Urban Europe / SET Plan Action 3.2, 2020). However, this approach has predominantly been technical and infrastructural in nature, often overlooking the social and political challenges of the neighbourhoods it seeks to transform. Justice and wellbeing issues related to PEDs are missing (Truffer, Murphy and Raven, 2015), consequently, they fail to contribute to a just energy transition. This is particularly true in underprivileged neighbourhoods, where energy injustices become tangible and could be exacerbated by energy transitions, as a consequence of unequal distributions of burdens and benefits, non-inclusive decision-making processes, and a misrecognition of structural and historical inequalities (Jenkins *et al.*, 2016; Williams and Doyon, 2019).

It remains uncertain in theory as well as in practice in what ways PEDs can help achieve just transitions (Hearn, Sohre and Burger, 2021), and commonplace approaches to PEDs can even increase exclusion, energy poverty and other inequalities (Hearn, Sohre and Burger, 2021). In this paper we therefore explore the main challenges and resulting energy injustices, when dealing with energy transitions in underprivileged inner-city neighbourhoods and aim to identify a conceptual framework to foster the 'transformative capacity' of such neighbourhoods. Firstly, we theoretically explore the different injustices related to energy transitions faced in underprivileged neighbourhoods. Secondly, we argue that adopting a place-based approach is necessary to scrutinise these energy injustices and to connect energy transition strategies with a neighbourhood's socio-spatial realities. We emphasise how PED-strategies often fail in adapting their approaches to underprivileged, often dense inner-city neighbourhoods. Thirdly, we explore how fostering collective agency rather than strengthening the vulnerability stigma provides steps towards inclusive energy transitions. Fourthly, we explore how the concept of 'urban transformative capacity' can be applied to underprivileged neighbourhoods to address what we term the urban transformation paradox. We introduce this concept to emphasise how such neighbourhoods face injustices on the one hand, and display spatial, social and institutional transformative potential on the other hand. Lastly, the paper develops a four-track approach based on these dimensions of transformative potential, to foster the urban transformative capacity of underprivileged inner-city neighbourhoods, as an incentive for further case-study research.

2. Energy justice and underprivileged neighbourhoods

Energy justice addresses justice issues in energy access, use and policymaking to overcome inequality (Feenstra and Özerol, 2021). Sovacool and Dworkin (2015, p. 436) define the concept of 'energy justice' as 'a global energy system that fairly disseminates both the benefits and costs of energy services, and one that has representative and impartial energy decision-making'. Energy justice research typically deals with 'the triumvirate of tenets', including distributive justice, justice as recognition, and procedural justice (McCauley *et al.*, 2013). Respectively, these relate to fairness in the distribution of burdens and benefits, the recognition given to different socio-cultural identities, and fairness in the decision-making process (Schlosberg, 2007; Jenkins *et al.*, 2016; Bouzarovski and Simcock, 2017).

The urban poor living in underprivileged neighbourhoods are confronted with distributional, recognition and procedural energy injustices (Bouzarovski and Simcock, 2017). The socio-spatial characteristics of these neighbourhoods, such as the quality and energy efficiency of the built environment, public and collective infrastructure, demographics, income, class and

ownerships structures, social networks, cultural and behavioural factors etc., influence both the barriers and opportunities for sustainable transformation (Dietz, 2002; Boardman, 2010; Robinson, Bouzarovski and Lindley, 2018; Knox, 2019). These factors play a role in shaping the context for sustainable development initiatives. Using the concept of energy justice, the next paragraphs highlight how underprivileged neighbourhoods face disproportionate challenges in realizing an energy transition.

Distributional energy injustices are inequalities in how the burdens and benefits of energy systems and energy transitions are distributed, and therefore 'who wins and who loses from transitions' (Bouzarovski and Simcock, 2017). Distributional injustice is strongly related to socio-spatial inequalities (re)producing energy deprivation in particular spaces and social groups (Bouzarovski and Simcock, 2017; Simcock and Petrova, 2018).

As argued by Walker (2009), distributional inequalities have a spatial expression and constitution. Inhabitants of underprivileged neighbourhoods face disproportionate burdens as a consequence of enhanced energy insecurity related to the energy transition (Carley and Konisky, 2020).

Concentrations of low-income households contribute to higher levels of energy poverty in underprivileged neighbourhoods (Bouzarovski and Simcock, 2017). A low income typically serves as a fundamental factor associated with energy deprivation. However, it overlaps with several other social and political identities that may deepen the state of deprivation, such as education, race, ethnicity, religion, gender, age, class, disability and health status. The burdens of rising energy prices disproportionately affect individuals at the intersections of these characteristics (Großmann and Kahlheber, 2018; März, 2018). For instance, because energy costs represent a larger proportion of their income, these individuals are not only more vulnerable to rising energy prices, but also have limited capacity to adapt to climate change impacts, such as affording cooling systems (Knox, 2019).

Uneven distributions of economic resources intersect with material deprivation, particularly evident in underprivileged neighbourhoods characterised by low-quality housing (Bouzarovski and Simcock, 2017; März, 2018). Low-income households typically live in the worst quality housing (Boardman, 2010; Bouzarovski and Simcock, 2017). Emergency buyers[1] or (social) renters here face heightened vulnerability, lacking the financial resources to invest in energy efficiency measures or access renewables (Carley & Konisky, 2020; Vanderstraeten & Ryckewaert, 2019).

Inhabitants of underprivileged neighbourhoods often lack access to energy transition opportunities. Mainly higher incomes can utilise low-carbon and efficient technologies (Carley and Konisky, 2020), which can be explained by the high upfront costs of these technologies (Angel, 2016; Carley and Konisky, 2020). Living conditions in underprivileged neighbourhoods can restrain access to climate-friendly energy solutions as well (Carley and Konisky, 2020). The dense morphology in underprivileged neighbourhoods, limited open public space (Knox, 2019), and higher concentrations of (social) renters may limit opportunities to integrate renewable energy systems, such as photovoltaics (Middlemiss and Gillard, 2015; Knox, 2019; Derkenbaeva *et al.*, 2022).

Recognition injustice manifests itself as a failure to recognise different perspectives rooted in social, cultural, ethnic, racial, and gender differences (Jenkins *et al.*, 2016). Central to

[1] An emergency buyer is someone that purchased a lower-quality property out of necessity, lacking the financial means to invest in bringing the property to a satisfactory standard

misrecognition are cultural and institutional processes of disrespect, denigration, insult and stigmatization (Walker, 2009). The devaluation of certain groups is intertwined with and manifests itself through the misrecognition of places (Walker, 2009). Place stigmatization and misrecognition may lead to certain spaces to be chosen for development before others. As a consequence, certain places in the daily life of poor individuals, or certain ethnic groups, are neglected and poorly served (Hastings *et al.*, 2005; Hastings, 2009; Walker, 2009). Local governments' lacking willingness or ability to provide resources contribute to a non-prioritised status for energy and infrastructure development (Golubchikov and O'Sullivan, 2020), reproducing vulnerabilities of different places even more (Bouzarovski *et al.*, 2017).

For instance, in the European context, Renewable Energy Communities (RECs) have been introduced as a key tool for citizen-led energy transition (Hanke, Guyet and Feenstra, 2021). These communities enable citizens to actively engage in local and collective energy systems (Caramizaru and Uihlein, 2020; Hanke, Guyet and Feenstra, 2021). While empowering consumers to joing RECs has potential to contribute to energy justice, vulnerable consumers remain underrepresented (Hanke and Lowitzsch, 2020). Multiple studies have highlighted that these initiatives often take place in affluent communities (Goedkoop and Devine-Wright, 2016; Caramizaru and Uihlein, 2020; Hanke and Lowitzsch, 2020; Kaandorp *et al.*, 2024). Moreover, REC members are mostly middle-aged men with higher incomes and educational backgrounds (Radtke and Ohlhorst, 2021; Kaandorp *et al.*, 2024).

Injustice arises as a consequence of the limited recognition of underprivileged groups to take advantage of these kind of energy initiatives. Agenda's targeting environmental issues are prone to remain 'socially blind' and policies that stimulate the energy transition, such as incentives for renovating or the uptake of renewables, mainly benefit middle-income households. The misrecognition of the daily life of households in energy poverty widens social inequalities and may even lead to a reduced public support for climate policies (Juwet, 2020; Carrosio and De Vidovich, 2023; Fransolet and Vanhille, 2023).

Misrecognition in energy transitions also plays a role in terms of the types of knowledge and the disciplinary perspectives that are represented in transition processes. Already in the 1980s, Laura Nader sharply analysed the dominance of technical perspectives in energy transition debates, underestimating the social, behavioural and political dimensions of energy transitions (Nader, 1980, 1981, 2010). More recently, for example, Juwet and Deruytter unravelled how the implicit planning processes of the Flemish network operator, and its positioning as a 'neutral', 'apolitical', technocratic and operational actor, misrecognise the territorial and societal dimensions of infrastructure planning and energy tariff structures (Juwet and Deruytter, 2021).

Procedural injustices are a consequence of lacking public participation and deliberation (Newell and Mulvaney, 2013). Decisions regarding the allocation, utilization, and the consumption of energy for specific purposes often occur out of the public eye and seldom within democratic forums (Newell & Mulvaney, 2013). For instance, 'strategic planning exercises' leave no room for responding directly to both climate change and social justice imperatives because they occur at a scale that is too broad for local residents to identify the local impacts and their implications (Steele *et al.*, 2019). Moreover, the technocratic nature of the energy sector, characterised by secrecy and arcane technical knowledge makes public involvement even more challenging (Szulecki, 2018). As a consequence, underprivileged groups are confronted with unfair decision-making processes (Bickerstaff, Walker and Bulkeley, 2013). Decisions related to energy systems often occur 'over the heads' of marginalised groups,

exacerbating social and economic inequalities. Addressing energy injustices and holding accountable the responsible parties is often challenging because they are frequently powerful elites or multinational corporations (Newell and Mulvaney, 2013).

At the same time, and importantly, research on energy transitions itself also usually fails to involve citizens and even participatory research approaches rather focus on professional stakeholders and only involve citizens to a very limited extent (Huttunen *et al.*, 2022). Participatory action research offers interesting potential for energy transition research that aims to contribute to more just urban transitions. It places the researcher next to the practitioner as 'expert', fostering emancipatory and collaborative goals.

3. Place-based approaches to district level energy transitions

Previously we have discussed the interconnection between injustices in underprivileged neighbourhoods and energy transitions, highlighting the relationship with their socio-spatial and socio-political characteristics. This calls for a spatially-sensitive approach that enables to tailor PEDs to unique needs, aspirations and dynamics to different specific contexts.

The concept of Positive Energy Districts explicitly draws attention to the scale of the district or neighbourhood as a promising scale to realise systemic transformation of the energy system and the built environment. However, the discourse around PEDs often remains placeless and many early PED cases involved greenfield development rather than the transformation of complex, existing inner-city neighbourhoods. While a strict interpretation of PED ambitions focused on energy efficiency, renewable energy and flexibility (JPI Urban Europe / SET Plan Action 3.2, 2020) is more aligned with new-build developments, recent discussions about the PED framework challenge this limited technological perspective. In order to be able to apply the PED framework to existing urban contexts, it requires a broader view emphasizing key considerations such as governance, awareness, stakeholder ecosystems, participation, and context sensitivity (DUT, 2024)

Indeed, the specific spatial, social, cultural, historical, governance and political characteristics of a neighbourhood shape the barriers, obduracies and opportunities for transformation. Understanding this context is therefore key to develop not only more effective but also more qualitative and inclusive transition strategies and solutions. Geographers have emphasised the need to understand how transitions play out differently in different geographical, socio-political and institutional contexts (Coenen and Truffer, 2012; Bridge *et al.*, 2013; Rutherford and Coutard, 2014; Binz *et al.*, 2020). Spatial planners and designers have shown how energy system transformation is, and historically was, connected to transformations in landscape, urban morphology and spatial quality (Owens, 1986; Sijmons *et al.*, 2014; Sijmons, 2017; Asarpota and Nadin, 2020; Juwet, 2022), and have visualised how energy system transformation at the neighbourhood scale can be linked with densification, urban renewal, introducing collective infrastructures, greening or soft mobility modes (van Bolhuis *et al.*, 2016; Hubrecht *et al.*, 2020; Juwet, 2020). Moreover, our discussion on energy justice illustrates how inequalities in energy poverty or access to sustainable energy solutions are strongly connected with social and spatial neighbourhood characteristics (Bouzarovski and Simcock, 2017) such as building morphology and energy efficiency, ownership structure, demographics, public neighbourhood infrastructures, etc. Using a spatially-sensitive lens is then crucial to address 'place-based deprivation' (Robinson, Bouzarovski and Lindley, 2018). Moreover, it helps to recognise the unique realities and contexts of different areas, and to address the needs and aspirations of inhabitants of underprivileged neighbourhoods. A place-based approach may moreover

emphasise the value of local knowledge to address community-specific needs (Elmallah, Reames and Spurlock, 2022).

Context-specific dimensions of energy transitions are particularly tangible at the neighbourhood scale, where socio-spatial barriers and opportunities become visible, and where initiating transformation and developing alternative solutions requires multi-scalar collaboration between different levels of government, civil society organizations and citizens. Neighbourhood energy strategies then involve shifting power relations and new coalitions between public, private and civil society stakeholders and citizens, new energy governance and new business models (Avelino and Wittmayer, 2016; Wolfram, 2016; Köhler *et al.*, 2019). These strategies need to respond to the specific morphological, institutional, legal, social and behavioural conditions

4. From a vulnerability stigma to urban transformative capacity and collective agency

Underprivileged neighbourhoods are often characterised as 'vulnerable' and deprived of quality, agency and opportunities for change. We argue it is vital to challenge this idea of 'vulnerability' as 'inevitable' in underprivileged neighbourhoods by focusing on opportunities and capacity for transformation (Weatherill, 2023). While such neighbourhoods indeed face overwhelming challenges for transformation, overemphasizing 'vulnerability' risks to limit possibilities for transformative change and increase stigmatization. On the contrary, concepts such as 'empowerment', 'agency' or 'collective action' may allow to resist 'vulnerability' and understand transitions as transformative processes involving a disruption of current pathways, and radically altering existing urban structures, cultures and practices (Wolfram, Borgström and Farrelly, 2019).

Reframing underprivileged neighbourhoods in transitions then requires to recognise the inherently political character of transitions, involving diverging and often conflicting interests and ideas, and producing 'losers' as well as 'winners' (Coutard and Guy, 2007; Shove and Walker, 2007; Meadowcroft, 2009; Rutherford and Coutard, 2014; Healy and Barry, 2017; Köhler *et al.*, 2019; Williams and Doyon, 2019). However, energy transitions research and transition management approaches have been criticised for underestimating and obscuring these politics of transitions (Shove and Walker, 2007; Kenis, Bono and Mathijs, 2016). Sierhuis et al. (2023), voice similar concerns about PEDs as experimental hubs for renewable energy solutions and as transformation areas towards more sustainable urban futures but failing to clearly address their political dimension. In particular, Shove and Walker (2007), and Kenis et al. (2016), raise fundamental questions about whether societal transformations can be 'managed' and about the framing, legitimacy and inclusivity of transition management approaches. For example, its focus on 'frontrunners' in transitions risks to create exclusionary processes where the voice of underprivileged or non-hegemonic citizens is not heard. They call for an explicit acknowledgement of power relations, conflict and contingency as constitutive in processes of societal change (Kenis, Bono and Mathijs, 2016). From a similar 'power' perspective, Avelino and Wittmayer (2016) conceptualise transitions as involving shifting power relations between state, market, community and third sector actors. Moreover, Avelino and Rotmans distinguish different types of power in transitions and different power relations, specifying power 'over', 'more' power than, and 'different' power (Avelino and Rotmans, 2009). Adopting this perspective, and articulating the politics of transitions, allows to shift the focus away from 'vulnerability' or 'lack of capacity' or 'limited agency' to questions of power and politics; it allows excluded voices, discourses or visions from outside the hegemonic social order to be heard; and it opens up opportunities to challenge the status quo and facilitate social

transformation (Kenis, Bono and Mathijs, 2016; Mikulewicz, 2018; Sierhuis, Bertolini and Van Winden, 2023).
We argue that highlighting the potentiality, agency, and capacity of underprivileged neighbourhoods, instead of addressing 'vulnerability' as inevitable or intrinsic, is a step towards energy justice. We use ‘urban transformative capacity’ (UTC) (Wolfram, 2016) as a critical concept in addressing the challenges faced by underprivileged communities, positioning itself as a counterbalance to vulnerable conceptions. This approach shifts the narrative, it underscores the inherent capacities of underprivileged neighbourhoods to initiate and sustain change.

Urban transformative capacity is always and necessarily political since it strives for deep and holistic urban change, shaped by agency and interactions within certain spatial-material settings (Wolfram, Borgström and Farrelly, 2019). It is invariably marked by contestation and social struggle: the determination of which urban future will materialise is influenced by the dynamics of urban transformation (Wolfram, Borgström and Farrelly, 2019). Developing urban transformative capacity should aim to nurture and harness diversity and contestation in order to enable justice (Wolfram, Borgström and Farrelly, 2019).

Urban transformative capacity identifies what enables cities and urban stakeholders to initiate and perform transitions by identifying the required abilities to forge new system arrangements (Wolfram, 2016). Developing agency and empowerment are key for developing urban transformative capacity. Instead of an all-encompassing approach, opportunities and strategic priority interventions need to be identified. In line with our argumentation above, this implies a place-based approach. As Wolfram (2016) argues, “place strongly conditions the characteristics of e.g. social needs, communities, institutional thickness, leadership and practical experiments, while providing an essential frame for the cognitive processes related to system awareness and foresight (Wolfram, 2016, p. 129)”. Therefore, the development of urban transformative capacity must depend on strategies and interactions that are specific to the place (Wolfram, Borgström and Farrelly, 2019). However, as the author underlines, it cannot be developed locally alone.

While the framework of urban transformative capacity refers to the transformative capacity of stakeholders, places and processes – both as a capacity source, and as a subject of transformation, the ‘spatial’ or ‘place’-dimension of this transformation remains underconceptualised. By adopting a place-based approach, we can identify the types of capacities and characteristics of underprivileged neighbourhoods that can drive urban transformative change, i.e. “disrupting current pathways by deeply and radically altering existing urban structures, cultures, and practices (Wolfram et al., 2019, p. 437). Such a perspective reveals an ‘urban transformation paradox’: while underprivileged neighbourhoods are indeed confronted with many interrelated characteristics that complicate energy transitions, they also offer opportunities for transformation that can be linked for example with morphology, ownership structure, stakeholder landscape, spatial qualities, social networks or infrastructure projects.

5. Towards a four-track approach to urban transformation for PED’s

As we have argued, addressing energy justice in PEDs requires a place-based approach which is based on identifying the transformative capacities that can cultivate inclusive opportunities for collective agency. However, while recent work has conceptually outlined the different interdependent components of what transformative capacity can entail, as well as its targeted outcomes (Wolfram, 2016; Wolfram, Borgström and Farrelly, 2019), we aim to respond here

to the need for an operational framework to address challenges of collective agency and institutional change in a place-based way. In order to do so we have developed a four-track approach to foster the urban transformative capacity of underprivileged inner-city neighbourhoods, which focuses on diverse yet interrelated components.

The proposed four tracks all respond to the outlined issues regarding energy justice and are specifically oriented at the challenges of fostering place-based transformative capacities of underprivileged neighbourhoods. Firstly, we emphasise the importance of engaging local residents as well as institutional stakeholders in collective visioning (track 1). Secondly, bottom-up actions can instigate behavioural change and tie in with everyday needs and concerns (track 2). Thirdly, this framework argues how lasting and inclusive transitions require the co-evolution between public and community stakeholders (track 3) as well as between social and technological innovations (track 4).

The tracks can be read as conceptual perspectives but also be developed into participatory methodological approaches to research collective agency in neighbourhood energy transitions. They are an incentive for further case-study research, for practical application and further operationalization. Each of these four tracks is (theoretically) elaborated below.

5.1 Collective visioning

The development and implementation of PEDs relies heavily on visions and visioning processes to inspire both policy programs and local action towards sustainable systems change and just energy futures (Kantabutra, 2020). Visioning processes can both articulate long-term goals and guiding principles for urban planning as well as align policies and stakeholders collaborations towards achieving sustainable energy futures (McPhearson, Iwaniec and Bai, 2016).

Visions can provide a framework for monitoring progress and adjusting strategies to stay on track towards realizing sustainability goals or PED targets, reflecting the specific requirement and opportunities of a particular context (Späth and Rohracher, 2010; Trutnevyte, 2014). However, visions and visioning processes can come with justice concerns when structural inequalities are not fully recognised. Therefore, they need to take into account the contextualised and unequally distributed agency of people to both act upon and change such visions. Collective and inclusive visioning processes are vital to ensure critical examination of existing transitions, in order to emphasise energy justice as a fundamental criterion and strive for equality and equity, both formal and substantive, within energy systems (McCauley *et al.*, 2013; Revez *et al.*, 2020).

Visioning processes can foster transformative capacity by translating abstract concepts of sustainable energy futures into more concrete agendas, reflecting the specific requirements and opportunities of a particular context, in terms of energy potentials, actor constellations etc. (Späth and Rohracher, 2010). Doing so, collective-inclusive visions can outline a radical departure from the current path and develop urban transformative capacity in underprivileged neighbourhoods (Wolfram, 2016). When a community shares a vision, it can give them a sense of capability, endurance, commonalty, and agreed-upon objectives (Parkhill *et al.*, 2015) and clear reasons for engaging in social action (Parkhill *et al.*, 2015). A shared vision is grounded in a sense of the common good, shared experiences, culture, and perspectives on the world and collective action (Silk, 1999).

5.2 Collective actions

The second track researches how bottom-up and collective PED actions can mobilise collective agency and behaviour change. In line with Horvath's (Horvath, 1999, p.221) definition of social action, we define bottom-up and collective PED action as the 'participation of local communities and stakeholders in PED initiatives to influence the outcome for the benefit of the people and the community. Developing participatory methods to identify and set up bottom-up and collective PED actions requires a place-based approach, as context is significant to foster collective social action (Parkhill *et al.*, 2015).

Bottom-up and collective PED actions seek to respond to the structural injustices that constrain the agency of individuals and communities in underprivileged neighbourhoods (Lennon, Dunphy and Sanvicente, 2019; Gaupp, Constantino and Pereira, 2023). They aim to empower local communities to actively participate in more meaningful and democratic low-carbon energy transitions. This can foster a sense of ownership, develop capacity, and increase responsibility among local residents (Hoffman and High-Pippert, 2010; Parkhill *et al.*, 2015). Not only does this lead to more sustainable solutions, it also garners widespread support (Musall and Kuik, 2011; Lennon, Dunphy and Sanvicente, 2019), crucial to achieving sustainable transformation towards low carbon systems (Coy *et al.*, 2021). In addition, collective participatory PED actions can mobilise behavioural change. By strengthening community engagement and social networks among neighbours, positive behaviours can spread more easily through peer influence (Gaupp, Constantino and Pereira, 2023).

Bottom-up and collective PED actions foster transformative capacity precisely by centring on inhabitants' everyday lives (Ortiz Escalante and Gutiérrez Valdivia, 2015) and focusing on meeting social needs (Wolfram, 2016). To transform sensitive living environments whilst addressing social needs, community participation, and empowerment, it is crucial to leverage commonly held community values and beliefs (Hoffman and High-Pippert, 2010), as well as connect and amplify local social and spatial assets and initiatives (Kretzmann and McKnight, 1993). This collective effort builds transformative capacity within communities towards sustainable development.

5.3 Institutional-community co-evolution

This track responds to the insight that energy transitions benefit from the co-evolution of institutional, material and relational change (Sareen and Haarstad, 2018). We argue that in order to address the complexities of equitable energy access, distribution and justice, public institutions and community stakeholders need to engage in a dynamic reciprocal relationship where both influence and permanently adapt to each other's actions and needs over time. In order for government-shaped energy policies and resource allocation to be equitable and effective, they have to be informed by the needs, experiences, and input of the communities they serve. Community stakeholders, including residents, local organizations, and advocacy groups, possess valuable knowledge about their unique energy challenges, priorities, and aspirations. By actively engaging with these stakeholders, public institutions can gain a deeper understanding of the specific issues faced in underprivileged neighbourhoods and co-create solutions that are responsive to local contexts and concerns (Burke and Stephens, 2017).

In underprivileged neighbourhoods, where energy injustices are often most pronounced, the co-evolution of public institutions and community stakeholders is particularly critical. Transition issues are frequently addressed in a fragmented manner, focussing on separate issues, without

taking into account the advantage of other agendas (Huntjens and Kemp, 2022). Energy transitions in underprivileged neighbourhoods requires the rethinking of institutional and community structure in a more integrated way. By working together, co-evolutionary partnerships can help address the intersecting challenges of (energy) poverty, environmental degradation, and social exclusion, while at the same time building more resilient and empowered communities (Baker, 2019). The co-evolution of community and public stakeholders directly respond to the imperative of procedural and recognition justice, involving the active participation, and the recognition of the voices of diverse stakeholders, eventually contributing to more distributional justice as well.

A collaborative approach to energy governance not only fosters trust and accountability between public institutions and local communities but also enhances the transformative capacity of both parties. For public institutions, it enables them to develop more inclusive and effective policies and programs to address systemic inequalities and promote social justice. By centring on the voices and experiences of marginalised communities, public institutions can better identify and dismantle barriers to energy access and affordability, increasing energy justice (Elmallah, Reames and Spurlock, 2022). Similarly, community stakeholders benefit from this co-evolution process by gaining increased influence and agency in shaping energy decision-making processes and outcomes. By actively participating in policy development, planning processes, and resource allocation, communities can advocate for their own interests and priorities, ultimately leading to more equitable and sustainable energy systems.

5.4 Social and technical innovation

Decarbonization is a multidimensional challenge that requires co-evolutionary interactions between technologies and societal groups (Geels *et al.*, 2017). As energy transitions in particular are socio-technical challenges (Geels *et al.*, 2017), we need to move beyond the dominant technology-driven conceptions of these processes (Suitner, Haider and Philipp, 2023). This track puts forward the necessity to intertwine social and technological innovation in order to overcome systemic lock-ins and to support late adopters towards positive energy district. A social innovation perspective distinguishes itself from traditional (technological) innovation through its iterative alignment with concrete societal needs, inclusive practices and its embeddedness in local capacities by creating new (social) business models, actor networks, governance modes, policy interventions or organizational entities, p. 1500). Moreover, social innovation can help to embed new practices in a specific spatial context by aligning the transition process to regional capacities (Suitner, Haider and Philipp, 2023).

Low carbon technological innovations can come with justice tensions in underprivileged neighbourhoods. The lack in access to and information on decarbonisation technologies (Sovacool et al., 2019) can lead to disparities in agency, where underprivileged inhabitants are being pushed into more passive roles (Sovacool et al., 2019). Additionally, initiatives solely focused on technological innovation overlook the reality that certain neighborhoods may not be ready to integrate these innovations into their dwellings (Halleck Vega, Van Leeuwen and Van Twillert, 2022). This oversight is compounded by the failure to recognise the need for behavioral adaptation alongside innovative technologies, further widening existing injustices, particularly among marginalised communities. It is noteworthy that individuals in energy poverty often already use energy efficiently, without innovative technologies (Paone & Bacher, 2018).

In order to strengthen transformative capacity on the neighbourhood scale, socio-technical innovation processes need to foster local agency and be embedded in a place-based institutional context. Doing so, 'opportunity spaces' for innovation can be created that build on regionally specific preconditions, temporally specific configurations of knowledge, institutions and resources, and specific local capabilities (Suitner, Haider and Philipp, 2023).

6. Conclusion

Transforming the energy system inclusively is critical in the face of the climate crisis. Positive Energy Districts (PEDs) are put forwards as a building block for climate-neutral urban transitions. In this research paper we address how applying PED approaches in underprivileged neighbourhoods requires better recognition of spatial, social and political energy transition dimensions. So far, the PED framework falls short to address the complex and interrelated injustices related to energy transition in underprivileged neighbourhoods. There is a risk that PEDs can increase exclusion of energy vulnerable people, exacerbate energy poverty, and potentially even stigmatise the energy poor (Hearn, Sohre and Burger, 2021), rather than contribute to inclusive and just energy transitions. This paper foregrounds the concept of urban transformative capacity in an effort to theorise more inclusive and just PED strategies. It proposes a four-track conceptual approach that responds to energy justice challenges in underprivileged neighbourhoods.

The concept of energy justice provides a useful lens to unravel energy transition challenges in underprivileged neighbourhoods and unravels how distributional, recognition and procedural injustices are related to socio-spatial neighbourhood characteristics. We argue in order to contribute to just transitions, PED strategies should be place-based approaches that acknowledge and leverage the socio-spatial and socio-political contexts of underprivileged neighbourhoods. We introduce the 'urban transformation paradox' as a way to challenge vulnerability stigmas by focusing on collective agency and empowerment, and by recognising social, spatial and institutional neighbourhood characteristics that offer opportunities for transformative change.

We respond to this problem statement by introducing a four-track approach to foster urban transformative capacity and address energy injustices in underprivileged neighbourhoods through different points of departure: (1) collective visioning, (2) collective actions, (3) institutional-community co-evolution and (4) socio-technical innovation. This four-track approach aims to foster the urban transformative capacity of underprivileged neighbourhoods.

Further research should translate these theoretical 'tracks' into practice in different case study neighbourhoods, as four components of fostering urban transformative capacity in underprivileged neighbourhoods. Firstly, such case study research can produce valuable insights to refine the PED framework and inform just energy transition policies. Secondly, the four tracks can also be interpreted as different methodological approaches to research and foster neighbourhood transitions in a participatory way. They can be developed into concrete participatory research methods, tested and critically evaluated in different case study contexts, and contribute to more inclusive energy transition research. Thirdly, the four-track approach can be used to co-produce, test and implement concrete governance tools for neighbourhood energy transitions, such as collective actions, new coalitions, governance structures or business models and use comparative case study research to evaluate whether and how such tools could be translated, expanded or upscaled to other neighourhood contexts.

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Impact of Development Process of Cultural Tourism on the Authenticity of the Production Space of Cultural Heritage Sites

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Abstract
Production space is an important resource for the survival of local communities. In the process of cultural tourism development, the entry of external resources and the demand of the market will change the original economic production of the heritage site. Different subjects such as local residents, operators from other places, local governments, and planners will continue to recreate the production space. This paper takes Xizhou Ancient Town and Zhoucheng Village in Yunnan Procince, China as examples. Xizhou Ancient Town made full use of rice field resource combined with land transfer procedures, introduced social enterprises to concentrate on farming, and held a "Rice Culture Festival" to create the "Xi" brand of agricultural products. On the basis of the original production tradition of tie-dye handicrafts, Zhoucheng Village renovated the abandoned state-owned factory building as a tie-dye museum, integrating sightseeing, display, production, experience and other functions, moving the production work from the original private family workshop to a public cultural place, and further promoting the communication between local villagers. In these two cases, the changes of spatial ownership and function are led by the government and planning departments, which have injected new connotations into the regional agricultural and handicraft traditions. In the process of cultural tourism development, planning, as a leading role with legal effect, should use key spaces as carriers to guide the functional positioning of the region. At the same time, an operation platform should be built to provide positive guidance for cultural heritage sites under the principle of authenticity.

Keywords
authenticity, production space, cultural tourism development, Xizhou Ancient Town, Zhoucheng Village

Full text

1. The connotation of “authenticity” in heritage protection

1.1 Understanding the development process of the concept of "authenticity" in the space-time dimension

The word "authenticity" evolved from the Greek word "authents", including both meanings of "authority" and "origin" (阮 and 林, 2003). In the 1960s, the concept of authenticity was officially introduced into the field of heritage protection. In 1964, the Venice Charter proposed that historical monuments be "authentic and completely passed on"; in 1977, the first edition of the Operation Guidelines for the Implementation of the World Heritage Convention clearly defines that "authenticity is not limited to the original form and structure, but also includes changes and additions that have artistic and historical value in the historical process"; the Nara Authenticity Document in 1994 further expanded the scope of authenticity, emphasizing that each culture can define the connotation of authenticity according to its own characteristics.

Scholars from China such as Luo Zhewen, Liu Lin'an and Ruan Yisan introduced the concept of "authenticity" into the domestic academic community(阮, 1998). Subsequently, the principle of "authenticity" has become a core issue in heritage protection and utilization work. With the continuous deepening of research, the connotation of "authenticity" has been expanded in both dimensions of time and space(曹 and 李, 2019).

In the time dimension, the formation of cultural heritage sites itself is the result of the joint accumulation of historical features, social culture, material environment and life scenes within a certain geographical scope. Cultural heritage sites are absolutely not limited to a specific, fixed historical time node, and there is no such "original" or "most representative" state. Each generation has the characteristics of that period, and the new generation is constantly creating characteristics. The pursuit of reappearance of a certain period is a denial of other periods. The focus of heritage protection has gradually expanded from museum-style authentic reproduction to respecting reasonable changes in each era.

In the spatial dimension, built heritage cannot exist without the environment. The environment is a complex, and built heritage is a part of it. A complete environment includes not only the artificially constructed physical space, but also the surrounding natural ecology, the built environment, the people living in it, and the culture inherited based on people's behaviors and activities. The role of a specific environment is decisive for the individuals in it. It is this complex environment that breeds specific cultural heritage. Just as in the field of natural ecology, the key point of studying biological units is to study the protection of the ecological environment; in the field of urban heritage protection, the key point of heritage is also the protection of the cultural environment. In the process of assessing the value of heritage and utilizing resources, various elements in the environment should be fully recognized and interact with each other. The scope of application of authenticity should extend from individual historical buildings to neighborhood protection, and then to the protection of the overall style of villages or towns.

1.2 Understand the multiple meanings of “authenticity” under the guidance of goals

As a principle of cultural heritage protection, authenticity is difficult to define in precise terms, and there is no unified evaluation standard that includes degree, form, scope, etc. Authenticity is one of the indicators of the compatibility between heritage and its cultural connotation. It will continue to change with the standards of value judgment, and the definition chosen depends on the protection purpose hoped to be achieved. Protection is based on change and development. Protection is not for restoration but for regeneration. It is the filling of gaps in the relics of historic sites and the inheritance and innovation of artistic craftsmanship development.

To sum up, authenticity is not an end point for measuring the degree of authenticity, but a development process similar to cultural construction. The purpose of authenticity protection is not to verify and reproduce historical details, but to restore and support an organic and dynamic system that integrates traditional culture and wisdom, witnesses traces of historical evolution. Such system is self-organizing, sustainable, and viable. Starting from the purpose of protection, authenticity should respect both historical reality and the construction of each period, paying attention to both the historical truth of the object and the current experience of the subjective group. It is a comprehensive principle based on a dynamic development perspective, covering natural and artificial environments, and taking into account characteristic regional culture and local daily life.

2. Spatial evolution characteristics in the process of cultural tourism development

2.1 Analysis of the needs of aboriginal people in the process of cultural tourism development

2.1.1 Daily life needs from a protection perspective

The indigenous people of the heritage site who have lived here for generations follow the given rules such as traditions, habits, and customs, and complete daily life such as production, consumption, and social interaction over and over again. As a product of the harmonious coexistence of human beings, resources, and the environment, traditional settlements contain valuable construction wisdom. Traditional crafts, folk customs, and festivals developed basing on local hydrogeographic conditions, natural climate, and native plant resources are the collective memory of local residents and have important life guidance and emotional value.

2.1.2 Cultural inheritance needs from a development perspective

The details of the daily life of the indigenous people in the heritage sites and the practices that have been embedded in people's behavioral habits and ideas over a long period of history all have become unique elements of local traditional culture in the eyes of the outside world. This is due to the differences in physical geography, folk culture and other factors between different regions. Today, when Internet communication and long-distance transportation are highly developed, it is important to discover, inherit and spread local traditional culture. This is not only a necessary way to build cultural confidence and identity within indigenous groups, but also an effective way to make full use of local resources and promote regional economic development.

2.2 Analysis of the influence of external forces in the cultural tourism development process

2.2.1 The driving effect of cultural products from an external perspective

The behavior of external institutions and external operators coming to cultural heritage sites to choose residence and employment is itself the result of the high-quality resources of heritage sites attracting external resources. Its intervention in heritage sites will also further bring in external resources including funds, construction plans, cultural promotion, operation and management models, etc(车 et al., 2019). Based on foreign perspectives and foreign experiences, traditional culture has been exhumed and redeveloped, and is sold to a large number of people in the form of packaged and symbolic products. On the one hand, culture is a dynamic product based on subjective feelings and is constantly being revised and constructed in the context of each generation. The profound traditional culture of heritage sites also needs to meet the needs of modern aesthetics and cultural consumption. It can be said that it is the packaging and secondary creation that strengthen the expressiveness and artistry of traditional culture, making it a cultural consumer product that meets the spiritual needs of modern people. The design of local tourism brands, the maintenance of tourism resources, and the creation of a tourism consumption environment with the intervention of external resources provide a lot of opportunities for displaying culture and reviving traditions, which can effectively strengthen the effect of cultural communication and bring economic and social benefits to the region. On the other hand, the business behavior itself is a kind of commercialization, and the characteristics of products are repetitive and standardized. The boundaries between artistic enhancement, cultural innovation and inventing and fabricating are blurred. In reality, a large number of commercial operations oriented toward instantaneous traffic and short-term economic benefits will bring about negative impacts such as the homogenization of tourism resources, out-of-control commercial development, and the disappearance of urban life landscapes.

2.2.2 Regional quality promotion effect from an internal perspective

The objective reason why a large amount of cultural heritage has been preserved is largely related to the region's lagging development in social, transportation, cultural and other aspects. Taking Yunnan Province as an example, due to the geographical environment of high mountains, rapid rivers, alternating mountains and dams, and the distribution characteristics of ethnic minorities living together in large and small settlements, there is little exchange or even isolation between settlements, forming a pattern of cultural diversity. The pattern also provides a shielding condition for the inheritance and long-term continuation of native culture. This has resulted in Yunnan still retaining a number of characteristic towns including Dali Ancient City, Xizhou Ancient Town, Weishan Ancient City, Dayan Ancient Town, Shuhe Ancient Town, Shaxi Ancient Town, Heshun Ancient Town, etc(刘 and 王, 2019). Behind the original, antique and characteristic residential buildings and the spatial layout of streets and alleys, there are a lot of problems of low building quality and poor quality of the residents' physical environment. In today's era of urbanization and modernization, the optimization of human settlements has become an important direction for the revitalization of historical and cultural blocks. Modern services such as electronic screens, surveillance, and wireless networks brought by external resources are of great significance to improving the livability of blocks.

In addition, the intervention of external resources can also help local communities re-examine the value of their own traditional culture. In an environment where local cultural products are packaged and symbolized, aboriginal people will also use it as an important way to identify their cultural identity, tell their own stories and rebuild their pride in local culture, thus strengthening the ethnic identity and awareness of the protection and inheritance of traditional culture.

2.3 Analysis of the authenticity of production space taking Xizhou Town, Dali as an example

The original production spaces of cultural heritage sites are mostly agricultural operations and facility spaces dominated by agriculture, and workshop-like spaces dominated by small-scale industry or handicrafts. On the one hand, urbanization has had an impact on agriculture and handicraft production in traditional villages and towns. The remaining labor force has moved into larger cities to work, leading to the exodus of some indigenous people. On the other hand, the development of tourism focuses on the resource advantages of heritage sites. External capital and operators conduct element exploration and artistic enhancement of the original space, injecting commercial and service attributes into a single production space, transforming it into a diversified complex space(毛 and 杨, 2020). This article takes Xizhou Town in Dali as an example for analysis.

2.3.1 Agricultural production space—taking Xizhou Ancient Town as an example

The topography of Xizhou is mainly alluvial flat dam. Streets, lanes, and courtyard buildings are embedded among mountains, rivers, and fields, closely integrated with the surrounding large open agricultural rice fields, forming a small town style that combines living and farming. It fully demonstrates the historical process of Xizhou Ancient Town, which once relied on agriculture and commerce as its pillar industries.

In the process of village tourism development, relying on the beautiful local pastoral scenery, the characteristic ecological agricultural landscape of Xizhou Rice Field was preserved after the expropriation for the protection and development of the ancient town. It has become a popular spot for tourists to take photos, and it is also an iconic spot for the integration of culture and tourism in Xizhou. The local government has led the introduction of many new agricultural

partners, such as Dali Ancient Tourism Town Xizhou Pastoral Development Company and Huayu Ranch, and has successively sold 13,000 hectares of land, focusing on the development of ecological recycling agriculture and sightseeing agriculture. Since 2017, Dali Ancient Tourism Town Development Company has continued the traditional farming model on the more than 3,300 acres of land that has been transferred, planting rapeseed in the early spring and rice in the late spring.

In terms of agricultural production, concentrating land resources to carry out large-scale planting has increased land yields. The average annual production of more than 1,000 tons of grain and an output value of more than 3 million yuan is the inheritance and development of the regional farming tradition. The expanded green organic agriculture, experiential ecological agriculture and sightseeing agriculture further enrich the connotation of agricultural production. It makes full use of modern planting technology and combines regional cultural communication to create a comprehensive development model of agriculture, culture, and tourism. In terms of fixed job supply, surrounding villagers are recruited for production and planting, with an annual labor volume of approximately 20,000 people. In terms of driving vitality, new forms of rural tourism such as specialty restaurants, house rentals, and Bai folk style B&B hotels around the rice fields are booming rapidly. The number of "cafés" alone has reached nearly 20. In terms of cultural communication, the "Rice Culture and Art Festival" was held in the autumn, and the organic rice brand "Ximi" and the organic rapeseed oil brand "Xiyao" were launched. There were also folk custom display activities such as the traditional harvest celebration ceremony of the Bai folk group and the experience of intangible cultural heritage crafts, presenting profound cultural connotations. This new green agricultural production pattern guided by the government with market-oriented operation, industrialized management, and socialized services can be said to follow the principle of "authenticity" in the context of the times. On the basis of continuing the farming tradition, it has increased villagers' income internally and created a regional brand externally.

2.3.2 Handicraft production space—taking Zhoucheng Village as an example

Xizhou Town deeply explores the spiritual connotation of national culture and continues the rural custom of the early Republic of China that "the town is a market, the village is a workshop" and “one village has one skill, no competition for mutual benefit". The 13 villages under its jurisdiction insist on creating branded local products, such as felt making, spinning wheel making, silverware, etc. Using the collective thinking of traditional communities to create a unique local art landscape. A regional business alliance community is also formed among different villages.

Zhoucheng Village in Xizhou Town is one of the areas in China that retains the most complete traditional tie-dying craftsmanship and has a long history of handicraft and commercial development. For the local residents of Zhoucheng Village, every process from isatis root cultivation, indigo fermentation, plate making, flower tying to dip dyeing is not only a basic skill passed down from generation to generation, but also an important source of family economy. In the 1980s, a state-owned tie-dye factory was established in the village. After the state-owned factory closed down in 2004, Zhoucheng tie-dye returned to the form of a small workshop where families can weave, tie, dye and sell their work. Inspired by foreign tourists, villagers gradually tried to develop tie-dye experience projects in family workshops. They also integrate artistic elements from other regions, experiment with color dyeing, and innovate various fashionable tie-dye products based on traditional blue and white tie-dye techniques. With the assistance of the Municipal Cultural Administration Office, the original village

collective tie-dye factory building was preserved and renovated, and a new house courtyard was built according to the traditional style of Bai folk residences of "three squares, one screen wall, four combined with five patios". This became the first tie-dye thematic museum, covering the exhibition area, experience area, and teaching area. Bai villagers in the village were recruited to provide guided tours, tie-dye teaching, and product production. With the changes in the socio-economic environment, tie-dye production in Zhoucheng Village has gone through the process of individual-collective-individual. This includes both the villagers' spontaneous competition and exploration, as well as the guidance and support of the local government. In terms of space, the original family-style workshop model makes the handicraft production space and living space highly mixed. The museum adopts a production method jointly with the community, changing the production form of individual workshops in the village with front shops and back houses, and courtyards as workshops. It reuses the "factory" as a collective production space and brings together villagers with tie-dying skills in a public art space. For villagers, the place where they engage in handicraft production has changed from private courtyards to public museums. In addition to making dyeing products, villagers also continue to communicate and interact with other craftsmen, venue operators, and foreign tourists. They not only gained economic income, but also had a more direct and close connection with society. In the process, they further recognized and passed on their own ethnic culture. The original factory space with a single function of manual production has been transformed into a comprehensive communication and experience space integrating handmade manufacturing, cultural display, and cultural tourism services. The elderly Bai people explaining and tying flowers in the museum have also become a unique scenery in the living display of intangible cultural heritage. Xizhou Town insists on building a characteristic industry of "one village, one skill" and has achieved branding and commercialization transformation for the traditional skills of each village. It provides jobs and economic sources internally, spreads local culture externally, and even attracts a large number of highly educated young people to start businesses here, injecting new vitality into the inheritance of traditional crafts.

3. Summary

Authenticity is the primary principle that should be followed in the protection and development of cultural heritage sites. On the one hand, the connotation of "authenticity" is rich and inclusive, and there is no exact standard or evaluation system. Starting from the principles of respecting the historical value of each period, sustainable development, and preserving ecological heritage, the various elements of the environment and the diverse subjects within the heritage site are all part of the authenticity connotation of local cultural development. For cultural heritage sites, appropriate cultural tourism development is necessary to fully utilize the value of local cultural resources and enhance local economic benefits. Moreover, the process of spreading and communicating with the outside world is also an opportunity to widely promote and promote the inheritance of local culture. In the process of cultural tourism development, heritage sites are constantly being pushed to the market as a unique space and cultural resource. Under this circumstance, the traditional self-sufficient agricultural and handicraft production models are bound to be impacted and changed. On the other hand, the requirements for authenticity are also strict. We respect the protection and transformation but do not condone magic transformation, fake antiques, or copying of foreign experiences. The boundaries between them require the planning to play the role of direction guidance and bottom-line control.

This article focuses on production space, taking Xizhou Ancient Town and Zhoucheng Village as examples to analyze the changes in their agricultural space and handicraft space in cultural tourism development from the perspective of authenticity. The commonality between the two

is that the main ownership of the original production space has been changed through land transfer and other methods, a unified design in terms of positioning and function, and new functions such as sightseeing display, tourism services, and cultural experience have been integrated into the traditional production process. These changes retain the local agriculture and handicraft traditions, and combine market demand and modern technology to give it more diverse forms and connotations. They are active expansion and exploration under the principle of authenticity. The Rice Culture and Art Festival, various "Xi" agricultural product brands, and the tie-dye museum that integrates sightseeing, display, production, and experience can also be said to be the preservation of authenticity in this era. This contributes to the living survival of the rice field landscape and the tie-dye process itself, injecting vitality into them.

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Dis-integrated urban biodiversity: an analysis of urban policies and plans in Italy

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Abstract

This contribution presents the outcomes of an analysis of urban policies and plans in Italy where the objectives of UB safeguarding, restoration, provision, and enhancement are explicitly acknowledged. The objective is to understand the interface between biodiversity and urban policies and identify guidelines and strategies for reorienting the action of city governments towards conserving and enhancing UB. The survey has a two-fold focus, respectively, on the urban policies adopted at regional, sub-regional, municipal levels, and on the spatial plans in charge of translating the general objectives identified in policies into concrete actions, and monitoring their implementations. The research findings show that, while at the European and national levels, a clear trajectory of policies regarding urban biodiversity can be observed, at the local level policies mainly have a sectoral focus as well as an ambiguous impact on UB and lack tools and mechanisms for monitoring their implementation. Concerning the plans, the survey highlighted the pervasive, although rhetorical, diffusion of UB strategies and actions in spatial plans. Nevertheless, the scarce integration between thematic and statutory plans results in the difficulty of implementing and monitoring in an integrated way the objectives related to the protection and restoration of urban biodiversity.

Keywords: urban biodiversity, urban policies, spatial plans.

1 Introduction

Since its recognition as a major global challenge at the Cities for Life Summit parallel to the 11th meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD) held in Hyderabad (India) in 2012, Urban Biodiversity (UB) has become a central topic in science and policy worldwide. Indeed, several research have pointed out the potential that cities have in supporting a broad array of plants and animals but also in playing a critical role in biodiversity conservation with initiatives that enhance residents' knowledge and stewardship of biodiversity (Secretariat of the CBD, 2012). Nonetheless, there are still several challenges and obstacles to overcome when scaling up the key benefits of UB through effective policies and plans in cities.

This contribution presents the outcomes of an analysis of urban policies and plans in Italy where the objectives of UB safeguarding, restoration, provision, and enhancement are explicitly acknowledged. The research is conducted within the framework of the National Biodiversity Future Center (NBFC) (2022-25), one of the five national research centers funded by the Italian Recovery and Resilience Plan within the NextGenerationEU program, aimed at aggregating and sustaining the scientific research on biodiversity in the different national territorial contexts. The three-year project was funded to aggregate and sustain scientific research at the national level to understand, monitor, preserve, and restore biodiversity in the marine, terrestrial and

urban ecosystems of the Italian peninsula, making it a central element of country's sustainable development. The goal of the NBFC is to investigate different levels of biodiversity and establish technological innovations to identify new products, processes (Bioprospecting) and solutions (Nature-Based Solutions–NBS) for promoting its economic, social and environmental value for communities (BenDor *et al.*, 2015; Chan *et al.*, 2016).

The research activities promoted by the NBFC refer to three main areas of study: marine, terrestrial, and urban. These areas are connected by the "One Health" strategy and the principle of «not causing significant damage to the environment» (DNSH). The purpose is to provide a holistic and pragmatic vision of biodiversity and identify sustainable management strategies for achieving this vision (WHO *et al.*, 2022). In particular, this article is part of the research activities conducted by Spoke 5 of the NBFC dedicated to investigating biodiversity in cities and urban areas. In Italy, the surface area occupied by high and medium-dense urban areas constitutes the 27.5% of the country's territory and the cohabitation between human beings and other living beings is made complex by the structural absence of nature in cities and the high fragmentation of natural spaces in urban areas, considering that only 2.7% of the territory of the provincial capitals is classified as urban greenery (ISTAT, 2014). At the same time, biodiversity in the city provides multiple benefits for urban communities which concern several environmental, health, social, and economic aspects (Müller, Werner and Kelcey, 2010).

Cities appear to be the places where the functional biodiversity is largely neglected with the presence of many groups of *taxa* (for example plants) that historically have had an aesthetic and ornamental role, but which do not belong to the local eco-regions, where the state of soil quality is scarcely known, and where the presence of plant and animal species is in continuous competition with the presence of humans. Therefore, in urban areas, beyond focusing on the conservation and monitoring of existing biodiversity, it is necessary to work on the development of strategies, guidelines and actions aimed at restoring and/or improving functional biodiversity and promoting the provision of ecosystem services (Woodruff and BenDor, 2016; Salata, 2023).

The research of the Spoke 5 is divided into 7 activities ranging from mapping the quality of soils and ecosystem services, to integrated and sustainable planning and design strategies, and to the management of interventions aimed at ecological and environmental restoration. As part of Activity 3 aimed at developing integrated and sustainable planning and design, the state-of-the-art on the relationship between policies, planning and urban biodiversity was investigated, identifying attributes, drivers and regulatory and strategic devices for contributing to strengthening the patterns of animal and plant diversity in cities (Nilon et al., 2017; Pierce et al., 2020).

Methodologically, the analysis relies on a mapping activity of the relevant urban policies and plans adopted by the provincial capital cities in Italy addressing UB in its multiple benefits. The objectives are to understand the interface between biodiversity and urban policies and identify guidelines and strategies for (re)orienting the action of city governments towards conserving and enhancing UB. The survey has a two-fold focus, respectively, on the urban policies adopted at regional, sub-regional, municipal levels, and on the spatial plans in charge of translating the general objectives identified in policies into concrete actions, and monitoring their implementations (Nilon et al., 2017). The first level emphasizes the discursive construction of, and the tools/mechanisms employed for, UB policies and their multi-level and multi-actor dimensions oriented to downscale general objectives from the EU and national levels to the local level (Uchida et al., 2021). The second focuses on the sectoral and thematic plans addressing UB, with attention to investigate the relationships with the statutory spatial plans and identify the relevant objectives, indicators, targets and resources for supporting the implementation of UB objectives (Pierce et al., 2020).

This research article is structured in five parts after the introduction; the following section two refers to the research background related to the topic of urban biodiversity and

planning from a general point of view. Afterwards, the sections three and four refer to methodological approach used for undergoing to the analysis related to public policies and urban planning procedures for biodiversity in Italy. Section five and six treat the discussions and conclusions consecutively, related to the emerging nodes from the disintegration between policies and planning rules and regulations related to the implementation of urban biodiversity actions and monitoring.

2. Research Background on urban biodiversity and planning

The concept of bringing nature and biodiversity to cities and urban areas is not new; the notion that surrounds the history of urban biodiversity research and practice dates back to the urban ecology studies from the 1980s (Nilon *et al.*, 2017; Rega-Brodsky *et al.*, 2022). While urban biodiversity is intertwined with the development of several associated sub-disciplines of urban forestry, urban wildlife, and urban nature conservation; the importance and impact of nature on citizens of cities is observed in social studies, cultural and urban planning, design and management. The research by Ossola, Irlich and Niemelä (2018) puts in evidence the importance of urban biodiversity as an ecological term interchangeably used with urban green space and urban green infrastructure, which is mainly underlined in some disciplines such as urban planning, landscape architecture and environmental management. The current landscape of research on urban biodiversity shows a mismatch between discourses and practices, mainly due to the lack of measurable actions in urban greening plans, as well as a lack of governance specificity and consistency across multinational scales and city scales particularly (Pierce *et al.*, 2020).

Meanwhile as the research on urban biodiversity advances, since 2020 the European Union has launched the Biodiversity Strategy 2030 to put biodiversity on the path to recovery for people, climate and the planet. The strategy is composed of specific actions, targets and includes relationships with other related strategies such as the Green Deal, the climate change adaptation plans and other food policies (such as the Farm to Fork Strategy) tackling nature restoration, protection and adaptation to resilient ecosystems. Another turning point in the year 2022 when the already mentioned Conference of Parties (COP 15) has adopted the Kunming-Montreal Global Biodiversity Framework (GBF)[1] which builds on "*The Biodiversity Plan"* that commits all parties to setting national targets by 2030. Specifically, targets 12 and 14 focus on urban planning for human well-being and biodiversity as well as on integrating biodiversity in decision-making at every level into policies, regulations, planning and development processes.

In Italy, the declination of the EU Biodiversity Strategy came in the form of the *"Strategia Nazionale Biodiversità 2030"* known as SNB 2030 (MASE, 2023), in the year 2023. That outlines a vision and sets 18 actions distributed along eight areas of interventions to *"bring nature back into our lives"* focusing on health, climate and economy. At the urban level, the most relevant aspect of this strategy is the promotion of urban greening and diffusion of nature-based solutions (NBS) in the urban and peri-urban green ecosystems which is one of the main 18 actions described in the Italian biodiversity strategy (Action B.10). It is also worth noting that the downscale from the EU Biodiversity Strategy implies for European cities and towns of at least 20 thousand inhabitants to develop "ambitious urban greening plans" with a particular stress on the importance of collaborative processes and inclusion of citizens and other stakeholders, and cross-departmental working and integration with other urban development aspects (European Commission, Eurocities and ICLEI, 2022).

One of the most interesting aspects of both strategies whether at the European Union level or the Italian national one, is that their implementation requires multi-disciplinarity of governance, active and shared management approach as well as constant and effective

[1] https://www.cbd.int/gbf

evaluation and monitoring for tracking the planned actions at the local level (Mahmoud *et al.*, 2021). Several research related to urban biodiversity and urban greening reiterate the concept of multi-level policies and multi-actor governance as an intrinsic aspect of urban biodiversity planning (Uchida *et al.*, 2021; Nilon, 2023; Lazzarini, Mahmoud and Pastore, 2024). This attention to the urban biodiversity and governance aspects delves into the need of alignment between stakeholders' values, the community needs, and the possible organizational support to forwarding the implementation of actions at the local level through partnerships and collaborations (Soanes *et al.*, 2023).

3. Mapping the urban biodiversity policies

As mentioned above, the research investigates public policies that deal with urban biodiversity. The definition of public policy is diversified in the literature (Bobbio *et al*, 2017). In this paper, by public policy we mean not only policies that deal with an issue that is perceived and defined as collective, but we look at policies developed by public bodies. Increasingly populated urban areas – by 2050, 70 % of humans will live in cities – are at the center of the global policy debate creating a sustainable and resilient future for cities (UN-Habitat, 2024: 54). The role of biodiversity in the city is addressed as a collective issue: international and national public bodies recognize that biological diversity is essential for species life, ecological balance and the ecosystem services it provides. To examine the variety and the interrelationship of public policies that deal with urban biodiversity in Italy, we considered it necessary to study the different levels of government and land management: from the European level to the national level, and then to delve into the local level for some case studies. We investigated eight northern Italian regions: Valle d'Aosta, Piedmont, Liguria, Lombardy, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia and Emilia-Romagna. This in-depth study stems from the need to understand possible alignments between the policies at different levels having the specific goal to preserve, enhance and restore urban biodiversity.

In this perspective, we put European, national, regional and municipal (Italian provincial capitals) policies in relation. The research sought to understand the tools that public actors deploy to address the challenge of implementing urban biodiversity. To this end, we investigated not only policies that deal centrally with the issue of urban biodiversity, but also policies centered on other issues that address the issue of urban biodiversity in a secondary manner, such as those that deal with forestation, sustainable development, climate change and agriculture. Public actors deploy both substantive (Hood, 1983) and procedural policies (Howlett, 2011). Substantive policies regulate through the imposition of obligations or prohibitions and related sanctions. These are policies that compel the implementation of processes to protect and increase biodiversity. Substantive policies are policies based on incentives or disincentives to encourage precise processes that result in calls for tenders that encourage and finance projects supporting urban greening. Examples include the Climate Decree Call for Proposal 2019 (Bando Decreto Clima) and the Forestation Programs 2020, 2021 related to the National Recovery and Resilience Plan (Programmi di Forestazione del Piano Nazionale di Ripresa e Resilienza). Procedural policies are guidelines or strategies that direct without binding. In this case, if policy-makers – when deciding – do not have all the elements to adopt a specific measure or standard and can prefer to design a pathway in which other actors can specify the content of the policy. Emblematic cases are the EU Biodiversity Strategy 2030 and the Italian Biodiversity Strategy 2030.

4. Mapping the urban biodiversity: a focus on the greening plans

As far as the level of plans is concerned, the research involved an activity of mapping of the spatial plans dealing with urban biodiversity in provincial capital cities in Italy. The objective is to understand which planning instruments the municipal and metropolitan

administrations adopt to protect, restore, and increase urban biodiversity. The mapping led to the identification of various typologies of planning instruments, where urban biodiversity takes on different forms, meanings, and degrees of cogency. Due to the significant role that the issues related to urban biodiversity assume and the policy consideration given to this typology of plan by both the EU Commission and the national government, attention was oriented to map and investigate the Greening plans.

Within this framework, the research has seen a systematic mapping of the Greening plans adopted by the provincial capital cities in Italy. The main policy reference for the Greening plans in Italy is the document of "Guidelines for the management of public green spaces" which was published in 2017 as an instrument for implementing the Law 14 January 2013, n. 10 "Regulations for the development of urban green spaces" (Norme per lo sviluppo degli spazi verdi urbani). The document was drafted by the National Committee for the Development of Public Green Spaces, a multidisciplinary group of experts formed by the Ministry of Environment to monitor the interventions introduced by law n.10/2013. It is aimed at responding «to the widespread need to have homogeneous technical guidelines on the national territory to support governmental policies for the rich and biodiverse green heritage of our cities» (Committee for the Development of Public Greens 2017: 4). The document recognizes three specific tools for the planning, programming, and management of public green spaces: the Green Census (Censimento del verde), the Green Regulation (Regolamento del verde) and the Greening Plan (Piano del verde).

Within this contribution, attention is oriented to the Greening plans which the Guidelines define as the policy instrument in charge of strategically addressing the problems and challenges linked to the integrated planning, management and monitoring of green areas.

The research has conducted a survey of the Greening Plans' documents on the websites of the provincial capital administrations, carried out between April and December 2023 in collaboration with the other researchers from the University of Florence and the University of Molise involved in Activity 3 of the Spoke 5 of the NBFC. The information collected through the survey was subsequently validated with the ISTAT survey "Environmental data in cities" updated to 2021, coordinated by the Statistics Office of the Municipality of Venice. The survey contains data on the Greening plans, the arboreal survey (bilancio arboreo) and several other issues related to the monitoring of the implementation of law 10/2013 in the 109 provincial capital cities in Italy (ISTAT, 2021).

At a methodological level, due to the still limited diffusion of the Greening Plan in our country as outlined in the Guidelines document, the research also took into consideration the Green Infrastructure Strategies and Action Plans. While the former share with the Greening Plans the objective to outline a strategic framework for green planning, the latter are more focused on the implementation dimension of the plan, giving space to strategic actions, and investment priorities for the improvement and valorization of the natural capital.

The mapping led to the identification of 19 Greening Plans and Strategies adopted in the provincial capital cities and 3 Greening Plans currently being developed (Greening Plan of Florence, Rimini, and Ascoli Piceno). 3 cases (Pisa, Cagliari, Sondrio) concern greening plans approved before 2017, while the remaining 16 refer to recent plans, approved during the last five years. An interesting aspect concerns the distribution of the mapped plans across the national territory: the north-south disparity is evident with the localization of the plans mainly in the central-northern Italian regions, with only two Greening plans mapped respectively in the southern regions (Avellino and Matera) and one in the island regions (Cagliari). Overall, the image shows a scarce diffusion of this instrument in our country: in the 109 Italian provincial capitals, the Greening Plan is present in less than 2 cities out of 10.

5. Discussions

As anticipated in the previous sections, the study of public policies on urban biodiversity has allowed some general considerations to emerge on the panorama of European policies as a fertile ground for the budding of national policies, on the type of policies currently dealing with this issue, and finally on the relevance of the theme of urban biodiversity in the various instruments investigated.

Firstly, the European Green Deal ushered in a new era of public policies on the environment and biodiversity (European Commission, 2020a). From agriculture to climate policy, there is a convergence of goals on the protection, enhancement and restoration of biodiversity. Among the various and numerous areas of research of the European Green Deal, some policies deal centrally with the relationship between nature and the city. Regarding the research area 'Environment and Oceans', one of its 11 actions is the EU Biodiversity Strategy for 2030, a policy that is also relevant to urban spaces. Action Trackers Nos. 51, 52 and 53 give indications on how member states are to draw up 'Urban Greening Plans' for cities of over 20,000 inhabitants. In addition, one of the four actions of the EU biodiversity strategy is the New Nature Restauration Law, a bill including urban areas among the ecosystems to be restored by setting targets to be reached in 2030 and 2050 for green areas. In this context, Italy's 'National Biodiversity Strategy 2030' was drawn up, adopted in August 2023 and aligned with European guidelines. This strategy constitutes the reference document about biodiversity for the entire national territory. This policy also addresses urban biodiversity by reaffirming the goal of implementing ambitious urban greening plans. The Italian 'National Biodiversity Strategy 2030' affirms the importance of urban green systems in cities and nature-based solutions (NBS) to provide ecosystem services to citizens. Encouraging their implementation in the urban environment allows cities to increase biodiversity and system resilience and to adapt to climate change. Biodiversity can provide multiple benefits, such as improved air quality and social benefits.

The second consideration concerns the role of urban biodiversity in the policies mapped. At the national level, few policies address the issue of urban biodiversity in a central way. The protection of urban biodiversity is a secondary and consequential objective of urban policies that directly address other issues such as sustainable development or climate change. The same situation can be observed at the local level. Taking Emilia-Romagna as an example, the region has not produced any policies explicitly focused on urban biodiversity in the last 10 years. Also, regarding provincial capital municipalities, the only document identified is the Guidelines for the management of biodiversity in public and private green areas (Linee guida per la gestione della biodiversità nelle aree verdi pubbliche e private) adopted in 2022 by the municipality of Piacenza. The other policies identified at regional, metropolitan and municipal level deal with urban biodiversity in a secondary or marginal manner, having as other topics as their focus: forestry, sustainable development, climate change and agriculture. Concerning forestry we mapped the Regional Forestry Plan (Piano Forestale Regionale, 2016), the Guidelines for Metropolitan Forestry (Linee Guida per la Forestazione metropolitana, 2021); concerning sustainable development we have the Metropolitan Agenda for Sustainable Development (Agenda metropolitana per lo sviluppo sostenibile, 2019), the Urban Transformation Agendas for Sustainable Development of Piacenza, Ferrara, Ravenna, Modena, Cesena, Rimini, Forlì, Reggio and Parma (Agende trasformative urbane per lo sviluppo sostenibile – ATUSS, 2023); concerning climate change we have the Climate change mitigation and adaptation strategy (Strategia per la mitigazione e l'adattamento per i cambiamenti climatici, 2015), the Jobs and Climate Pact (Patto per il Lavoro e il Clima, 2020), the Reggio Breathes programme (Programma Reggio Respira, 2016), the Local Adaptation Strategy Reggio Emilia (Strategia locale di adattamento Reggio Emilia, 2021), the Green strategy for Bologna's urban climate (Strategia del verde per il clima urbano di Bologna, 2022), the Bologna Resilient City (Bologna Città Resiliente, 2020); and concerning agriculture we have the Regional Programme European

Regional Development Fund 2021-27 (Programma regionale FERS), the Rural Development Completion 2021-27 (Completamento Sviluppo Rurale). On the one hand, this analysis has allowed us to deduce that there is a commitment to integrate different themes and various axes of urban development even if they are always linked to the environmental aspects, but on the other hand, we observe that the role of urban biodiversity in these documents is sometimes merely rhetorical.

The last consideration concerns the type of policies currently in place to protect and increase biodiversity in cities. According to the investigations done, at the European level, if we consider that the New Restoration Law is only a bill for now, the EU Biodiversity Strategy for 2030 is a procedural policy that devolves to the member states the drafting of instruments for the implementation of the defined objectives. At the national level, the Italian Biodiversity Strategy for 2030 is also a procedural policy, while Law no. 10 of 2013 is the only law that gives indications and obligations on the development of urban green even if it does not give precise indications on urban biodiversity. This law has been followed by other procedural policies – the Guidelines for urban green management first indications for sustainable planning (Linee guida per la gestione del verde urbane prime indicazioni per una pianificazione sostenibile, 2017) and the National Urban Green Strategy (Strategia Nazionale del Verde Urbano, 2018) – that address and encourage the planning and design of green areas at different scales (territorial, urban, architectural) but that have actually led to the development of few thematic plans.

As far as the analysis of greening plans is concerned, we mentioned in the previous section that the recency is an important aspect characterizing the sample under investigation. Most of the Greening plans have been adopted in the past 6-7 years, with just three plans adopted before 2017. Despite the still scarce diffusion of this instrument in Italy (less than 2 provincial capital cities have an adopted greening plan), the analysis shows that the Guidelines introduced at the national level are slowly producing an impact on the elaboration and adoption of greening plans throughout Italy, providing a useful framework for the local administrations that manifest the political commitment to develop a greening planning framework. Another catalyst is the already mentioned EU Biodiversity Strategy that calls on the European cities and towns of at least 20,000 inhabitants to develop Urban Greening Plans including "measures to create biodiverse and accessible urban forests, parks and gardens; urban farms; green roofs and walls; treelined streets; urban meadows; and urban hedges" (European Commission, 2020b: 13). In the case of the EU Biodiversity Strategy, the reference goes to the "Guidance for cities to help prepare an Urban Greening Plan", which was adopted as a draft version in 2022. The guidance stresses the importance of the collaborative process underlying the Greening plan elaboration, including the need for working with citizens and other stakeholders, and for cross-departmental dialogue and integration with other aspects of urban development, from mobility and health, air and water, to energy and climate adaptation (European Commission, Eurocities and ICLEI, 2022). While in some Greening plans the relationship with these documents of guidance appears to be clear and direct, it is interesting to notice that other cases show a different pathway which is related to specific EU-funded projects that display knowledge and economic resources for their elaboration. For instance, this is the case of the Green Infrastructures Action Plan of Ferrara adopted in 2019 as an outcome of the Interreg Project PERFECT (Planning for Environment and Resource efficiency in European Cities and Towns) or the case of the Bologna Urban Climate Green Assets Plan, which comes as one of the results of the LIFE Clivut project (Climate Value of Urban Trees).

A second relevant aspect emerging from the analysis concerns the structure of the Greening plans. The research has pointed out a high level of heterogeneity and differentiation in the contents and arrangement of the plans. Despite the identification of some basic contents that the greening plans *should* have according to the National Guidelines (Pastore and Lazzarini, 2024), the weight that the Greening plan gives to the analytical and strategic dimensions varies

significantly from plan to plan. In some plans, the analytical part prevails over the strategic one, which means that the description and investigation of the local green system is rich and articulated, but this is not accompanied by a set of effective strategies and actions for supporting the transition towards greener and more resilient urban spaces. In others, the strategic and/or design dimension is dominant but the analytical part that should be at its basis is not sufficiently developed.

This differentiation also translates into the role that the objectives and strategies related to urban biodiversity have in the greening plans. For instance, some plans, as the one of Avellino, treat the topic of biodiversity mostly working on consolidating and completing the ecological network of the municipal territory, strengthening the connections between the protected natural areas present in the hinterland and the urban green spaces located in the town. Other plans, such as the one of Padova, introduce a set of specific objectives, strategies and actions explicitly tackling biodiversity. These rely on a survey made by local experts to monitor the diffusion of selected animal species in specific areas of the municipality.

One problem that emerged from the analysis concerns the weak commitment to implementation characterizing the majority of the greening plans investigated. Several plans do not specify which devices, tools, mechanisms, and processes are needed to implement the objectives and strategies. It is also often reported the lack of specification of the economic and human resources that would be required to bring those objectives to implementation. Despite this weakness, the greening plans mapped make an extensive use of quantitative indicators to monitor the actions included which mainly refer to the increase of both habitat area (e.g., total green surface area, number of trees and their canopy cover, etc.) and biodiversity performances (e.g., number of animal species or percentage of tree species diversity reported in each portion of green area) (Lazzarini, Mahmoud and Pastore, 2024). One open issue concerns the lack of quantitative targets that should accompany the monitoring indicators for preserving or increasing biodiversity habitats and species. Indeed, greening plans often introduce a set of specific indicators for monitoring the achievement of biodiversity objectives and actions, but they do not establish any specific quantitative target for these objectives, making their commitment to implementation weak.

6. Concluding remarks

From the research conducted, our observations are mainly considering the evident challenges from integrating urban biodiversity objectives between the EU and national to the regional and local level, even though the European policies and roadmap clearly facilitate the adhesion to increasing urban and blue greenery to improve quality of life and well-being in cities.

On one hand, and in some rare cases, the national policies and local policies align with the same vision on urban biodiversity conservation, restoration and increment, as highlighted in the case of Bologna. On the other hand, the urban greening plans are clearly sectorial, and in some cases, they do not dialogue with other thematic plans also operating on urban development themes that could have actions related to urban biodiversity in them. A clear disintegration happens at the spatial planning level whereas the planning regulations and thematic plans operate locally in municipalities and in cities abiding by the statuary planning laws and regulations that, nonetheless, do not get combined with each other towards creating a wider urban nature strategy at a larger scale, except in some cases.

Another disintegration happens within the same municipality governance level itself; in some cases, the technical knowledge and expertise needed for developing an urban greening/nature plan are sitting within the directorate of urban planning and do not dialogue with other sectors or directorates such as the mobility and infrastructure, health and built environment, etc. This disintegration is however a challenge that should be looked at from

within the governance process of the urban biodiversity strategy itself, by increasing the dialogue between stakeholders, citizens and decision-makers while trying to break silos circles.

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Insights into the Evolution of Airbnb Accommodations: Beyoğlu Beyond Borders

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Abstract
In recent years, the sharing economy has revolutionized urban tourism, shifting from traditional hotels to amenity-based house stays facilitated by platforms like Airbnb. Istanbul, Turkey's most populous city, with approximately 16 million annual visitors, has seen a significant presence of Airbnb listings, particularly in the Beyoğlu district. This study delves into Airbnb's impact on Istanbul's urban tourism, focusing on Beyoğlu. By analyzing the spatial characteristics and development disparities of Airbnb listings, closely tied to city centres and major tourist attractions, the research utilizes spatial analysis to understand Airbnb's impact amidst varying socioeconomic and environmental conditions. Utilizing data from InsideAirbnb.com, the analysis highlights that a significant number of Airbnb listings are strategically located near key tourist attractions such as Taksim Square and Istiklal Street, enhancing accessibility for tourists. While these accommodations drive consumer spending towards small businesses and foster cultural exchange by enabling guests to engage deeply with the local community, challenges such as disruptions to neighborhood dynamics and residential tranquility also arise. The study emphasizes the importance of balanced urban planning and regulatory strategies to harness Airbnb's benefits while mitigating its adverse impacts, ensuring that Beyoğlu's growth as a tourist hub enhances both visitor experiences and community well-being.

Keywords: Airbnb, peer-to-peer accommodations, sharing economy, urban tourism, Istanbul

1. Introduction
In recent years, the rise of the sharing economy, particularly platforms like Airbnb, has significantly transformed the landscape of urban tourism worldwide. This paradigm shift brings forth not only new opportunities but also challenges in understanding its impacts on local economies, communities, and urban dynamics. Within this context, this study focuses on Airbnb accommodations in the vibrant Beyoğlu district of Istanbul, with a specific emphasis on the iconic Cihangir neighborhood, renowned for its cultural richness and touristic appeal.

Leveraging data sourced from insideairbnb.com, our analysis delves into the spatial characteristics, socio-economic factors, and the overall influence of Airbnb on Beyoğlu's local tourism economy. Through a methodical approach encompassing proximity analysis, socio-economic exploration, and trend examination, this study aims to provide a comprehensive understanding of Airbnb's role within this urban ecosystem.

By juxtaposing insights garnered from the broader Beyoğlu dataset with detailed analyses of Cihangir-specific reviews, the study endeavors to shed light on the nuanced interactions between Airbnb, urban tourism, and community dynamics. Through this exploration, it aims to discern the extent to which Airbnb contributes positively to the local economy and cultural tourism in Beyoğlu, while also identifying avenues for sustainable growth and community development.

The subsequent sections will commence with a literature review to contextualize the study within the existing body of research on urban tourism and the sharing economy, thereby

establishing a robust theoretical framework for the analysis. Following this, findings will be represented with an overview of the dataset and methodology employed, followed by a detailed analysis of Airbnb accommodations in Beyoğlu and Cihangir. Subsequently, the research will delve into the implications of our findings within the broader context of urban tourism and the sharing economy, offering insights for future research and policy considerations.

2. Literature Review

In scholarly discussions concerning the sharing or platform economy, a significant portion of its expansion is attributed to the rise of peer-to-peer (P2P) accommodation providers, exemplified prominently by Airbnb. These platforms have become the subject of rigorous debate within academic circles owing to their multifaceted impacts across various facets of the tourism and hospitality sectors, spanning socio-cultural, economic, and environmental realms (Hall et al., 2022). While certain scholars accentuate the positive aspects, such as enhanced accessibility and flexibility for travelers, others underscore the negative ramifications, including heightened competition with conventional lodging establishments and the potential disruption of local communities.

The proliferation of Airbnb and analogous platforms has precipitated spatial transformations within urban landscapes, prompting concerns regarding their implications for neighborhood dynamics and community welfare (Curto et al., 2022). Empirical evidence suggests that the spatial distribution of short-term rentals often clusters around city centres and tourist hubs, exerting discernible impacts on local housing markets and exacerbating socio-economic disparities. For example, investigations conducted in cities like Turin, Barcelona, and Melbourne, as demonstrated by Curto et al. (2022), illuminate how the prevalence of short-term rentals correlates with factors such as income levels, educational attainment, and housing characteristics, thereby influencing their spatial distribution across diverse neighborhoods.

Furthermore, the expansion of Airbnb has elicited inquiries into its role within the dynamics of urban tourism, particularly within mid-sized cities characterized by heterogeneous economic landscapes (Ioannides et al., 2019). Inquiries conducted in locales such as Utrecht shed light on Airbnb's potential to catalyze the expansion of tourism bubbles, particularly within nascent neighborhoods undergoing socio-cultural transformations. These phenomena underscore the exigency for nuanced policy responses that navigate the intricate interplay between tourism development, housing markets, and community welfare.

The spatial dynamics of Airbnb accommodations within Istanbul's Beyoğlu district are examined in this study. Findings are parallel to researches from other global cities, notably London. (Liqing La et al., 2022) Observed distribution pattern is similar to London, where Airbnb listings concentrate around tourist attractions and in peripheral urban zones, suggesting strategic placement to enhance tourist accessibility: a trend likely mirrored in Beyoğlu. The economic and social impact of Airbnb on local communities is a focal point, echoed by Alexander's 2018 research on Airbnb in Melbourne (Alexander, 2018). Insights reveal how Airbnb influences housing markets and urban planning, posing challenges and opportunities for Beyoğlu's residential dynamics and urban development strategies. Policy implications derived from comparative urban analyses, such as those by Alexander, stress the need for comprehensive planning strategies to manage Airbnb's impacts. Similar approaches recommended for Melbourne advocate for urban sustainability and resident welfare, offering valuable insights for Beyoğlu's policymakers.

Insights from Benítez-Aurioles and Győdi provide a framework for understanding Airbnb's broader economic implications (Benítez-Aurioles, 2019 & Győdi, 2019). The study emphasizes competition with the traditional hotel industry and the need for adaptive economic policies that has a potential to adapt Beyoğlu's tourism sector. Spatial analyses (Gutiérrez et al., 2017) highlight Airbnb's strategic placement within urban landscapes, influencing real estate dynamics and socio-economic disparities, findings that likely resonate in Beyoğlu., Like Gurran's examination of housing markets and community welfare (Gurran, 2018), incorporating recent scholarly explorations into Airbnb's impact on urban environments enriches our understanding of Beyoğlu's situation. This holistic approach ensures a well-rounded exploration informed by global trends and practical insights, vital for developing effective policies and strategies tailored to Beyoğlu's unique context.

In conclusion, the literature on Airbnb and the sharing economy furnishes invaluable insights into the evolving contours of urban tourism. By scrutinizing the socio-economic, spatial, and cultural dimensions of Airbnb's influence, scholars contribute to a nuanced comprehension of its impacts and the formulation of efficacious policy interventions. Looking ahead, interdisciplinary research endeavors are imperative to address the multifaceted challenges and opportunities engendered by the integration of sharing economies into the urban fabric.

3. Methods and Materials

This research aimed to investigate the landscape of Airbnb accommodations within Istanbul's Beyoğlu district, with particular attention to the Cihangir neighborhood (Figure 1), renowned for its appeal to tourists. Utilizing data sourced from insideairbnb.com (https://insideairbnb.com, 2023), the analysis delved into the spatial characteristics, socio-economic dimensions, and their interplay within the local tourism economy. The methodological framework involved several sequential steps, including the meticulous curation of listings by district, detailed proximity analyses concerning notable tourist attractions, comprehensive exploration of socio-economic variables, and a longitudinal examination of evolving trends.

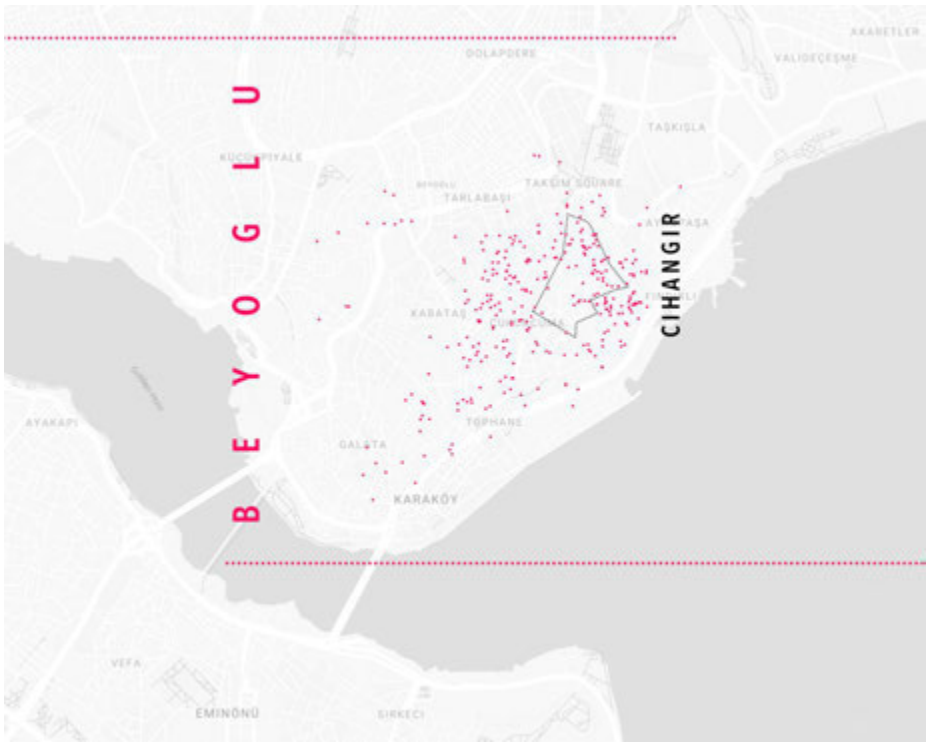

Figure 1: Map of the case area (produced by the authors, 2024)

By the end of 2023, Beyoğlu emerged as a host to a substantial inventory of Airbnb rental units, totaling 34,446, with 18.6% of Istanbul's listings concentrated within this district, constituting 6,393 units, exclusively comprising entire home offerings (Figure 2). Among these, 452 units were situated in Cihangir, thus forming the central focus of this inquiry. The analytical scrutiny concentrated on these Cihangir-based rental units, excluding those without prior rental history or those garnering fewer than 10 reviews, culminating in a comprehensive assessment of 312 units.

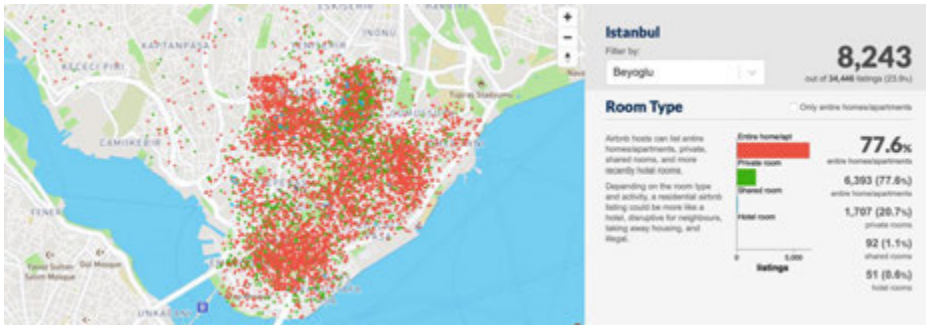

Figure 2: A graphical visualization for Beyoğlu on the website Inside Airbnb (https://insideairbnb.com, 2023)

The analysis focused on spatial characteristics, socio-economic factors, and their influence on the local tourism economy as outlined in the paper. This included assessing proximity to tourist attractions, the socioeconomic status of neighborhoods, and the distribution of Airbnb listings across Beyoğlu. The data provided contained a detailed listing of Airbnb accommodations in Istanbul, including location descriptions, URLs, and reviews. To align with the study's focus on the Beyoğlu district, the following phases were taken:

- Phase 1: Listings were filtered by district to isolate entries specific to Beyoğlu based on the neighborhood overview or any district identifier present in the data.
- Phase 2: Spatial analysis
  Proximity to Attractions
  - The examination commenced by assessing the proximity of accommodations to key tourist attractions. Leveraging latitude and longitude data from the dataset, distances were calculated to prominent landmarks in Beyoğlu, including Taksim Square and Istiklal Street.
  - The majority of listings are situated in close proximity to Taksim Square, with distances ranging from approximately 0.46 km to 0.77 km. This close proximity is likely to enhance their appeal to tourists seeking convenient accommodation options.
  - Listings also boast close proximity to Istiklal Street, a prominent shopping and cultural hub in Istanbul. This proximity offers visitors easy access to shopping, dining, and nightlife experiences, further enhancing their attractiveness.

  Accommodation Features
  - The listings exhibit a diverse range of bed arrangements, suggesting accommodation options suitable for individuals as well as larger groups. While the dataset lacks information on the number of bedrooms, the provided number of beds offers insight into the accommodation's capacity.
- Phase 3: Pricing Dynamics
  - Prices display variability, potentially influenced by factors such as proximity to key attractions, bed capacity, and other amenities not explicitly detailed. Prices display variability, potentially influenced by factors such as proximity to key attractions, bed capacity, and other amenities not explicitly detailed. For example, the average nightly price for homes is 3,002 Turkish Lira, with an annual average income of 198,803 Turkish Lira, indicating a diverse array of accommodation options catering to different market segments.
  - Economic Impact: Trend analysis examined the distribution and evolution of listings over time, and their relationship with local economic data such as housing prices and income levels.
- Phase 4: Socio-economic analysis explored variables related to the socioeconomic status, such as perceived neighborhood quality from listing descriptions and review sentiments.

4. Results

This study adopts a content analysis methodology to delve into the keywords and sentiments expressed within guest reviews sourced from Insideairbnb.com. Leveraging the comprehensive features of the MAXQDA program[1], the analysis process is structured to meticulously explore

[1] MAXQDA is a qualitative data analysis software that facilitates in-depth exploration and interpretation of textual, audio, video, and image data. It offers a range of powerful tools for organizing, coding, and analyzing qualitative data, making it an invaluable resource for researchers conducting content analysis and qualitative research (https://www.maxqda.com, 2023).

the textual data, enabling the identification of underlying themes, patterns, and trends. By employing content analysis coupled with sophisticated analytical tools, this research aims to gain nuanced insights into the perceptions and experiences of Airbnb guests, contributing to a deeper understanding of the platform's impact on urban tourism dynamics.

Review analysis utilized natural language processing techniques to extract keywords and sentiments from guest reviews, providing insights into overall guest satisfaction. By examining the content of reviews, common themes and sentiments expressed by guests regarding their stays in Beyoğlu's Airbnb accommodations were identified. The analysis yielded the following key findings:

- *Cultural and Scenic Appeal:* Guest reviews frequently highlight the proximity of accommodations to cultural sites and scenic areas, such as seaside bars in Cihangir, underscoring Beyoğlu's vibrant nightlife and aesthetic allure.
- *Location Advantages:* Many reviews underscore the strategic positioning of accommodations, emphasizing their proximity to key areas within Beyoğlu and well-known streets, which enhances their appeal to guests.
- *Neighborhood Characteristics:* Discussions in reviews often emphasize the safety, beauty, and historical richness of Beyoğlu's neighborhoods, indicating that guests value these attributes when selecting accommodations.
- *Proximity to Taksim:* Numerous reviews specifically mention the proximity to Taksim Square as a significant factor for tourists seeking convenient access to Istanbul's central attractions, highlighting its importance in guest satisfaction.
- *Safe and Established Areas:* Safety and the established nature of the area emerge as recurring themes in guest reviews, reflecting a preference for secure and well-known locales among guests.

The text from neighborhood reviews was analyzed to identify common themes or sentiments that might have influenced guests' experiences. This analysis aimed to understand what guests valued most about their stays in Beyoğlu and could have implications for review scores. Simple keyword extraction was utilized to identify frequently mentioned terms in the neighborhood descriptions. The results of this text analysis are as follows:
"Istanbul": Indicates the broader geographic reference, emphasizing the location within the city.
"Galata" and **"Taksim"**: These are specific areas within Beyoğlu, known for their cultural and historical significance as well as vibrant nightlife and shopping options.
"Istiklal": Refers to Istiklal Street, a famous pedestrian street in Beyoğlu, lined with shops, cafes, and historic sites.
"Street", **"Square"**, **"Minutes"**, **"Walk"**: These terms suggest that proximity and ease of access to attractions are important features.
"Restaurants": Highlights the culinary experiences available in the area, which is a key attraction for many visitors.

The top keywords extracted from the reviews offer insights into the aspects guests most frequently mention in their reviews for Cihangir Airbnb listings:
"Apartment": The most common term, likely reflecting discussions about the accommodations themselves.
"Great", **"Location"**, **"Place"**, **"Stay"**: These words highlight positive experiences related to the quality of the stay and the geographic convenience of the accommodations.
"Clean", **"Nice":** Often associated with guests' satisfaction with the cleanliness and overall appeal of the places they stayed.

"Host": Indicates that interactions with hosts are a notable aspect of guest experiences, which can significantly affect their overall satisfaction.

To offer more nuanced insights, we conducted a detailed sentiment analysis, focusing on specific categories mentioned in the reviews, such as cleanliness, location, and interaction with hosts. This approach allows us to understand how different aspects of the stay contribute to the overall sentiment. Detailed sentiment analysis results by category, targeting specific aspects of the Airbnb experience, yielded the following average sentiment scores:
Cleanliness Sentiment: 0.378 - This score indicates a generally positive sentiment when reviews mention cleanliness, reflecting satisfaction with the cleanliness of the accommodations.
Location Sentiment: 0.419 - Similarly, this score demonstrates a positive sentiment, suggesting that guests often appreciate the location of their accommodations in Cihangir.
Host Sentiment: 0.427 - This category yielded the highest sentiment score, indicating very positive experiences with hosts. It highlights good service and hospitality as significant factors contributing to guest satisfaction. Analysis of guest reviews uncovers a strong theme of community interaction, with many guests appreciating the "local" experience facilitated by their hosts. This includes participating in local festivities, visiting neighborhood markets, and engaging with local artists. Such interactions underscore Airbnb's role in enhancing cultural exchange and deepening guests' understanding of Istanbul's diverse cultural tapestry.

The average sentiment score of the reviews stands at approximately 0.345, suggesting a generally positive sentiment among guests. This score indicates that the majority of reviews convey favorable experiences, potentially reflecting satisfaction with both the accommodations and the neighborhood attributes of Cihangir. The sentiment and thematic analysis of the reviews from Airbnb listings in Cihangir indicate a generally positive guest experience, with significant emphasis placed on the quality and location of accommodations, as well as cleanliness and host interaction. These factors play a pivotal role in upholding high guest satisfaction levels and can offer valuable insights for Airbnb hosts in Cihangir to enhance guest experiences even further.

4.1. Spatial Analysis

To explore the spatial experience of guests, the urban context, and the architecture and interior design of Airbnb accommodations in Beyoğlu, we focused on elements within the reviews that specifically mentioned the physical aspects of the spaces, their aesthetic appeal, and their integration into the urban environment. Terms and phrases within the reviews related to these themes, such as "design", "architecture", "spacious", "layout", "modern", "traditional", "style", and "urban", were identified. This helped us to capture insights related with the spatial and architectural characteristics of the Airbnb listings in Beyoğlu. This focused analysis was performed to provide insights into the spatial and architectural experience of guests.

The focused analysis on the spatial experience, architectural design, and urban context of Airbnb accommodations in Beyoğlu provided the following insights based on the frequency of related terms in the reviews:

Interior Design & Architecture: 274 mentions - Guests often noted elements of design and architecture, such as style, modernity, and traditional aspects of the interiors, suggesting their importance in the guest experience. While not as prominently mentioned as other factors, comments on unique architectural features and modern interior design were frequent, aligning with literature on "Interior Design" and "Architecture" codes. This underscores the significance of visual and functional appeal in guest satisfaction, with mentions of "modern amenities" and

"beautifully designed interiors" reflecting appreciation for contemporary and traditional styles alike.

Review data emphasized the significance of amenities in elevating the guest experience, with specific mentions of "comfortable beds," "well-equipped kitchens," and "spacious bathrooms" aligning with detailed amenity codes such as "Beds," "Kitchen," and "Bathroom." Additionally, the frequent discourse on views and environmental comfort elements like air conditioning and heating provides further support for themes categorized under "Functional" aspects related to space quality and usability.

Listings often highlight the architectural uniqueness of the properties, which may range from restored Ottoman-era homes to modern apartments with panoramic city views. For example, a listing might describe, "Our home combines Ottoman architectural grace with contemporary design, featuring high ceilings and large windows overlooking the Golden Horn." Guests frequently express their appreciation for these features, with comments like, "The architecture of the place was a blend of classic and modern, which really added to our experience of the city."

In terms of interior design and space quality, hosts frequently leverage interior design as a selling point, showcasing how spaces are tailored for comfort and aesthetic appeal. A typical description might read, "Designed with a keen eye for style, our apartment features bespoke furniture and art pieces that complement its historical context." Reviews support this focus, with guests noting, "The beautifully decorated interiors made our stay feel luxurious and comfortable, a perfect retreat after a day of touring."

Urban Context & Experience: 533 mentions - Significant mention of the urban experience, including the vibe of the neighborhood, local community, and the general atmosphere, was observed. This indicated that guests appreciated accommodations that integrated well with the urban environment and provided a genuine experience of city life in Beyoğlu.
These findings suggested that while the interior design and architectural elements were appreciated, guests placed a higher value on the functionality and quality of the space, as well as the broader urban experience offered by the accommodations. This could be a key consideration for Airbnb hosts looking to improve their offerings, as well as for urban planners and local policymakers aiming to integrate tourism more deeply into the urban fabric of Beyoğlu.

To provide a detailed analysis of the *"Urban Context and Experience"* theme from the Airbnb reviews in Beyoğlu, the focus was on extracting and interpreting guest comments that discussed the interaction between the accommodations and their urban environment. This included examining how guests perceived the neighborhood's atmosphere, the characteristics of the local community, and the overall city life surrounding them. The sample reviews gathered under this theme highlighted various aspects of how guests perceived and interacted with the urban environment in Beyoğlu. Here's a breakdown of the key elements derived from these reviews:

Neighborhood Atmosphere: Descriptions of the ambiance, vibe, or spirit of the neighborhood as perceived by the guests. Guests appreciated the local ambiance, noting the vibrancy and cultural richness of the neighborhood. For example, one review mentioned enjoying the local cafes and glimpses into Turkish life, suggesting that the neighborhood's character significantly enhanced their experience.

Local Community and Culture: Observations about the people, cultural practices, and daily life in the neighborhood from the guests' perspective. Many reviews highlighted interactions with the local community or observations of daily life, indicating that the social environment was an integral part of the urban experience. Comments about children playing in the streets or local customs provided a deeper connection to the place.

Proximity to Urban Amenities: Many Airbnb listings in Beyoğlu underscore their proximity to Istanbul's cultural and historical landmarks, such as museums, historic mosques, and art galleries. For instance, a host highlights, "Just a five-minute walk from the famous Galata Tower and the bustling Istiklal Street, our apartment offers guests a chance to immerse themselves in the city's historical charm." Reviews often express appreciation for these locations, with one guest noting, "Loved being so close to major attractions, it made our cultural excursions easy and enjoyable."

Accessibility and Convenience: Guest reviews commonly highlight the ease of accessing public transportation, facilitating exploration of Istanbul. One review mentions, "The proximity to the metro station made it effortless to explore the city, from historical sites to modern shopping areas." Listings also mention amenities like cafes, markets, and nightlife within walking distance, indicating the urban convenience that Beyoğlu offers. For example, one listing states, "Surrounded by local cafes and vibrant street markets, our location is perfect for those who want to experience Istanbul's lively urban life."

Challenges and Concerns: Some reviews also discussed challenges related to the urban context, such as difficulty navigating backstreets, the condition of sidewalks, or the general maintenance of the area. These insights were crucial for understanding potential areas for improvement in urban planning and tourism management.

These findings suggested that the urban context of Beyoğlu significantly shaped guests' experiences, with cultural vibrancy, community interaction, and accessibility playing key roles. Understanding these aspects could help stakeholders in tourism and urban planning capitalize on strengths and address any weaknesses. This detailed insight into the urban experience could guide improvements in local infrastructure, cultural engagement strategies, and overall hospitality practices to enhance the attractiveness and functionality of urban tourism environments like Beyoğlu.

4.2. Economic Impact Analysis

Looking at the annual earnings, Figure 3 shows an increase in income as the length of stay increases. This indicates that longer-term rentals generally yield higher total income. However, the highest earnings are not in the range of 241 days or more, but rather in medium-term rentals (such as 91-120 days). This may be due to the popularity or higher prices of medium-term rentals. Additionally, according to the graph, as the rental duration of Airbnb properties in Beyoğlu increases, there is a general downward trend in the number of properties used. While the highest number of properties is in the range of 1-30 days, this number slightly increases for 241 days or more, but is less than other duration ranges.

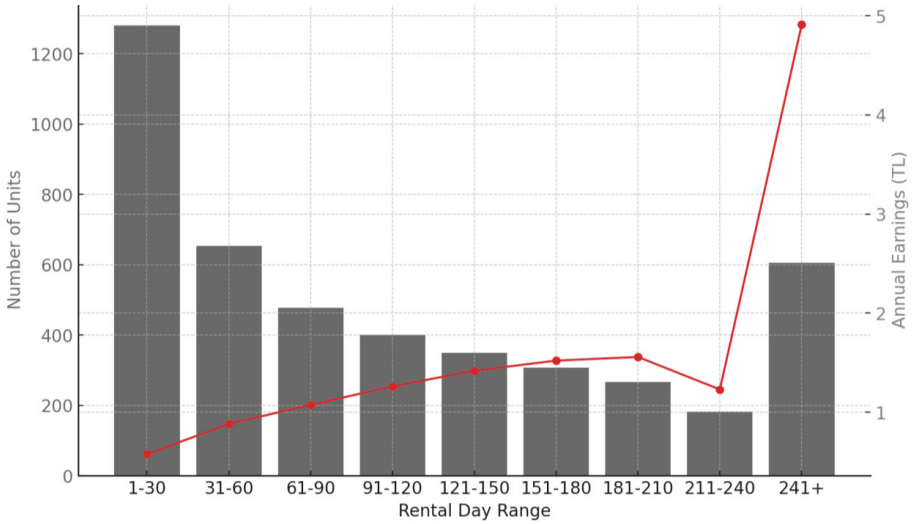

Figure 3: Beyoğlu Airbnb rental periods and annual earnings

The analysis of listing descriptions reveals a noteworthy trend wherein local amenities feature prominently, indicating Airbnb's substantial influence on the local economy. Specifically:

- Restaurants: These are mentioned 1,325 times, underscoring their significance to guests seeking dining options during their stay.
- Shops: With 1,308 mentions, the presence of nearby retail establishments emerges as a key consideration for guests, reflecting the convenience and accessibility of shopping opportunities.
- Markets: Mentioned 425 times, the presence of local markets highlights the appeal of proximity to fresh produce and other goods for Airbnb guests.
- Cultural Sites: These are referenced 387 times, indicating the interest of guests in exploring cultural attractions within the vicinity of their accommodations.
- Tourist Sites: With 608 mentions, the proximity to tourist hotspots emerges as a major selling point for Airbnb listings in Beyoğlu, catering to travelers keen on exploring popular landmarks and attractions.

These findings suggest a strategic positioning of Airbnb listings in Beyoğlu, capitalizing on the allure of local economic and cultural amenities to enhance their appeal to tourists. Reviews further substantiate this trend, with guests frequently mentioning nearby attractions and businesses:
"The location is also phenomenal, a short walk to museums and galleries which enriched our cultural experience."
"His flat is well situated for easy access for local festivals and markets."
"This is a very happening area with many shops and cafes which add to the vibrant neighborhood feel."
"You can find shops, coffees, and restaurants nearby which makes it very convenient."

Overall, the emphasis on local amenities in both listing descriptions and guest reviews underscores the symbiotic relationship between Airbnb accommodations and the broader economic and cultural landscape of Beyoğlu.

4.3. Socio-Cultural Impact Analysis

The analysis of the text for socio-cultural impacts revealed several key insights into how Airbnb might have influenced the local culture and community in Beyoğlu:
"Historic": Mentioned 1,002 times, highlighting the significance of historical aspects of the neighborhood in attracting guests.
"Neighborhood": Mentioned 790 times, reflecting the emphasis on the local community and environment in listing descriptions.
"Traditional": Mentioned 126 times, indicating the value placed on traditional elements of the local culture.
"Community": Mentioned 62 times, showing some focus on community engagement or aspects.
"Heritage": Mentioned 46 times, underscoring the cultural heritage of the area.
"Local Life": Mentioned 9 times, which could indicate a lesser focus but still present interest in the everyday life and experiences of local residents.

In terms of host-guest Interaction; the data highlighted the significant role of hosts in shaping the Airbnb experience. Positive interactions, characterized by personalized tips and warm welcomes, were highly valued by guests, aligning with the "Host-visitor relations" and "Communication" codes. These interactions often extended to include local recommendations and assistance with navigating the city, underscoring the importance of host engagement in shaping the social dynamics of guest experiences. Host descriptions and guest reviews often highlight the personal touch provided by hosts. For example, a host might offer, "I love sharing my local knowledge with guests, from hidden gems to the best dining spots." Guests frequently appreciate this interaction, with reviews stating, "Our host's recommendations transformed our visit; we felt like locals thanks to his insider tips."

Some reviews reflect direct interactions with the local community facilitated by Airbnb. A guest shared, "We attended a neighborhood festival recommended by our host, which was a highlight of our trip, giving us a true taste of local culture." Hosts also mentioned community engagement in their listings, such as, "We support local businesses and encourage our guests to visit nearby artisans and cafes, helping to sustain our vibrant community."

While Airbnb brings numerous benefits, it also poses challenges to traditional neighborhood dynamics. Some residents express concerns over increased noise and a shift in neighborhood character due to the influx of tourists. This aspect of the socio-cultural impact calls for a balanced approach in managing Airbnb's integration into community life to maintain the authenticity and tranquility of residential areas.

Additionally, when evaluated in terms of community engagement and security; while less explicitly emphasized in the review data, indications suggest that guests prioritize secure accommodations and feel more comfortable when safety features are clearly communicated, in line with the "Security" codes. Occasional references to engaging with the local community and participating in neighborhood activities imply that Airbnb can facilitate deeper social interactions, although further detailed data collection could enhance understanding in this area.

5. Discussion and Conclusion

Drawing upon insights derived from both the comprehensive Beyoğlu dataset and the detailed Cihangir reviews, we assert that Airbnb exerts a substantial positive influence on both the local economy and cultural tourism within the Beyoğlu district. Our analysis not only underscores

the favorable impact of Airbnb on urban tourism in Beyoğlu but also underscores prospects for sustainable growth and community advancement.

Urban context is a significant indicator for Airbnb experience and consummates with the home experience, neighborhood atmosphere, culture involvement, accessibility and proximity to tourism attractions. The Airbnb usage affects the economy of tourism venues like restaurants, shops, markets and tourism sites. Due to the location of Beyoğlu in Istanbul, social engagement and consciousness on historical aspects of the neighborhood and local life works as a motivator for socio-cultural dynamics in the region.

Thematic examination reveals that Airbnb listings in Beyoğlu serve as integral components of the tourism infrastructure, seamlessly merging urban living with tourist experiences. These themes illuminate how Airbnb enhances guest access to cultural and social facets, offers aesthetically pleasing and functional living spaces, and fosters community engagement.

Furthermore, sentiment and thematic analyses of the Cihangir dataset underscore key factors contributing to guest satisfaction, including accommodation quality, host responsiveness, and property location. To further elevate guest experiences, Airbnb hosts in Cihangir are encouraged to prioritize maintaining high standards, leveraging location advantages, and enhancing host-guest interactions.

The content analysis underscores the multifaceted role of Airbnb in shaping urban tourism landscapes. By deepening tourism integration into the urban fabric, Airbnb facilitates distinctive experiences often absent in traditional accommodations. However, the integration of short-term rentals into urban areas necessitates cautious consideration of their effects on local communities and urban dynamics.

Additionally, our analysis confirms a significant correlation between literature-derived codes and themes identified in Airbnb reviews, particularly in functional and cognitive domains. The physical attributes of accommodations, encompassing design, amenities, and maintenance, significantly shape guest experiences. While social interactions, primarily facilitated by hosts, also wield considerable influence, more explicit data on broader community engagement and security could further enrich our understanding in these realms.

This systematic approach guarantees rigorous analysis of the dataset and its seamless integration into the broader academic discourse of the paper, enriching theoretical discussions on urban tourism and the sharing economy with empirical depth. For further research, these findings could be contextualized within the broader urban ecosystem, examining Airbnb's impact on Beyoğlu's urban landscape and comparing it with similar trends in other global cities to identify unique or common patterns.

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Urban Mining of Mineral Building Materials in the Ruhr Area: A Spatial Analysis

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Abstract

The concrete industry in the Ruhr region faces critical challenges, including primary raw material shortages and the need to reduce anthropogenic greenhouse gas emissions. Immediate action is essential as primary resources remain necessary even with secondary raw materials being used, and cutting emissions is crucial to mitigate climate change. This research proposes that establishing a Resource-conserving Concrete Hub (RCH) can positively affect the image and efficiency of Resource-conserving Concrete by unifying key stakeholders and integrating new participants. The Ruhr region, with its dense population, rich industrial history, and polycentric structure, seems to provide an ideal setting for implementation. Although current data on urban mining is insufficient for precise planning, as a material registry has not been implemented yet, the study identifies promising locations, particularly the Essen city harbor, as prime candidates for advancing the RCH concept and therefore boosting urban mining practices within Germany.

Keywords: Resource-conserving concrete, Urban Mining, Recycling hub, Location-Allocation analysis, Ruhr area

1. Introduction

Concrete, due to its material properties, is an inherent component of modern construction, leading to a global demand for the building material like no other (Miller et al., 2016). In 2020, according to the Global Cement and Concrete Association (GCCA, 2023), approximately 14 billion m^3 of concrete were produced worldwide. This trend can be attributed in part to factors such as a growing global population, increasing urbanization, and a continuously expanding global economy (UNEP, 2022). Resulting in a threefold increase in demand over the past 40 years (UNEP, 2021).

However, due to the high demand and therefore production of the mineral building material, challenges such as resource security, as well as climate and environmental protection, are gaining increasing relevance. For instance, during the production process of concrete, approximately 280 kg of CO_2 are emitted per cubic meter of the building material being produced (LANUV, 2021), making the production of concrete responsible for around 8.6 percent of anthropogenic climate potent emissions (Miller et al., 2016). The high amount of climate potent greenhouse gas emissions in concrete production can be attributed mainly to the production process of clinker for Portland cement production - an elemental component of concrete - and partly to the transport of the building material and its primary raw materials (Miller et al., 2016; LANUV, 2021).

Due to the high demand, sand is considered one of the most heavily exploited resources worldwide after water (UNEP, 2022). The extensive extraction of this mineral resource also has negative effects on regional ecosystems and the water cycle (Albrecht-Saavedra and Lippelt, 2015). Consequently, a significant portion of the remaining raw material reserves in Germany has been protected from further extraction efforts by conservation initiatives, leading to potential regional shortages of primary raw materials as the industry has failed to transition early to alternative secondary raw material sources (VDZ, 2022; Elsner, 2018). Such scarcity increases distances to be traveled, further negatively impacting the environmental footprint of the raw material, and consequently of concrete as a building material, while also intensifying the economic and (geo-)political pressure on business and political entities to explore alternative sources of raw materials (Arora et al., 2017; Fluchs and Neligan, 2023; Hilgers and Becker, 2019).

As such, Urban Mining of construction and demolition waste (CDW) can serve as an alternative source within the Circular Economy (CE), being necessary to face upcoming raw material shortages. By utilizing locally sourced recycled aggregates (RA), the demand for primary raw materials can be reduced, thereby lowering extraction levels. Additionally, it helps prevent the landfilling or inferior recycling of materials classified as waste according to the Waste Framework Directive, through downcycling processes. Within the framework of the CE, materials obtained from dismantled structures are sorted and processed before being reintegrated into concrete production and ultimately used in construction (Müller, 2018).

In Germany, mineral CDW constitutes the largest material flow within the national waste balance, amounting to 229.4 million tons (55.4 %). Out of this total, approximately 95 percent (218.8 million tons) are classified as non-hazardous waste and are thus eligible for recycling (UBA 2022c). However, only materials categorized as construction debris, totaling around 59.8 million tons, are suitable as RA in concrete production and therefore eligible for being reused in building construction (bbs 2021; Müller 2018).

A majority of all mineral CDW in Germany undergo further processing (89.7 %). However, the recycling rate of these waste materials is only 33.7 percent (bbs 2021), with the definition by bbs encompassing downcycling processes such as usage in road substructures. Consequently, the use of RA in the production of resource-conserving concrete (R-Concrete), and thus an adequate recycling process in line with the CE, is exceedingly low, at approximately 0.9 million metric tons (VDZ 2021).

While the substitution of sand and gravel can notably alleviate the impacts of the described raw material shortages, reducing climate potent greenhouse gas emissions in concrete production necessitates the substitution of clinker in cement production. This substitution is already practiced on a large scale, resulting in a 30 percent reduction in clinker and thereby nearly the entire greenhouse gas emissions in cement production through the use of fly ash and slag sand (VDZ 2022; VDZ 2020). However, due to the planned coal phase-out in Germany and the transition to hydrogen in the steel industry, a significant reduction in the availability of both substitutes is expected in the near future (Voland and Westendarp 2021; Holcim Deutschland 2021; acatech 2023). Current research and initial practical attempts indicate that the current substitutes can be replaced by RA from construction waste processing; however, further research and experiments are needed to implement this on a similar scale (Kytzia and Stürwald 2021; Müller et al. 2020; Holcim 2023). The VDZ (2022) predicts the share of RA in concrete production to reach around 26 percent by 2050.

Consequently, the concrete industry is currently undergoing a transformation out of necessity. In order to sustainably remain competitive and meet the climate targets outlined in the Paris Climate Agreement, a restructuring of current processes is imperative to transition the linear economic system to a CE.

Thus, this study develops a concept of an Resource-conserving Concrete Hub (RCH), which aims to consolidate relevant stakeholders in one location and thereby enables the utilization of synergies. In doing so, the concept of an RCH is being based on, but not limited to already existing concepts (e. g. Müller and Kurkowski (2017) and Zabek et al. (2024)). Building upon this, the identified location factors of the stakeholders are transferred to the Ruhr area through a spatial analysis to identify an ideal-typical location for its implementation.

2. Methodology

2.1 Development Of A Resource-efficent Concrete Hub (RCH) Based On Expert Interviews And Literature Review

The primary aim of developing an RCH is to achieve high-quality and efficient processing of mineral construction waste of dismantled buildings and the utilization of recycled aggregate in concrete production, which is then used in building construction. Additionally, a modular system is developed, which can be adapted based on existing local requirements as well as site conditions and aims to enhance the hub's accessibility to a broader audience.

This is based on a transformation from the currently limited mineral material cycle in the concrete industry (see Figure 1) towards a circular cycle based on urban mining of secondary aggregates and their usage in concrete and cement production (see Figure 2).

The concept of the RCH is based on three semi-structured expert interviews conducted with representatives from Remex (construction waste processing), Holcim (concrete and cement production), and Madaster (provider of a materials passport) in early 2023. The information gathered from the interviews was compared with existing literature, particularly a feasibility study by Müller and Kurkowski (2017) in the Rhenish lignite mining area, and best practice examples such as those by Feeß (Heinrich Feess GmbH & Co. KG 2023) in southern Germany.

Based on this, a catalogue of requirements for the core businesses was subsequently developed, serving as the basis for the site selection process.

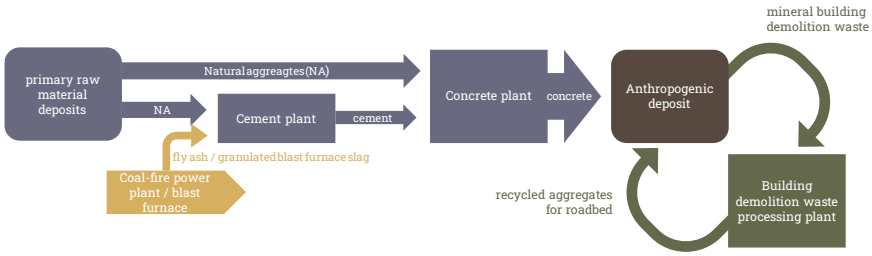

Figure 1: current and primarily linear system of concrete production.

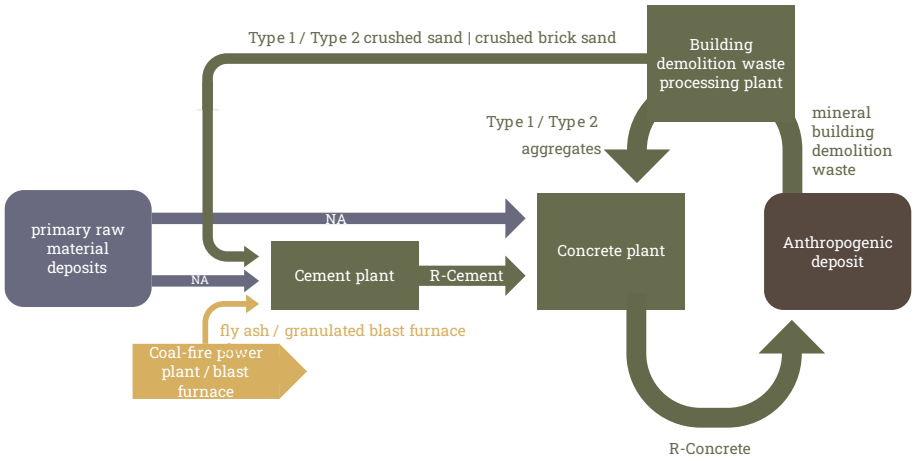

Figure 2: possible circular economy in concrete production.

2.2 Spatial Analysis With Geo Information Systems (GIS)

The objective is to identify specific regions and zones within the Ruhr region as a representative area, conducive to the establishment of an RCH. This entails conducting a Location-Allocation Analysis. Initially, emphasis is placed on the concrete evaluation of hard location factors, namely secondary raw material accessibility for the construction waste processing facility and the market viability for R-Concrete. To prevent peripheral zones within the study area (Figure 3) from being disadvantaged, data within a 20 km radius is also factored in, with the exclusion of areas in the Netherlands due to data limitations. Subsequently, the chosen areas from each category undergo a reevaluation to assess their suitability within the local context, thereby eliminating unsuitable locations like sites being completely surrounded by residential uses or not adequately connected to existing feasible road infrastructure.

Figure 3: Study Area | Data Source: GEOportal.NRW (2023).

The applied network layer is based on a dataset from Geofabrik (2023), which consists of data derived from OpenStreetMap. Further processing of the data regarding intersection points is required.

Based on the identified location requirements described in Chapter 3.2, cement plants, coal-fired power plants, and port areas located in the Ruhr region are considered as potential sites separately. The areas designated in ALKIS as commercial and industrial zones are filtered based on their distance to residential areas (overlaid with a 250 m buffer) and size (3.05 hectares).

For the indicator of secondary raw material availability, there are no data available for the study area regarding material availability or demolition volume. Therefore, the formula proposed by Müller (2018) is employed, where the population serves as an indicator for calculating the amount of construction waste (Figure 4). Census data from the most recent census conducted in 2011 (Statistische Ämter des Bundes und der Länder 2011) are used as the basis for this analysis as they are found to be the most recent data based on their scale. To further refine the respective areas, the data from each one-square-kilometer grid cell are transferred to the built-up areas within the corresponding square. However, due to data limitations, drawing conclusions about the generated construction waste based on population density is not feasible, resulting in only a weighting being considered.

$$Catchment\ Area = \frac{Annual\ \ Capacity}{Population\ \ Density\ *per-capita-volume}$$

Based on

catchment area in km²

annual capacity in t

population density in inhabitant/km²

*per-capita-volume in t/inhabitant*a*

Figure 4: Equation used for assessing the expected availability of secondary raw material based on Müller (2018).

As a demand indicator, construction activity within the municipalities is applied. A high-quality and available information source is the completion of residential and non-residential buildings within the last 10 years at the municipal level in square meters of floor area (IT.NRW 2022). The application of this dataset is based on the assumption that construction activity and concrete consumption are strongly positively correlated, although this correlation is not precisely quantified. By using the average of the data from the last 10 years, possible fluctuations (such as the completion of a new housing development within a rural municipality) within the dataset are expected to be better balanced. These data were also intersected accordingly with the ALKIS settlement areas, open spaces such as cemeteries and parks being excluded beforehand.

To assess a site's suitability for establishing the core elements of an RCH, it is therefore necessary to integrate both of the indicators described earlier. Since the respective values are in different units of measure (people and square meters), a simple multiplication is not appropriate. Therefore, it is necessary to group the values into categories, opting for categorization based on natural breaks (Jenks (ESRI 2023)). The data are standardized on this basis and divided into five groups. The layer containing the census data is considered a suitable scale for this purpose, as it evenly subdivides the entire study area into 1 km² squares. A larger scale is deemed too coarse, while a smaller scale increases the data inaccuracy of the secondary raw material indicator, as the original information is based on the shapefile of the 1 km² parcels used. To increase the weighting of densely populated areas with extensive construction activity compared to regions with low population and below-average construction activity, it is decided to multiply the two categorized indicators (1 to 5) together in a final step. Consequently, the range between "sparsely populated and low construction activity" to "densely populated and high construction activity" is 1 to 25.

3. Results Of Interviews: The Concept Of A Resource-conserving Concrete Hub (RCH) And Its Location Factors

3.1 The Concept

A new proposal for an RCH is suggested to overcome the limitations of current demolition waste recycling systems and to fulfill the future demand for Recycled Aggregates (RA). Existing systems face logistical challenges such as fragmented operations across various sites and communication gaps among stakeholders (Remex 2023; Holcim 2023; Madaster 2023;

Zabek et al. 2024). Typically, a building is being demolished by a demolition company, in the following recycling companies collect construction and demolition waste from demolition sites, then transport it to their recycling plant and to consumers, e. g. concrete mixing plants, after recycling, involving multiple intermediate steps. This fragmented approach leads to high transportation costs and therefore environmental impacts due to repeated material handling and long-distance transportation. Transportation is identified as the primary environmental impact during the recycling of demolition waste (LANUV 2021; Hilgers and Becker 2019). Consequently, consolidating stakeholders at a single location reduces travel distances or even ways and can furthermore improve communication between the different stakeholders.

The core of the RCH consequently consists of processing facilities: the cement plant, the construction waste processing plant, and the concrete mixing plant, as these are essential for the production of R-Concrete. Depending on factors such as the size of the site and demand, this core group of companies can be expanded to include additional stakeholders.

The expansion of the RCH in this work is divided into four categories: *Complementary businesses*, *education and research*, *services and institutions*, and *public stakeholders* (Müller and Kurkowski 2017; Zabeck et al. 2024; Holcim 2023; Remex 2023; Madaster 2023).

The group of *complementary businesses* comprises companies involved in various aspects of the R-concrete recycling process, complementing the functions of core businesses. Benefits of integrating those, who are directly involved into the recycling process, e. g. demolition contractors, is emphasized due to the coordination required among stakeholders (Holcim 2023). The potential for knowledge spill-over in the form of Porter Externalities is expected. However, spatial proximity does not reduce transportation distances in this particular example, as demolition contractors still need to travel to the demolition site and return machinery to their premises after completion. Nevertheless, they do benefit from the central location of the RCH as well. On the other hand, logistics companies specializing in construction waste benefit from proximity due to localization effects, significantly shortening the distance traveled after delivering construction waste, thereby minimizing empty return trips. However, these companies benefit minimally from dynamic agglomeration effects. To further promote the use of RA beyond R-Concrete production, additional businesses should be established to utilize RA as a secondary raw material. The production of brick substrates or precast concrete enables the utilization of those secondary raw materials which, due to their suitability or volume, are not eligible for concrete production, while utilizing industries still benefiting from the same agglomeration effects as the core businesses (Müller and Kurkowski 2017).

Integrating *educational and research* facilities within the RCH is expected to foster collaborations between these institutions and other companies within the RCH, enabling practical education and industry expert involvement. This synergy can enhance expertise and therefore stimulate demand for R-Concrete. For monitoring R-Concrete production, sampling by external entities is essential (Holcim 2023, Remex 2023). This task can be delegated to the university, scientific institutes, or specialized labs, benefitting from efficient oversight due to proximity (Zabek et al. 2024).

The group *service industry and institutions* encompasses architecture, planning, and engineering firms, along with authorities and industrial associations. Integrating these stakeholders can facilitate knowledge exchange within the RCH, potentially increasing the consideration of R-Concrete as a construction material in building projects. Furthermore, the

needs of service companies in R-Concrete production can be better addressed and potentially accommodated. As a result, the presence of service companies can enhance the expertise of all involved actors and stimulate demand for the material. Further, establishing reputable service companies within the RCH elevates the site's profile, attracting attention to R-Concrete and enhancing its image as a building material. Soft agglomeration effects, alongside tangible location factors, are crucial for the hub's success as a service destination. Incorporating municipal stakeholders and industry-specific associations demonstrates official confidence in the secondary building material, aids in site profiling, and streamlines quality assurance through simplified monitoring channels.

Including event spaces and gastronomy as services being open to the broader *public* within the hub can have multiple benefits. For example, integrating event spaces, as demonstrated by Feeß (Heinrich Feess GmbH & Co. KG 2023), allows companies within the RCH to showcase their progress publicly. A cooperation with a university is conceivable due to its demand for lecture halls, as both require similarly sized facilities. External events can also attract individuals from outside the field to the RCH, positively influencing public perception of R-Concrete, thereby improving its current negative image (Remex 2023; Holcim 2023; Madaster 2023). To showcase the material's versatility and expertise, the establishment of an exhibition ground for events such as the Solar Decathlon or circular construction-themed fairs is necessary. Likewise, implementing gastronomic offerings can invite external visitors to the RCH, while providing lunchtime benefits for workers and students. The incorporation of green and blue infrastructure can also have a similar effect, enhancing the appearance and sustainable function of the commercial and industrial district, especially during times of climate change.

However, the concept avoids integrating multiple core processing plants of the same type. This assessment is based on the limited operating radii of these facilities, determined by ecological, economic, and technical factors. If the capacity of a plant is exceeded, it is therefore considered more sensible to place additional facilities outside the RCH to maximize operating areas and minimize transportation routes. This can accordingly have a positive impact on the ecological footprint and cost-effectiveness of R-Concrete.

Therefore, the establishment of an RCH can be deemed beneficial. It is important to note that it is a mixed-use high-quality commercial and industrial district, with its conceptual center being the core businesses. However, due to their emitting nature, a certain distance between the industrial and the other areas is necessary to avoid conflicts. Green and blue elements can help create this distance, while elevation differences can also aid in overcoming these challenges.

Concluding, the presented concept of an RCH focuses primarily on stakeholder knowledge exchange, reducing transportation distances, and improving the image of recycled building materials. Therefore, stringent collaboration among stakeholders is essential to realize these aspects fully; otherwise, potential benefits may remain untapped. While the impact of soft location factors on the success of core businesses is considered secondary, they are mandatory for other stakeholders, particularly office and public uses.

Additionally, using recycled building materials during the hub's construction phase can facilitate the establishment of both service and core businesses involved from the outset. It can also create a living laboratory, demonstrating the feasibility of a high-quality district built with recycled materials, thereby helping to reduce reservations about their use.

3.2 The Location Factors

As the design of the RCH entails a modular system centered around the core enterprises of R-Concrete production (construction waste processing plant, concrete mixing plant, cement plant), with the remaining actors being variable, the subsequent discussion focuses solely on the spatial requirements of these core stakeholders.

Given limited impact of globalization on supply chains within R-Concrete production, the selection of processing plant locations aligns with Weber's Industrial Location Theory. This implies that proximity to raw material suppliers and customers predominantly dictates site selection (Farhauer and Kröll 2013). Analyzing various transportation modes and networks aims to minimize transportation costs, thereby mitigating ecological and economic burdens. Figure 5 depicts the salient location factors pertinent to the three involved enterprises, illustrating their mutual complementarity. It underscores that diverse location requirements coalesce rather than conflict, emphasizing the interconnectedness of stakeholders in R-Concrete production. Notably, three pivotal factors in location selection emerge across stakeholders: location within an industrial area, Distance to residential areas and good road connection. Therefore, good street connection sites ideally situated in urban industrial zones yet maintaining distance from residential areas to sustain demand and resource availability while safeguarding sensitive land uses are considered ideal locations.

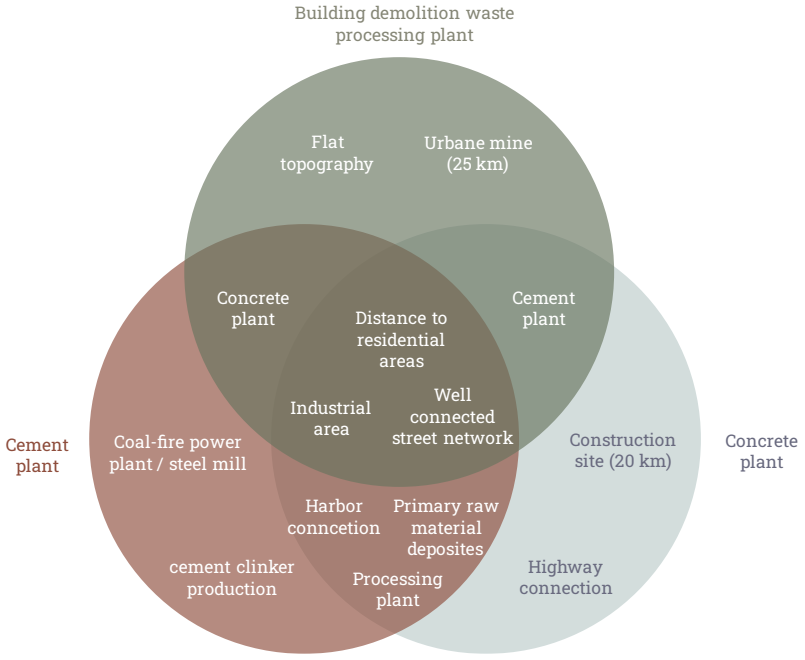

Figure 5: Location Factors of an RCH.

Hence, when selecting a site for the RCH, it is important to consider maintaining a sufficient distance from sensitive land uses, although this distance cannot be universally quantified.

Additionally, high demand for construction materials, a comprehensive supply of construction waste, and good accessibility to the site are fundamental requirements.

Further, economic factors make integration with an existing cement plant highly advantageous. If such a plant is being planned, careful consideration should be given to integrating an RCH, especially the remaining core enterprises. However, establishing a cement plant as part of the implementation of an RCH is considered challenging. Therefore, already existing plants may be a well suited location for being extended by an RCH and hence should be considered within the location analysis.

The establishment of an RCH is particularly suitable in close proximity to water bodies also as these can be used to transport necessary primary aggregates. Although, it might not be as relevant for concrete production today, the region's limited availability of local primary aggregates will likely make importing them from further regions necessary in the future (Holcim 2023; Remex 2023; Elsner 2018). Furthermore, part of the dock area can enhance the site’s appearance and be developed into a waterfront promenade, expected to have a positive impact on the other stakeholders. Therefore, port areas and areas adjacent to a canal are considered particularly suitable.

Former power plants and coal-fired power plants, on the other hand, are suitable for the establishment of an R-Concrete Hub due to their large size, high existing sealing rate, and established industrial use. Additionally, many of these plants have established connections to the waterway network. The dismantling of existing structures can also serve as a catalyst to establish the concept further.

In general, consideration should be given to selecting sites that are already sealed. The establishment of an RCH on greenfield sites may be necessary in certain cases but should only be considered as a last resort due to the project's sustainable nature, after all alternatives have been exhausted.

For further site analysis, additional exclusion criteria are applied to narrow down the areas to be considered. Accordingly, only existing industrial areas with some distance to residential use and large enough to accommodate at least a construction waste processing and a concrete plant (about 3.55 ha according to Müller (2018) und Holcim (2023)), cement plants, port facilities, and coal-fired power plants are taken into account.

4. Results Of The Location-Allocation-Analysis

The Ruhr Area is of particular interest as a case study region for implementing an RCH due to various reasons. According to the Geologischer Dienst Nordrhein-Westphalen (2022), the local primary resource reserves of gravel and sand are projected to last for 21 and 33 years, respectively. However, due to extraction limitations, supply shortages emerged as early as 2017, leading to significant increases in primary resource costs (Elsner 2018; Hilgers and Becker 2019). Consequently, the exploration of alternative resource sources through urban mining is attributed particular significance for this region, leading to a higher need for action.

Additionally, the Ruhr Area covers an area of 4,438 km² divided into 53 municipalities with an average population density of 1,149 inhabitants/km² (RVR 2021), making it one of the fifth largest metropolitan regions in the European Union with around 5 million inhabitants (Statista 2022). The region's rapid development during the industrial revolution has resulted in a

structurally heterogeneous polycentric region, consisting of independent large, medium, and small towns, which are considered unique in Germany and Europe (Reicher 2022). It is expected that this regional structure will facilitate the implementation of an RCH, as it allows for placement not only in peripheral areas but also in the region's center as well as providing high enough resource flows.

Expanding the study area to include a 20 km radius around the Ruhr Area's borders results in a total area of 11,227 km², encompassing or intersecting 159 municipalities in North Rhine-Westphalia. Of the 2,535 km³ designated as settlement areas according to ALKIS within this expanded area, representing areas eligible for development excluding existing open spaces within municipalities, 52 percent are within the Ruhr Area, despite it occupying only 39.5 percent of the total area. Within the Ruhr Area, the proportion of settlement areas is particularly concentrated in centrally located municipalities, where their share of the total area is particularly high, such as Herne (58.4 %), Oberhausen (56.4 %), Bochum (53.2 %), Essen (52.0 %), Gelsenkirchen (51.6 %), and neighboring municipalities.

The spatial distribution of the population within the study area per square kilometer, based on the 2011 census, is illustrated in Figure 6. Within the Ruhr region, the central residential areas of the municipalities of Duisburg (≤ 14,756 inhabitants/km²), Dortmund (≤ 14,741 inhabitants/km²), Gelsenkirchen (≤ 2,415 inhabitants/km²), Oberhausen (≤ 12,380 inhabitants/km²), and Essen (≤ 11,365 inhabitants/km²) stand out due to their particularly high population density. The northern part of the Ruhr metropolis is comparatively sparsely populated, with larger uninhabited areas noticeable, while in the east, the municipalities of Hamm (≤ 5,672 inhabitants/km²) and in the south, Hagen (≤ 7,793 inhabitants/km²), emerge as local population centers. Outside the Ruhr region, apart from the state capital Düsseldorf (≤ 18,401 inhabitants/km²), the municipalities of Krefeld (≤ 1,791 inhabitants/km²) and Wuppertal (≤ 13,709 inhabitants/km²) are present.

According to available data, of the total approximately 8.73 million inhabitants within the study area, around 5.06 million people are located within the Ruhr region, accounting for 58 percent of the total population.

Figure 6: Inhabitants / km² | Data Source: Zensus 2011 (2011); GEOportal.NRW (2023).

Figure 7 depicts the average annual newly constructed area in square meters per square kilometer between 2010 and 2020. Unlike the population data, these are processed data available only at the municipal level, hence the figure presented shows the overall construction activity reflected on settlement areas and again merged with the raster used in Figure 6. The final step was undertaken solely to establish a consistent visual representation; the calculations were conducted based on the results of the first two steps.

In general, it can be observed that within the Ruhr region, the municipalities of Kamen (520.69 m²/km²), Essen (503.92 m²/km²), and Dortmund (479.11 m²/km²) had the highest average newly constructed areas per square kilometer of municipal area. Conversely, the lowest construction activities occurred in Breckerfeld (31.53 m²/km²), Rheinberg (52.46 m²/km²), and Schermbeck (61.24 m²/km²). Expanding the scope of analysis reveals that the construction activity during the study period in Düsseldorf, with 953.41 m² of newly constructed area per square kilometer of municipal area, was 83 percent higher than in Kamen. Other municipalities with comparatively high construction activity include Neuss (574.97 m²/km²), Straelen (537.82 m²/km²), and Hilden (504.10 m²/km²).

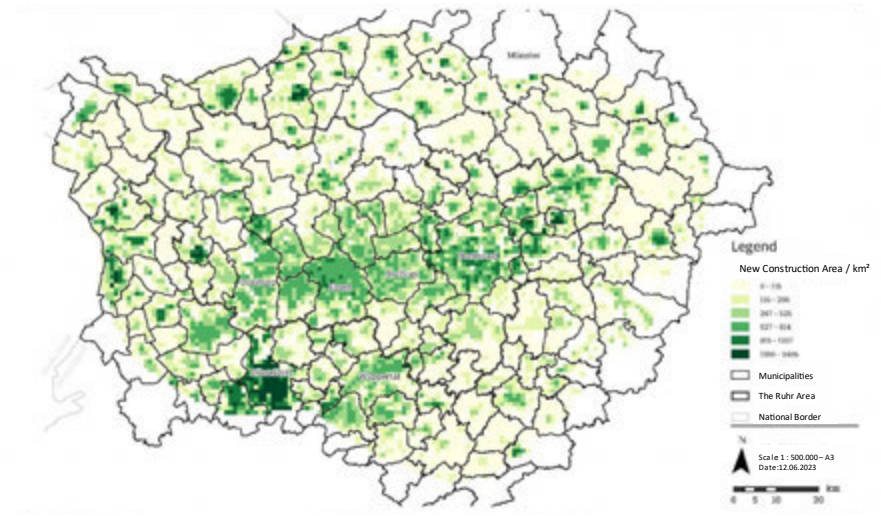

Figure 7: Construction Activity | Data Source: IT.NRW (2022); GEOportal.NRW (2023).

For further computation, the integration of both datasets is mandatory. The derived values, ranging from 1 to 25, are depicted in Figure 8. A total of 9,430 km² grids receive a score equal to or less than 5, of which 7,028 km² grids receive the lowest score of 1. Only 356 km² grids are rated 15 or higher, among which 17 km² grids achieve the maximum score of 25. All top-ranking areas, due to their high construction activity and dense population, are located within the municipal boundaries of Düsseldorf. This analysis emphasizes not only Düsseldorf but also the central Ruhr metropolitan areas, as well as Krefeld and Wuppertal.

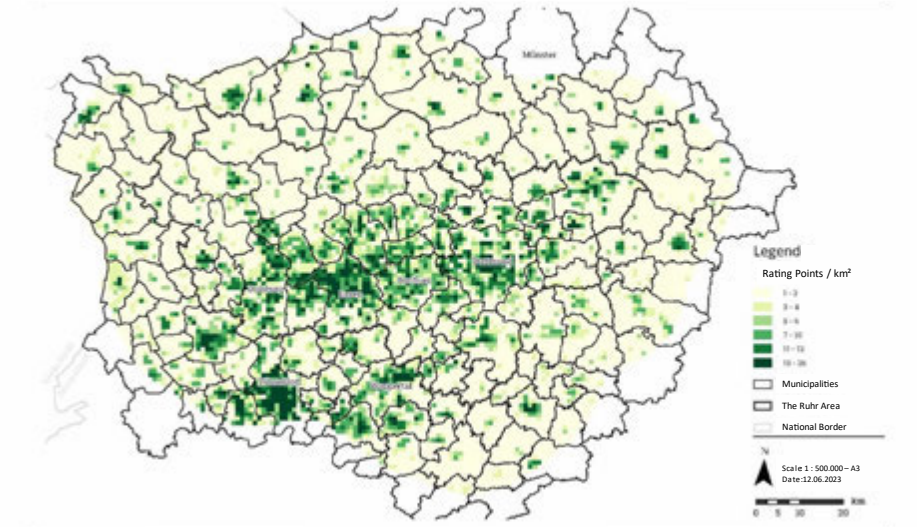

Figure 8: Rating Points / km² | Data Source: Zensus 2011 (2011); IT.NRW (2022); GEOportal.NRW (2023).

Figure 9 illustrates the results of the location-allocation analysis, aiming to identify the region with the highest expression of an indicator within its corresponding catchment area. The focus of the indicator for R-concrete demand (red point) is based on the completed new construction areas per municipality. The catchment area for this analysis spans 20 km, the distance within which the construction material can be transported without losing its qualities. The selected parcel is situated in the southern part of Duisburg, adjacent to the urban area of the state capital, Düsseldorf. The surrounding region exhibits relatively low development but benefits from close proximity to a highway interchange. The catchment area fully encompasses the municipality of Mülheim an der Ruhr, as well as significant portions of Düsseldorf, Krefeld, and the Ruhr metropolitan municipalities of Duisburg, Oberhausen, and Moers. Within the entire catchment area, an average of 336,195 m² of usable area is completed annually, making it the highest value among the points under consideration.

The point within whose catchment area the indicator for the volume of generated construction waste—the 2011 population density—is most pronounced (blue point) is located in Essen. The catchment area for this analysis spans 25 km, the distance within which the transport of construction waste is environmentally and economically more sustainable than the use of primary aggregates. The determined centroid, concerning population density, is in close proximity northwest of Essen's main railway station (1 km). The catchment area of the parcel dominated by commercial use almost entirely covers the Ruhr metropolitan cities of Essen, Bochum, Mülheim an der Ruhr, Gelsenkirchen, Gladbeck, Oberhausen, Bottrop, Hattingen, Herten, and Herne, as well as large parts of Duisburg and Dinslaken. In total, around 2.65 million people lived within the catchment area of the selected location in 2011.

The outcome of the analysis, based on the data from both indicators, identifies a centroid in the western part of Bochum-Wattenscheid (green point). The catchment area for this analysis spans 20 km. Within this area, the mean of the usable area completed between 2012 and 2021 amounts to 307,523 m², and the total population sums up to 1.92 million individuals. Unlike the previous analyses, the indicator values no longer rely on the settlement area but solely on the parcels used for site selection. The sum of the scoring points for the 774 considered parcels amounts to 5,418.

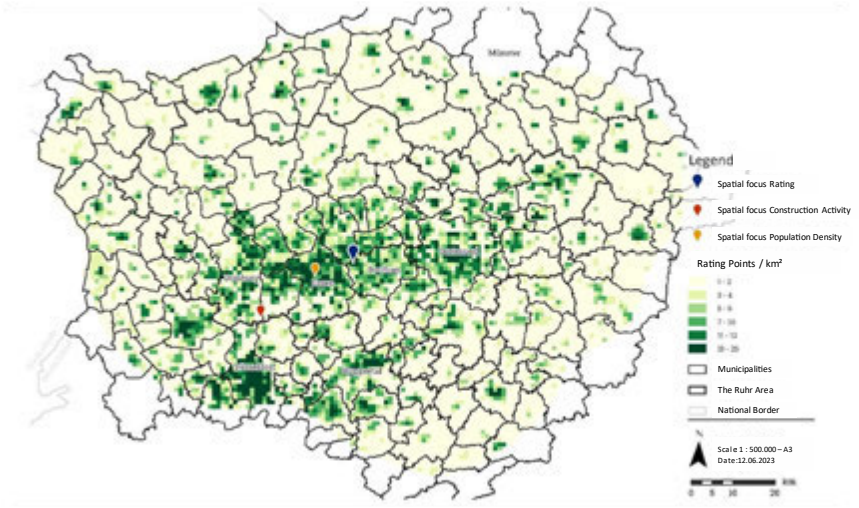

Figure 9: Spatial Focal Points of Population Density, Construction Activity and Rating Points | Data Source: Zensus 2011 (2011); IT.NRW (2022); GEOportal.NRW (2023).

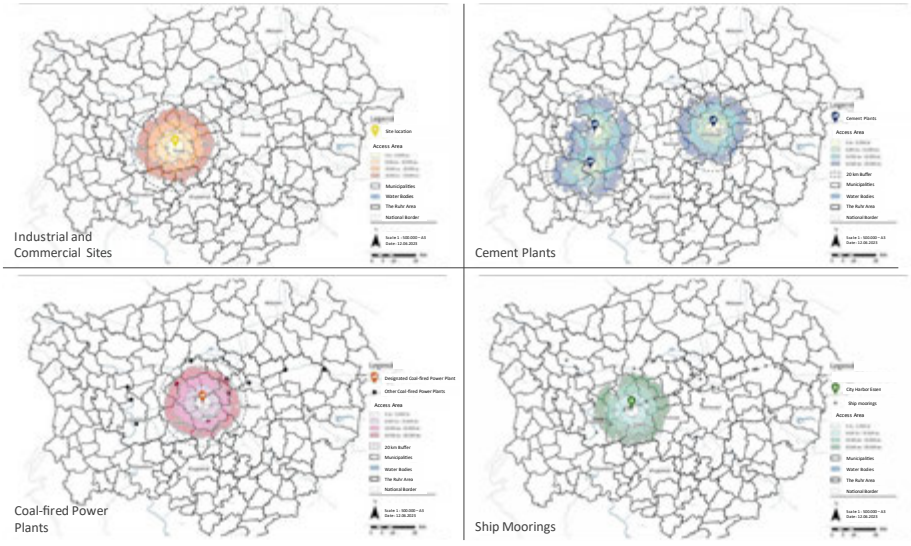

Figure 10: Calculated Catchment Area of Different Locations Performed on the Results of the Location-Allocation-Analysis | Data Source: Zensus 2011 (2011); IT.NRW (2022); Geofabrik (2023); GEOportal.NRW (2023); Bundesnetzagentur (2022).

Designation	Rating (pts.)	Supply (inhab.)	Demand (m^2)	Catchment area (km^2)
Coal_1	4789	1,85 Mio.	293.749	800

Coal_2	4605	1,70 Mio.	281.001	770
Cement_Do	3847	1,08 Mio.	282.584	693
Cement_DuNo	3368	1,20 Mio.	211.730	602
Cement_DuSu	3253	1,15 Mio.	230.917	616
Ind_Site	5399	2,64 Mio.	313.488	876
Harbor	4929	1,82 Mio.	291.057	739
Supply_max	-	2,65 Mio.	-	-
Demand_max	-	-	336.195	-
Rating_max	5418	-	-	-

Table 1: Comparison of the characteristics of investigated indicators according to identified locations.

Table 1 presents a summary of the findings outlined in Figure 10. Upon direct comparison, the comparatively low population values of the three cement plants, as well as the limited expression of the demand indicator regarding the plants in Duisburg, are striking. Conversely, the values of the prioritized harbor location, as well as the two power plants, are relatively close to each other and form the mean concerning the results of all sites. A categorization into three groups is also supported by the rating system (cement plants | power plants and harbor | commercial and industrial area). However, a detailed examination reveals that the ratings within the groups are not always consistent with the actual expressions of the indicators, albeit the differences are relatively minor. Regarding the research findings, it can also be noted that the average catchment area of the depicted sites is 728 km². Since the utilized distances are 20 km, on average, 57.9 percent of a circle with a radius of 20 km is covered. Here, the catchment area of the prioritized commercial and industrial site is notably large at 69.7 percent, while that of the cement plant in the north of Duisburg is relatively small at 47.9 percent. The average constructed area within the respective catchment areas amounts to 272,066 m², with the area derived from the commercial and industrial areas exceeding the average by 15.2 percent, and cement plant in the north of Duisburg falling 22.2 percent below the average. The population located within the sites' catchment areas averages at 1.63 million people, with values varying significantly between the site in the center of Essen (2.64 million) and the location of the Dortmund cement plant (1.08 million).

5. Identification Of An Ideal Location Within The Ruhr Area: Validation Of The GIS-Analysis

The analysis of demand concentrations within the Ruhr area and its periphery reveals Düsseldorf municipality as a significant influencer in determining the location of the demand hotspot, owing to its notably high construction activity. This influence is particularly

pronounced due to extensive urban development projects undertaken in recent years, exemplified by the development of entire urban quarters (cf. Quartier Central). However, indicators in the immediate vicinity (up to 7.5 km) exhibit relatively modest levels. According to Holcim (2023), a substantial proportion of deliveries from a concrete plant occur within a radius of 10 km. Consequently, the region identified as the hotspot appears comparatively unsuitable for establishing a concrete plant. Therefore, the choice of Düsseldorf as a site should seemingly be explored within a different study, and its consideration for a suitable location within the Ruhr area should be tempered accordingly.

The population density, as an indicator of supply, is particularly pronounced within the Essen center based on the analysis results. Within a catchment area of 867 km² around the prioritized industrial and commercial area, 2.64 million people can be reached. This represents 52.2 percent of the Ruhr area's population, despite the catchment area covering only 19.5 percent of its land area. Unlike construction activity, municipalities southwest of the Ruhr area do not appear to play a significant role in this analysis.

The comparative analysis between the region with the highest accessibility – the industrial and commercial zone near Essen's urban core – and the one with the lowest connectivity – the grinding and mixing facility in northern Duisburg – elucidates fundamental distinctions contributing to a diminished catchment radius. Notably, the catchment zone of the top-performing site exhibits a complete absence of unconnected areas within its scope, indicative of exceptional connectivity likely attributed to the absence of significant open expanses such as forests, fields, or protected areas. Conversely, the northern Duisburg area features numerous such expanses, notably the Rhine River and the Kirchheller Heide in the northeast, markedly impeding accessibility. Furthermore, the natural obstacle of the Rhine and the absence of a nearby bridge hinder connectivity, particularly in the northwest region of the site. A detailed examination of the Essen central area also unveils non-concentric catchment zones, with deficiencies in the southern and northwestern sectors, suggesting a rural environment with comparatively limited connectivity, as inferred from population density.

The analysis outcomes reveal substantial variances between the area of a simple 20 km radius circle (1,256.6 km²) and the actual catchment area delineated by a road network (867 km² to 602 km²), even within densely inhabited regions like the Ruhr area. In this instance alone, the actual catchment area represents only 69.7 percent and 48.2 percent of the circle area, respectively, underscoring the intricacies of urban connectivity.

The location-allocation analysis performed to ascertain the requisite number of facilities for comprehensive coverage of the Ruhr area concludes that a total of 15 facilities are necessary. However, uncertainties persist regarding how many of the designated facilities can procure adequate raw materials and demand to ensure seamless and profitable operation. Particularly in less urbanized locales such as the Ennepe-Ruhr district and the Wesel district, the viability of sustaining such facilities is dubious. The resultant map from the analysis distinctly delineates regions featuring significant unconnected areas in the road network, notably the Rhine River in the west and the municipalities of Breckerfeld and Haltern am See.

Upon closer examination of the locations identified through the Location-Allocation Analysis, it is evident that not all areas are suitable for the implementation of an RCH. For instance, due to accessibility constraints and the anticipated heavy traffic from trucks associated with an RCH, the centrally located industrial and commercial area in Essen is deemed unsuitable. Similarly, the area of the cement plant in the north of Duisburg, which is relatively difficult to

access, is also excluded. Conversely, the coal-fired power plant in Bochum is excluded due to its direct adjacency to residential areas on multiple sides.

The sites in Dortmund and Duisburg are particularly advantageous because there is already a cement plant located at these sites. Given the high investment costs, it must be considered that implementing an RCH at another location may have to do without the cement plant component. Nevertheless, the evaluation of these sites in the Location-Allocation Analysis is significantly lower compared to other sites. Additionally, these sites lack the address-forming characteristic of the areas in Essen and Herne, which can utilize proximity to water to attract other companies and stakeholders to the location.

For the implementation of a new RCH, however, the Essen city port is perceived as an ideal location. This is attributed to its excellent connectivity and central position within the core metropolitan areas of the Ruhr region, potential integration into existing industrial structures, and the presence of blue and green infrastructure. Additionally, the city's plans for the reorganization of the port (Stadt Essen, 2022) and the development of the Freiheit Emscher (Freiheit Emscher Entwicklungsgesellschaft mbH 2023), which aims to enhance adjacent areas, are viewed positively, as they offer the potential to act as catalysts for the implementation of an RCH.

6. Conclusion

As stated, the concrete industry in the Ruhr region faces critical future challenges, including primary raw material shortages and the necessary reduction of greenhouse gas emissions to meet Paris Climate Agreement targets. Addressing these issues is urgent, as primary resources will still be needed alongside secondary raw materials due to legal and static requirements of Resource-conserving Concrete (R-Concrete), and reducing carbon emissions is essential for mitigating anthropogenic climate change.

The research presented highlights that the formation of a Resource-conserving Concrete Hub (RCH) can substantially enhance the perception and effectiveness of R-Concrete itself. This enhancement is achieved by not only unifying the three primary stakeholders to streamline the R-Concrete production process but also by incorporating additional participants from the construction and planning industry as well as the public sector. Further, the Ruhr region presents optimal conditions for this initiative due to its high population density, industrial heritage, and polycentric structure, making it an ideal location for the implementation of an RCH.

However, due to inadequate data on the extent of the urban mine, the analysis performed does not provide a precise volume estimate that could serve as a foundation for detailed planning. Therefore, in order to facilitate effective reuse of construction and demolition waste and ensure accurate site planning regarding an RCH, the establishment of a material registry is expected to be crucial. Despite this limitation, the study offers new insights into the spatial dynamics of R-Concrete production and identifies specific locations within the Ruhr metropolitan area for further investigation. The Essen city harbor area, in particular, emerges as a promising site, especially due to its connectivity and infrastructure. As this area is currently the subject in a master planning process, it presents a timely opportunity to further develop and implement the RCH-concept developed, thereby boosting urban mining practices within the entire region.

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Urban Forestry Plan: an overview through different contexts, governance and policies

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Abstract

Urban forestry plans became an essential integrated tool in urban planning to promote adaptation and mitigation policies and strategies in contemporary cities.

This contribution presents a selection of plans developed in different countries, applying a structured critical interpretation to bring out and compare innovative elements and weaknesses to trigger a challenging comparison between American and European cities. This work frames the Forestami research project within the international urban forestry context to measure its impact and relevance and to address further activities.

The research reveals a heterogeneous approach and results by countries due to different political and cultural contexts to define which are the critical elements that each plan should use to contribute to the sustainable development of the territory.

1. Introduction

Urban forestry concept, developed in the 19th century in America, refers to an integrated, multidisciplinary and 'flexible' (Moeller, 1977) discipline which considers individual green space elements as part of an integral system (Miller, 1997; Konijnendijk & Randrup, 2004) by defining "the design, planning, establishment and management of trees, woodlands and associated flora and open space" (Ball et al., 1999, p. 325) to promote human well-being and urban biodiversity conservation. Urban forestry promotes the implementation of woodland, tree groups, individual trees, and associated open spaces, tending to emphasise the complete role of the forests rather than just their economic provision.

This discipline, widely developed in North America first and then in Europe, refers both to vegetation management within built-up areas both to the one located on the edge of the city (Randrup et al., 2005). Therefore, this different scale-based approach regards the implementation of trees in cities and urban contexts and the management of forests in large national parks and ecological corridors; defining a broad, aware and complete vision that recognises the important role that nature has in the urban territory.

Within the international scene, governance institutions addressed the urban greening topic through several planning and prescriptive levels, deliberating laws and regulations at different government degrees and defining new innovative approaches (Konijnendijk, 2003). The number of plans, laws, and research promoted recently underline a growing interest in sustainable planning and the emergence of urban forests as an integrated tool to contrast climatic transition, better citizens' well-being and health, and promote environmentally fair cities (Nilon et al., 2017, Pierce et al., 2020)

This contribution frames the Forestami research project - which started in 2018 to plant 3 million trees in the Metropolitan Area of Milan - within the international urban forestry context to measure its impact and relevance and to address further activities. It aims to explore urban forestry plans operating in different contexts and environments to define a common ground and develop a critical interpretation for grasping key concepts useful to enrich the possible goals and tools of the Forestami project. Within the broader context of the project research, analysing

effective case studies allows us to measure opportunities and limits of existing plans and provide an overview of actual urban forestry discipline assessment.

The paper analyses seven cases in Europe and the USA, selected among a wide range of international plans. These have been an interesting comparison for achieved results, goals and governance proposals. The inquired cases are Austin, Cleveland, Philadelphia and San Francisco in the US and Barcellona, Birmingham and Manchester in Europe (fig. 1). The comparison was also applied to the Forestami experience. The analysis shows preliminary results, highlighting interesting trends in the discipline.

Fig. 1 Description

2. Recognition of urban forestry tools: methodology and first results.

The research operated through analysing plans and projects developed over time by municipal and metropolitan authorities to study the strategies applied to implement urban forestry as an adaptive and mitigating tool. The first research phase identified 29 plans and projects distributed worldwide (tab.1), operating a screening on several cities, inquiring about the presence of urban forestry plans and projects, including diverse legislative and normative tools that complement urban forestry. The screening, operated in 2022, represents a partial framework of the topic assessment, considering the number of existing plans and language constraints since the research was conducted mainly in English.

We identified three main categories of interest based on chosen key concepts considered relevant for current research trends on urban forestry: (i) green and health, (ii) governance, and (iii) ecosystem services. These key concepts have been used as lenses to read the plans and enhance the main innovative features for urban forestry (tab. 1).

(i) The **Green and Health** topic embraces the concept of nature as a fundamental element for people's health and well-being. Trees and forests can provide direct and indirect benefits (Mitchell et al, 2007) to the environment by reducing temperatures (Schwaab et al., 2021), reducing pollutant levels (Nowak & Greenfield, 2018), and on people's health by reducing stress and depression (Kondo et al., 2018),improving attention and restoration levels, enhancing social cohesion and promoting physical activities (Lachowycz et al., 2011).
Plans that work primarily with this theme are designed to consider citizens' and

socio-health needs, reflecting on the relationship between the urban environment and its effects on human well-being.

(ii) The **Governance Strategies** topic indicates existing governance approaches and planning mechanisms challenged by multifunctionality across temporal and spatial scales (Asadzadeh et al., 2023).
These strategies describe innovative tools to engage stakeholders at different levels and comprise active discussions and debates with citizens, enhancing critical aspects of forestation, innovative funding methods and engagement of stakeholders, as well as citizens' and companies' involvement in planting and monitoring activities. It also reflects upon the public or private initiative and the opportunity urban forestry could represent for social inclusion, offering job and building a local community network.

(iii) The **Ecosystem Services** (Pinto et al., 2022) theme identifies plans that focus on increasing public awareness by measuring the economic value of urban nature. By this, with accurate communication and an overall valuation, the strategy is to raise awareness of forestry socio-ecological values and identify the potential of afforestation intervention on the economic public budget.

Plan	Strengths	Period	Normative-Administrative tool
An Urban Forest Master Plan for Birmingham (UK)	Strategy and mapping data	2021-2051	Strategic Plan
London Urban Forest Plan (UK)	Ecosystem services and mapping	2020-2050	Integrated strategic Plan
Manchester City of Trees (UK)	Governance	Since 2015	Integrated strategic Plan
The Urban Green Infrastructure of Vittoria Gasteiz (Spain)	Green and health	Since 2014	Masterplan
Trees for Life, Barcelona (Spain)	Ecosystem services	2017-2037	Integrated strategic Plan
Bosque Metropolitano, Madrid (Spain)	Data mapping	2020-2040	Masterplan
Plan Arbre, Paris (France)	Green and health	2021-2026	Masterplan
Plan Canopee, Liege (Belgium)	Green and health	2020-2030	Participative Tool
City Trees Berlin (Germany)	Green and health	2012-2026	Participative Tool
FUN Porto – Native Urban Forests in Porto (Portugal)	Green and health	2013-2021	Participative Tool
City of Lubjana Urban Forest Strategic Plan	Governance	2020-2045	Strategic Plan
Cleveland Tree Plan (USA)	Green and health	2015-2040	Strategic Plan
Trees Atlanta (USA)	Green and health, mapping	2021-2025	Strategic Plan
Urban Forest Plan Denver (USA)	Governance	2018-2028	Strategic Plan
Halifax tree project (USA)	Green and health, mapping	since 2010	Strategic Plan
Vancouver Urban Forestry Plan (USA)	Green and health	2022-2050	Strategic Plan

Million trees NYC (USA)	Data mapping	Since 2016	Strategic Plan
City Plants, Los Angeles (USA)	Green and health	Since 2001	Strategic Plan
Green Plan Philadelphia (USA)	Green and health	2016-2028	Strategic Plan
Austin's Urban Forest Plan (USA)	Governance	2014-2034	Strategic Plan
Tree Pittsburg (USA)	Governance	since 2012	Strategic Plan
Urban Forest Plan San Francisco (USA)	Governance	2015-2035	Strategic Plan
Corridoras verdes, Medellin (Colombia)	Green and health	2016-2019	Masterplan
Proyecto Montes Verdes, Belo Horizonte (Brasil)	Green and health	Since 2019	Masterplan
Arboles para Lima (Peru)	Green and health		Masterplan
Make a Great City Greener, Melbourne (Australia)	Governance	2012-2032	Masterplan
Urban Forest Strategy, Bayside (Australia)	Governance	2022-2040	Masterplan
Sidney Urban Forestry Plan (Australia)	Governance	2022-2040	Masterplan
One Million Tree Movement (Singapore)	Data mapping	2020-2030	Participative Tool

Table 1. Recognition of plans and projects

The analysis reported the complexity and heterogeneity of implemented approaches from different cities worldwide.

The first consideration resulted in the diversity of normative and legislative tools. We identified different normative and administrative tool: (a) Strategic Plans provide spatial and strategic planning guidelines, (b) Integrated strategic Plans are an integration of an existing broader plans regarding a sustainable vision, (c) Masterplans are projects that provide spatial guidelines to design specific context, (d) Participative Tool concerns plans entailing citizen participation as a critical feature.

Because of this complexity, with the aim to investigate the plan tool as an important device to strengthen urban forestation, we mainly referred to the cases of the (a) Strategic Plan and (b) Integrated Plan, selecting interesting cases to reflect upon the following research themes.

The first research question inquired how cities face urgent and relevant issues related to climate change, investigating the effective interventions and their impacts.

The second reflection was carried out on the different governance processes (public and private) relevant to transferring the goals within public policies. In this field, it results interesting to investigate the differences between bottom-up and top-down approaches, as highlighted by Sanz et al. (2022).

The last investigation regarded the innovative engagement and communication implemented tools, referring to specific contexts and reflecting upon their replicability in other territories.

The research selected 7 main cases to deepen from the USA and Europe. These two contexts provide an interesting comparison due to various historical, environmental, and legislative factors, aiming to highlight common characteristics and strengths of each plan that can constitute the basis for structuring a comprehensive forestation plan. The comparison also

brings attention to the distribution of the Urban Forestry Master Plan planning tool within public planning. In Oceania, it is quite an adopted approach in cities, while in South America, Asia and Africa, there are mostly afforestation projects that, showing anyhow, a great growing interest for the topic.

3. The legislative context of the USA and Europe

Concerning the legislative framework, we found substantial differences between the USA and European approaches to the topic of urban forestry.

The plans selected within the North American context have been mainly conceived by state obligations, defined through established and unified legislation.

The establishment of the first United States Department of Agriculture (USDA) dates back to 1875, leading to the inception of the Forestry Department a year later, aimed at safeguarding the country's existing forests (Johnston, 1996). Simultaneously, the enaction of various acts, including the "Forest and Land Management Act", outlined a program to assess the benefits of urban forests. Another significant initiative was the creation of the 'Tree City USA Grant Program' to develop a comprehensive inventory of vegetation to enhance green spaces within cities. This program, developed by the Arbor Day Foundation, saw participation from 16 states and 42 voluntary communities. Furthermore, in 1990, the National Urban and Community Forestry Council was established to oversee and manage policies and projects related to urban forestation.

The obligation to draw up forestation plans emerged after the 2008 “Farm Bill”, an Act for which each Member State was responsible for evaluating the conditions of trees and forests in US territories and consequently developing "Strategic Plans for landscape conservation, forest protection and the increase of public benefits deriving from natural capital". These State Forestry Action Plans, initially developed and completed by all Member States in 2010 (Sambeek, 2017) and updated in 2015, were revised in 2020 by all 59 Member States (USDA, 2021). These plans establish effective worktables and are accompanied by strict economic planning for federal, statal, local and private resources to achieve national forest system conservation objectives. In addition to the action plans developed by individual states, the Department of Agriculture provides technical and economic assistance for forestation projects. It draws up monitoring reports on the state of US forests, evaluating and quantifying their ecosystem services.

Currently, the laws issued regarding urban forestation are about 105: in this context, the United States underlines how urban forestation, citizens' health, inclusion, and energy saving are strictly current and interconnected themes, moving towards an interdepartmental and multidisciplinary approach.

On the contrary, Europe has a different normative framework since the European Union does not include all the continent countries (as the UK), and its member states benefit from greater legislative autonomy than US. The Green Deal directive presented in 2019 is undoubtedly incisive, aiming to achieve climate neutrality by 2050 and planting 3 billion trees. Sinergically, with this directive, the promulgation of two plans -the European Strategy for Biodiversity 2030 and the Strategy for Forestry 2030- highlights the importance of forestation in urban environments for the well-being of citizens and the achievement of the objectives of the Green Deal. Moreover, the Nature Restoration Law is currently under approval, with the aim to restore degraded ecosystems in all member states, help achieve the EU's climate and biodiversity objectives and enhance food security. In this regulatory framework, many large European cities are therefore starting to equip themselves with plans to achieve climate neutrality objectives, adopting specific tools for urban forestation, as done by London, Barcelona, Paris and Milan. Despite the context being more uneven and linked to the national regulatory situation, there is

a progressive diffusion of the forestation, suggesting its adoption as a valuable tool for achieving community objectives.
Similarly, in the United Kingdom, the 2008 Climate Action Plan was updated in 2019 with the objective of zero net greenhouse gas emissions by 2050. This goal can be achieved by drafting the three-year action plans: the first plan refers to 2021-2024 and pursues the initial goal of creating 30,000 hectares of new forests annually by 2025. In particular, the role of the Forestry Commission Department is essential; it supports forestation policies and projects and the collection of available data, promoting for more than ten years the mapping of ecosystem services given by trees in cities. Moreover, in the United Kingdom, it is possible to observe a tradition linked to the active participation of citizens, who, since the 1990s and 2000s, have formed themselves into organised groups, meeting the interest and involvement of the administrations, as in the cases of Birmingham and Manchester. The first laws and urban forestry plans based on the US model were indeed promulgated in the United Kingdom.

In Italy, there is no defined national legislative panorama on forestation. At a national level, ISPRA (an Institute for Environmental Protection and Research) draws up reports on the State of Natural Capital in Italy. The regions in the Regional Territorial Plans identify the ecological corridors and the elements to be safeguarded, such as regional and national parks. They can determine some guidelines for protecting and safeguarding the existing natural heritage. Municipalities with more than 15,000 inhabitants have the legislative obligation (L. n. 10/2013 and guidelines of the Ministry of the Environment 2017) to draw up the Municipal Green Plans, tools that design the urban, peri-urban, agro-silvicultural structure of the city, providing guidelines for the creation of new green areas within the general urban planning. The green plan configuration differs from a real forestation plan, but it is currently the only defined legislative instrument that can have planning effects.

This tool has not yet become fully operational within urban management and planning activities at a local level. For example, only 11 provincial capitals in northern Italy adopted a green plan (Lazzarini et al., 2024), showing the necessity to improve the planning approach to urban greening.

4. An overview of selected Urban Forestry Plans

The selection of the 7 case studies identified plans presenting both particular elements of innovation in governance and strategy tools, in communication and the active involvement of stakeholders and citizens, and both when covering the role of 'pioneer plans' for specific themes that others have incorporated. For these reasons, the selected plans stand out for the approach used in addressing relevant environmental and social issues, constituting an accurate model that other cities can replicate in their forestation plans.

The proposed approach is a critical analysis conducted using this structure:

- City's state of the art: Why an afforestation plan?;
- Plan's goals and mission;
- Governance;
- Plan structure;
- First feedbacks;
- Additional communication activities and plan promotion tools if present.

The plans strengths are described below and divided based on the key concepts identified.

4.1 Green and health

The *Cleveland Tree Plan*, established in 2013 by the municipality's initiative and created in collaboration with the Cleveland Tree Coalition association, proposes a careful survey of the city's current state. Starting from assuming that trees are the only public infrastructure that increases in value over time (the more the trees grow, the more the benefits provided increase and the greater the impact on the health of the inhabitants), a precise mapping accompanies the Plan, assigning different environmental parameters that positively and negatively influence the health of citizens to each district and neighbourhood.

The plan showed a correlation between tree canopy distribution and citizens' health: in the districts where the loss of tree canopy was more significant it was found a reduction in the inhabitants' health, given the incidence of hospitalisations and the widespread presence of respiratory problems and cardiovascular disease in a variation between 3 and 4% depending on the distribution of the tree canopy. This approach aims to promote a fair distribution of the tree canopy to reduce health disparities.

The city of San Francisco has one of the lowest tree canopies among US cities (13.7%), being located in an arid and not naturally forested area.

The forestry plan, *Urban Forest Plan San Francisco*, adopted in 2015, allows for effective maintenance of trees and identifies new public and private areas to be forested to build a shared public vision for the city's development, involving various local actors and promoters. Three main actions divide the Plan, and their implementation follows different strategies and different time thresholds: rows of trees along the roads, parks and open spaces, and buildings and private properties.

The Plan addresses the relationship between citizens' health and the presence of green areas by implementing and managing trees along the streets. Ensuring shaded paths, safe streets, and a homogeneous distribution of trees throughout the city are the prerequisites for its implementation.

According to a previous analysis made by the municipality, it identifies the most popular routes, the safest ones and those suitable for different types of inhabitants (for example, elderly, disabled, people with strollers, and children), also proposing guidelines to make the street safer and healthier according with the type of traffic. In this sense, the forestation project becomes an urban regeneration tool that provides cultural, social and environmental benefits. The Plan addresses the relationship between citizens' health and the presence of green areas by implementing and managing trees along the streets. Ensuring shaded paths, safe streets, and a homogeneous distribution of trees throughout the city are the prerequisites for implementing the Plan. According to a previous analysis made by the municipality, it identifies the most popular routes, the safest ones and those suitable for different types of inhabitants (for example, elderly, disabled, people with strollers, and children), also proposing guidelines to make the street safer and healthier according with the type of traffic. In this sense, the forestation project becomes an urban regeneration tool that provides cultural, social and environmental benefits.

4.2 Governance

The *Green Plan Philadelphia,* reformulated by the administration in 2020 under the name *Philly Tree Plan*, is a strategic plan that pays attention to social aspects, guaranteeing equity and sustainability objectives that will improve the current state of the city, increasing the trees in the poorest neighbourhoods where most minorities live, also directing investments and development projects.

The Plan's base is the existing survey, which relates the tree canopy distribution to the income levels, the total population, the population affected by respiratory diseases, and exposure to high-temperature levels. For example, the survey records more deaths due to heat stroke in the hottest areas, where the temperature increases by around 6°. Those indicators are a part of the

priority map created in collaboration with the citizen organisation Community Voices Steering Committee. Three levels of priority have been identified: poverty, health problems (such as respiratory diseases and stress disorders) and temperatures. The overlapping of these three issues generated a priority map, allowing the identification of the areas most needing forestation interventions.

Concerning governance, it is significant the inclusion of the association 'Tree Philly' to develop the Action Sheet and strategic guidelines based on different problems identified from a continuous dialogue with citizens and stakeholders. For each problem, the Plan develops an action according to an intervention program and defines further proposals that citizens can remark on.

In Austin, *Austin's Urban Forest Plan* was implemented in 2012 to counteract a prolonged drought that had significantly reduced the presence of trees in the city.

Rather than defining a goal to be reached in a limited time, as other American Cities did, the municipality adopted a broad, long-term vision to establish guidelines for every City Department to manage the urban green infrastructure. The Plan proposes a critical approach, integrating the USDA tree canopy forecast, which requires cities to reach different tree canopy thresholds depending on climate.

The Plan's five goals include implementing a sustainable and resilient forest, improving tree management and care, growing a fund for each Department, protecting and preserving biodiversity and preserving ancient trees. With these defined goals, the municipality developed the 'Austin priority map', which assigns different environmental, social, economic and sanitary parameters for each city's district that, once crossed and overlapped, display the prioritisation of forestry projects according to the different sites.

Birmingham is the second largest English city by population, with over a million trees and large parks; since 2020, it has been among the Tree Cities of the World. However, due to the city's shape, urban greenery is mainly concentrated in peripheral areas, leading to unequal distribution and consequent non-uniform accessibility.

Due to the presence of such a large arboreal heritage and the need for its management, at the beginning of the 2000s, the administration promoted a strategy for the protection and maintenance of trees without allocating funds to implement biodiversity, causing a reaction among citizens. The protest over the lack of a vision for the city's green transformation led to establishing a working group in the City Council to promote the definition of the first "Birmingham Tree Policy" guideline report. The experience of the Council led to the creation of the "Birmingham Tree People" association, which became one of the leading promoters together with the municipality.

This first experience guided the development of the *Urban Forestry Master Plan* in 2021, created in collaboration with the municipality and the Birmingham Tree People association, which defines a vision for the forestry of the city in thirty years, providing a line of action for the first decade 2021-2031. The first part of the Plan defined a prioritised mapping based on the importance of the targets, which became the basis for defining subsequent lines of action. Moreover, the definition of a Tree Board allows coherent management of all the topics analysed. In this way, the administration provides a tool through which citizens can directly report problems relating to the state of trees to promote better heritage management.

In 2017, the tree canopy of Barcellona stood at around 25% and was characterised by an uneven distribution in the urban territory. In early 1995, the municipality promoted various plans for

managing and maintaining city trees, whose aims merged in 2013 into the '2030 Biodiversity Plan', created to increase urban greenery by 1 m2 for each inhabitant.

At the same time as the promulgation of constantly updated Biodiversity Plans to achieve the Carbon Neutral objectives for 2050, the municipality, in 2017, promoted the *Trees for Life* Forestry Plan for the thirty years 2017-37, which focuses its action on planning and managing the tree heritage of the city, to complete the 2030 Nature Plan.

The latter promotes a vision for implementing tree capital, divided into ten strategic lines, each including different actions defined in a temporal action program. The Plan also defines different areas of intervention according to the ratio of square meters of tree canopy per inhabitant for each city district. Plantations must be prioritised following equity, strengthening biodiversity, and integrating the metropolitan scale and connections.

An interesting strategy the municipality defines is the "Mans al Verd" program 2020-2023, a plan to promote citizen participation in maintenance and management projects of public green areas. The program presents different projects directly involving residents, inviting citizens to take care of the trees and shrubs by "adopting" them and providing the necessary resources for their care.

4.3 Ecosystem services

The *Manchester City of Trees* Plan was born from the experience that began in the 1990s of the "City of Trees" citizens' movement, which, during its work, found the support of institutions and administrations, promoting since 2019 a strategic plan drawn up following the ecosystem services mapping carried out with the I Tree software.

The Plan is part of a political context in which forestation is strongly encouraged and works on a metropolitan scale. Institutions have already promulgated plans for reducing emissions, the first of which is the Great Manchester Environmental Plan 2019-2024.

After evaluating the benefits reported by the existing assets, the Plan defines a priority mapping that identifies the areas to carry out strategic plantations, aiming to work on the different trees' benefits. Citizen participation in planting interventions is fundamental. City of Trees coordinates their engagement, offering tutorials to teach tree maintenance and organising collective planting events that also systematise the individual initiatives of citizens, who can implement tree capital even in private areas.

5. Critical comparison of plans

The proposed approach used to analyse the plans reveals the different approaches used by cities, allowing the understanding of the context of plan development and within which it operates and interacts with the territory.

This contribution highlights the common use of multidisciplinary tools, which are part of governance strategies and are shared by multiple sectors of the city, allowing the achievement of sustainable objectives by working on the political, economic and social front. All forestation plans work in parallel on several themes. However, the proposed classification (fig.2) highlights only the innovative approaches to compare the investigated plans in an interpretative approach.

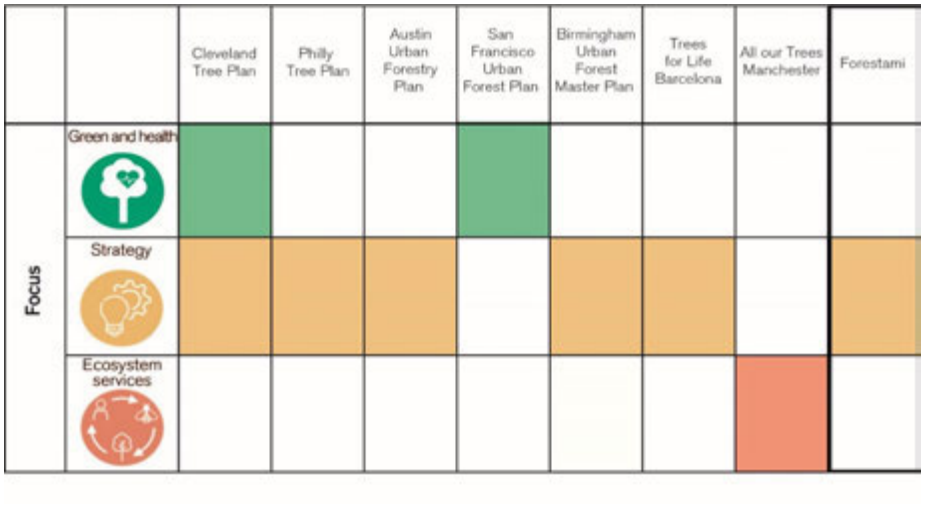

Figure 1. Strenghts of each examined Plan

In particular, the health topic emerges primarily in the USA, widely treated in different forms, e.g., in Cleveland with a focus on the increase in diseases and the loss of tree canopy, in San Francisco, paying particular attention to the quality of the busiest streets. In Europe, however, since the forestation discipline gained importance in urban planning only in recent years, the plans are more focused on formulating strategies useful for involving various local and institutional actors and evaluating ecosystem services linked to forestry interventions.

In America, therefore, the topic of forestation and well-being has been discussed for almost a decade; the monitoring information for the plans, unlike in Europe, is complete and exhaustive, and the plans themselves, now revised and updated, integrate principles that guarantee social equity, in order to use forestation as a tool of urban, environmental and social regeneration.

The legislative point of view also constitutes one of the main differences. While in the USA, the legislation requires individual states to formulate a forestation plan with the support of the Forestry Department, in Europe, the autonomy of individual states results in legislative fragmentation.

The directives formulated by the main governmental body, the European Union, are perceived as guidelines by individual member states but do not always become part of the legislation, even though many European cities have recently promoted the definition of plans for greenery and biodiversity. Promoting urban biodiversity is then not related only to the urban forestry plan tool, but it is conceived in other planning approaches, such as the Barcelona Nature Plan demonstrates. The United Kingdom, on the other hand, stands out as one of the leaders of forestation in the European context. Therefore, this partial examination returns only to the context of the forestry plan, remembering that, at the same time, other cities are equipping themselves with other tools, such as the Biodiversity Plans.

In the USA plan, the municipality is always involved in the plan formulation, with initiatives that sometimes involve and activate local organisations but are mainly promoted by public bodies. Even in Europe, public bodies support many plans, but looking at some citizens' initiatives necessary to start these processes, as in Birmingham and Manchester, is interesting.

		Cleveland Tree Plan	Philly Tree Plan	Austin Urban Forestry Plan	San Francisco Urban Forest Plan	Birmingham Urban Forest Master Plan	Trees for Life Barcelona	All our Trees Manchester	Forestami
Governance	public	■	■	■	■	■	■		■
	private	■							■
	citizens				■	■		■	
Financiers	public	■	■	■	■	■	■	■	
	private		■					■	■
Partners	public	■	■	■	■	■	■	■	■
	private					■			■
Engaged subjects	companies		■			■		■	■
	citizens	■	■	■	■	■	■	■	■
	third sector	■						■	■

Figure 2. Engagement and governance levels

From the plans comparison (fig.3), it is, in fact, clear that most of these have a public nature, characterised both by the initiative, often carried out by individual municipalities, and by the participation of financiers and partners. Instead, the Birmingham and Manchester plan stands out for the approach that involves more citizens and private entities, combining the requests of a plan with a bottom-up approach that meets the needs of associations and communities in parallel.

While the governance and financiers are primarily public, the presence of public partners and the involvement of citizens in the plan's activities are a constant for all plans.

This comparison shows that the level of governance employed does not influence the level of engagement: even public plans work in close contact with citizens and local realities (less with the third sector), and even bottom-up plans manage to obtain financiers and partners public.

5.1 Comparison with Forestami project

In Italy, one of the most relevant forestation projects is Forestami, born in 2018 by a research of Polytechnic of Milan, to plant 3 million trees and improve air quality in the metropolitan city of Milan, through constant dialogue between public administrations, universities and bodies operating in the territory, citizens and companies, and the construction of memoranda of understanding that mark the shared commitment to sustainable change in the territory.

In this context, the project is not defined by a legislative obligations, but it is raised by the cooperation of different entities that operate together in the territory to achieve a common objective.

Collective planting activities and cultural dissemination carried out by various training events are a part of the project that also involves schools and citizens and establishes the commitment to participate in the collective change of the territory.

The Forestami project, although not born with a superordinate planning nature, is comparable with the plans described above for these three main reasons: a) the scale, 2) the cultural value, and 3) the governance.

In fact, Forestami includes a broad territorial dimension, not dealing only with a limited area; its spatialisation has characteristics that interact with planning tools. Then it has a collective nature that communicates with the public and private sectors.

And finally, if governance is one of the main strengths, the project has also started reflections on green issues and health and ecosystem services in recent years.

It constitutes an important reference in the Italian context as it holds a public partnership with various bodies, including cultural ones, which operate in the area at all government levels.

6. New perspectives for Urban Forestry plans

As previously mentioned, the elements highlighted in this research can be used in different ways and on different levels to investigate effective tools to improve urban forestry plans in Italy. Public and private governance, citizen engagement, and site-specific objectives adaptable to local, environmental, political and economic contexts are the essential elements that emerged from an analytical synthesis.

Starting from the analysis of the selected plan, the first consideration regards the governance point of view; the public interest in shaping the vision and providing an economic base is crucial for the structure and composition of multidisciplinary teams (Ordóñez et al., 2019).

From an engagement point of view, we underline the interest in the active involvement of citizens through training and participatory events, the sharing of the plan goals with stakeholders and associations, the engagement of local entities that deal with sustainability already present in the territory with the consequent creation of new job opportunities, and the involvement of minorities such as social groups of different cultures and religions. These elements are relevant points involving the constant construction of a dialogue between the administrations and the inhabitants of the cities, which also guarantees the reduction of disparities. However, it is necessary to provide effective tools to measure the impacts of these interventions on the social realm.

Another fundamental aspect resulting from the analysis is the plan's flexibility and its goals, which are closely related to the context's environmental, social, and political conditions, by analysing and reading the state of the art of the city. In this way, considering the challenge of climate change (Gill et al., 2007), it is possible to guarantee a gradual transition in the territory. Then, the constant temperature increasing and the severe droughts that have affected almost all urban contexts led to a significant loss of tree canopy and the reformulation of various plans. In this sense, the proposed objectives cannot only be quantitative but also aim to improve our cities' urban, environmental, and social quality.

Plans can then treat open green spaces and health themes by using the mapping tool, which precisely identifies the spaces that contribute to the psychophysical well-being of people, determining their distribution and accessibility. Verifying the fair distribution of trees in cities is fundamental to guarantee environmental justice, whereby all citizens benefit equally from open spaces by reducing disparities (Wolch et al., 2014,Sharifi et al., 2021). Plans also often use mapping as an interactive and participatory tool in which citizens can acquire an awareness of the environmental quality of the neighbourhood in which they live, which forestation interventions will be carried out and the degree of priority of the interventions.

The lack of defined and complete European and Italian legislation has consequences on planning balances, whereby the most capable territories and cities, with more economic resources and knowledge, spontaneously initiate virtuous forestation plans and projects.

Therefore, it clearly emerges the importance of a public coherent legislation that directs the definition and programming of forestation plans sharing common objectives and concretely contributing to the sustainable development of the territory.

Pending comprehensive and unified legislation on urban forestry, the recommended best practices and highlighted features should aim for urban forestry plans to be recognised and conceived not merely as sectoral plans but as integrated development tools within territorial governance frameworks.

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Dispositive-disposition dyads as a lever for change-making: the reconfiguration of school spaces promoted by the Metropolitan Regeneration Program of Bologna

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Abstract
The paper discusses the modernization of school facilities, to address contemporary educational and social demands, as a critical issue for the public sector. The study focuses on the "Progetto Scuole Terre di Pianura," part of the Metropolitan Regeneration Program in Bologna, which aims to reconfigure school spaces to foster educational and social initiatives. The paper critically examines how public officials (disposition) engage with technical and regulatory frameworks (dispositive) to implement local projects. It underscores the crucial role of public officials in interpreting and applying these frameworks to achieve effective urban regeneration, navigating the complexity of public administration in resource-constrained environments.

Keyword
City-education relationship
Territorial governance
Public action
Small and medium-sized towns

A phase of return on public assets: new dispositive-disposition dyads

The current legacy of school facilities is one of the most significant outcomes of public investment, which received a decisive boost from the obligation to develop regulatory plans through the application of urban planning standards introduced in 1968 by an interministerial decree[1]. After decades of application, local governments have obtained land and structures that have contributed significantly to shaping and creating hierarchies in urban contexts of large and small municipalities.

Today, many reasons justify the need for a new cycle of interventions, incorporating different lines of reasoning (Annese, 2016; Chipa, Mangione, 2022; Renzoni, Donadoni, 2022). The modernization of facilities and the articulation of learning spaces relates to the affirmation of more inclusive educational projects attentive to environmental challenges. The effects of some significant social changes (such as the generalized decrease in the number of children per family, the collapse of the population in mountainous and hilly areas, the reproduction of pockets of educational poverty pose the need to rethink the geographies and functioning of the school infrastructure. The opening of schools to other socio-cultural functions and the interdependence with other public spaces that complete the educational offer (libraries and cultural spaces, gyms and spaces for practicing sports as an activity included in the educational path for all, spaces for outdoor lessons) suggest a rethinking of the role and layout of schools

[1] The obligation to develop regulatory plans was introduced by Law 765/1967. Subsequently, Decree 1444/1968 mandated the reservation of minimum quantities of green spaces and public services or those of public interest, at a rate of no less than 18 square meters per inhabitant. Both measures remain in force.

as nodes of a “fundamental infrastructure” (Collettivo per l’economia fondamentale 2019), based on proximity relationships.

New perspectives and new forms of intervention on schools find opportunities for experimentation through the territorialization of national and regional public policies, which promote and support local initiatives through calls for projects. The need to translate general objectives and instances into local initiatives changes the role, agenda and approaches of local actors (administrators, public-private networks) and cities, understood as recognizable collective actors in decision-making processes (Bifulco, 2016).

Within this context, the theme of the AESOP congress can be understood by examining how the Public Administration manages the implementation of public projects and policies. This occurs in a phase marked by increasing contradictions, as the complexity of managing local changes grows while internal resources and capabilities diminish.

More specifically, we want to reflect on the relationship between dispositives and disposition as a determining factor for the permanence of a space for action. We use the term "dispositive" to mean a heterogeneous set (Agamben, 2006) that incorporates the complex of relationships that is built around and starting from the definition of technical artifacts, such as plans, regulations, projects. We understand by "disposition" the way in which individuals - in this case public officials - position themselves in relation to dispositives, in terms of agency and attribution of meaning.

To reflect on this theme, the present contribution critically revisits an initiative promoted in four small towns in the plains of Bologna, in which I was personally involved as a consultant for the public administration: the "Progetto Scuole Terre di Pianura, included in the Metropolitan Regeneration Program promoted by the Metropolitan City of Bologna and financed by a fund established to promote urban regeneration in areas of greater socio-economic fragility. The project translates the call for proposals' goals of increasing accessibility and energy efficiency in public buildings by redefining relational spaces (courtyards, entrances, service structures, thresholds, and pathways) in four preschools to promote educational and social initiatives.

After illustrating the fundamental contents of the project and the main stages of its implementation, the text dwells on the dispositive-disposition dyad, that is, on the relationship that was determined between the Metropolitan program, the local Project and the public officials responsible for their implementation.

The Metropolitan Regeneration Program and the “Progetto Scuole”

Following the 2014 institutional reform, the Metropolitan City of Bologna has equipped itself with the entire spectrum of tools to exercise its role as a federating body, in relation and cooperation with the Municipalities and the Unions of municipalities[2]: the Strategic Metropolitan Plan, the Metropolitan Plan for Sustainable Mobility, the Bologna Charter for the implementation of the 2030 Agenda, and the Metropolitan Territorial Plan.

[2] A Union of municipalities is a local authority formed by at least two municipalities to exercise certain functions. The Union shall have legal personality, statutory, regulatory, organizational and financial autonomy and its own political and management bodies. The metropolitan city of Bologna is subdivided into 50 municipalities, 45 of which are associated in 7 Unions.

The Metropolitan Strategic Plan[3] has provided the general framework of objectives to be territorialized and has made explicit the overall intentions and priorities for action including the promotion of urban redevelopment and regeneration projects in areas characterized by lower quality and/or urban and building degradation, economic and social marginality, to enrich public facilities and promote sustainable mobility, avoiding land consumption.

This indication is operationalized by the Equalization Fund, which is set up by The Metropolitan Territorial Plan[4] to ensure the financing of regeneration programs through a share of the planning fees due to urban expansions producing land consumption. The fund has a compensatory and solidarity character towards the territories not directly involved in urban transformations and is also intended as a lever to attract additional resources necessary to promote territorial rebalancing (Baioni et al, 2019, 34).

Its initial implementation benefited from already available resources. A grant of €700,000 from the Ministry of Infrastructure and Sustainable Mobility was used by municipalities and Unions for the preparation of technical and economic feasibility projects[5] concerning the works to be financed with the fund's resources. In line with MIMS guidelines and the objectives of the PSM, the design focused on interventions for energy autonomy, energy efficiency, and the reduction of energy poverty, with supra-municipal or metropolitan significance, and primarily involving existing public buildings.

Subsequently, a Call for the composition of the Metropolitan Regeneration Program was issued, with a total budget of 2.3 million euros. All Unions and a single municipality submitted proposals based on the feasibility projects, for a total of 54 interventions. The selection was made through two criteria, to which the same weighting was attributed: the economic, demographic and social fragility of the municipality[6] and the quality of the proposal (giving 3/5 of the score based on the strategic and urban dimension). Following the evaluation, the Program was composed of 15 interventions and approved on 29 November 2023.

The formation of the program is not episodic. It is part of a process initiated by a series of national calls[7] that have already stimulated a season of public initiatives. Metropolitan City intends to contribute through the formation of the Metropolitan Programs, on a biennial basis. For this purpose, the Metropolitan City has provided guidance tools (Guidelines for Metropolitan Regeneration Programs) and set the Workshops for Metropolitan Regeneration, to train and support local initiatives.

[3] Approved by Council Resolution of Città Metropolitana di Bologna no. 34 of 11 July 2018.
[4] Approved by Council Resolution of Città Metropolitana di Bologna no. 16 of 12 May 2021
[5] Technical-economic feasibility projects are the preliminary level of design of public works. Introduced by Decree-Law 50/2016 and confirmed in the new Procurement Code entered into force in 2023, they provide all the information to define the characteristics of the work.
[6] Metropolitan City carries out periodic monitoring of the demographic, social and economic fragility in the municipalities, the results of which are published online.
[7] The most relevant initiatives are the Innovative program for housing quality (DM 7 October 2021); the Extraordinary Intervention program for urban redevelopment and suburban safety (DPCM 25 May 2016); the Integrated urban plans, established by the Recovery and Resilience Plan of Italy (approved on 13 July 2021 by Decision implementing the European Council).

The Union of Municipalities Terre di Pianura[8] submitted the "Progetto Scuole delle Terre di Pianura" for funding. The initial impetus was given by the technical structures of the urban planning office, which is entrusted with the associated exercise of the management, urban and territorial planning functions under municipal jurisdiction, with the indirect assistance of the author, as a consultant for the urban planning general plan being drafted. From the outset, the proposal was oriented towards broader objectives beyond merely reducing energy consumption and physically upgrading the facilities. The funding for the feasibility project was viewed as an opportunity to define a comprehensive action plan addressing the three key aspects of school spaces previously mentioned: learning environments, new social demands, and the relationship with the urban context.

The project's report emphasizes that the pandemic's enforced denial of school attendance has made everyone more aware of their influence on the individual and social sphere. As stated by Alessandro D'Avenia, writer and professor, the poor habitability of schools is a determining factor in inducing young people to seek a digital elsewhere, where they can be better off. Moreover, the report underlines that schools are not monads. They shall be considered as condensers of relationships that primarily involve children, their companions and teachers, but which can extend, through the action of groups and associations, to large segments of the population. This broadening of perspective was made possible thanks to the formation of a working group composed of researchers and university professors, and professionals (architects and engineers)[9].

The interventions in the four preschools[10], one in each municipality, include:
- The reconfiguration of outdoor spaces and paths that connect schools to other services present in urban centers and public transportation nodes
- The implementation of interventions in service spaces to make the school more welcoming to associations and groups involved in social activities (threshold spaces in Altedo, a multi-purpose community space in San Gabriele, a multi-purpose laboratory in Minerbio and a solar greenhouse in Cadriano).

The proposals were profiled to the physical-functional characteristics of each school facility, the needs identified through dialogue with the teaching staff, and the detected relationships with the surrounding area. The discreet direction carried out by the urban planning office allowed the working group to engage in collective work sessions and moments of discussion with sector managers, school principals and teachers. The contribution of the various expertise has proved to be fruitful. The results of university-level research have been incorporated, ensuring prerequisites for immediate implementation. This has been achieved by calibrating the feasibility projects for progressive implementation in phases, according to available funding, the first of which is secured by the Metropolitan Program.

[8] The Union Terre di Pianura is a local authority established in 2010 that covers a territory of 177 square kilometers, located between Bologna and Ferrara, with about 40,000 inhabitants.
[9] The working group of Politecnico di Milano, coordinated by Cristina Renzoni, provided scientific support. Angela Ceresoli (ABC studio), with Mauro Baioni (PUG consultant), oversaw the framework project. Massimo Bernardelli and Angela Ceresoli (ABC studio) were responsible for the elaboration of the four feasibility projects. The analysis of plant engineering was developed by Emilio Morandini. Kiez Agency contributed to the drafting of guidelines for an inclusive approach to the equipment of public spaces.
[10] Preschool of San Gabriele (Baricella), Preschool of Altedo, Preschool “R. Caldarone” in Minerbio, Preschool “Fresu” in Cadriano (Granarolo dell’Emilia).

Moreover, the project offered concrete tools to extend future action. The interpretation of recurring situations regarding accessibility conditions, the relationships between schools and other proximity facilities, and the multifunctionality of spaces translated into indications for the general urban plan. The design criteria on mobility, accessibility in application of the Design for All principles, on the treatment of relational spaces (thresholds, entrances) and open spaces in application of NBS principles have been incorporated into guidelines for future public works planning, including those that can be carried out by private entities when promoting urban transformations.

Fig. 1 – Relationship between the school and the other facilities of the local educational infrastructure. The preschool of San Gabriele. Source: Gruppo di ricerca DAStU, Politecnico di Milano (Cristina Renzoni, Ettore Donadoni, Chiara Nifosì, con Giulia Crotti). *Supporto scientifico al progetto Scuole di Terre di Pianura, Report conclusivo*.

Fig. 2 – Intervention on the preschool of San Gabriele, funded by the Metropolitan Regeneration Program. Source: Unione Terre di Pianura, Progetto Quadro (ABC studio).

Between Dispositive and Disposition

To reflect on the relationship between dispositives and disposition, I made use of two interviews with Mariagrazia Ricci and Francesco Selmi (Metropolitan City of Bologna) and Irene Evangelisti (Union of Municipalities of Terre di Pianura), the technical officials who dealt with the formation of the program and the preparation of the proposal, respectively. The interviews were conducted on May 9 and 10, 2024 and were based on the following three questions:

- What is the space for action created by the Metropolitan Program / by the local project?
- What is the space for action that you have created autonomously, having to follow the program, especially with respect to the political mandate and the sensitivities of the administrators?
- What are the enabling conditions for expanding the space for action?

Regarding the dispositive, the technicians of the Metropolitan City underlined the value of the program in terms of empowering the territories. The program prompted the technical structures of the Unions and individual municipalities to overcome the habit of operating in the existing city through single interventions defined by the logic and procedures of public works. This possibility was only seized in two instances, to concretize urban-scale reasoning already in place on energy communities or to propose innovative solutions (like Terre di Pianura). On the other side, compared to previous calls that had received few applications from municipalities, in this case the number of proposals exceeded the overall amount of the allocation.

For the head of the municipal office, the value of the dispositive is linked to the possibility of proposing a lateral perspective on general themes to overcome reductionist approaches based on the "problem-solution" binomial. The call created a space for action because it didn't impose codified solutions (such as the purchase of a tool or the use of a technology) but allowed for the formulation of proposals commensurate with the specificities of the territories and their ability to intercept emerging trends at the local scale. In small municipalities, however, to seize this opportunity is by no means obvious. In the eyes of technicians, it is a problem to give up a

practice that relies on strict sectorization and simplified problem-solution approaches that do not include multidisciplinarity and skill integration.

The Metropolitan City emphasized the broad degree of autonomy left by the administrators. The promotion of the calls was prompted by the technical structures, in the presence of general political guidelines. Political support was easily obtained due to the interest in backing local authorities and the possibility of communicating concrete results. At the Union scale, political figures expressed interest in securing funds to reduce energy costs, without engaging in discussions about the nature of the proposals.

The broad freedom left to officials is counterbalanced by the lack of recognition of their initiatives. The organizational forms of public administration are rigidly profiled for the governance of ordinary proceedings. For the municipal technician, freedom and initiative go together if "you have a little courage" and – as Manzoni has Don Abbondio say - "courage, if one doesn't have it, one can't give it to oneself." That said, the interviewees lament that the public administration does not value a proactive attitude towards innovation, unlike professionals – driven by work interests – and the University – for which research and experimentation are constitutive of its mandate. Those who work in public administration remain in the middle, without a client and without incentives.

The technician from Terre di Pianura highlights a paradox arising from this gap: while public administration is required to make rapid decisions, the reliance on outdated or standardized solutions fails to address emerging issues and results in 'acting without being contemporary,' leading to overall ineffectiveness. To overcome this impasse, the Scuole project was built through a "coalition of perspectives" between public administration technicians, professionals and academics. The triangulation gave greater depth to the proposals, allowing to incorporate the results of research, to put them into concrete practice, and to demonstrate the practicability of the solutions to both other professionals and other local administrations, with a pedagogical effect. The formation of working groups including external resources to the public administration should therefore be encouraged.

As for the future, all three interviewed recognized the availability of economic and technical resources, the redefinition of internal organization, and regulatory changes as enabling conditions. Among the enabling conditions, the presence of the urban planning offices at the scale of the Union of Municipalities was seen as a guarantee to ensure minimum conditions for action, especially in small municipalities, and to overcome the segmentation of initiatives by sector (urban planning and public works) and areas of competence (education, sports, culture, social assistance).

Open Strands

As Giovanni Michelucci (2022, 230), a prominent figure in Italian architecture, observed, the "most immediate traces" of the country's transformation are recognized in the school-city relationship. In the second half of the twentieth century, "school and city found themselves submerged by that same growth that they had hoped for" (ibid). Today, the material, organizational and symbolic legacy of the long period of public equipment of cities constitutes a key place to test the public sector's ability to respond to present-day issues.

The case of Bologna offers, in this regard, some interesting insights into the possibilities for action at the local scale.

The transformative capacity at the local scale rests on a series of interdependent components (Wolfram, 2016) referring to three main fields:
- preconditions of agency/interaction (governance between communities of practice and leadership)
- path-deviant envisioning (from initial experimentation to programs based on awareness of the challenge)
- working on (innovation embedding, social learning, political-administrative action). Following the initial affirmation of pioneering practices, change is produced through actions of acceleration, stabilization, scaling-up and diffusion in which institutions can play a proactive role, since they are able to act on the "structuring conditions that configure the very possibility of agency" (Martin, 2019). The equalization fund, the metropolitan programs, the presence of the Unions' urban planning offices can be considered as enabling dispositives. To realize their potential, however, the disposition of the officials is crucial. The case described confirms how decisive public officials are in their skillful assembly of internal and external resources on their own initiative.

In conclusion, if we recognize the value that the location, conditions and functioning of schools have for the present and the future of communities, especially in fragile contexts such as small municipalities on the margins of metropolitan areas, an integrated vision must be promoted - as indicated in the special session to which this contribution contributes. In this perspective, the role of the public administration and, more specifically, of the technicians involved in the promotion and planning of urban scale interventions is decisive.

Beyond the specific perimeter of the interventions on educational infrastructure, therefore, the case of Bologna offers some suggestions about the "set of capabilities" required by public administration: "namely, the ability to adapt and learn; ability to align public services and citizens' needs; ability to govern resilient productive systems." Mazzucato's considerations (Mazzucato and Kattel, 2020, 257) seem to be particularly apt, not only to address the wicked questions of the relationship with market initiatives, but also to give quality to actions on a local scale, in a condition characterized by increasing instability and uncertainty.

The diffusion and stabilization of innovative proposals - as in any transition process - are influenced by dynamics that go beyond the technical sphere and pertain the configuration of the dispositives and the resulting space of action. The dispositive-disposition dyad, which is formed regardless of intentionality, can be consciously considered to mobilize resources, even without comprehensive reforms, to overcome the segmentation of competencies and the rigid dualism between internal planning and outsourcing.

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Aging in (urban) Place: a multidimensional study to explore opportunities for healthy longevity in the city

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Abstract
Aging in place is an increasingly discussed topic in the study of urban aging, especially in light of the new challenges of our century: population aging and urbanization. Understanding the interaction between individuals and their environment is critical to promoting healthy longevity. A mixed-methods case study in the Italian city of Bergamo examines this relationship, focusing initially on two models of aging in place: senior housing and home ownership. Preliminary data reveal individual differences in social life and in the use of urban space between the two groups. The research, which aims to investigate how to support healthy "aging in place", could involve policymakers, urban planners, and architects in promoting inclusive and age-friendly urban environments, by introducing a new perspective to aging in place studies.

Keywords: Aging in place, age-friendly city, healthy longevity, empowerment, inclusion

Topic and theoretical focus

The 21st century has to face two important challenges: the aging of the population and the continuous urbanisation of land and urban growth (especially in some areas of the planet). The World Health Organization (WHO, 2017) and the United Nations (UN, 2019), dedicate a lot of attention to them, promoting projects and good practices to sustain the shaping that the world is living, and relative challenges in social, economic, cultural, and political, that it's called to face. It's properly this intersection of population aging and urban environments that is the privileged field in which fits "urban aging", an increasing field of research all over the world.

However, the prevailing perception of aging as a 'problem' or 'economic burden' on society (Phillipson, 2013) persists, hindering efforts to empower older individuals and communities. A paradigm shift is needed to embrace a holistic view of aging that recognizers the active role older adults play in shaping their aging trajectories and promoting healthy longevity, in a lifespan course perspective (Morganti, 2022). Initiatives such as the WHO's Age-Friendly City program (WHO, 2007) aim to create urban environments that are conducive to the well-being and participation of older adults by addressing multiple domains such as housing, transportation, and social inclusion. This underscores the importance of both the physical and social environments in enhancing the quality of life for older individuals, which is consistent with scholars' emphasis on the significance of place in the aging experiences (Skinner, Andrews, and Cutchin, 2016).

Within this context, there is a strong emphasis on conceptualizing aging in place (AIP) as an achievable and valuable objective (Vasunilashorn, et al., 2012), driven by two main factors. Firstly, it responds to political movements advocating for support for older individuals,

particularly in the face of uncertainties about the sustainability of welfare systems (Pynoos et al., 2008). Secondly, it reflects the individuals' desire to remain in their own homes (see, for example, Golant, 2020) and the recognition of the importance of place for older people (McGrath and Hand, 2021). This concept has been integrated into public policies in many countries, such as the United States (Metlife, 2010) the United Kingdom (Lofqvist et al., 2013; Hammarström and Torres, 2012; Sixsmith et al., 2014), and Australia (Stones and Gullifer, 2016), where it serves as a strategy to conserve resources (Greenberg and Schwarz, 2012) and empower older people by expanding access to support services, that enable them to maintain their independence (Stones and Gullifer, 2016). In some cases, such as in the UK, housing-related programs aim to support older individuals in maintaining and enhancing their residences, facilitating extended periods of independent living at home. The rationale behind such initiatives lies in the belief that informal support networks are more cost-effective than institutional care (Wiles et al., 2011).

Since its inception, the concept of AIP has evolved, as highlighted by Rogers et al. (2020). The term originated in 1978, with Grass and Wiseman, focusing on the growing number of older adults. It gained traction in the 1990s, with increasing emphasis on the significance of familiar environments, albeit with vague descriptions. From the 2000s onwards, the literature diversified with various definitions of AIP, becoming a central concept, particularly for policymakers, as noted by Vasunilashorn et al. (2012).

Nevertheless, the definition of AIP remains an open topic, encompassing functional, symbolic, and emotional attachments and the importance of homes, neighbourhoods, and communities (Wiles et al., 2011). Multiple disciplines approach AIP from different perspectives, leading to varied definitions and interpretations. To better understand the concept, there is a need for a comprehensive definition that integrates its heterogeneity and complexity. Aging in place stimulates reflections across various fields and sparks critical discussions about its theoretical ambiguity and its implications for spatial justice and inequality (Finlay et al., 2021). To summarize the different definitions of AIP, three main categories are often considered when it is studied: people, places, and time (Rogers et al. 2020).

In this contribution, we propose to study aging in place by exploring the nuanced interplay between individuals and places, focusing on older adults living in the city, so in the dimension of "Aging in (urban) Place".

The research selects the Municipality of Bergamo as a case study due to its well-defined spatial, social, and institutional conditions, which exemplify those of a "medium-sized city". Medium cities are urban entities of significance within Italy, representing approximately one-fifth of the country's residents, with a population ranging between 200,000 and 500,000 inhabitants (Organisation for Cooperation and Economic Development, 2014).

Bergamo stands in the Lombardy Region, the most populous Italian region with nearly 10 million residents and 1,504 municipalities across 12 provinces, with Milan as its capital. Located in northern Italy, the region spans 23,860 square kilometers, with terrain divided almost equally between plains, hills, and mountains. It sits at the crossroads of routes linking the Mediterranean and Central Europe. The city of Bergamo has over 120,000 inhabitants and serves as the capital of the province, which boasts more than 1.1 million residents. It is a city with a complex spatial structure. It is internally organized into 22 neighbourhoods, which are characterized by the presence of both ancient and modern urban fabrics, affected in the 20th century by important processes of urban growth. At the same time, this city is part of a large megalopolis that runs from East to West, incorporating various cities and metropolitan areas (Torino, Milano, Padova).

Due to its characteristics, Bergamo represents an example of a "medium city" useful for the definition of an analytical-interpretative model applicable to other urban contexts. This research, in fact, represents a first exploratory phase that will provide us with useful indicators

to develop a more complex analysis model, which will attempt to involve the entire Bergamo population over 65, which is around 30,000 people. This innovative multidimensional and multilevel methodology to examine the correlation between urban environments and longevity could produce results applicable to similar medium-sized cities across Italy.

Since we believe that studying the subtle space between people and contexts, and their relationships, can be crucial in offering opportunities to promote the empowerment of individuals for their healthy longevity within the city, the research question we ask ourselves is how to study the urban context not as a neutral space, but as a place of constraints and possibilities for older adults so that it can constitute for them opportunities for healthy longevity or limitations (not only physical) that lead people towards potential trajectories of fragility.

Research objectives

Focusing on the small geographic areas (neighbourhoods) that characterize mid-sized cities, the research aims to analyse individuals and places, to understand how the different possibilities of aging in place can contribute to healthy longevity. To achieve this, a comprehensive understanding of the older adults in urban areas and their interactions with urban spaces is essential. By adopting a bio-psycho-social and ecological model of development throughout the lifespan (Bronfenbrenner, 1979), with a strong multidimensional and multilevel connotation, we intend to give importance not only to the AIP choices of individuals and the creation of their proximal relationships, but also to the role of the entire system surrounding the individual capable of determining them. Through the creation of a complex methodological model of analysis, the project intends to understand how urban space can prove to be a constraint or a resource, when placed in relation to the motivations to move, the personal characteristics of individuals and the urban spatial variables. Starting from the individual level up to the macro context, we intend to analyse not only the physical barriers that could hinder everyday life in the city, but also the cognitive ones. In other words, an analysis is proposed able to integrate the psychological and complex determinants of individuals into the concept of space. The outcomes of this research will be able to provide suggestions to support AIP policies in the city, allowing the redesign of more inclusive urban spaces capable of supporting active aging and healthy longevity. This new methodology for investigating the relationship between cities and longevity could ultimately produce results that can be generalized to other medium-sized Italian cities.

Research methods

The research focuses on the Municipality of Bergamo as a case study due to its distinct spatial, social, and institutional characteristics, making it an exemplar of a "medium city" suitable for developing an analytical-interpretative model applicable to similar urban contexts. The methodology chosen for the indicated objective is the mixed-method case study (Curry et al., 2009; Phillips et al., 2013). The study, which has two main focuses – people and places – adopts an epistemological complex approach, in a biopsychosocial and ecological perspective of development throughout life (Bronfenbrenner, 1979), and integrates the determinants indicated by the WHO for the creation of Age Friendly cities (WHO, 2007).

Two groups of individuals over 70-year, living in two different AIP models situated in two different neighbourhood in the city of Bergamo are analysed as case study. One sample group is composed by 16 aged persons (14 females; 2 males) living in their home and attending activities in an association dedicated to older adults placed in “Sant’Alessandro” neighbourhood. The other group is composed by 13 older adults (11 females; 2 males) living in a senior house (a group of independent apartments organized around common services) situated in “Borgo Palazzo” neighbourhood. This housing model is particularly interesting for

our research as it is the first form of independent senior living not only in Bergamo but also in Italy. The reference neighbourhoods of the two sample groups are almost similar: residential and central in the city of Bergamo.

Starting from an individual perspective the research assesses the healthy status by quantitative measurements and the motivation to empower in aging by qualitative method. The first step of the study is a qualitative interview (audio-recorded) lasting approximately thirty minutes, composed by three questions aimed at investigating the motivations for aging, resources and difficulties during this process, the motivation of certain housing choices and how much and how the space around them (neighbourhood) home is used. The second part of individual analysis is made using quantitative measurements, and represents a multidimensional evaluation of the participants, resumed in four dimensions: Cognitive, Functionality in daily life, Emotional state, Quality of life.

This first part of the analysis allows us to have a complete and in-depth picture of the older adults, not only from a health point of view, but also in terms of thoughts, life stories, needs and motivations, also in relation to the use of urban environments.

Preliminary results

The preliminary results are about the qualitative and quantitative data on the individual focus. With the current analysis, we will delve into the examination of qualitative data, which proves to be more revealing and thought-provoking.

Into the sample we had to drop out two subjects. As shown in Table 1, the definitive sample is composed by 13 over 70 years old living in the senior house (2 males; 11 females); and 14 people living in their homes (2 males; 12 females).

Table 1
Socio-demographic and self-reported health details of participants.

	Own Homes	Senior House	total	% of total
Population				
total	14	13	27	100%
famale	12	11	23	85%
male	2	2	4	15%
Age				
70-74 years	0	1	1	4%
75-79 years	2	2	4	15%
80-84 years	7	5	12	44%
85-89 years	4	2	6	22%
90 + years	1	3	4	15%
Marital status				
Married / Living with Partner	3	2	5	19%
Separated / Divorced	2	2	4	15%
Widowed	5	9	14	52%
Single / Never Married	4	0	4	15%
Qualification				
Elementary School	1	1	2	7%
Secondary school	2	5	7	26%

High school	10	6	16	59%
Degree-Para-university diploma	1	1	2	7%

From an individual perspective preliminary quantitative data revealed no significant differences between the two groups. These two case studies appeared, in fact, to be similar in the four dimensions examined. On the other hands, qualitative preliminary data reveal differences between the two groups, in particular in the personal aspects of empowerment in aging, in social life, in the motivation of the housing choice, and in the use of urban environment. Several themes are emerged during the interview, some about their life histories, resilience, needs, thoughts, while some others about the current life in the AIP model chosen, and their relationship with urban environments.

Starting the analysis with the first question posed to them, about them perceptions of aging and about resources and difficulties linked to this period of life, the two groups appear quite homogeneous. For both the themes of sociality, physical health and safety appear to be very important. Among the resources, sociability is most often cited, while among the difficulties, motor fragility or the loss of independence, in some cases forced, mostly emerge. Some of them raise the issue of the stereotype of old age, emphasizing their role and dignity as self-determined people, before being tied to the sole label of "old". Below we report a reflection proposed by one person of "own homes" group on this regard: *"but what also annoys me in quotation marks, these stereotypes, which surround this passage of life, that up to a certain point you can do some things, after that you cannot do others, however this also has a value socially, because you still feel , I'm labelled, you don't belong to that age group, okay, you're allowed to do things, after which I don't know you go beyond that, so you already seem out of the sphere, let's say, of a certain type."* In both two groups, we observe stories of resilience, where moments such as the death of children, widowhood, or COVID are indicated as very difficult times in life.

Analysing the question relating to housing choice, for the group of individuals who have chosen to live in their own home, emerge the issues of autonomy and attachment to the place in which they have lived for most of their lives. All the subjects interviewed decided to live in the home in which they are located autonomously and independently. This choice seems to reveal a good degree of empowerment in one's aging process. As highlighted by the literature (Rowles, 1983; Degnen, 2016), place attachment where one has lived throughout one's life seems to have a strong connection with healthy longevity, particularly due to the presence of a great relationships between people and places, which encourage movement and social networks, and, as a consequence, the maintenance of active aging. The group interviewed, in fact, has a good social life, thanks also to attending the association two days a week as a point of reference and input for reflecting and doing activities. Deficiencies in this sense are highlighted if the person finds himself in difficulty from a motor point of view and is therefore dependent on third parties for his travel, whether on foot or by car. Out of fourteen interviewees, most are independent in their travels. Almost half of them drive a car, while the others travel by other means such as public transport, bicycle, or on foot. Only one person needs to be accompanied even for very short journeys. The meetings that the association proposes also allow them to have a moment of discussion and cultural enrichment. In addition to this, those affiliated with this group regularly participate in exhibitions, concerts and guided tours of the city and trips out of the city, encouraging movement, sociability, and curiosity to learn. Furthermore, from the analysis of the interviews, a good degree of awareness and self-determination regarding one's aging emerges. For example, during an interview, an 80-year-old woman, with a good degree of physical and mental health, states: "*I want to be a "subject" until the end, and I decide on my own*", also adding how it was fundamental throughout her life to make conscious choices capable of orienting her towards healthy aging. Some of them, in recent years, have become actresses, accepting the challenge of putting themselves on stage. Urban

space appears to them as the place where they can carry out their services, but also where they can carry out the activities they prefer.

The qualitative data obtained from the older adults living in the senior house reveal that the choice of this specific form of housing is guided by two main concepts: the sense of security and the need for sociability. Among the reasons why a certain housing choice is made, in fact, the theme of loneliness stands out a lot, either as an event that has already happened or something that is feared. Most of them urged their children to look for a possible solution away from loneliness. Differently from the group that lives in their own home, for the "senior house" sample, the attachment to the place is rather poor, since they mostly come from elsewhere. Only three persons was resident in Bergamo city, including one in the same neighbourhood. In fact, the latter, appears to continue to move easily within the city. Some of them miss their home and the place in which they have always lived, while some complain that they have not found what they thought, because loneliness is an element that continues to stay, despite believed they would defeat it thanks to such a place. Only three residents declare that they went to the senior house by their own choice, the others mostly demonstrate that they received an address from their closest family members. Among the latter, however, there are those who maintain a certain degree of self-determination, having in fact accepted and chosen to live there, while others are dissatisfied and have given up on the idea of returning to their home, even though they want it. In other words, they experience the choices made by others (generally their children) with extreme passivity. Another important theme emerged is the need of security. Many individuals have opted for this housing model to enhance their sense of security. They expressed concerns about potential falls or health issues when alone at home. Additionally, this living arrangement offers greater ease of movement compared to their previous residences.

The older adults who have chosen this housing model generally have a daily routine that unites the residents. There is great participation in the proposed activities, but in general, they do not organize other activities on their own initiative inside or outside the senior house. The structure organizes daily moments in which to meet, including outdoor activities, from shopping to the use of leisure services, such as the cinema, but only some of them participate in the latters. The use of urban space is, in fact, mostly relegated to the satisfaction of some needs. Only a few of them continue to maintain their independence, participating independently in the activities proposed by the Municipality and taking advantage of leisure services, such as the gym. The others feel hindered in the use of urban spaces, both for reasons contingent on the city (e.g. traffic), and because they do not know the spaces or do not feel safe in moving around, also due to a fragile walk.

Preliminary conclusion, future research, and study implications

From our preliminary findings, we can draw some initial conclusions.

The group of people who live in their own homes seems to be more aware and empowered about their aging trajectory. Furthermore, the latter seem to be in a more favourable situation capable of supporting healthy longevity. In fact, attachment to the place, as also supported by the literature (Rowles, 1983), allows them to keep social networks active within their community, favouring, as a consequence, good sociability, and a certain degree of mobility within of the city, both protective factors considered fundamental to supporting active aging (Holt-Lunstad et al., 2010; Hause et al., 1988).

In contrast, living in a senior house appears to limit activities within the city, possibly due to the availability of services within the facility and a lesser attachment to the place by the older adults' residents. This situation raises the question of how to increase the relationship of senior house residents with the broader community and urban environment. Furthermore, the high degree of sociability that could act as a protective factor for those who live in their own homes (Holt-Lunstad et al., 2010; Hause et al., 1988) seems not to be so present in the group of

individuals who live in the "senior house", who tend to feel lonelier. This reflection prompts us to consider how we can help these residents increase their social interactions. These insights and questions will guide the next steps of our research, as we seek to improve the quality of life for the over 65 population in Bergamo through comprehensive analysis.

Since the research is ongoing, to have a complete a multidimensional and multi-level photography of the analyse the interaction of people with urban spaces we will proceed to run a participant ethnographic observation (Geertz and Leonini, 1988) combined with spatial analysis (e.g. functional and morphological setting; presence of physical barriers or limitations) in order to understand the differences on using spaces in depending of the role/motivation to move in the city. We think that the use of ethnographic observation will be fundamental for the research because it allows a more accurate understanding and complete with the individual and spatial characteristics that determine the use of city space in the context of Aging in Place. It also allows us to collect qualitative field notes, which will help focus attention on topics deemed important to research participants. For the in-depth analysis of the latter will be carried out in specific focus groups (Morgan, Krueger, King, 1998). The collaboration with urban planners and geographers will also allow the analysis to be conducted in the 22 neighbourhoods of the city of Bergamo, focusing on: 1) Demography 2) The story 3) The spatial organisation, which will be explained in: - Prevalent uses and functions - Service system - Mobility - Environmental ecological system. The spatial analysis will result in the creation of specific maps of the 22 neighbourhoods analysed (Software QGIS®).

The research presented constitutes an initial exploratory phase, offering valuable insights for the construction of a more sophisticated analytical model, to involve the entire population over 65 in Bergamo, also through automated data collection.

A possible implication of this study could be the involving of policymakers, urban planners, and architects, in order to propose new empowerment possibilities of urban spaces for aging individuals. Moreover, this study will contribute to introduce urban and services innovation that can turn cities into age friendly and affordable places for people who decide to adopt an AIP model. In particular this research will contribute to innovate Bergamo as a city of longevity. This will be congruent with the World Health Organization proposal (WHO, 2017) and with the concepts of inclusion and equality suggested by the NextGeneration EU (next-generation-eu.europa.eu).

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Transhumance routes as tourist destinations: a concrete opportunity for inner areas or a romantic suggestion?

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Abstract
The ancient practice of transhumance has generated on a large part of the Mediterranean territories a heritage of an intangible type (linked to the historical, cultural and socio-anthropological value), and of a material type, consisting of the infrastructures used for centuries to move herds, characterised by intrinsic landscape and environmental qualities.
In recent years, a renewed attention is emerging towards transhumance and the routes used for this purpose. In various European contexts a growing number of initiatives linked to the promotion of transhumance and to the enhancement of its routes are being implemented, both thanks to the bottom-up contribution of local associations and to top-down policies and projects.
The research collects the ongoing experiences related to transhumance from the Italian, French and Spanish context, with the purpose of providing a contribution to answering the following questions: can transhumance be converted into a tourist experience with positive effects on the territory? How can the ancient transhumance routes be reconverted into infrastructures for slow tourism, enhancing the identity culture linked to it?

Keywords: transhumance, slow tourism, experiential tourism, inner areas

1. Transhumance, sheep tracks and tourism: three concepts that sometimes overlap

1.1 Transhumance

In recent years, interest in transhumance as a phenomenon with cultural, ecological and territorial development value has been steadily increasing. This is due, on the one hand, to the growing visibility deriving from the UNESCO recognition (Belligiano et al., 2021) given in 2019 to the practice of transhumance (on a candidature promoted firstly by Italy, Austria and Greece, and then extended in 2023 to Albania, Andorra, Croatia, France, Luxembourg, Romania and Spain), and, on the other hand, to the flourishing of various initiatives aimed at

promoting the cultural, social and folkloristic aspects linked to transhumance, promoted both at an institutional level and bottom-up. The most recent recognition of pastoralism, of which transhumance is one of the highest expressions, came with the declaration of 2026 as the International Year of Rangelands and Pastoralists by the United Nations.

According to recent studies (Nori, 2022) about one-fifth of agricultural land in Europe is devoted to extensive livestock breeding, covering several tens of million hectares, most of it concentrated in the Mediterranean area. Pastoralism has always been linked to mobility as a survival strategy for centuries, embracing different forms such as nomadism, transhumance, migration and pasture rotation (Fernandez-Gimenez & Le Febre, 2006). Transhumance is practised in areas that feature complementary pastures or forage resources located at different altitudes (Bunce et al., 2004; Santillo Frizell, 2010). It can be distinguished into two types: vertical, consisting of short displacement from the pastures in the mountains to those on the plains; and horizontal, connecting different climatic areas hundreds of kilometres apart through journeys that take days or weeks. As Braudel (1985) described, the latter is the one that 'moved torrents of animals and shepherds between the Southern Alps and the Crau, between Abruzzo and the *Tavoliere delle Puglie*, between northern Castile and the southern pastures of Extremadura and Don Quixote's La Mancha'.

In recent decades pastoralism mobility has decreased dramatically and livestock farmers are becoming sedentary, adapting their practice to new circumstances, or, in some cases leaving the herding sector (Fernandez-Gimenez & Le Febre, 2006). As a result, in spite of the many recognised values of transhumance, its diffusion as a necessary practice for animal welfare has been declining since decades. The reasons are mainly two: the general spread of intensive livestock farming, and the replacement of transhumance on foot by journeys made first by train and, since the 1950s, by truck (Bieber 2010; Toulze 2022).

Nevertheless, nowadays in some areas transhumance is still practised. Among those the most known is the Provence-Alpes-Côte d'Azur (PACA) region in southern France; in this area, around 600,000 head of cattle spend their summertimes in the mountains (Figure 1), while 90,000 move to the coastal departments during winter each year (Maison de la Transhumance, 2022).

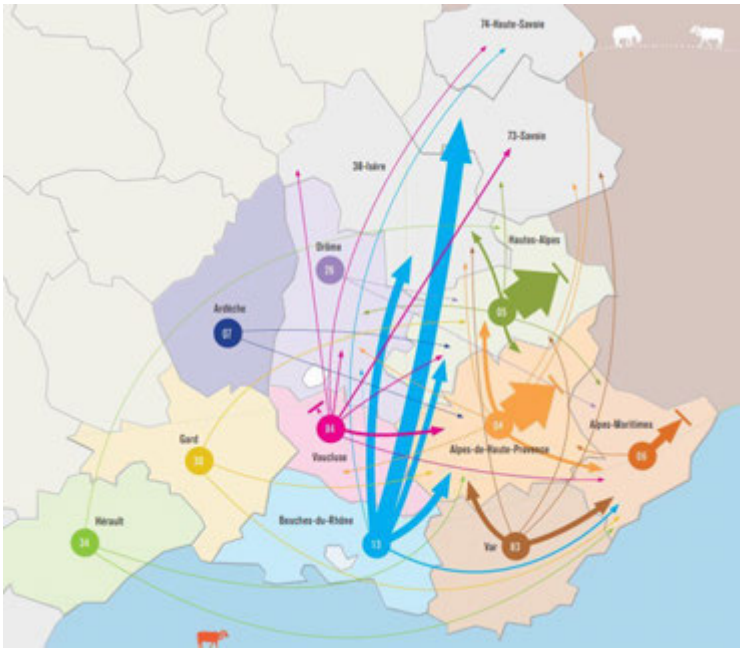

Fig. 1. Summer sheep transhumance in the Provence-Alpes-Côte d'Azur region, France, in 2021. Source: *Transhumance de la Provence aux Alpes*, Maison de la Transhumance

1.2 Transhumance routes

Transhumance usually followed established itineraries along green routes where animals could feed themselves during the travel. These long grassy roads, found in most of the Mediterranean countries, often present similar features. They can be articulated in networks of paths hierarchically structured into principal (111 metres wide *tratturi* in central southern Italy; 75 metres wide *cañadas* in Spain; between 50 and 100 metres wide *drailles* and *carraires* in the south of France), and secondary ones (*tratturelli* and *bracci* in Italy; *cordeles*, *veredas* and *coladas* in Spain). Transhumance routes also acquire local denominations in different regions of the same country, as it happens in Spain where they can be called *azagadores*, *cabañeras*, *camins ramaders, ligallos* or *ardibideek* (Villalvilla Asenjo, 2000).The transhumance routes are dotted with rural architectural elements offering resting zones, shelter and services to animals and shepherds, such as drinking troughs (Figure 2), bridges to count the animals, bakeries, small churches, shearing houses (Figure 3), etc.

Fig. 2. Left: A drinking trough near the Real Cañada Soriana, in the province of Castilla y Leon, Spain. Photo by the author. Right: A drinking trough along the *tratturello* Corato - Fontanadogna, Corato, Italy. Source: Document for the Enhancement of the *Tratturi* of Apulia Region. Photo by Roberta de Iulio.

Fig. 3. An old shearing house (*palacio de esquileo*), near Sepúlveda, close to the Cañada Real Segoviana, in Spain, transformed into a wedding venue. Photo by the author.

These roads are characterised by specific vegetative features, since transhumance has contributed to the creation of valuable sylvopastoral landscapes and natural habitats (Gómez Sal & Lorente, 2004). Moreover, in different countries all over the Mediterranean area, drove roads are marked with stone elements that allow them to be recognised (Figure 4). These are called *cippi* in Italy and *mojones* in Spain.

Fig. 4. Left: *cippo* along the *tratturo* Melfi-Castellaneta, near Poggiorsini, Italy. Photo by the author. Centre: stone element marking a *draille* on Mont Lozère, France. Source: Wikimedia Commons. Right: *mojón* marking the boundary of the *Cañada Real* in Puerta de Alcalà, in the Madrid city centre, Spain. Source: Wikimedia Commons.

Over the centuries, the combination of natural and anthropic elements linked to the practice of transhumance has generated a clearly identifiable landscape that, when well preserved, is widely recognisable. The extent of the transhumance routes varies in different geographical contexts. The country with the most extensive transhumance routes network is Spain, where they count up to 125,000 linear kilometres with a total extension of 420,000 hectares (Burgos, 2007), equal to about 1% of the national territory. In Italy, the officially recognised sheep-track network stretches along 5 regions in the centre-south of the country measuring a total of more than 3,000 km. Along the Alpine arc, despite transhumance has been practised for thousands of years and is still consistent, the routes used for this purpose have not been systematically identified and mapped, nor subjected to specific protection regimes until recent time. In France, the ancient transhumance routes, which originally overlaid the ridges of hilly regions, since the 19th century have been gradually replaced by other routes through the valleys (Fabre, 1997).
Land ownership is another key feature of transhumance routes. While in central-southern Italy and Spain the sheep track areas are still state-owned and their management is a regional responsibility (a legacy of the complex management system of the *Dogana della Mena delle Pecore* on the one hand, and the *Consejo de la Mesta* on the other), in other geographical areas the land is often privately owned. In France, the picture of the ownership of the transhumance routes is quite varied: some are private areas, others are owned by municipalities, state or pastoral syndicates. For instance, in Languedoc most of the *drailles* belong to private landowners but shepherds were guaranteed to use them free of charge; on the other hand, the *drailles* between the Crau and the Alps were public lands, but for their use shepherds had to pay taxes to the municipalities, which took charge of their maintenance (Biber, 2010). Currently, collective pastoral organisations have a key role in pasture maintenance, managing a total of about 600,000 hectares in the French massifs (Toulze, 2022).
Another key aspect that distinguishes transhumance networks is their state of preservation. Over the decades the transhumance routes have also seen an unavoidable decline that has led to their abandonment, or, in worst cases, to privatisation, urbanisation and heavy infrastructure. In some cases the public property of transhumance routes has been a major incentive for public administrations to build infrastructure of all kinds on them (roads, railways, electrical conduits,

sewage collectors, telephone poles, etc), without having to resort to expropriations (Villalvilla Asenjo, 2000). Reconstructing the current extent of the transhumance networks and classifying their state of conservation is a fundamental task that local governments are facing in order to enable their protection and enhancement.

1.3 Slow, experiential and rural tourism

In recent years several bottom-up initiatives and public policies are exploring the touristic development of transhumance and its heritage. Transhumance has been practised mainly in inner and rural areas, nowadays often corresponding to marginal regions affected by shrinkage, depopulation, ageing and unemployment. Tourism is recognized as a strategic sector for the economic development of inner areas (Espon, 2017) although it can not be seen as the only solution to problems affecting them (Pelc & Koderman, 2018). Moreover, as several studies on the risks of overtourism show (Dodds & Butler, 2019), tourism also has negative impacts, especially on fragile territories.

The type of tourism usually linked to transhumance belongs to three categories: slow, experiential and rural tourism. These three types of tourism present specific features although they slightly overlap.

As analysed by Pileri and Moscarelli (2021) in their literature review on slow tourism, three different meanings are associated to it: 1) a way of travelling in opposition to mass tourism; 2) a low-carbon impact tourism, i.e. using alternatives to air and car travel; 3) an experience seeking authenticity of the territory. This third interpretation of slow tourism overlaps with that of experiential tourism, defined as a type of tourism that calls for active participation, involvement, and even immersion (Edgell & Swanson, 2019). Experiential tourism has been defined as a type of tourism that 'encourages visitors to actively participate in the experience and promotes activities that draw people outdoors, and into cultures and communities' (Smith, 2006 :3). Experiential tourists seek memorable experiences made possible by the people they meet, places they visit, activities participated and memories created.

Lastly, the third type of tourism considered is rural tourism, defined by the UNWTO as 'a type of tourism activity in which the visitor's experience is related to a wide range of products generally linked to nature-based activities, agriculture, rural lifestyle / culture, angling and sightseeing'.

The initiatives that are being implemented aim on the one hand to promote transhumance as an activity that fully embodies the definition of experiential tourism, and, on the other hand, to adapt transhumance routes as ideal infrastructures for slow and rural tourism (Meini et al., 2018; Belliggiano et al., 2021). Recent studies have highlighted the growing tourist appeal that the pastoral world, and transhumance-related activities in particular, exerts (Ruiz Morales et al., 2024), at the point that a new niche tourism - defined 'pastoral tourism' (Sauer et al., 2022) has been identified. Experimental projects aiming at promoting new initiatives that combine transhumance and experiential tourism have been developed also in collaboration with universities and research centres (Pilla et al., 2022).

The aim of this paper is to provide a contribution to answering the following questions: can transhumance be converted into a tourist experience with positive effects on the territory? How can the ancient transhumance routes be reconverted into infrastructures for slow tourism, enhancing the identity culture linked to it?

2. Transhumance promotion events in Italy, France and Spain

In order to approach the first research question, a survey on the transhumance-related initiatives was conducted. The study area has been limited to Italy, France and Spain, since, as Braudel (1985) states, these three countries are transhumance regions par excellence. Moreover, among Mediterranean countries, they present similar socio-cultural and economic features, as well as a similar development level of the tourism sector[1].
A total of 237 transhumance-related initiatives that take place periodically in Italy, France and Spain were listed. These include transhumance festivals, livestock fairs, and any type of public event that directly involve transhumant sheep, goats or cattle. The identified initiatives are mainly of a socio-cultural kind and do not pretend to be a reliable indicator of the real rate of persistence of the practice of transhumance. In addition to transhumance events, also a few traditional transhumances with a real or potential impact on tourism were analysed.

The survey was carried out through web searches and documentary sources where available in literature. Particularly useful were the websites of associations working to safeguard transhumance (*Trashumancia y Naturaleza* in Spain, *Maison de la Transhumance* in France), and the tourism promotion websites of certain regions (Catalonia in Spain, Trentino in Italy). In addition, online searches were carried out using "transhumance" and the name of each of the regions of the three countries under study as keywords. Itinerant initiatives taking place over several days and touching different cities were counted as a single event, while all locations touched by the initiative were reported in the map (Figure 5).

[1] However, the three countries record different levels of development in the slow tourism sector. In France, the association '*Agir pour un tourisme responsable*' has been operating since 2004, issuing a label that indicates the sustainability of tourist packages proposed by travel agencies. In Spain, the popularity of the Pilgrim's Way to Santiago has given great impetus to the affirmation of slow tourism in recent decades. In Italy, this type of tourism has been consolidating in recent years, thanks also to institutional initiatives, such as the recognition of 2016 as the national year of slow tourism by the Ministry of Culture.

Figure 5. Location of the 237 transhumance-related initiatives taking place in Italy, France and Spain. Icons in grey indicate initiatives that are no longer active. Digital version of the map available at: https://www.google.com/maps/d/u/1/edit?mid=1Ig0t5Vm_sBhYdCR7HkUMhBHbtDt55P0&usp=sharing

Transhumance-related initiatives were classified according to the following categories (Table 1): 1) Transhumance festivals: folkloristic events celebrating the local culture linked to pastoralism, usually organised by associations with the collaboration of local authorities. Often these initiatives are organised to enliven the passage of transhumants through urban centres, with a programme of activities revolving around it. In other cases, the events are organised by municipalities or local associations with the main purpose of promoting local culture, folklore and enogastronomy, with animals having a secondary role. The activities that usually animate transhumance festivals are tastings (cheese, wine, seasonal products), music and dance performances, craft markets, conferences, workshops, exhibitions, historical re-enactments, exhibitions of ancient crafts, etc. 2) Traditional transhumances organised by livestock farms, which, although not involving celebratory or collateral events, exert a certain media and touristic appeal; press articles, documentaries or film productions have been dedicated to them. 3) Participatory transhumances, understood as experiences in which external actors and tourists can participate (for free or upon payment of a fee). This opportunity is provided by intermediaries (travel agencies or associations), or directly by the livestock farms that conduct the transhumance. Their tasks include promoting the initiative, collecting adhesions, and offering all the necessary services to allow participants to follow the transhumance (food, accommodation, transfers, possible excursions, etc.). 4) Livestock fairs including collateral activities appealing to a general public. 5) Animal parades in city centres to assert the value of pastoralism and transhumance. 6) Other activities of a different kind.
Initiatives that could be classified in two or more categories were placed in the most related category. In the analysis of the initiatives the focus was placed on those of greater relevance

from a tourism point of view, and in particular those falling under category 3) Participatory transhumance and experiences open to the public.
24 of the 237 analysed initiatives -or 10%- are not currently active; these are 17 transhumance festivals, five traditional transhumances and two activities of other type.

Event	Italy	France	Spain
1) Transhumance festivals or similar	74 (12 of which no longer active)	54 (2 of which no longer active)	43 (3 of which no longer active)
2) Traditional transhumance with media coverage	12 (3 of which no longer active)	1	7 (2 of which no longer active)
3) Participatory transhumance, experiences open to the public	2	2	4 (1 of which no longer active)
4) Livestock fairs	7	7	16
5) Claiming parades	0	1 (along Champs Elysées in Paris, organised only in 2022)	1
6) Other	1 (Transhumance Walk on Horseback)	1 (Transhu Pic-Nic)	0
Total	**96**	**66**	**71**

Table 1. Transhumance-related initiatives in Italy, France and Spain.

Given the vastness and heterogeneity of the data found, it was decided not to include in this study cultural initiatives linked to transhumance that do not directly involve animals (conferences, round tables, exhibitions, film festivals, etc.).

2.1 Italy

55 of the 97 transhumance-related initiatives identified in Italy take place in the Alpine areas of the north of the country (Fig. 6). These initiatives are linked to the practice of mountain pasture (*alpeggio* or *monticazione)*, i.e. vertical transhumance, and mainly involve cattle herds. An important exception is that of Val Senales which takes place between Italy and Austria and involves more than 4,000 sheep. In the conducted survey, only those involving urban centres, mainly small mountain villages, were listed, while public events of *alpeggio* taking place at mountain pastures were not included. According to a study by Corti (2004), in 2003 *alpeggio* events were already quantified at 212, with an estimated 12,000 participants.

The transhumance along the Alpine arc acquires different names depending on the regions: in Trentino Alto Adige and Veneto is called *desmontegada*, while in Valle d'Aosta is known as *désarpa*. It is celebrated with festivals and public events that amplify the appeal that the passage of the cattle herds, usually decorated with garlands of flowers, already constitutes in itself.

Figure 6. Transhumance-related initiatives taking place in the north of Italy

The initiative with the greatest national resonance is called *Transumando* (Fig. 7) and takes place in Bressanvido (Veneto). It is the longest vertical transhumance in Italy, involving 600 head of cattle over a distance of 80 kilometres. Since the first edition of the Bressanvido transhumance festival in 1998 to date, the transit of the herds has turned into a multifaceted itinerant event including concerts, conferences, shows and workshops. The 2023 edition of *Transumando* took place over 10 days and included, in addition to the traditional transhumance festival, the Festival of Agriculture and the Festival of the cheese producers from the province of Vicenza; according to the organisers the event was attended by over 20,000 participants.

Fig. 7 - *Transumando*, Bressanvido. Source: https://www.transumandobressanvido.it/

Another noteworthy initiative in the Alpine area is the Transhumance of the *Bergamini*, organised by the association *Pastoralismo Alpino*, an initiative that proposes a series of events and activities along the itinerary of cattle transhumance between Bergamo and Brescia, lasting ten days. The first edition took place in 2019 and each year a different route is planned, touching different towns.

In the central Italian regions, only nine transhumance-related initiatives have been identified, three of which are no longer active. Among the noteworthy initiatives is the Transhumance March between Falasche (Anzio) and Jenne, in Lazio. This is a re-enactment of the ancient sheep transhumance, now in its 31st edition in 2023. The march is carried out on horseback along a route that lasts five days and crosses 16 municipalities, connecting two natural parks (Simbruini and Castelli Romani).

In southern Italy and the islands, a total of 34 transhumance-related initiatives were identified (Fig. 8). While in Abruzzo and partly in Molise transhumance concerns essentially sheep, in the other regions, particularly in Campania, Basilicata and Calabria, it is mainly the movement of herds of *podolica* cows that keeps the practice and celebration of transhumance alive.

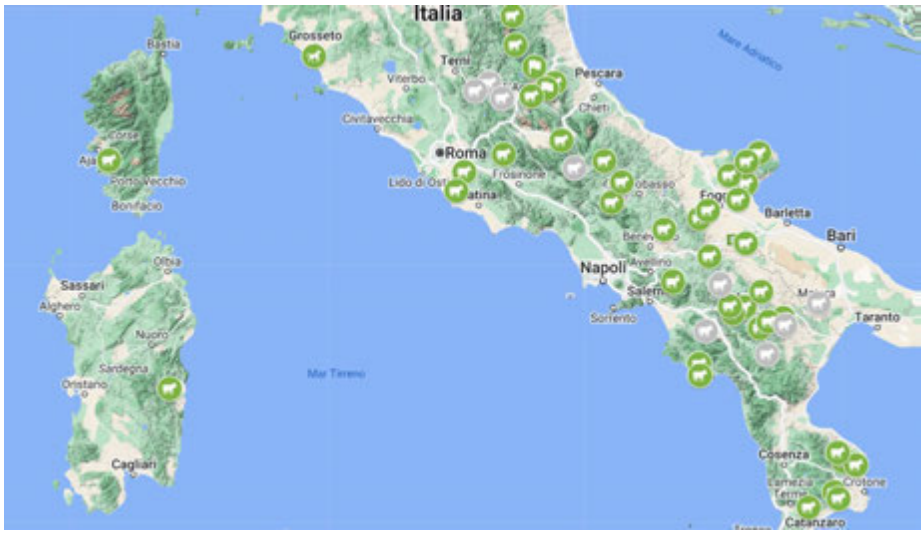

Figure 8. Transhumance-related initiatives taking place in the central-southern Italy

One of the most interesting initiatives in Abruzzo is the transhumance organised by a livestock farm in Anversa degli Abruzzi (*La porta dei parchi)*, which offers tourist packages that include the possibility of following the seasonal transhumance of its flock of sheep, as well as accommodation at its agritourism facility. The experience includes two days of transhumance for a total of 39 km in a high-value landscape and a total stay of four days and three nights. In 2023 the complete package had a cost of 390 euro per person.

The other initiative that allows visitors to participate in a transhumance journey is defined by the organisers as the first example of a long-distance 'participatory transhumance' in Italy and features a herd of *podolica* cows. It takes place between Oppido Lucano and Tito, in the Basilicata region, along a route of about 50 km covered in two days. The initiative is promoted by the livestock farm that conducts the transhumance (*Masseria Santorsa*) and is organised in collaboration with the association *Fuorisentiero*. The participation fee for the 2023 edition was 30 euro for both days and included the shuttle service and an overnight stay at a refuge, or alternatively in a camping tent. The initiative was first carried out in November 2021 and takes place twice a year.

In southern Italy other major initiatives feature livestock farms that persevere in the practice of transhumance, which over the years has become an event that generates curiosity and interest among citizens. Particularly noteworthy is the longest horizontal transhumance in Italy, taking place between Frosolone (Molise) and San Marco in Lamis (Apulia). The transhumance is led by Carmelina Colantuono and involves 300 *podolica* cows walking 180 km in four days, twice a year. The passage of the herd is in itself a major attraction, to the point that it has caught the attention of the international press.

A similar experience is organised by the Moscariello family, who from Montella (Campania) lead their herd of *podolica* cows to Lake Capacciotti (Cerignola, Apulia), 130 km far away. Again, there are no festivals celebrating transhumance, but its practice is in itself an element

of fascination, such that it was the subject of a recent film production (*Sulla via dei padri*, by Bruno Palma).
A slightly different case is represented in the Apulia region by the transhumance of flocks of the *Gentile di Puglia* breed of sheep from the Carrino livestock farm between Borgo San Giusto (Lucera) and the village of Santa Luciella, in the Dauni Mountains, along the *tratturello* Foggia - Camporeale. The itinerary includes the crossing of the historical centre of the city of Troia by 700 sheep (Fig. 9), generating an attraction that since 2018 (the year of the first transhumance festival in Troia) to date has been enriched by other activities, such as representations of scenes of rural life and demonstrations of dairy art.

Fig 9. The transhumance crossing the city of Troia, Foggia. Photo by Luigi Geraci

2.2 France

In France (Fig. 10), transhumance historically mainly affected the southern regions of the country. Of the 66 identified initiatives, almost half (30) take place in the Provence-Alpes-Côte d'Azur (PACA) region. Almost all the initiatives identified in this area concern sheep transhumance (56 out of 66), an activity that still has a relevant economic value due to cheese production (Toulze 2022).

Figure 10. Transhumance-related initiatives taking place in France

France is the country where the *fête de la transhumance* format was first implemented in the 1970s, that from the 1990s onwards was quickly replicated in different locations in the south of the country (Garnier & Labouesse, 2015). The origin of transhumance festivals as we know them today arises from the desire to recreate the festive moment of flocks crossing urban centres that in the past marked two key moments in social life: the summer and winter solstice (Duclos, 2016).

An important boost to the spreading of initiatives supporting transhumant pastoralism, especially in Provence, has been given by *La Maison de la Transhumance*, a centre for the interpretation of Mediterranean pastoral cultures whose objective is to defend the practice of transhumance and to spread its knowledge. In the PACA region, known for important events such as the festival of Saint-Rémy-de-Provence and the fair of Saint-Martin de Crau, 11 new initiatives have been created since 2020, demonstrating the growing interest in the topic and the effectiveness of the communication strategies carried out in recent years.

Despite the numerous initiatives in the PACA region, none of them was identified as belonging to the category of participatory transhumances. The research then focuses on the Rocamadour-Luzech transhumance in Occitania and the *Route de la Transhumance* between the Pyrenees and New Aquitaine.

The first was a transhumance started in 2009 and organised by the Luzech / Labastide-du-Vert landowners' association, the *Transhumance en Quercy* breeders' association, the local government of the *Département de Lot* and volunteers. The main motivation behind this transhumance was to reduce the fire risk, which became a priority following a major fire in the area in 1998. The route is about 70 km crossing natural parks and mediaeval villages. The distance is covered in five stages (each 12 to 16 km) by 400 animals including sheep, donkeys and horses. Six towns are crossed by the herd, and convivial moments are organised at each stop. The transhumance is widely promoted online at the institutional websites of local authorities and through social networks. According to reports on local sites, in 2023 more than 500 people participated in the first day of the transhumance (Fig. 11), and 130 people attended

the dinner at the end of an intermediate stage. Joining the transhumance is free of charge and participants are guaranteed logistics all over the journey. On the institutional website of the organisers, eighteen accommodation facilities of different types are featured, offering 550 beds overall.

Fig. 11. A break moment during transhumance Rocamadour-Luzech near a pond. Participants are outnumbering animals. Source: https://transhumance.lot.fr/le-programme

La *Route de la Transhumanc*e is a 280-kilometre route that engages 600 sheep during three weeks, from Lac d'Estaing, in the High Pyrenees, to Aillas, in the Gironde département. The initiative has been organised by the association *La Route de la Transhumance* since 2001 with the collaboration of the municipalities reached by the route, which actively contribute to the organisation by covering the costs of security and communication. Transhumance is promoted locally with printed material, and globally through a website active since 2014. Participation in the transhumance is free of charge but participants are asked to become members of the association by paying a membership fee of 20 euros, which is used to meet organisational costs. No data was found on the number of participants in the transhumance or any of its stages.

2.3 Spain

In Spain (Fig. 12), transhumance-related initiatives are present all over the country, counting 71 total events, with a higher concentration in Navarra (11 in an area covering 10,391 km²), Catalonia (19 in an area covering 32,108 km²), Castilla y Leon (16 in an area covering 94,225 km²). The identified initiatives mainly concern sheep transhumance (42); fewer are cattle transhumance (22), often linked to taurine breeding in the Pyrenean area and in Navarre; in seven cases transhumance engages both sheep and cattle. The Spanish transhumance-related initiatives are quite heterogeneous: alongside the transhumance festivals following the format found in Italy and France (called *artzai eguna* in the Basque Country), there are other types of

events such as shearing festivals (*fiestas de esquileo*), religious festivals (*romerías* or short pilgrimages), and horseback excursions accompanying transhumant herds (especially in Navarre and Castile and Leon). In addition, in Catalonia most common events are livestock fairs (13 out of the 19 initiatives identified in this region). Over the years these events have been converted into attractions with gastronomic stands and various types of activities, such that they are included among the tourist attractions on local promotional sites.

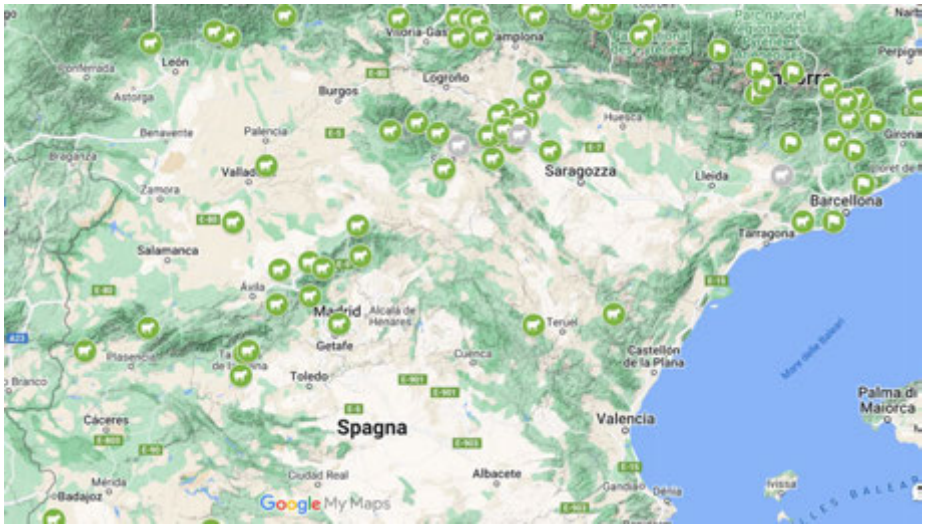

Figure 12. Transhumance-related initiatives taking place in Spain

Spanish public opinion is strongly catalysed by the great transhumance festival that takes place every year in the centre of Madrid in October (Figure 13). This event is organised since 1994, first by the association *Concejo de la Mesta*, then, since 1997, by the association *Trashumancia y Naturaleza*, whose aim is to promote the importance of transhumance, protect the sheep tracks, and claim for the adoption of a national strategy to safeguards extensive pastoralism. Shepherds and animals from all over the country (1,200 Merino sheep and 200 goats) take part in the event, creating an unusual and impressive sight. The parade, which reaches its climax in the re-enactment of the moment of the payment of the traditional fee (*maravedíes*) to the municipality, is preceded by a series of initiatives at the Environmental Education Centre in the Casa de Campo park, where the flocks temporarily stay. Collateral activities include promenades with the flocks particularly conceived for children, cheese-making and poetry workshops, photo exhibitions, among others. At the time of its creation, the transhumance festival in Madrid wasn't meant to be a tourist attraction at all. However, over the years, growing media attention contributed to turn it into a unique tourist attraction, featured on the city's tourist promotion page as one of the most awaited events. No data has been found on the number of participants in the festival in recent years, but according to media reports thousands of people pour into the streets of the Spanish capital every year, including both residents and tourists.

Fig. 13 *Fiesta de la Trashumancia* 2018, Plaza de Cibeles, Madrid, Spain. Photo by the author.

Among the most important events that take place every year in Spain there is the *Sanmiguelada*, the sheep transhumance in the Bardenas Reales natural park in Navarre, which crosses the historical centre of Carcastillo. The transhumance, which has been repeated annually since the Middle Ages, has recently been joined by complementary activities to broaden the attractiveness of the event to a wider public, such as gastronomic tastings, a market of traditional products and demonstrations of ancient crafts. Every year thousands of people witness the passage of the flocks in El Paso, from where 15,000 sheep transit to their winter pastures. However, the number of transhumant sheep has been declining significantly in recent years, partly due to climate change that is altering the seasonal and rainfall cycles.

Among those identified in Spain, the most interesting initiative concerns a sheep transhumance from Castilla La Mancha to the city of Soria (39,000 inhabitants), in the *Mancomunidad de Tierras Altas*, along the *Cañada Real Soriana Occidental*. This initiative, called *¡Somos Trashumantes!*, allowed tourists to follow a transhumant flock of more than 1,000 sheep during three days of walking, for a total distance of 30 km, in early July. The flock passes through the small town of Oncala, a village that once played a key role in the *Mesta* territorial system, hosting a Museum of Transhumance. Nowaday the village is almost uninhabited (70 inhabitants). In addition to sheep transit, activities such as counting, shearing demonstrations and the preparation of typical dishes (*migas del pastor*) were organised. The logistics of the initiative was entrusted to a local travel agency specialised in ecotourism. Places available to participate in the full experience were limited to 16; the participation fee was 179 euros, including two nights in a bivouac (alternatively, two nights in a hotel raise the fee up to 335 euros). The format adopted by *¡Somos Trashumantes!* embodies a model that supports the

practice of transhumance while providing an innovative tourism experience. However, since the tourism offer proposed is totally anchored to the practice of transhumance, unforeseen events that compromise its feasibility may occur. In 2023 the event did not take place because the flock of shepherd Eduardo del Rincón was stranded in Ciudad Real due to health restrictions imposed by the spread of the sheep pox virus, while for 2024 edition, no data was found.

2.4 Considerations on events promoting transhumance in Italy, France and Spain

The analysis of the initiatives identified in the three countries reveals different ways of understanding transhumance and different ways of developing the tourism potential linked to it. The types of event identified, in fact, range from events that turn into tourist events even though they originate from needs linked to the practice of transhumance (Troia, Rocamadour, the *Sanmiguelada*), to events that originate almost exclusively for the purposes of attracting tourists, evoking transhumance through folkloristic expressions, but in fact not including it in any way.

In general, the most widespread format is that of transhumance festivals, lasting just one day, or at most two to three days, almost always coinciding with weekends. The programming of the events almost always includes activities of a different kind that extend beyond the moment of the passage of the animals, where foreseen. Although transhumances are phenomena that by definition are on the move and involve different territories, the initiatives identified are almost always organised by a single municipality.

Despite a certain level of uncertainty due to the difficulties experienced at tracking the date of creation of all the initiatives, it is found that a considerable number of events among those analysed (48 out of 237, i.e. 20% of the total) were organised after 2019, i.e. after UNESCO recognition. This denotes a renewed interest in the topic, for which a new perspective in terms of tourism has been developed in recent years. In some regions of northern Italy, a boost to the organisation of events promoting transhumance and pastoral culture is due to regional political will, implemented by Lombardy Regional Law no. 14 of 2022, followed by Piedmont Regional Law no. 12 of 2024, which provide, among other things, for the institution of a regional transhumance day and allocate an *ad hoc* budget for this purpose.

While new transhumance festivals are flourishing, however, there is also a decrease in the number of traditional transhumances still active. Of the 19 listed in the survey, six have ceased to be practised in recent years. Although the road to the tourist enhancement of transhumance has now been opened up with diverse experiences, the involvement of shepherds and stakeholders from the livestock sector should remain a precondition, especially since there are very few people left working in this sector. As the case of transhumance in Soria shows, in order to develop the tourism potential of transhumance, it is necessary to support those who practise it in their struggle to maintain their activity alive. In this scenario, the key role of actors such as the *Maison de la Transhumance* and *Trashumancia y Naturaleza*, which not only promote the dissemination of the culture of transhumance, but also offer practical, logistic and legal support to livestock farmers, must be recognised and encouraged.

Due to its uniqueness and rareness, transhumance offers concrete opportunities to develop out-of-ordinary tourist experiences. Following a thousand animals for several days, walking at their

pace, experiencing life as a shepherd is undoubtedly a travel concept that meets the increasing demand for total escape from everyday life. While ensuring unique experiences for external participants, participatory transhumances also provide a complementary economic income for livestock farms.
The economic impact of the tourist attractiveness of transhumance is difficult to estimate due to the scarcity of data and monitoring of events. As a sample, the case of the Rocamadour-Luzech transhumance was in-depth analysed. Data on the accommodations available in Rocamadour via the booking.com website on the transhumance week and the following one were collected. The analysis showed that there is no consistent variation in occupancy rates in the hotels of the city between the two periods. As a result, it can be deduced that, in this kind of context, transhumance attracts either proximity tourists, who do not need to spend nights away from home, and/or tourists who prefer accommodation types not included on booking.com, such as collective dormitories. The feeling is that, with a few exceptions (Saint-Rémy en Provence, Madrid), at the moment the transhumance-related events are mainly attractors for proximity tourism, since they are seen as opportunities to live the unique experience of the incursion of the pastoral world into cities.

3. Slow tourism along the transhumance routes

Another development perspective linked to transhumance concerns the possibility of transforming the transhumance routes into walking or cycling itineraries. Their reuse for tourism purposes is a target that most local governments have set themselves. As an example, in Spain, the introduction of new uses along the sheep-track network, compatible with and complementary to transhumance, such as transit on foot or by other non-motorised means, is reported in the national legislation (*Ley de Vías Pecuarias*, 1992).
In order to approach the subject, three emblematic cases have been analysed as follows.

3.1 La Routo, France-Italy

The Routo is a cross-border hiking route consisting of 33 stages between Borgo San Dalmazzo, in the Stura Valley, Italy, and Arles, in the Crau Plain, in Provence, France, for a total of 540 km (Figure 10). The French part of the route (400 km) is part of the circuit of the national *Grandes Randonnées* trail network. The itinerary runs along routes that are still used for the summer transhumance, so that the tourist use of the route coexists with the original use for sheep farming.

Figure 10. The itinerary of the *Routo*. Source: https://larouto.eu/it/

The itinerary crosses several protected areas, pastoral landscapes, and historic towns until reaching the city centre of Arles. The French section of the route was completed in September 2022, the Italian one in October 2023. For the promotion of the itinerary a web page was launched, as well as a complete guidebook available for online and physical purchase.

La Routo is the result of almost twenty years of synergies between the *Maison de la Transhumance* and the *Ecomuseo della Pastorizia* di Pontebernardo (Fabre 2016).

The case of *La Routo* represents a model of comprehensive enhancement that involves not only the route itself, but also the intangible aspects linked to it. This makes it a cultural project with social and economic impact, rather than a simple trekking route. In fact, in addition to the physical itinerary, the project reconstructs a chain of productive and economic activities related to pastoralism. Under the umbrella of *La Routo* a line of hiking clothing made with local wool was developed, dairy products from local farms are sold along the itinerary, livestock fairs and transhumance events are networked, cultural events (exhibitions, art installations, lectures, festivals and documentary screenings) are organised, restaurants proposing traditional pastoral dishes at km0 are reunited under the *Routo* label.

Although it is difficult to assess the impact on the territory of *La Routo* since no data was found on the subject, the total length of the itinerary and its cross-border nature suggest that travellers would spend more than one day along the route. Therefore, they need to stay overnight, get refreshments and make purchases during their journey, thus generating an impact on the local economy.

3.2 The *Vías Pecuarias* network of the Community of Madrid, Spain

The case of the Community of Madrid concerns the network of transhumance routes that fall within the regional territory. The Community of Madrid has a total of 4,104 km of transhumance routes (*vías pecuarias*), amounting to a total of more than 13,000 hectares, corresponding to the 1.64% of total regional area (De los Ríos Carmenado & Hernandez Aguado). Approximately one third of these were included in the *Descubre tus cañadas* project, an initiative started in 1998 which aims to create 74 new hiking itineraries accessible on foot, by bicycle or on horseback along the *cañadas* and secondary transhumance routes of the region. The itineraries, grouped in 17 geographical areas, are between 5 and 35 km long, each walkable in a single day, counting a total extension of 1,150 km. The routes vary in contexts crossed, lengths and altitude, meeting the preferences of different types of users, from experts to kids. A free downloadable guidebook has been published for each geographical area, as well as gpx tracks are available for free use. Along the routes, project signage, consisting in the traditional element of the *mojón* with the graphic symbol developed for the project, has been installed.
In 2005, a complementary project to *Descubre tus cañadas* was launched by the Community of Madrid: the *TRASHUMAD* project (González, J. A. M., 2011). Its main objective was to promote the regional transhumance routes among citizens to encourage their use as hiking and cycling itineraries.
Unlike *La Routo*, the *Descubre tus cañadas* project does not seem to have undertaken an ambitious multi-level and multi-sectoral strategy for the enhancement of the tangible and intangible transhumance heritage, since its focus is mainly on the accessibility and promotion of the routes as hiking trails. However, in a context such as Madrid, a metropolitan area inhabited by approximately 5,000,000 people, the importance of this purpose should not be underestimated. Equipping transhumance routes as public infrastructures for slow mobility embodies a concrete opportunity for a vast multitude of citizens to reconnect with the natural environment and with local history. This is all the more valuable in a context in which the demand for natural spaces at a short distance from the city is such that it has led to the overcrowding of the natural areas near the city. As an example, since 2021 the regional park of *La Pedriza*, north of Madrid, is no longer accessible to the public on holidays to reduce anthropic pressure on it.
So far, no data were found concerning the economic impact of the reconditioning of the Madrilenian sheep-track network as hiking and cycling routes. However, since these are usually one-day itineraries, accessible within 1-1,5 hours from the city centre, there are reasons to believe that typical users are proximity tourists. Thus, the economic impact is deemed to be limited, especially in those cases where routes do not cross towns or villages.

3.3 Tourism development along the sheep-tracks of Molise, Italy

In Italy, an important project is currently underway for the tourist development of the sheep-tracks in the Molise region, and in particular for the enhancement of six *tratturi*, two *bracci* and two *tratturelli* for a total of 325 km, distributed in 36 sections. The project also involves 59 municipalities, most of which are suffering from a marked depopulation process. The project, known by the acronym CIS (*Contratto Interistituzionale di Sviluppo*), is financed with

state funds with a total budget of more than 129,000,000 euro. Besides making the paths accessible and equipped, and connecting them with 77 historic villages, the project aims at creating ecological corridors for biodiversity along the routes by planting 40,500 new trees and maintaining 850 hectares of existing forest. The masterplan is currently being developed by an interdisciplinary group, being the planning part in charge of Stefano Boeri Architects.
The case of Molise cannot be fully analysed, as it is still at the planning stage. What stands out, however, is the ambitious scope of the project, its top-down genesis and the (so far) lack of involvement of local stakeholders, excepting municipalities.

3.4 Considerations on slow tourism routes along transhumance routes

The three examples illustrate very different approaches in tackling the enhancement of sheep-track networks as a tourist destination. The experience of *La Routo* shows how the continuous action over time of local actors, combined with strategic vision and synergies, can materialise complex projects, in which tourist use is one of the components of the economic and socio-cultural activation of the territory. In this case, the result was reached through a long process of stakeholder involvement at different levels and scales, from single pastures to cross-border vision.
The cases of the Community of Madrid and Molise share some features, since they both are top-down projects, and they both concern the enhancement of several transhumance routes in their regional territory, rather than a single itinerary. However, the two projects differ in several aspects. First of all, the potential users they aspire to catch: while in the case of Madrid users easily come from its extended metropolitan area, in the case of Molise potential proximity users are limited to the 300,000 inhabitants of the towns touched by the project; this implies that the aspired users are supposed to be mainly tourists coming from abroad. Another key aspect is time: while in the Madrid region the first actions for the enhancement of the sheep-track heritage were started as early as 1998, and the gestation process of *La Routo* lasted 20 years, for the CIS Molise project the timeframe for the design and implementation of the planned actions is extremely compressed, from 2023 to 2026. The economic resources are another aspect that makes the difference with the other cases: although the fundings used for the Spanish initiative are not known, and those of *La Routo* are only partially identified (Interreg V-A France-Italy ALCOTRA 2014 - 2020, among others), it is highly probable that they did not benefit from such a high budget as that of CIS Molise. Lastly, another key aspect is the involvement of stakeholders and the engagement of the local population, which in the case of Molise seems to be one of the most challenging aspects.

4. Conclusions

The growing attention to transhumance, proved by the proliferation of celebratory events and the spread of tourism development projects centred on the recovery of its routes, is an incentive to strengthen the tourism potential of the inner areas. However, the search for visibility and the ambitions of tourism development linked to a subject that has become topical, sometimes seem

to be pushing more towards promotional and celebratory activities than towards the preservation of the practice of transhumance and its heritage.

The experiences analysed show that territories are rapidly acquiring awareness of the potential of transhumance as an economic driver linked to tourism. Transhumance and its routes, however, constitute a heritage that may prove to be strategic in the development of inner areas, not only in terms of tourism, but also ecologically, economically and culturally activating. A territory in which transhumance is a living and tangible practice, with visible repercussions all year round, is able to propose a cultural, landscape and gastronomic offer that goes beyond the single event or the trekking path. These features make it more attractive in the eyes of users seeking quality tourism, and produces positive repercussions on local dynamics. Moreover, the historical and cultural uniqueness of transhumance routes, together with the multiple expressions of its economic value, are key aspects that distinguish a transhumance route from many other existing slow tourism routes.

As stated by Curci & Gaeta (2019), the challenge for the future of transhumance lies in restoring a territorial scene that allows pastoralism to positively accompany the presence of tourism without being reduced to mere folklore. In this direction, the growing multifunctionality of transhumance farms may constitute a drive towards responsible tourism and the green economy (Bindi et al., 2022).

Lastly, the interest and enthusiasm of a growing number of people towards transhumance is such that there is reason to believe that it could be converted into a trending niche, a 'transhumance tourism' that would lead travellers to discover events and routes on the theme around different contexts. This pushes the tourism development of transhumance to a next level: networking different regions and geographical areas that are united by this practice.

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International, transdisciplinary and place-based academic activities: education, research and third mission. The experience carried out in Sant'Eusanio Forconese (L'Aquila, Italy)

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Abstract
This contribution refers to a cooperation between ENSA Paris-Belleville and University of Naples Federico II concerning the Build Back Better of the Italian hamlet of Sant'Eusanio Forconese that was struck by the 2009 earthquake.
Considering the complexity determined by the current multiple crises, the reconstruction process has to be rethought. Within these transformation processes and their corresponding temporalities, place-based academic activities – e.g., through living labs – merging together education, research and third mission can represent a tool for activating, boosting and guiding public engagement, strengthening networks and renovating policies. Since the "*Intervenir dans un territoire à risque: vulnérabilités, enjeux, opportunités*" workshop experience, universities will be proposed as game changers.

Keywords: Build Back Better, living-lab, territorial sustainability, third mission, time-based design.

Introduction

This contribution refers to a cooperation between ENSA Paris-Belleville (France) and University of Naples Federico II (Italy) started in 2023 and concerning the case study of Sant'Eusanio Forconese (L'Aquila, Italy). The activity focused on the Build Back Better of this Italian hamlet that was destroyed during the 2009 earthquake, a seismic event that struck 56 villages.
Both academic partners carry out research related to risks investigating the topic through a design-based approach to understand risks' repercussions in terms of landscape transformation – both in its material and immaterial dimensions – and operational innovation. Such an approach aims at a broader territorial sustainability that takes into account the multiple factors of crisis and especially the time parameter.
The paper in the first part outlines the crisis condition of the territorial system analysed in the research, describing the peculiar overlapping of crises that characterises the inner and marginal Italian territories also referring to a significant historical progression. Furthermore, with reference to two main post-disaster phases, the contribution will provide a synthetic institutional analysis aimed at describing the responsibilities and relationships of the various players involved. Finally, it highlights how the complex coexistence in space and time of multiple crises determines the need to rethink in both theoretical and operational terms the project within the post-disaster design. In this multi-crisis context, the needs to step back from the dominant techno-centric approach and to create opportunities for innovation arise with strength. In the second part, in the light of the framework previously outlined, the teaching and in-field research

experience – considered as an arena of innovation – carried out in Sant'Eusanio Forconese is presented in terms of methodology and outcomes. In the end, what has been mentioned above will be the material discussed in the theoretical and methodological proposal that is advanced in the third and final part of the contribution.

Which context? The definition of a peculiar geography of risk

The Italian territory and its history are atavistically marked by hazards, but more importantly, the relationship between progress, project and risk finds specific conditions of existence.

Moreover, the areas exposed to greater seismic risk in Italy are the Apennines, which constitute a complex territorial system in which infrastructure and urban settlements, with varying degrees of density and intensity, define ever-changing conditions of co-existence with a topography that varies its characteristics along the entire peninsula. In this sense, the classification of Italian municipalities proposed by the DAStU of the Politecnico di Milano is interesting, by means of 13 classes it interprets characteristics such as: the degree of rurality of the territories, with a gradient ranging from the most inner territories to the most urban ones; geo-morphological condition, identifying mountainous and coastal areas; and population density, from the most sparsely populated municipalities to the most densely populated metropolitan areas (Curci, Kërçuku, Lanzani and Zanfi, 2023). The classification proposed by the Politecnico di Milano enables a finer and broader reading of Italy's territorial polycentrism, which is by now constrained too much by the normative definition identified in the National Strategy for Inner Areas (Barca, Casavola and Lucatelli, 2014).

Indeed, it is becoming increasingly important to recognise that this territory corresponds to a multitude of landscapes, although the most common imagery is that of small hamlets (Barbera, Cerosimo and De Rossi, 2022) perched on hilltops or lying on slopes. Yet these more historic urban settlements are flanked by territories defined by: small and medium-sized enterprises, the largest industrial or productive landscapes, the urban sprawl of recent decades, the landscapes of illegal building and large non-places that have become cornerstones of the ever-expanding peri-urban. In these territories, social relations and communitarian interactions, the production of culture and quality of life, economic conditions and productive activities, the perception of distances and modes of travel, and the ways in which the territory is transformed and built are profoundly dissimilar to what we are used to experiencing in Italian cities. Although the idea of an inevitable concentration in metropolises that is beneficial to everyone still seems too common (Barca, 2018), the characters of exceptionality and difference referred to above are also a necessary premise in order to recognise in these territories resources and opportunities that have found in the Covid-19 pandemic an exceptional opportunity for new narratives (Fenu, 2020).

Within this complex system made up of large territorial disparities (Coppola, Del Fabbro, Lanzani, Pessina and Zanfi, 2021), particularly interesting for the research and educational activities to which this contribution refers is the trans-regional territorial system that has been hit several times by disastrous earthquakes in the last twenty years. Considering the earthquakes of the Umbro-Marchigiano Apennines in 1997, of L'Aquila in 2009, of Emilia Romagna in 2012 and of Central Italy in 2016, we have inherited – almost seamlessly from the Emilia Romagna region, in the north, to the Lazio region, in the south – a territory that still displays considerable traces of these events as much in the reconstruction sites as in the temporary heritages that still remain.

Furthermore, the fact that a large part of these territories lies in those project areas identified by the National Strategy for Inner Areas – defined by the lack of basic facilities such as education, health and infrastructures – renders the overlapping of a geography of risk with an Italian geography of physically inner and socio-economically marginal territories. In this sense, the disastrous seismic events that have followed one after the other have considerably aggravated

the crisis condition of the Italian internal landscapes (Guidoboni and Valenise, 2012). These phenomena have acted as accelerators of the depopulation processes that characterise these territories and have damaged – sometimes completely compromising – those material and immaterial heritages of which inner Italy is a rich witness. In this sense, the risk related to seismic phenomena in inner areas is increased by the general ageing and obsolescence of the built heritage – of which depopulation is a concomitant cause – which has as a direct consequence a condition of serious widespread vulnerability (Dolce *et al*., 2020).
Therefore, in this paper the territories described so far are observed through the lens of seismic risk, which is mainly investigated with reference to the two main phases of the territorial transformation: the early recovery phase, to which generally correspond temporary housing and equipment settlements, in its actual and potential relations with the long reconstruction processes of the heritage damaged or destroyed by the earthquake.

Central Italy: a land of disasters and multiscalar reconstructions
The multiplication of crises is exacerbated and therefore even more tangible in those territories where there has been a recurrence of the event in a short period of time. Moreover, this condition enhances the plurality of narratives that could contribute to defining the histories of these places and events. In cases of temporal recurrence and spatial proximity, there is an amplification of the possibility of getting the same story by adopting the point of view of multiple actors (inhabitants, municipal administrations, representatives of national institutions, etc.). This is useful in order to compare, on the one hand, the processes and projects carried out, and on the other, the relationship of stakeholders with the inequalities and disparities that the emergency condition determines or exacerbates by suddenly questioning previous balances. So, we will mainly consider the earthquakes of 1997, 2009 and 2016 and then outline an institutional analysis in relation to the last two.
Following the earthquake that struck the Umbro-Marchigiano Apennines in 1997, the Civil Protection promptly mobilized in the first emergency phase, being able to rely also on a considerable number of volunteers who reached the affected areas. Yet the vulnerability of the historic buildings, on the one hand, and the settlement pulverization, on the other, were elements that put a strain on the early recovery phase for the provision of mobile housing modules such as prefabricated shelters and containers to that part of the population that did not have habitable housing anymore. This condition was made even more complex by the desire not to uproot communities from their places of belonging, which on the other hand represented an important psychological advantage for those affected by the loss of their homes that are places of individual memory and family life, but also a basic economic value (Guidoboni and Valenise, 2012). It is also considered significant that during the 1997 earthquake, for the first time, technical guidelines were provided for the realization of the urbanization works of housing settlements understood as urban systems capable of ensuring the reconstitution of the primary functions necessary for communities: for the first time, in order to reduce the vulnerability of urban systems, it was decided to intervene in an integrated way on entire parts of cities (Imbroglini, 2018). Ultimately, on the 1997 earthquake, Guidoboni states: "the form of housing assistance provided was internationally unsurpassed in terms of implementation time, scale and quality" (Guidoboni and Valenise, 2012, p. 374).
On the occasion of the earthquake of 6 April 2009, the largest number of damaged buildings and victims was in the historic centre of L'Aquila, the capital of the Abruzzo region. The Civil Protection Department on this occasion demonstrated great speed in the first aid operations and in the temporary accommodation of the evacuees. On 28 April 2009, the government issued Decree-Law No. 39, which was followed by the allocation of 14 billion 767 million euro for reconstruction – estimated in 10 years – of which about 1/3 for the reconstruction of private buildings and 2/3 for public buildings (Guidoboni and Valenise, 2012). Besides the

management of temporary housing solutions in the tent camps set up, in hotel facilities or in accommodation outside the province, the government financed the C.A.S.E. project (Complessi Antisismici Sostenibili ed Ecocompatibili) with 792 million euro, through which 185 buildings were to be built. These high-quality residential buildings constructed in record time housed more than 12,000 people at the end of January 2010. The post-earthquake emergency was tackled in an unprecedented way by proposing a huge program of new constructions to be completed within the emergency timeframe, these buildings were neither temporary nor permanent but a strange combination of the two (Bassoli, 2010). At the same time, approximately 2,300 inhabitants were relocated in 3,535 wooden houses (Dolce, 2010) built on 141 sites by the M.A.P. (Moduli Abitativi Provvisori) programme, conceived for the purpose of providing temporary housing mainly in small towns outside the municipality of L'Aquila, i.e. villages located in the inner and marginal territories mentioned above. Despite the considerable means and resources employed to address the problem of housing security, due to the mass relocation of the inhabitants, community and work relationships were compromised because the problems of housing continuity and the recomposition of urban life, which is the objective of any reconstruction, were not specifically addressed (Guidoboni and Valenise, 2012). Moreover, the fate of the inhabitants and of that huge programme of new construction completed in record emergency time remains uncertain. These settlements have become a public housing stock that contributes to a public debt that increases year by year. Because of this, and confirming the centrality of the polycritical scenario in which we are immersed, it is interesting to highlight how, through funding allocated under the NRRP (National Recovery and Resilience Plan) following Covid-19 pandemic, possible redevelopment strategies are being outlined for this heritage.

The seismic swarm that occurred between August 2016 and January 2017 affected a wide area, leaving traces in a territory divided between the regions of Abruzzo, Lazio, Marche and Umbria. On this occasion, since the beginning of the emergency phase, the DPC has operated in order to make the evacuees stay as little time as possible inside the tent camps, although due to the perduring seismic phenomenon and the increasingly critical weather conditions, the scenario has progressively become more complicated. To this end, alternative temporary housing solutions were immediately identified: a contribution for people finding a new accommodation on their own (C.A.S. – Contributo per Autonoma Sistemazione), hospitality in hotel and public facilities and the use of empty or underused houses and public assets (Della Valle and Romania, 2019). The housing solutions implemented in the emergency relief phase were followed by the provision of S.A.E. (Soluzioni Abitative d'Emergenza) in favour of citizens previously living in destroyed or seriously damaged and therefore uninhabitable houses.

Starting from these intricate histories of reconstructions and temporariness, it is possible on the one hand to detect advances and trends in terms of planning and processes and on the other hand to identify some municipalities affected during more than one event, determining the coexistence or reuse of temporary solutions from different periods and the overlapping of reconstructive processes.

Central Italy: a plurality of projects, a complex normative framework and networks of experts

In the framework of an analysis of the institutions involved, it is first of all fundamental to clarify that the main post-earthquake design interventions – the provision of temporary housing in the early recovery phase and the reconstruction – in Italy involve different processes, times and actors. In Italy, the provision of temporary post-earthquake housing solutions is a task of the State and is part of the duties of the Civil Protection Department (DPC) – a structure of the Presidency of the Council of Ministers – responsible for managing not only the emergency relief phase but also the early recovery phase. Instead, reconstruction is managed by special

offices in charge through the promulgation of emergency law decrees that follow the occurrence of damage.

The Civil Protection Department acts in accordance with the Civil Protection Code introduced by Legislative Decree No. 1 of January 2, 2018. Six offices with specific tasks and competences report to the Head and Deputy Head of Department. Office III 'Planning and emergency infrastructure interventions' is the one that mainly deals with projects and processes related to temporary facility provision. In addition, various Centres of Expertise deal with specific topics providing services, data, elaborations and technical-scientific contributions in specific fields.

Concerning the M.A.P. project, the supply of the residential units was assigned by the DPC to five companies that won the public tender launched after the earthquake, while the urbanisation works were managed by the municipalities of the earthquake area. Also because of this double assignment of responsibilities, on the one hand, there was a widespread condition of degradation of residential buildings due to inadequate technical and design choices, and on the other hand, at the urban and landscape scale, the interventions turned out to be in most cases unsuitable to determine any form of urbanity, sometimes even compromising the urban systems concerned due to their not effective temporariness.

The S.A.E. residential units, on the other hand, were the object of a call for tenders issued by Consip – on 9 April 2014, therefore in peacetime differently from the M.A.P. programme – which in the framework of a 6-year Framework Agreement established a set of organisational procedures, standards and technical characteristics for the supply of post-disaster temporary housing. The DPC was in charge of selecting the economic operators to be commissioned for the supply of up to 18000 temporary shelters throughout the country and for an estimated value of EUR 1.2 billion. In addition to the supply, transport and assembly of the S.A.E. modules requested by the local authorities, the selected economic operators were required to define the settlement layouts and executive projects of the urbanisation works of the areas – proposed by local authorities – and the foundations on which to install the housing units (Oggioni, Chelleri and Forino, 2019).

From these two recent Italian experiences in emergency management, it can be positively deduced that the approach and strategies identified in 2016 have successfully addressed some of the failures that occurred in the system proposed in response to the 2009 emergency. In fact, on the one hand, a considerable improvement in the technical and architectural quality of the houses provided under the S.A.E. programme can be observed – apart from specific design faults in some of the realised projects – and a major procedural change in the allocation of urbanisation works and residential modules to a single actor can be detected. Although, on the other hand, the neglect concerning the provision of public spaces and the urban quality of the settlements, the failure to relate them to the pre-existing urban structures, and the lack of foreshadowing of possible future scenarios in which these assets do not become waste but resources has remained almost unchanged.

Currently, the DPC, by means of Consip, has a Framework Agreement for emergency housing solutions that in case of disaster will be implemented by the company that won the tender.

One of the main distinctions that can be drawn between the emergency relief phase managed by the DPC and the reconstruction phase – which is instead the responsibility of regional and municipal authorities – is the relationship with the communities. In the emergency relief phase following the disaster, the community is a passive actor receiving support and assistance provided by the DPC, while during the reconstruction phase the local authorities work – in the most virtuous cases, even in peacetime – to structure a vision, i.e. a strategic policy oriented towards the definition of a shared scenario that is more or less predictable. This foresight work – which often matches prevention work – outlines political strategies that increasingly involve participatory practices in which communities are challenged to be active participants in decision-making processes. In this context, there is an intermediate phase – the phase of early

recovery – in which the approach is unclear; the approach described in reference to the emergency relief phase frequently recurs, i.e. the population is subjected to the decision-maker's choices without contributing to the definition of any shared vision. Yet, having now ascertained with a retrospective view that the phase distinguished by the provision of temporary post-emergency buildings is far removed from the concept of temporariness – increasingly tending towards permanence – in the early recovery phase it would be necessary to adopt an approach more similar to that of reconstruction than to the one of emergency relief. In this sense, the need to negotiate the maximisation of the speed of decision-making processes with the ability to assist a collective and strategic vision of future developments is evident (Oggioni, Chelleri and Forino, 2019). Towards this same direction, the new Civil Protection Code also identifies as a strategic objective of the Department the increase of intersections between ordinary planning and prevention.

Furthermore, the endowment of temporary structures should also be reconsidered in relation to a more synergic and balanced interplay with other measures used during the 2016 earthquake – such as the *Contributo di Autonoma Sistemazione* (C.A.S.) or the temporary use of disused buildings – to be proportioned according to the urban, social and economic specificities of the different contexts affected by the disaster. This desirable interplay of means would first of all foresee a profitable interaction between bodies and strategic actions as well as an interconnection between crises (for instance, the phenomenon of abandonment in the inner and marginal Italian territories) that could represent useful premises for the construction of future scenarios of territorial sustainability.

Instead, the reconstruction phase is managed with a multilevel central governance structure with strong cooperation of the state, regions and municipalities. With reference to the 2016 earthquake, the Extraordinary Commissioner of the government for the repair, reconstruction, assistance to the population and economic recovery of the territories of the regions of Abruzzo, Lazio, Marche and Umbria establishes the overall damage situation and estimates the related financial needs, coordinates the reconstruction and repair of buildings, oversees the support activities for businesses located in the affected territories and the recovery of the socio-economic fabric in the areas affected by the earthquakes, and promotes the implementation of seismic microzoning for the municipalities concerned. Moreover, as a result of the above-mentioned polycritical condition, the Extraordinary Commissioner is entrusted with functions and tasks on the Urgent Measures related to the National Plan for Complementary Investments to the NRRP. In tandem with the Extraordinary Commissioner, the four affected regions have established as many Special Offices to ensure the joint exercise of functions, activities and services in the affected areas. The objective of the special regional offices is to ensure, in agreement with the National Commissioner, that the reconstruction activity is effective and is based on cost-effectiveness and efficiency principles.

In conclusion, these processes and projects bear witness to a long-standing Italian history in the field of post-disaster design – in the broadest sense – consisting of successive verifications and refinements. What emerges is a great competence that certainly sees in the National Civil Protection Department an excellence and in the special offices for reconstruction progressive experiments that reinforce the strength of approaches and processes. In addition, the rootedness of an experimental and evolved technocentric approach, among the most up-to-date in the world, is evident.

At the same time, our intention is to focus on three aspects that are becoming increasingly important and central: the multiple timeframes of the actions implemented and the different temporalities of the institutional and political actors involved in these complex processes is crucial; the complexity of multi-critical scenarios becoming increasingly undeniable determines a necessary questioning of intervention processes and practices due to multiple timeframes and complex challenges; the intertwining and overlapping of policies and funds requires more

rooted and elastic strategic visions that valorise potentialities and projects related to territories and communities.

The USRC: a possible trigger for a game change

In the light of the above, considering the complexity determined by these multiple crises – both local and global – the reconstruction process cannot be considered as a mere reconstruction of the destroyed heritage.

In this sense, the general approach and the procedures developed by the Special Office for the Reconstruction of the Crater Municipalities (USRC - *Ufficio Speciale per la Ricostruzione dei Comuni del Cratere*) constitute a good practice centred on a broader idea of urban regeneration and territorial development, both for the valorisation of local resources and for the strengthening of communities and social relations.

The USRC was established (by Law 134 of 7 August 2012) in December 2012 and has been operating since April 2013. Its establishment followed the end of the state of emergency that arose after the earthquake of 6 April 2009. The USRC supports municipalities in drawing up Reconstruction Plans and provides technical assistance for public and private reconstruction, promotes its quality and carries out financial monitoring. Under the jurisdiction of the USRC are the 56 municipalities in the seismic crater (except for the city of L'Aquila, which is under the jurisdiction of the Special Office for the Reconstruction of L'Aquila) and the more than 100 municipalities outside the crater.

The specific interest for the USRC lies in two interconnected factors: the time gap from the disastrous phenomenon in reference to which it operates and the interpretation it provides of the reconstructive act in terms of sustainable territorial development.

Indeed, in contrast to the sharp fragmentation of competences and temporalities of intervention described above, the USRC is an innovative actor that is currently experimenting with operational methods through which it can build bridges with possible future scenarios.

The innovative experimentations that the USRC is conducting are rooted in the desire and effort to look towards the end of reconstructive processes by attempting to interpret with a systemic approach the multiple crises that the territories in which it works are going through. The assumption underlying the work carried out by the USRC seems to be the belief in the need to operate in the territories, where managing local change has become more challenging, nuanced, and intricate.

Within this approach, the USRC pays considerable attention to the need to improve urban quality, first of all by rethinking the public spaces of the villages under reconstruction and therefore the relationships between inhabitants, where this category should be reconsidered as a system of multiple social groups that will live these territories within different temporalities. In fact, the involvement of the inhabitants in the reconstruction processes is crucial in order to increase both a culture of inhabiting and a culture of risk. Both require a conscious and updated local culture of the territories to be rethought in the new post-disaster geographies.

In particular, an interesting device identified to frame urban regeneration projects is the definition of four cultural, thematic and historical Routes (*Cammino dei Francescani, Cammino tra i Vestini, Cammino della Baronia, Cammino Grande di Celestino*). This territorial revitalisation strategy is of great interest for two main reasons. First of all, through the device of the route – that is par excellence a way to appropriate and understand the territory – the USRC seeks tangible and intangible connections with other territories not damaged by the earthquake, and this means the construction of new narratives that transcend risk while addressing it. Secondly, the history and actuality of these places are addressed, reinterpreting them within a contemporary relational system that becomes an opportunity for community building through collaborative methods envisaging participatory processes aimed at analysing and discussing the inhabitants' needs and dreams in order to define sustainable future prospects.

These processes are fostering and triggering the cooperation of actors who were previously not in dialogue, tending towards the overcoming of a mere technical approach and a disconnected sequence of interventions whose temporalities failed to define fruitful synergies.
In this sense, the public sphere and market actors are reconnecting, also leading to an enhancement of the material and immaterial heritage of local communities and an increase of their skills and potential (e.g., in terms of ecological transition or ability to attract and manage funding). However, urban growth and redevelopment often conceal unsustainable social and environmental costs. More and more people are calling for an approach that rebalances urban ecosystems and rebuilds the natural environment. Therefore, the need to rethink design in both theoretical and operational terms in post-disaster planning becomes evident.

The Academic Franco-Italian Partnership: an urban innovation arena

Nowadays, Sant'Eusanio Forconese (AQ) is pursuing the reconstruction process, representing a good practice – among the 56 affected villages under the jurisdiction of the USRC – in terms of the percentage of private housing rebuilt. Although, in addition to the Covid-19 pandemic, which has represented a dramatic event worldwide increasing social and economic vulnerabilities, other phenomena such as depopulation – a typical characteristic of the Italian marginal and inner areas – are overlapping with the crisis caused by the earthquake.
Whitin this complex scenario, following the Covid-19 pandemic, Italy has been the recipient of "National Recovery and Resilience Plan" funds. In this framework, the municipality of Sant'Eusanio Forconese had the opportunity to implement a design proposal for a strategic building on the site of a former school that coincides almost perfectly with the barycentre of the new urban system configured by both historical and "temporary" settlement. This project demand became the premise for the international, transdisciplinary and place-based academic collaboration we are referring to. The teaching and in-field research experience conducted in the municipality of Sant'Eusanio Forconese is presented in terms of methodology and outcomes, and referring to the several stages in which it has been structured.

- A week-long in situ workshop involving many different stakeholders.

The philosophy behind this academic initiative is to provide an arena for meetings and debates between different stakeholders. Each speaker was invited to give his interpretation of the challenges and vulnerabilities of the Italian territory. The operational experts involved in emergency management following the 2009 earthquake and the reconstruction stakeholders introduced in the previous part of the article presented their projects and discussed them. The participation of researchers in risk management, architecture and the human and social sciences helped to consolidate expert knowledge of the area, and also to take a reflexive view on preconceptions and implemented projects.
Organizing the workshop in situ is a fundamental principle of this initiative. The territory is seen as a player in its own way. Living in the area for the period of the workshop enables students and professors to take account of the multiple realities that coexist. The inhabitants of the villages and their administrators, the existing architecture (of different typologies), the natural ecosystems, the infrastructures and networks make up a mosaic of humans and non-humans that is occasionally undermined by seismic hazards. The representations of these various actors impose multiple temporal and spatial considerations that must be taken into account when thinking about the Italian inner areas.
At this stage of the workshop, the technical, social and sensitive aspects are documented by the student architects taking part at the workshop. Also, some debates are organized with the speakers to give a better account of existing realities and to break down prejudices and any cultural, technical or social ethnocentrism.

- Development of projects in France and Italy and feedback on students' projects from stakeholders in the field to help them reflect on the issues at stake.

The aim of this workshop was to propose projects concerning a "strategic building" on a site suggested by the Sant'Eusanio Forconese village council.
In the framework of this initiative based on the collaboration of two academic teams and the participation of students from two different European institutions, the discovery of the case study and the project site is essential as the approach is based on the specific features of the local area.
A series of projects are proposed following the diagnostic phase developed during the stay in Sant'Eusanio Forconese. On the one hand, these projects question the temporalities of the site in relation to the temporalities of the natural territory (e.g. the seasons), those of human activities (e.g. transhumance) and those of seismic hazards (crisis, prevention and reconstruction). On the other hand, spatial scales are also questioned and challenged: is the project on the scale of a plot, of the village of Sant'Eusanio Forconese, or of a network of villages in the Crater? In this way, the projects question the predefined perimeters of action to propose a new perspective on the challenges and vulnerabilities of the territory. According to these two main topics – the interpretation of time and space – architectural media has being questioned while the use of Art has made it possible to express the multiple sensitivities of humans and non-humans. In this sense, connections have been established between the various narratives of other territories inhabited by the participating students: inhabiting a risky or unsettled territory becomes a kind of shared common heritage. The presence of humans in their ecosystem is questioned. The act of building, discussed by Martin Heidegger (1958) in terms of building, living, being and caring, is at the heart of the discussions on the proposed projects. Finally, the discussion and comparison of projects conceived in the academic context with the expertise of professionals generates very interesting debates around standards, funding, technical possibilities and climatic and environmental issues, and more generally about the contemporary idea of inhabiting. In this sense, the strategic buildings projects developed propose multiple narratives of the area no longer restricted to disaster management.
In conclusion, since this European academic experience, several concepts can be discussed and developed further:
- The project as a medium for consultation viewed through different timeframes;
- The need for a new narrative of the territory and a renewal of approaches to concertation, which must involve citizens more as active players in their resilience, without depriving the city's political players and managers of their missions and prerogatives. This new narrative must also take account of existing architectural and urban typologies, and go hand in hand with a re-examination of the act of planning, to include natural ecosystems as active fundamental components rather than as a support object for territorial planning.
- Taking care of the site: the humans and non-humans who structure it should be the leitmotiv of a Build Back Better approach to this Italian territory. Reflections on the regeneration of nature and also on the socio-economic resources of the inhabitants should therefore be at the heart of the project. In this sense, deconstruction can be an approach for better territorial and social constructions, since it tends to allow the regeneration of nature on sites that are no longer suitable for construction.

Conclusions: the university as a possible game changer

In this multi-risk Italian context, which challenges us with the spatial and temporal complexity of the issues and vulnerabilities, how can universities contribute to questioning approaches to risk management and territorial reconstruction?
Through a multi-disciplinary academic approach, the university aims to create arenas that challenge the dominant technocentric approaches by bringing together a variety of stakeholders, enabling them to share their expertise and take part in the process of intervening in the area (political players, economic players, planning professionals and, lastly, local residents).

In addition, through a European university partnership, this academic approach creates levers for concerted action and for taking a critical view of prejudices and preconceptions about the studied areas. Thus, by playing the role of mediator, the university is contributing to a renewal of questions about reconstruction, risk management and planning.
In conclusion, universities can play a central role as game changers. Within the transformation processes inherent to contemporary transitional landscapes concerned by multiple heritages and their corresponding temporalities, place-based academic activities – e.g., through living labs – merging together education, research and third mission can represent a tool for activating, boosting and guiding public engagement, strengthening networks and renovating policies.

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The French AFPCNT and AFPS are also partners in the Round Table carried out with the aim of debating about Italian and French case studies, also with the representatives of Sant'Eusanio Forconese and USRC. Also, another workshop is scheduled in next spring within a Blended

Intensive Programme (BIP) that is widening the network of involved institutions (Université de Mons and National Technical University of Athens).

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Empowerment and Participatory Approaches to Urban Health: The E-City Programme

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Abstract

This paper explores the importance of urban health in contemporary urban planning. It aims to address the question on how planners can actively contribute to knowledge and practices related to urban health, promoting equality and equity in future cities through empowerment and participation. The study analyses the strategies and initial steps of the method used by E-city, a long-term university program at the University Paris-Est Creteil since 2020. Focusing on intersectionality dynamics in planning and urban health from interviews with project leaders and professionals, survey data, and participation observation, valuable lessons from the E-City program aim to inspire a new generation of planners committed to intersectional approaches to urban health planning.

Keywords: intersectionality, pro-equity, urban justice, uncertainty experimentation

Introduction

The focus on empowerment and participation in urban planning is increasingly crucial for fostering more sustainable, liveable, and healthy cities. Pressing issues such as climate change, environmental hazards, emissions, pollution, international conflicts, and global disparities have brought attention to existing urban challenges such as isolation, stigma, and poverty cycles, exacerbating the adverse impact on urban environments. The COVID-19 pandemic has highlighted urban health as a critical concern, exposing intricate social, environmental, and economic discrepancies and inequalities in urban areas and among their inhabitants (Williams et al., 2023). Urban experts have stressed the need to incorporate comprehensive approaches to urban health into urban planning. This is crucial for advancing our understanding of the social determinants of sustainable development goals (Ramirez-Rubio et al., 2019), gaining insights into subjective well-being within the built environment (Mouratidis, 2021), and supporting the lasting inclusive development of communities (Mohamed et al., 2020).
The paper addresses these gaps by explicitly acknowledging urban health in urban planning, beyond providing health care services (Ramirez-Rubio et al., 2019). The main research question is how planners can actively contribute to knowledge and practices concerning urban health, bringing urban equality and equity to future cities. By highlighting empowerment and participation as critical elements, this paper introduces an innovative framework that inspires

planners to adopt a pro-equity approach in thinking and acting for future healthy, sustainable, and just cities.

The paper establishes an intersectional framework that combines empowerment and participation to planning theory and urban health reserach. Both strands of research acknowledge stakeholder engagement and the existence of multiple and conflicting knowledge claims while emphasising the importance of nurturing 'active subjects' capable of taking ownership of their situation and conditions. Patsy Healey's concept that 'planning practices have the potential to shape not just the physical qualities of places but their political ambience' (Healey, 2008, p. 380) prompts consideration of planning communicative rationalities that promote 'empowerment' through participatory democracy (Healey, 1997).

Empowerment and participation are crucial in discussions about sustainable development and urban health (WHO Regional Office for Europe, 2002). These strategies not only help to resolve conflicts and build consensus but also make people feel involved and heard, empowering them to experiment with changes and perceive the impact of their actions on their everyday lives. Empowerment and participation are essential not only for legitimising processes but also for integrating local knowledge into specific policies for different groups and contexts, fostering a sense of ownership over issues related to the quality of places and social conditions. Although uneven power dynamics can influence planning processes (Bailey, 2010), it is essential to recognise that planning is never neutral. Urban health, therefore, plays a crucial role in fostering active participation and shaping governance spaces at the centre of planning for sustainable, healthy, and just cities (Foley, 1997; Campbell, 2018).

The paper presents a novel approach to urban health planning, and delves into the E-City program, an initiative launched by the University Paris-Est Creteil University in 2020, with a planned duration of a decade. The program aims to comprehend social inequalities in urban health and their determinants within the French/Parisian/Ile-de-France context through a cohort of university students. Additionally, it seeks to function as an incubator of urban actions. The paper's primary focus is to scrutinise issues of empowerment and participation from an intersectional perspective, utilising a qualitative interpretation of the E-City method. Findings derives from engaging in focus group meetings, conducting interviews with proponents and professionals of the program, interviewing project leaders, collecting insights from student surveys, and participation observation.

The E-City program activates a young generation of students, giving feedback on the service campus and municipalities to expand local knowledge and support and empower a new generation of ambassadors and a new generation of intersectoral planners. The paper concludes by drawing lessons from the ongoing progress of the E-city program on the complexity of interactive governance forms, interdisciplinarity and transdisciplinary dynamics with academia, governmental, and professional institutions. Planning needs to face many uncertainties over the unpredictability of complete knowledge over the future (Pløger, 2023; Lissandrello et al., 2023) hopefully leaving "no one behind" (UN Agenda, 2030).

Theoretical Framework

'And if so, what is the hope that a more participative model can address the challenges of promoting more liveable and sustainable urban places for the many and not just the few?' (Healey, 2008: 379)

Empowerment and participation in planning

In planning, the issue of empowerment and participation has been a long-lasting issue since the 1960s. It concerns public involvement, advocacy and collaborative planning, and inclusive

partnerships. Participation has various meanings and processes that lead to citizen control (Arnstein, 1969), but not all can be considered empowering. However, collaborative and deliberative planning theories consider empowerment and participation as essential processes linked to power dynamics for collective and social intelligence. Empowerment is, therefore, a social learning process valuable for advancing a critical participatory democracy (Foley, 1997) and occurs *through* the planning process (Healey, 1997; Forester 1999). By involving citizens in deliberative forums, citizens can express different expectations, awaken open possibilities for new planning practices (Booher, 2008), and create arenas by bringing voices to monitor formal government actions (Kam Ng, 2008). As urban futures cannot be predicted (Albrechts, 2008) or 'owned' (Pløger, 2023), the engagement of citizens in the imaginative work of the future is essential to create common imaginaries of wishful urban futures. Recognising and valuing diversity is a crucial prerequisite for finding solutions that reflect people's needs and moving towards urban justice, equality and equity (Perrons & Skyers, 2003).

The formation of collective intelligence and the opportunity for citizens to be heard through the planning process remain still controversial. Participation and empowerment depend on the ability of citizens and communities to have a voice, be heard, and turn their voices into opportunities for action. In other words, empowerment and participation depend on methods of public engagement, often strongly influenced by the opportunities of institutional design within governance practices (Torfing & Sørensen, 2008). While empowerment and participation have been long integrated into a planning vocabulary in procedures and routinised planning practice in European and Western cities and countries, performing participation and dealing with empowerment still suffer from unequal and exclusionary conditions (Petersen, 2008). Although local government policy documents and strategies, as well as global institutions, embrace participation and empowerment as principles, citizens too often remain outside the decision-making arena at the local level. The issue of redistributing resources and acknowledging the need for fairness and equal opportunities is often overlooked. As a result, solutions to create more equitable urban policies and sustainable cities are often ineffective. Additionally, the current planning mindset tends to maintain existing power imbalances and exclusion, which is a significant challenge to overcome.

Contemporary urban society sectoral policies such as energy, mobility and nature-based solutions continue to be dominated by a techno-democracy embodied in narrow ideals of 'good' citizenship (Roy & Neveu, 2023) and more often lead questions on social acceptability (Warren et al., 2012) of pro-environmental behaviours for critical policies to twist into a 'corrective' individual behaviour – in the morality our common future (World Commission on Environment and Development,1987). However, urban planning concerns the nexus of complexity in which urban environmental exposure, the quality and affordability of housing, the opportunities for transportation networks, green and public spaces, socio-economic services, urban communities' identity. Urban change depends, therefore, on complex dynamics – not only planning decisions or governmental authorities alone – but on what often are framed by the theory of change (e.g. Popay, 2010): the system interaction of individual behaviours, routinised social practice and structural and institutional regulation and dynamics of change on multiple levels and temporalities (Geels & Turnheim, 2022; Lissandrello, 2020). The dynamics of empowerment and participation in planning for more agonistic deliberative democracy (Mouffe, 1999) entail consistently challenging the political community by considering when and how planners and urban managers should revitalise or support protests or pacify troubled situations. There is a concern that claims for empowerment and participation may replicate a managerial "business as usual" approach, which limits the space for agonistic forms of democratic practice and intersectionality. Empowerment is a necessary social learning process for promoting critical participatory democracy and revolve around the fundamental concept of "working on problems with people" to bolster democratic processes (Foley, 1997; Forester, 1999).

Empowerment and participation in urban health

Empowerment and participation have been central concepts in urban health research and policies (WHO, 1986). Since the United Nations Conference on Environment and Development (1992), the concept that health actions should be carried out by and with people rather than on or to people. This concept involves enabling people to actively participate in defining the issues that concern them, making decisions about factors that affect their lives, formulating and implementing policies, planning, developing and delivering services, and taking action to achieve change (WHO Regional Office for Europe, 2002). In the field of public health, the implementation of no-smoking policies in the 2000s showed that government-led decision-making, also known as 'top-down' policy interventions or 'control over', effectively addressed complex issues like protecting the health of all citizens. The COVID-19 pandemic has highlighted the critical and complex nature of public health issues, with a high degree of uncertainty about future unforeseen impacts. Addressing this uncertainty and ensuring the effectiveness of health policies requires a collective commitment from all of society. In response to the challenges posed by the COVID-19 pandemic, communities have proactively devised autonomous measures to address the uncertainties and enduring impacts of prolonged isolation, remote work, and mobility constraints. This situation has manifested in the form of community-driven solidarity initiatives. A noteworthy observation is that uncertainty can catalyse heightened awareness and empowerment. For instance, localised endeavours have surfaced amid the pandemic to promote mutual assistance by sharing facilities and spaces. Furthermore, utilising public spaces has transformed the pandemic, expediting implementing tactical urbanism projects, such as temporary bicycle lanes, street-level terraces, and urban gardening.

In the context of change management, planners and urban managers must mitigate change's disproportionate impact on underprivileged communities. Therefore, urban planners and managers must ensure that these already disadvantaged communities are not unfairly burdened with the added challenges that come with change. The essential aspects of empowerment and participation in urban health policies involve defining and implementing techniques to promote good local governance (Carly, 2003), effective community participation, and support of disadvantaged communities through social capital and capacity-building. Studies have shown that health promotion is now seen as a form of empowerment in itself (Amdam, 2010). According to Ramirez-Rubio et al. (2019), cities are experiencing significant demographic and epidemiological changes, leading to substantial health inequalities, such as segregation by social class, gender, age, or ethnicity within or among city neighbourhoods. Therefore, urban health is a crucial issue that plays a fundamental role in guiding the UN's sustainable development goals, particularly in issues related to empowerment and participation, which have long been discussed by the World Health Organization (WHO) and the European WHO Healthy Cities initiatives.

According to the WHO, behaviour change involves the organisational behaviours of intermediaries, including leadership, agenda setting, policy formulation, adaptive management, network formulation, innovation, teamwork, and implementation at strategic, tactical, and operational levels. However, most existing literature on empowerment and participation in community involvement comes from Europe and other high-income countries. Community participation and empowerment have evolved from specific ad-hoc or occasional events to an integrated strategic component that significantly influences the health-related sustainability issues in urban development (Scriven et al., 2023). The need to build participatory community networks and, specifically, to empower socially excluded people must be addressed in urban health. There are increasing and well-founded concerns that participation in urban health is

often a superficial 'tick box' process in which unequal power relations remain unaddressed, compromising the potential of participatory processes to achieve more significant equity and justice (Egid et al., 2021). It is crucial to consider reflexivity when engaging in critical discussions about the roles of stakeholders about privilege and power and how these roles impact urban health research and practice. Popay (2010) proposed the theory of change in urban health, outlining four approaches involving individuals, social practices, and system change in empowerment and participation: informing, consultation, co-production, and community control.

Urban health planning: An intersectional approach to empowerment and participation

The COVID-19 pandemic has highlighted the importance of urban health in urban planning, providing valuable insights to improve urban preparedness, adaptability, and resilience during emergencies. However, current planning theory and practice still need to consider urban health from an intersectional perspective. Planning theory and urban health research shares similar concerns on empowerment and participation, but from different ontological and epistemological perspectives (Pineo et al., 2020) that reflect the division between natural and social sciences, such as positivism and social constructivism. Scholars have highlighted the diversity of goals, values (Lee & Zarowsky, 2015), and ethics (Campbell & Marshall, 2002) among those who aim to "reduce suffering and improve health" and those who instead manage change in urban environments. However, the dynamics of power are a common point of intersectionality. In both planning theory and urban health, positions of power (such as planners and health practitioners) and those seeking empowerment (like citizens and clients) must work together to establish the conditions needed for empowerment (Laverack, 2006). An inspiring aspect is that both planning theory and urban health research have emphasised that — practitioners (must) act as advocates, enablers and catalysts for empowerment. Participation and empowerment require a synergistic interaction between individual empowerment, organisational empowerment, and broader social and political actions (Laverack, 2006, p. 36).
Urban health research views public participation not as a 'ladder' (Arnstein, 1969) but as a 'wheel' of participation (Davidson, 1998) and emphasises the ongoing collaboration across institutions, encompassing the responsibilities of actions ("top-down") and the empowerment of citizens and communities to take action ("bottom-up"). This approach intertwines health, well-being, and sustainable development with urban societal equity and equality (Dooris & Heritage, 2013). Creating intersectionality between planning theory and urban health research involves integrating ideas such as advocacy and communicative planning (Innes & Booher, 2010) to address social and health inequities in cities (Williams, 2020) and adopting a "relational, health equity-oriented approach to planning" (Corburn et al., 2015, p. 267). This approach enables planners to evaluate the prevailing values and assumptions (Collins, 2000; Fincher & Jacobs, 1998; Sandercock, 1998, 2000; Williams, 2020). The active involvement of the public, particularly vulnerable groups, in planning processes can effectively reduce inequalities and enhance social cohesion. This approach, known as an empowerment strategy, is closely tied to social justice. In this context, social justice aims to ensure equitable access to resources and rights for all social groups. When applied to urban health planning should enhance the active role of citizens in producing, reproducing, and representing urban spaces as socio-spatial processes (Soja, 2013) within a specific urban socio-economic context.
Urban health planning is here considered a lens to uncover urban gentrification and the segregation of specific urban areas, focus on how urban planning can enhance urban health impacts without perpetuating social and urban disparities and recognise that proximity does not always guarantee accessibility (Glock & Gerlach, 2023).

The E-City Program

The E-city program, established in 2020 with an envisioned lifetime of a decade, focuses on understanding the social and environmental factors that affect population health in urban areas. The program aims to investigate social inequalities in urban health and their determinants. Urban health is a significant and complex topic that has been widely acknowledged. It involves individual behaviour but goes beyond behavioural changes and includes values, equity, and social justice issues. The E-city program has established four main objectives since its inception. The first objective is to improve the quantity and quality of existing public health data. Often, data exist but are too fragmented, dispersed across several authorities, institutions, and organisations, and temporarily gathered according to projects and may only be partially utilised.

Public health data are vulnerable because they can quickly become outdated when studying urban health equity and equality. Therefore, the program's primary focus is to build a database that specifically addresses these questions, serving as a tool to collect and exchange data and regularly monitor them. This approach aims to empower individuals and communities by giving them control and understanding over their data. The second objective of the E-city program is to create the conditions for advancing interdisciplinary knowledge in urban health research. The study of urban health involves various research fields coming together to comprehend the impact of the urban environment on health.

Some directions in urban health research are exploring different factors that affect health in urban areas, identifying potential ways to improve health, and understanding the various influences on health in cities, such as environmental, social, and lifestyle factors, as well as integrating knowledge from various fields such as medicine, environmental science, natural sciences, data analysis, humanities, and social sciences. Urban health research considers different viewpoints to tackle complex urban health challenges. The third objective is to create a transdisciplinary approach that can serve as a tool for political decision-making. Understanding urban health dynamics can help shape public policies that are more value-driven, equitable, and just by informing ongoing monitoring and diagnosis that can influence urban planning and the testing and development of solutions. The E-City program integrates urban space and environmental quality with health concerns.

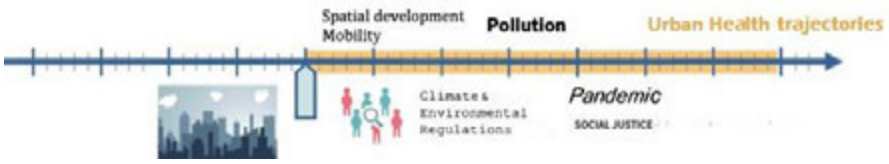

Figure 1 – the concept of urban health in the societal transformation in the E-city program

The program aims to establish a public health monitoring system in urban areas, creating an 'urban cohort' as a living laboratory for citizen science and open science that includes developing a data platform to collect, utilise, and share information. The E-city program aims to analyse the long-term effects of social and environmental factors on urban populations, such as noise, environmental risks, and pollution, which impact social, demographic, and lifestyle dimensions. Lifestyle changes require a wide range of skills to improve citizens' quality of life and health and evaluate public policies. The E-city program involves various skills within the University Paris Est/UPEC, including 32 research institutes with interdisciplinary approaches.

It seeks to build on past experiences, successes, and initiatives from diverse disciplines and research groups.

Description of participatory methods used in the E-city program

The E-city program is designed as a tool focused on an urban community around which partners can align themselves and structure projects. It also serves as a platform for mobilising customised scientific expertise, funding innovation, and fostering scientific collaboration to address major societal issues. The program is based on creating experimental teamwork for diagnostics, data interpretation, and experience feedback. E-city serves as a platform for addressing urban health issues by bringing together data, people, and resources for researchers and institutions. What sets the E-city program apart is its comprehensive approach to urban health, considering socio-environmental factors. This comprehensive approach positions E-city as a hub for interdisciplinary research, aiming to design an urban ecosystem as a real-world laboratory - essentially bringing the University into the city and the city into the University.
The urban population cohort is a crucial element for empirically analysing territorial data. The E-city program aims to establish an inclusive research program with flexible parameters, promote scientific freedom, and encourage innovative methodological approaches. The E-city program's transdisciplinary and inclusive scientific research aims to benefit the Paris Ile-de-France metropolitan area by enhancing the ability to account for urban dynamics.
The vision of the E-city program is to create a network to gather data about urban health in a participatory and empowering manner. The E-city program does not rely on predefined tools that are not based on local problems and knowledge. In many cases, local knowledge is often overlooked. By prioritising local knowledge at the end of the research process, it is difficult to understand how the context changes and how enduring social inequalities persist. In E-city, local knowledge is central to the research process and is dynamic, involving active experimentation with the community.
As illustrated in the program diagram (Fig. 1), E-City collaborates with a wide range of private and public partners, including municipalities, regional authorities, associations, and companies. A continuous dialogue with these representatives of metropolitan society regarding current needs and questions about urban health and well-being issues leads to research projects that align with the holistic vision of the E-City program. These projects are co-designed with local and territorial stakeholders and researchers from the interdisciplinary scientific community of UPEC University.
In addition, E-City actively generates research projects by inviting researchers from other universities and public or private research institutes to submit project proposals. E-City maintains regular communication with the research community to identify and develop specific projects that align with the overall research goals of the E-City program. In collaboration with the 42,000 students at UPEC University, the students at E-City contribute to research data collection through scientific surveys. Multiple surveys are conducted annually, and a dedicated interdisciplinary committee of researchers oversees the ongoing methodological adjustments. The survey results are analysed and discussed in research seminars and workshops throughout the survey process.
The research projects conducted with E-City partners aim to achieve three types of results:
1. Creating scientific knowledge shared with various research communities and disseminated through papers, workshops, and conferences. The scientific results are also shared with citizens and public institutions, and locally specific methods for shared language and lifelong learning are co-created at the local level.

2. Generating operational outcomes for public or private practitioners and providing recommendations for public policymakers. These operational results aim to co-construct collective action in urban health.
3. Emphasising the link between research and education, E-City uses the scientific results from cohort surveys as input for developing teaching methods and topics. E-City conducts workshops and seminars with students from different faculties. Additionally, E-City participates in "citizens' students' conventions" (CCE), a participative and deliberative arena where critical societal issues are co-constructed and collectively decided.

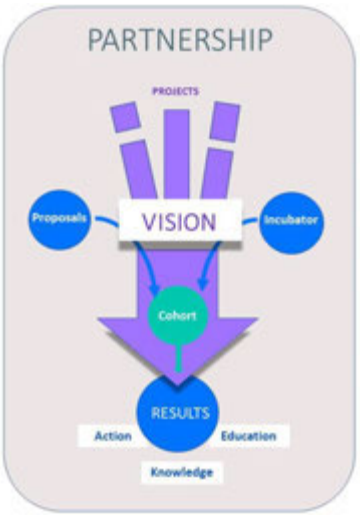

Figure 2 – the concept of partnership for empowerment and participation of the E-city program

The E-city program is based on a holistic approach to urban health, seen as a vision of a system and a set of guiding principles (autopoiesis). The "auto-poietic" approach follows an "abductive" epistemological logic as a continuous process of gaining knowledge and refining practices through learning by doing and reflecting on experience (Aliseda, 2006). This approach is rooted in embracing and navigating uncertainties rather than seeking to control or eliminate them. It acknowledges the impossibility of fully predicting the future but encourages a reflective approach to action. The vision of a system that evolves through learning and reflective practice is implemented through citizen participation, intersectoral and interdisciplinary cooperation, and the deliberate attempt to co-produce interdisciplinarity and transdisciplinarity within public policies.

Thinking of urban health as a self-generating system

The concept of autopoiesis, derived from the Greek words "autos" (self) and "poiein" (create), refers to a system's ability to learn and adapt to changing circumstances by reorganising its structure, such as roles, functions, processes, and tools. A system that exhibits autopoiesis is self-referential, establishing its own frames of reference. Its individual components, actions, and interactions continually sustain it, creating a dynamic and self-sustaining environment (Maturana, Varela, 1980).
John Urry offered a compelling example of autopoiesis in the context of automobility, describing it as a system comprising interconnected social and technical practices that have reshaped civil society (Urry, 2000, p. 190). The system of automobility encompasses not only the car as a manufactured object but also as a consumer product, a complex of mechanical components, an environmental factor, a mode of mobility, an economic instrument for trade and consumption, and a prevailing cultural narrative. Additionally, it involves the economies of car dealerships and fuel distribution, as well as specific interactions with urban spaces. These various dimensions interact, generating and sustaining mobile civil societies that rely on the automobile system, influencing the characteristics of space, time, residence, and social interaction (Urry, 2000; Urry, 2004; Gartman, 2004). The concept of an E-city revolves around creating a living system that establishes its dimensions through data, the participation of citizens and researchers, their interactions, and assemblages. It aims to develop the capacity to

continually learn, iterate learnings and reflections (Schön, 1983), and self-produce itself constantly.

Developing a shared language

It is essential to have a shared understanding and use of language to strengthen arguments, enhance communication, and build connections and alliances among involved parties (e.g. specialised terminology, different ways of presenting and representing information, and communication protocols) (Habermas, 1984). Language serves as a tool to increase participation and broaden access to knowledge and resources in participatory democracy, establish platforms for deliberation, and empower citizens to become active political participants (Schön, 1983). The E-city program aims to establish a shared language through various communication methods and spaces for deliberation. The goal is to provide ongoing platforms for discussion where urban health issues can be shared, debated, and collectively defined. The fundamental principle is that interpersonal communication helps share qualitative and reasoned arguments to establish a shared understanding without disregarding individual, non-universally accepted interpretations. As a result, E-City regularly hosts: 1. Discussion seminars with experts, known as "Café E-City"; 2. Podcasts featuring experts and citizens; 3. Citizens Students Conventions (CEE); 4. Round table discussions with associations and institutions.

Co-creative research methods to analyse the surprising facts

The E-City programme follows an "abductive" epistemological approach, which involves introducing new ideas into the research process and treating it as a creative endeavour where surprising facts can be crucial. This approach allows for questioning established assumptions and validating empirical results. The abductive epistemological logic combines abduction, deduction, and induction as a methodological framework. This approach is beneficial for researching complex urban systems with numerous interrelated health issues.
Different representations of value (e.g., sentimental, economic, cultural) are used to co-produce opinions and formulate objectives regarding desirable futures in urban development, raise awareness, mobilise, consult, understand, share, and experiment.

The E-City Programme proceeds incrementally

From the beginning, E-City has taken a comprehensive approach to urban health, avoiding a narrow focus on any specific research area related to sectoral planning and urban health. By working inclusively with various partners, E-City has gradually evolved and experimented to develop solutions without assuming they are final. To identify research needs from academic and operational partners, E-City prefers a spontaneous and flexible approach to organising research projects, gaining democratic approval for the collaborative process. The approach is iterative and negotiated, embracing uncertainties along the way.

Insights from focus group meetings, interviews, surveys, and participation observation

The first phase of the E-city program (2020-present day) has tested the concept of a comprehensive vision for a healthy urban environment. The initial months of its activities have been dedicated to mobilising scientific stakeholders through a tailored platform focused on implementing the first phase of the urban cohort. This phase consisted of establishing a scientific environment to advance research on urban health. It involves creating experimental

sites for action research, interpreting field diagnostics, and utilising data and experience feedback. Additionally, empowerment initiatives have been implemented to involve students and local stakeholders in the operational processes.
The research projects for the student's cohort focused on land use planning. They included topics such as "Understanding the problems of isolation and health deprivation of a growing ageing population" (Val-de-Marne), "Involving students in research into the health and well-being trajectories" (UPEC/ERASME), and "Urban planning for blind and partially sighted people" (Guyot Center for blind and partially sighted people).
These research projects focused on training a new generation of intersectionality planners, with students being supervised in multiple urban design and spatial planning curricula. Additionally, students received training in meanings and empowerment theories through workshops and master-tutored workshops. During the training, consulting companies and experts who were E-City members participated in the Network for the Regional Plan for Health and Environment. Professionals from different departments and institutions in the Ile-de-France region participated in interdisciplinary seminars.

Communication is Key

The development of E-city's activities is supported by communication efforts to publicise the research program and promote its activities. This is done through various platforms such as LinkedIn, targeting professionals and students in the process of professionalisation, as well as those interested in working with the E-city team. The purpose is to present the progress of projects, especially those related to the territories. Additionally, activities are promoted on Instagram to target students in the UPEC cohort. All E-city projects are also featured on the E-city/University website.
Furthermore, E-city has collaborated with the EUP to launch an Interfaces podcast. Co-hosted with the Chair in Planning Greater Paris, Interfaces aims to bridge academic research, society, and territorial authorities, giving researchers, students, experts, and activists a voice. The popular podcast format can effectively share essential research elements at EUP, UPEC, and neighbouring universities. It can also be used for targeted communications within other research and local communities.
In addition to the podcast, targeted publications such as the booklet with the first results of the student cohort are being distributed to UPEC students. These publications present the first analyses using graphic work to engage the audience produced by work-study students. The communication work supporting each E-city project aims to achieve the following objectives: raising awareness about the E-city program, which is part of UPEC's overall strategies, promoting projects carried out within the University and in collaboration with local partners, and popularising and disseminating the anticipated research results to the general public. Starting with students and the support of UPEC scientists, the E-city highlights the strengths of UPEC. The podcast "Interfaces" consists of academic research and diagnostics, presenting initial results on the exposure of society and urban areas. The first series of "Interfaces" focused on the environmental exposures of urban areas (July 2022), while the second series was about the management of the exposure of urban areas (March 2023). A third series presented the first results of the cohort (March 2024).

The Student Cohort at Paris-Est Créteil University

Today, there are two main initiatives in E-city: the student cohort, which will continue, and the general cohort. The student cohort focuses on subjects that provide a framework for ERASME,

a state-funded university project aimed at transforming the University to be more locally embedded in the eastern and southern parts of Greater Paris. This cohort is linked to student empowerment and was essential in constructing the E-city program. Methodologically, the student cohort provides an opportunity to develop learning about the approach, while thematically, it is a strategic focus on its own. The idea is to start working with diverse competencies that connect research on urban health. The student cohort is, therefore, a testing phase and a call for colleagues and partners.

The term "students' cohort experience" refers to a particular group of students in a specific location. These students are all at a critical juncture in their lives, which is significant for their education, chosen fields of study, and future endeavors. The student cohort is a critical element that allows the E-city program to provide opportunities similar to ERASMUS, addressing the specific needs at UPEC.

The E-city approach involves engaging with students and the campus service. The student body is diverse, and it's important to account for the changing demographics as new students enter and graduate each year. Additionally, the survey should adapt to the students' circumstances as they enter or complete their studies, considering changes in their attitudes, health, and behavior. The student body is being studied to gain insights into their health and to raise awareness about the issues students may face. This approach also allows for testing the structure of the student body and reaching the entire student population quickly, all in one day through the campus service.

The student cohort is established as a key component of the E-city program, following three main steps:

1. Development of a questionnaire in collaboration with experts and students, collected through stands and meetings with sociologists, health geographers, and mental health medical professionals.
2. Launch of the student cohort in coordination with university services, including the campus health service, the office for personal data protection, and the Department for Student Studies and Life.
3. Anticipated enrollment of approximately 2,000 new participants annually over ten years, enabling UPEC to assess and address the needs and expectations of the student population through concrete actions, including research-based teaching and opportunities for experimental research. The ultimate goal of the student cohort is to empower students by integrating local knowledge, fostering awareness and confidence in their health, and enhancing their ability to take action on health-related issues and their place.

Figure 3: Tutored workshop with the Master 2 AUDE-EP (Paris School of Urban Planning) for the assessment of students' well-being at the UPEC campuses.

The Survey on Urban Health

The student cohort is based on a questionnaire that aims to be holistic. It covers multiple and transversal themes to understand urban health determinants. Urban health is defined by the WHO as "a state of complete physical, mental, and social well-being, not merely the absence of disease or infirmity". The cohort questionnaire should enable E-city to investigate the factors influencing the lifestyle and health trajectories of students with a multifactorial approach to explore what contributes to students' well-being, success, and overall quality of life. This will involve examining aspects such as the social and urban environments of individual students, their health trajectory, and the resources available to them, including infrastructure and financial resources.

For this survey, the E-city team initially collaborated with students to gather feedback on their concerns regarding participation in the student citizen convention. They also used existing surveys, such as the OVE. Additionally, the work was performed in close collaboration with various university services (SSU, DEVE) and researchers in the fields of psychiatry, geography, and sociology. Furthermore, the E-city team addressed regulatory issues by collaborating with the DPO.

The survey was created in 2022 and tested in the first wave in Spring 2023. The results were analysed in the first few months of 2024 and covered the following themes: socio-demographic characteristics (ten questions on individual situation such as place of residence, gender, and age), course of studies and student life (twenty questions on academic background, workload, and perception of university environment), environment/living situation/activities (fifteen questions on housing, daily mobility, and everyday behavior), personal situation (twelve questions on financial resources, family support, and episodes of discrimination), and health situation (twenty questions on perceived personal health, mental health, seeking care, and diet).

The experimental approach to connect the University and territory

The E-city program also serves as an incubator, implementing action research in the area. It acts as a meeting point where communities present their needs, fostering relationships between universities (and research actors) and the local area. This involvement integrates students into the societal issues of the territory, promoting a pedagogical approach.

In 2023, the Department of Val-de-Marne contacted the E-city team, seeking to leverage scientific expertise, coordination skills, and connections with the university community, including researchers and students. They wanted us to conduct a study tailored to the specific needs of the Val-de-Marne region. This interest led to an experimental project focused on the ageing population with consultation in the Haie Griselle - La Hêtraie district in Boissy Saint Léger and Limeil Brévannes.

The objective of the survey for the departmental council of Val-de-Marne is to improve consideration of the needs of older people and people with disabilities in priority neighbourhoods. This action is dedicated to priority neighbourhoods because ageing populations will affect all territories, but it promises to be more rapid in some urban areas.

Public policies usually focus on active populations and families, and they need to address the needs of populations that are losing their independence and getting older. The aging population in these areas encounters daily challenges such as unsuitable housing, limited mobility, access to services, and isolation. The department's commitment to an experimental approach was unanimously approved by the elected representatives of the Departmental Council in December 2020 during the adoption of the departmental autonomy plan.

The Haie-Griselle / La Hêtraie district has been chosen as the focus of the experiment because it is one of the 20 most deprived neighborhoods in Val-de-Marne according to the ranking by

the Department's Observatory of Social Housing Neighborhoods (OQHS). The aging process is particularly pronounced in the neighborhood, with a significant 70% increase in the population aged 75 and over in Priority Neighborhoods (Quartier Prioritaire de la Politique de la Ville) between 2013 and 2018. The district's population is also declining (5024 in 2018 compared to 5301 in 2013). It is unique in that it is a residential park and is affected by an urban renewal project of regional interest (PRIR).

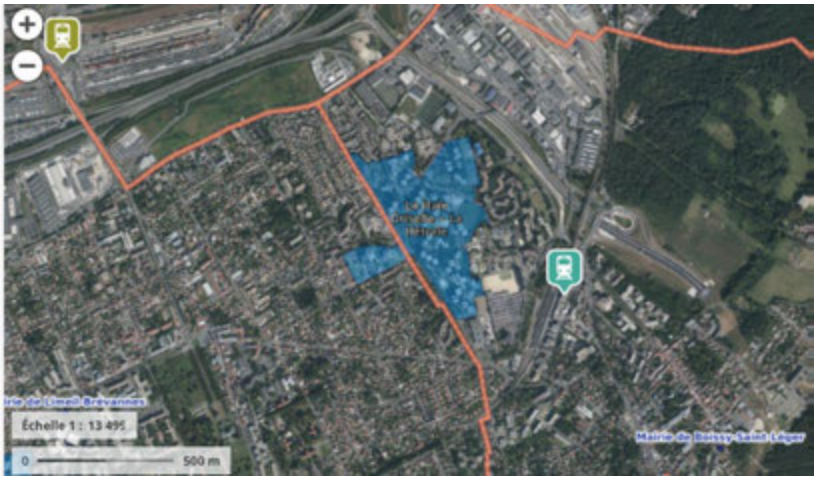

Figure 4: Haie-Griselle / La Hêtraie district

The project's objective within the E-city program is to conduct an experimental consultation process in the La Haie Griselle – La Hêtraie district on the issue of an ageing population, taking advantage of the district's urban renewal operation (NPNRU). The students will be involved in the analisis of the ageing experience using various methods such as field observations with photos, participatory workshops, and semi-structured or biographical interviews. The goal is to understand how the residents of the Haie-Griselle - La Hêtraie district experience ageing. The aim is to improve their access to rights, housing, public spaces, and prevent social isolation. The E-city team will use both qualitative and quantitative tools such as questionnaires, field observations, photovoice, participatory workshops, and semi-structured interviews to gather information and work with our partners to plan concrete actions for the aging population.The project requires the mobilisation of actors and partnerships. The project sponsors (CD94) regularly organise project implementation meetings and monitor meetings with stakeholders (CD94 members, their elected officials, and GPSEA for the NPNRU aspect) throughout the project duration from October 2023 to September 2024.
From October 2023 to January 2024, a group of students in the Master of Education Sciences program at the University of Paris-Est Créteil has conduced research on the intergenerational aspect as part of an intensive seminar. Additionally, from October to March 2024, a group of students in the Master 2 AUDE-EP program at the Paris School of Urban Planning is working on public spaces, involving observations, interviews, participatory workshops, and an assessment of the use of space.; and from February to September 2024 a Master student in health geography (University of Nanterre and Créteil) on an internship for five months is working on qualitative tools with isolated people; and from May to July 2024, a student on an

internship for three months is carrying out interviews with stakeholders, and help the restitution of data to identify concrete actions in the region.

Lessons from the E-City Program

The E-City program has several expectations for UPEC, the scientific community, and local communities. The program aims to produce scientific findings on urban health by monitoring a cohort over time. Findings are expected to contribute to a better understanding of life trajectories, the factors contributing to inequalities, and scientific challenges. The cohort model, which explores the interplay between urban health and planning issues, has the potential to help in developing future scenarios through co-design.

Local knowledge has proven to be essential from an operational perspective. It is vital not only for understanding the community but also for implementing various forms of engagement and experimentation in urban areas with residents and the urban population. This helps to make participation and empowerment being at the center of co-creation processes to enhance people ability to act in the face of the challenges they encounter. Establishing living labs and engaging in the co-production of public action in a tangible manner requires a significant level of commitment.

The E-city program offers two types of lessons. The first type involves scientific research on urban health, focusing on understanding the relationship between urban environmental exposure to noise, risks, and pollution, and the health conditions of the urban population. Data on potential health trajectories contribute to understand inequalities, and conditions of urban inhabitants. The second type of lesson focuses on engaging urban stakeholders in co-producing knowledge about urban health determinants, overcome issues of inequality, and define pathways to empower people through information on health determinants, risk factors, and learning about socio-environmental determinants. This involves experimentation in living lab contexts, prototyping solutions, and neighborhood houses to establish trust and co-produce public action. An essential aspect is the evaluation of public policies (ex-ante, in-itinere, ex-post) related to health, urban conditions, and lifestyles.

Vulnerable Group of Young Generation University Students

In the first wave of the student cohort, nearly 1000 participants took part in a survey. The cohort has gathered research material from various fields including health geography, health economics, psychiatry, and sociology. The results aim to provide more detailed insights into the students' conditions, which will be used as feedback for University services. The findings will be compiled into an annual report and presented in Autumn 2024. In Spring 2023, student internships and workshops will be conducted, focusing on "health profiles and living environment." Additionally, a new questionnaire will be enriched with a new round of surveys from the second student cohort, to be submitted in Autumn 2024.

The findings from the survey of the first group of students were discussed in a workshop that included experts in health geography, health economics, psychiatry, sociology, and urban planning. The workshop helped the E-city team to analyse the survey data and identify disparities in access to higher education and graduation, as well as the challenging living conditions experienced by certain students. It was also identified perceived health issues among students, difficulties faced by certain student groups in accessing public health services, and concerning signs of potential comorbidities.

Figure 5: Workshop with multidisciplinary experts interpreting and discussing the first data aquired through the first wave of the survey of the student cohort (March 2024).

Vulnerable Neighbourhoods of Ageing Population

Challenges of the experimentation-consultation project in the Haie-Griselle - La Hêtraie district. The work areas approved by COPIL (June 15, 2022) focus on five main aspects:
1. Communication about the neighbourhood's redevelopment to assess communication needs and methods within the PRIR (Project of Regional Interest) framework.
2. Neighborhood accessibility and movement within the space (user journeys) to evaluate building accessibility, road layouts, and shared spaces (residential areas, thoroughfares). Identifying traffic routes, resting places, and public spaces such as benches.
It is adapting housing for the older population to enable them to stay home and understand existing devices, using technical aids and the services offered by home care and medical facilities and focusing on social life, citizenship, and measures to prevent loss of autonomy. Planning prevention systems and actions such as sports, cultural activities, and leisure, adapting local services, and promoting community activities are essential for enhancing social life. The project also focuses on changing perceptions of old age and disability by studying how older populations are represented and their role in the community and promoting intergenerational activities. This project requires the participation of professional staff to conduct this action research.

Conclusions

The E-City program's vision and strategies have led to significant opportunities for establishing partnerships with the EUP to address participation and empowerment in urban health. The themes addressed by the E-City program are directly related to the concept of a "Healthy City" and show intersectionality with youth and the ageing population, which is likely to be of interest to future generation of planners and research-based educational activities in the Paris School of Urban Planning.

The E-City program has achieved a significant outcome through the collaborative effort of the students' cohort. The "E-City students cohort" underwent a 2-year preparation phase, during which various methods and techniques of communication, awareness, participation, and collaboration were tested. A methodological framework was continuously tested with segments of the student community, and it was consistently improved to align with the students' capacity to comprehend and engage with the E-City program, considering their individual living and working conditions.

The COVID-19 pandemic has had a significant impact on urban health conditions, especially for students. Many students were confined to their small apartments and had reduced access to learning resources, facilities, and amenities. These impacts continue to affect the mental health and well-being of many students today. The latest E-City survey has revealed interesting findings on the urban health conditions of students at UPEC and has raised important questions for sustainable planning. The survey found that the time spent in transportation for commuting to the University has a negative impact on students' working conditions, with 56% spending less than 1 hour in transport and 12% spending more than 2 hours. More than a third of the students need to work to pay for their studies, and almost half are facing significant financial challenges. These findings are important because of the accessibility of universities in outlying urban areas. How can we enhance accessibility through various modes of transportation? What options are available for providing financial assistance to local students?

Another important aspect related to urban health and planning is young people's mental health. According to the E-City survey, half of the students regularly experience bad moods, sadness, and anxiety. A quarter of the students have had panic attacks, and 5% seem to have psychotic issues. It is crucial to understand the causes and sources of these mental health problems. Are these issues based on pathologies? Are they severe? What initiatives can be improved to ensure the best care for young generation with their participation and empowerment?

The rapid growth of cities poses significant challenges on urban health planning. Over 55% of the world's population lives in urban areas, and this number is expected to increase to 68% by 2050 (Santos-Tapia et al., 2024). It is crucial to rethink planning in relation to urban health, with participation and empowerment as key aspects of this intersectionality. Citizens need right to access information, voice their opinions, and participate in decisions related to urban health planning for more sustainable equity, equality, and social justice to promote healthy urban contexts. This means to face experimentation and uncertainty (Zepf & Ramirez-Cobo, 2022).

Within the E-City program, the university campus service has implemented new and innovative approaches to delivering services that could bring future benefits to students. These benefits include support for mental health, training focusing on positive future scenarios, and enhanced social capital. There is a growing awareness that issues such as transportation, financial assistance, and guaranteeing a more positive vision of the future are essential for the younger generation. Rapid urbanisation has impacted traditional social bonds and cultural affinities, affecting the ageing population (Galea & Vlahov, 2005). The E-city program has therefore identified a role for the University to lead the way for equality and equity and identifying some crucial vulnerabilities for a new generation of intersectional planners. There are communities to empower in numerous ways in health provision, such as education, security, maintenance, and planning activities in the context of place-making, solidarity needs and possibilities, and social practices. Planners need to adopt intersectional frameworks to discuss and debate future visions based on ethical principles, future generations, and communities where will be essential promote equality and social justice by collaborating to create knowledge, identify crucial aspects, and develop models to cultivate practice and education on inclusive urban health planning.

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Online Sessions

Achieving proximity in Public Space: Inclusion, Flexibility and Accessibility

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Achieving proximity in Public Space: Inclusion, Flexibility and Accessibility

Abstract

The city of proximity can be defined as a city able to offer to all its inhabitants everything they need to live, work and have fun to be reached on foot or bike in no more than 20 minutes (Moreno, 2020).
An important factor is that the city of proximity has to be created with the support of a wide process of participation with the actors involved and interested in its realization.
Starting from these premises, this study - carried out in the framework of the research project PRIN 2020 SUMMA #20209F3A37 - aims at presenting the process of participation and the proposed project interventions for the regeneration of the former fair of Rome, interested by dismission and then isolation from the rest of the neighbourhood. As a result, the 25 principles Charter of Proximity - flexible, inclusive and updatable - was realized, which consists in a holistic tool for design or verify proximity in an area and assure equitable accessibility (Sepe, 2023).

Keywords: public space, proximity, inclusion, flexibility, accessibility

Introduction

The city of proximity can be defined as a city able to offer to all its inhabitants everything they need to live, work and have fun to be reached on foot or bike in no more than 20 minutes.
Proximity - as Jane Jacobs (1961) states - allows people to exchange knowledge, ideas, ways of thinking to generate diversity. It is necessary to create the right conditions to make a place accessible to everyone as each place is different from the other; the diversity of the city is also based on the fact that so many people with different tastes, needs and abilities are close to each other. The conditions for diversity are: the different parts of a district must perform more than one primary function and must ensure the presence of people with different hours who can use many facilities in common; roads need to be well connected to each other in order to generate interest and further uses; the district must provide services, activities and goods with a different range of prices, especially accessible; there must be a dense concentration of people who are in that place for different purposes. The combination of these conditions results in vibrant districts and cities with - at the same time - good economic effects.
In continuity with these ideas, 15-minutes city (Moreno, 2024) arisen to offer more and new possibilities of use within the same place: a cinema can become a laboratory of ideas in the morning or a nightclub can act as a gym in the afternoon. Residents must have ease of access to goods and services, each neighbourhood must have a variety of housing types in terms of size and accessibility levels, including economic ones, and be close to the workplace. To achieve proximity, city plans, regulations and zoning need to be updated to ensure public services, infrastructures and public spaces accessible to all, as well as schools, small health facilities and retail including fresh product shops and pharmacies (Moreno 2020).
An important factor is that the city of proximity has to be created with the support of a wide process of participation with the actors involved and interested in its realization.
Starting from these premises, this study - carried out in the framework of the research project PRIN 2020 SUMMA #20209F3A37, within the ISMed-CNR Unit (with the author's responsibility) and the relative agreement between Sapienza Università di Roma and ISMed-

CNR, that has among the objects to create guide lines for resilient, healthy and flexible places Carmona, 2019; Corburn, 2009; D'Alessandro et Al., 2015; Gehl, 2010, 2016; Koohsari et Al., 2013), – aims at presenting the process of participation and the proposed project interventions for the regeneration of the former fair of Rome, interested by dismission and isolation from the rest of the neighbourhood, realized in the framework of the 2022-23 Urban Planning Course at DICEA Sapienza University of Rome by the author of this study and her students and the Charter of the Proximity.
As a result, the author has ideated the 25 principles Charter of Proximity, that consists in a tool for design or verify proximity in an area. The Charter is an holistic tool - flexible, inclusive and updatable - that can be adaptable to any kind of sites to assure a proximity with both equitable accessibility and attention to place identity (London, 2020; Madanipour, 2011; Montgomery, 1998; Sepe, 2023; Sim, 2019).

Urban regeneration and proximity

Inclusive regeneration

Urban regeneration consists of an integrated approach between vision and action for the resolution of various problems related to disadvantaged urban areas in order to improve their socio-economic, physical and environmental conditions with actions such as the requalification, recovery and conservation of heritage.
To the term regeneration must be added the term sustainable understood in its triple meaning (Sepe, 2021-2023), although as Evans and Jones (2008) affirm it can create ambiguity on what weight to give to the environmental, social and economic component, determining that greater emphasis can be placed in the regeneration processes on one element instead of another depending on the developers' goals (Davies, 2002).
Indeed, in the most recent studies for this purpose, additional key elements of sustainability in relation to the planning system have been identified, namely: cohesion and social inclusion; protection and enhancement of the natural environment; prudent use of natural resources; sustainable economic growth; integration of sustainable development into development plans (ODPM, 2004). This highlights the importance of integrating the components and not just ensure their presence (Forrester, Snell, 2007).
Each transformation operation may have to undergo changes due to sudden crises of different types; it is important to be able to guarantee the resilience of places and their adaptation which require flexibility of all the involved components and at all levels.
The kinds of connections between people and place are increasingly growing. Social infrastructure in urban regeneration areas is an important element in sustainable development and must have equal access for residents. It is also important to remember that stakeholders do not have equal rights and powers in the transformation process. Stakeholders in urban regeneration projects must include not only public administrators at different levels and stakeholders in the private sector, but also citizens and, in particular, those who live close to urban renewal projects.
A dynamic relationship must be created between different actors who share objectives agreed together and which must be pursued through the understanding of mutual needs and benefits (Brinkerhoff, 2002). Similarly, the creation of green and blue infrastructures is fundamental to guarantee ecological sustainability, economic regeneration and proximity. Cultural networks are another important element in sustainable regeneration as they have the potential to improve social cohesion and the city's brand. Accordingly, urban planning attentive to perceptions of one's heritage can improve interaction with this and the surrounding urban environment, with a positive effect on the health and liveability of the place. Accordingly, the integration of all the infrastructures will be the key factor to ensure more sustainable connections.

The monitoring of the regeneration process throughout its path is also important to obtain more sustainable results and improve existing programs by modifying the proposed solutions with others that are more adequate to actual needs.

Indeed, the holistic approach to the design of places is an approach that considers all the components that determine their implementation in terms of sustainability, healthiness and liveability, as well as all those involved in a logic of integration and inclusion. The holistic approach (Lehmann, 2010; Xu, 2011) can be read in various Charters, Agendas, Principles, International Reports which in recent decades have formed the framework within which local Agendas have been built. Some principles of the New Urban Agenda and of the 17 Sustainable Goals which constitute an important reference for the contents of this Book will be reiterated below.

Many principles that are contained in the Agenda concerns topics related to public spaces, liveability, healthy and inclusion. It was adopted during the UN-Habitat III Conference which was held in Quito in October 2016. It represents - as can be observed in the following principles - "a shared vision for a better and more sustainable future" (UN-Habitat, (2016).

Principle 36. "We commit ourselves to promoting appropriate measures in cities and human settlements that facilitate access for persons with disabilities, on an equal basis with others, to the physical environment of cities, in particular to public spaces, public transport, housing, education and health facilities, public information and communication (including information and communications technologies and systems) and other facilities and services open or provided to the public, in both urban and rural areas". This principle sets out a very important element for the health of places, i.e. facilitating access for people with disabilities in public spaces and built structures but also in the sphere of communication and information, allowing inclusive access to tangible and intangibles of a territory.

Principle 37. "We commit ourselves to promoting safe, inclusive, accessible, green and quality public spaces, including streets, sidewalks and cycling lanes, squares, waterfront areas, gardens and parks, that are multifunctional areas for social interaction and inclusion, human health and well-being, economic exchange and cultural expression and dialogue among a wide diversity of people and cultures, and that are designed and managed to ensure human development and build peaceful, inclusive and participatory societies, as well as to promote living together, connectivity and social inclusion".

The important points that are expressed in this principle concern the promotion of public spaces of all types that have different functions - an important aspect even in times of pandemics in which it is important to have different uses to be carried out outdoors - and that are designed and above all managed to promote a dialogue between all. Public space, if it is of quality, is also able to promote health and well-being in those who live it, but also economic and cultural exchange.

Principle 67. "We commit ourselves to promoting the creation and maintenance of well-connected and well distributed networks of open, multipurpose, safe, inclusive, accessible, green and quality public spaces, to improving the resilience of cities to disasters and climate change, including floods, drought risks and heat waves, to improving food security and nutrition, physical and mental health,

and household and ambient air quality, to reducing noise and promoting attractive and liveable cities, human settlements and urban landscapes and to prioritizing the conservation of endemic species".

In this principle, the issue of resilience to environmental disasters is associated with that of creating networks of public spaces, understood as places that can help improve resilience along with other aspects such as air quality and the liveability of urban landscapes.

Principle 118. "We will encourage national, subnational and local governments to develop and expand financing instruments, enabling them to improve their transport and mobility

infrastructure and systems, such as mass rapid-transit systems, integrated transport systems, air and rail systems, and safe, sufficient and adequate pedestrian and cycling infrastructure and technology-based innovations in transport and transit systems to reduce congestion and pollution while improving efficiency, connectivity, accessibility, health and quality of life".
This principle highlights the improvement of all transport and mobility infrastructures in the logic of integration on the one hand but also of safety and healthiness on the other. Reducing air pollution due to transport systems also has a positive effect on slow mobility systems – and proximity - and therefore on the quality of life.
Before the III Un-Habitat Conference, in 2015 the General Assembly of United Nations Member States the 2030 Agenda for Sustainable Development was adopted and 17 Sustainable Development Goals (SDGs) provided (UN, 2015). The Goals contain strategies to improve health and education, reduce inequality and incentive the economic growth. These include: 1: End poverty in all its forms everywhere, 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture, 3: Ensure healthy lives and promote well-being for all, at all ages, 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, 5: Achieve gender equality and empower all women and girls, 6: Ensure availability and sustainable management of water and sanitation for all, 7: Ensure access to affordable, reliable, sustainable, and modern energy for all, 8: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all, 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation, 10: Reduce inequality within and among countries, 11: Make cities and human settlements inclusive, safe, resilient, and sustainable, 12: Ensure sustainable consumption and production patterns, 13: Take urgent action to combat climate change and its impacts, 14: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development, 15: Protect, restore, and promote sustainable use of terrestrial ecosystems, manage forests, combat desertification and biodiversity loss, and halt and reverse land degradation, 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions, 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.
These 2030 Agenda goals present a holistic approach as the principles concerning the 2016 New Urban Agenda. Topics such as resilience, inclusion equity, health, safety, sustainable economic growth, resilient infrastructures, nutrition improvement are some of those in common between the two Agendas and constitute the wider framework of the proximity regeneration topic.

Proximity
The proximity city is a city able to offer all its inhabitants everything they need to live, work and have fun to be reached on foot in no more than 15-20 minutes.
The starting point of the 15-minute city model, conceived by Carlos Moreno (2020), is that it needs to move from urban planning to planning urban life. This can be achieved by creating a 15-minute city in a compact area accessible to all and where people can live, work, take care, refuel, have fun and educate themselves. To preserve the quality of life for Moreno, two components must be changed, namely time and space. To this end, a new urban planning must be created with other rhythms of life and ways of using the urban space in order to access the main functions of the city; it is a question of transforming the monofunctional urban space into a polycentric city, connected and with public spaces accessible to all.

In this way, active mobility on foot or by bicycle can be promoted by reducing the use of the car and long journeys by public transport. All the actors of urban life are involved in this transformation as for its realization it is necessary to connect the demand of the inhabitant with the offer through different actions: creating an adequate mix of social, economic and cultural functions, increasing public spaces of meeting, transforming the streets into spaces of free movement for walking or cycling and rediscovering hyper-proximity.

The city of proximity offers more and new possibilities of use within the same place: a cinema can become a laboratory of ideas in the morning, a nightclub can act as a gym in the afternoon, but also bring art and culture on the street with digital cultural platforms or to raise awareness of historical traditions with multimedia technologies. The desired city is in solidarity and participation where there is exchange, creation and mixing.

Accordingly, the way of living and staying in the city changes thanks to the "multifunctional features" that allow to reduce the travel to reach theme, making proximity accessible even to the most fragile (Moreno, 2020).

The principles of proximity city therefore include: residents must have ease of access to goods and services, each neighbourhood must have a variety of housing types in terms of size and accessibility levels, including economic ones, and be close to the workplace of the people, the residents they have to breathe clean air and more people can work close to home or remotely thanks to the diversity of work spaces available (smaller offices, co-working spaces, etc.).

To achieve proximity, city plans, regulations and zoning need to be updated to ensure public services, infrastructures and public spaces accessible to all, as well as schools, small health facilities and retail including fresh product shops and pharmacies. This could be achieved with: the opening of shops on the ground floor of the main streets; the expansion of school courtyards, the transformation of abandoned lots and street spaces into small gardens or pocket parks; the construction of small-scale offices; and light industry spaces.

Flexible use can concern buildings and public spaces, and, in the longer term, cities can encourage the design of reversible buildings that are designed to be easily converted for different uses by decreasing demolitions and reconstructions with economic benefits and in terms of greenhouse gas emissions. (Bergevoet, Van Tuijl, 2016; C40 Cities Climate Leadership Group, C40 Knowledge Hub, 2020).

It is therefore necessary to territorialize the short distance multicentralities by creating urban commons where to live, work, have fun and educate itself and where elements such as water, air, time, space are at the centre of new urban issues.

In the proximity city, the way of experiencing the city also changes: we move from suffering mobility to chosen mobility, hyper-proximity leads to new socio-economic models, plants and biodiversity become an integral part of this approach. Density must in fact be understood in a reasoned way with green connectors to be made with living materials present throughout the life cycle to be combined with internal green spaces, roofs, squares and streets that foster social bond. Green spaces in the compact city are an attractive factor as they are places where people can take a break near their home by reducing forced mobility.

For Moreno, the services available must then be optimized with the use of digital technologies and collaborative models, transforming digitization into an inclusion factor and creating new generation multimodal public services.

Technological innovation can contribute profoundly to the improvement of services for citizens: the multitude of data available can become social objects and be designed for new uses in which new technologies and social inclusion are linked: from personalized public health to open spaces for culture, from open collaborative systems to the best quality of life for the third and fourth age.

Accordingly with the concepts illustrated above, the emblematic case of the former fair of Rome, interested by dismission and then isolation from the rest of the neighbourhood, will be illustrated.

The case study: methodology and results

The methodology used for the case study of the former fair of Rome is constituted by the collection and overlapping of both primary and secondary data. The primary data are constituted by the site visits (with photos, perceptive surveys, analysis of the built environment, mobility system, green system, and main users and uses), the study of the planimetries of the place and its surroundings (related to the built environment, mobility system, green system) and the proposed project interventions. The secondary data are constituted by the bibliographical research of the history of the former fair, the general regulatory plan variant, and the process of participation.

Accordingly, the case study will be illustrated in relation to: a brief history of the place; the 2011 variant of the 2008 general plan of Rome (Italian acronym P.R.G.); the results of the 2015 process of participation carried out by the Rome municipality and the 2020 agreement for the redevelopment of the former fair approved by the Municipal Assembly; the outcomes of the analysis of place and the proposed project interventions carried out in the framework of the Urban Planning Course at DICEA Sapienza University of Rome by the author of this study and her students according to the achievements of both the analysis and the 2015 process of participation also in relation to the questions related to proximity.

Fig. 1: Rome, the study area with, starting from the right side, the former fair pavilions, the sport centre, the parking, the market, the second parking, the Mario Picchi park.

The project of the former fair of Rome is linked to the Universal Exhibition of Rome, scheduled for 1942, which was then blocked by the war, and until 1959 the Roman trade fairs took place in different areas from year to year.

In 1959 the Rome fair was completed, on the great urban artery of Via Cristoforo Colombo which connects Rome with Ostia. This is a temporary headquarters, which will remain in service for almost half a century. Over time, conferences, business tourism and large public administration competitions were added to the traditional trade fair activities. In 2006, a new headquarters was built, which takes the name of "New Fair of Rome", on Via Portuense close to the freeway to Fiumicino.

Then the 2011 variant of the 2008 general regulatory plan of Rome was carried out. It reports that the area of the former Rome fair is located in a consolidated city context, made up of: twentieth-century expansion fabrics of medium and high density, free construction and public greenery in close proximity to the Tor Marancia estate and the Appia Antica ancient park; a primary component of the network characterized by highly natural areas with the ditch system and the hydrographic network; and a component of completion of the system of connections with the ecological network, identified by areas with a strong anthropization character, for

which regulatory guidelines are envisaged aimed at redevelopment through specific environmental projects.
The objective is to activate the regeneration process which involves the location of a new settlement integrated with the context and with the ongoing transformations, based on innovation and quality, from a settlement, morphological and environmental point of view, with uses that are both integrative and complementary to existing ones.
The connoting character of the intervention takes the form of the structuring of a new residential settlement, equipped with commercial, office and public services facilities that integrate the existing or planned facilities within the neighbourhood.
The area is here conceived as a space that can be enjoyed mainly on foot, reducing incoming traffic to a minimum and isolating the routes in order to guarantee safety and tranquillity. Surfaces intended for non-residential activities must contain functions that are compatible and sustainable by the fabric within which these will be inserted.
With respect to the quantity, 67000 sm are for the built environment, of which 65% is intended for residential construction (and social housing), 20% destined for non-residential and 15% for flexible uses, a 28 m buffer zone (2011, Roma Capitale).
Then, a wide process of participation was carried out by the Municipality of Rome (2015). The listening process took place through participatory planning workshops between citizens, neighbourhood associations and the municipal administration, the results of which will be illustrated below in relation to three systems: built environment, green and mobility. With respect to the built environment, the first request was to think about the new interventions with a view to integrating them with the neighbourhood outside the former fair conceiving this as a continuum. It was also requested that the new neighbourhood be permeable and permeated with the rest, open and welcoming and that it becomes an opportunity to create the missing services. To this end, among the decisions, it was asked to review the surface area intended for residential use in favour of non-residential uses considered more urgent for this area, without prejudice to the economic-financial balance of the intervention. As regards residences, the laboratory requested to have buildings with the ground floor used for services, commerce, and other non-residential neighbourhood functions to create a living urban fabric even in the evening. The share of residential construction at controlled prices will also have to be distributed rather than concentrated in a single building.

Fig. 2: Rome, the wall of the former fair pavilions,
from the Via Cristoforo Colombo axis

Fig. 2: Rome, the former fair pavilions,
from the main entrance

In this regard, the possibility of creating individual large buildings which could constitute a visual and physical barrier to the internal spaces was excluded.
The creation of a multifunctional hub is also required with services distributed according to the rule of permeability with the other functions; and beyond realize retails and services within the ground floors of the residential buildings, it was required that these are designed in continuity with the rest of the new built system.
The activities proposed for the multifunctional hub should include: craftsmanship, business creation (start-up), spaces of intersection and cross fertilization between professions and trades, artistic and cultural activities, scientific, technological and environmental activities, educational activities.
With respect to the local services level, it was required to create a nursery and children's school, a comprehensive school, a health centre, and student accommodations. Particular attention is also required for the integration of disabled people into the social fabric they belong to, which could be realized through laboratory of art in its various forms.
Regarding the green system, the laboratory of participation expressed the desire to use part of the standard green areas as a garden with particular attention to biodiversity. In this regard, it was proposed to create compatible, functional and capacious community composting plants with respect to the settlement and surrounding areas.
The residents of the area could bring the wet waste and in exchange obtain useful fertilizer for the gardens, terraces and greenery of the area. Furthermore, the design of the new green system must be integrated with a system of internal squares, with green areas and pedestrian and cycle paths which will form public spaces that relates the buildings and connects the area with the surrounding neighbourhood.
This natural barrier will be open in some points – such as the urban gardens - with a path that will create a large green surface meant as a meeting place for the new neighbourhood and where the multidisciplinary hub will be located.
As regards to the mobility system, the new residential buildings should occupy the site of the former fair area according to a fabric system permeated with cycle and pedestrian paths, greenery and small squares that connect the area to the rest of the neighbourhood. The main connections must ensure sustainable and innovative mobility with privilege for public transport.
To protect against noise and air pollution generated by the heavy traffic on Via Cristoforo Colombo, the 28 m buffer zone envisaged by the variant will have to become a green area and public car parks acting as a natural filter through modelling of the terrain and the planting of various tree species useful for this purpose. The road surface of the Colombo section in front of the former Fair must be made with sound-absorbing materials as a further measure to reduce noise pollution.
The laboratory finally requested that the new buildings and streets be realized with simple and effective maintenance to prevent the new project interventions from degradation. To guarantee maintenance, it was required the greatest use of materials and methods that achieve the highest possible degree of maintainability of the materials and new artefacts, with characteristics of the materials and of the design definition suitable for defence against vandalism. It is also required to build buildings that are totally self-sufficient from an energy point of view as a model of the new housing culture.
As a result of this participation process, on 15 December 2020, the agreement for the redevelopment of the former fair of Rome area was approved by the Municipal Assembly; this reduces the amount of building construction available to 44 thousand sm, instead of the 67 thousand sm previously envisaged, of which 80% for residential construction (of which 20% social housing) and the remaining 20% destined for services. The agreement also provides for the complete transformation of the site in via Cristoforo Colombo with the demolition of the buildings and their replacement with new public and private functions.

According with the aforementioned information and the three systems – built environment, green and mobility - the analysis of the area concerning the sites bordered by Via Cristoforo Colombo and Via dell'Arcadia, Via di Grotta Perfetta and Viale di Tor Marancia, carried out in the framework of the Urban Planning Course, results as follows.

As regards the built environment, the analysed shapes a rectangle that in sequence presents: a park; a sport centre in use; an asphalt open space used for parking; an asphalt open space for market that is an important point of socialization; another asphalt open space used for parking; a non-completed sport centre in a state of abandonment; a little sport centre in use; the former fair pavilions bordered by a wall with many graffities that are not used and in a state of abandonment and totally asphalted. Close to the study area there are: a residential area of good quality, the Lazio Region building, a Roma Tre University building, a church, and an ambulatory.

As regards the green system, within the area there was observed the Don Mario Picchi park characterized by a not used playground, some benches, a path for pedestrian, lawn and trees with lack of care and suitable lighting. In the surrondings there are many little green spaces, and the Tor Marancia and Appia antica ancient park.

As regards the mobility system, the big axis which characterizes the margin of the area is the Cristoforo Colombo with 9 car lanes for a 25 metres section, a long lane of trees in the centre and a cycle lane with a lack of furniture reserved for cyclists: few meeting and stopping points (the only one is inside the Don Mario Picchi Park), E-Bike charging points, bike parking racks. It was also noticed an interruption in the cycle path in the intersection with Via dei Georgofili. Furthermore, despite the dense presence of shelters along via C. Colombo, the other streets, parallel and transversal to it, have no spaces dedicated to the bus stop, creating a congestion of the urban traffic. More in general, there are few connections for pedestrian, cycle or bus routes, which enhance the different parts of the study area, resulting disconnected and isolated.

From the perceptive analysis it was observed that: the visual perception of the wall that perimeters the area of the former Rome fair appears as a very strong delimitation which both does not allow for integrity with the urban context and constitutes a closure of the view with the surroundings; there is a strong and not agreeable sounds coming from the means of transport in Via Colombo; there is poor quality of the pavements in several streets and uncultivated and neglected flowerbeds; there is a sustained pace in via C. Colombo, via Tor Marancia and in some neighbourhood streets such as via Mario Musco.

Finally, as regards users, despite the proximity to the university, the residents are predominantly elderly, and there are also few families and children.

As results of those analyses and process of participation, the project interventions identified include the following.

First of all, it was decided to consider the 2020 municipality agreement that considers 44000 sm as a built area instead of the previous 67000 sm deliberated by the 2011 regulatory plan variant. The general idea was creating a place of identity continuity, a sort of sequence of wholly accessible open-air spaces – the sum of these shapes a rectangle – crossed by a long path that from Via di Tor Marancia to Via di Grotta Perfetta connects all the sequence of spaces.

As regards the built environment system, it will contain all the necessary services to be reached in no more than 15-20 minutes by foot or bike, namely: already existing functions for the inhabitants – the market and the sport -; some new ones according with the desires of locals, namely social housing with commercial ground floor; residences for students; a multifunctional centre and an open-air amphitheatre for different kinds of performances; art and music laboratories for people with disabilities and the elderly; shops, restaurants and bar open also in the evening.

Accordingly, the idea was to create an only one area as a sort of multifunctional and multigenerational place, - which takes into account both the urban identity, flexibility and

liveability - and that can change uses in different hours (e.g. a school can became a gym in the afternoon or shops can become laboratories of art in the evening). For this reason, it was decided to recover one of the existing warehouses of the former fair – the most identitarian one -, transforming it into a cultural hub, where various types of cultural activities can be carried out inside, creating a community centre of reference for residents.
Furthermore, it was decided to realize the new residential buildings with "pilotis" on the ground floor where various commercial environments are located and public activities can be included, such as libraries, study spaces, recreational spaces to offer services for every age group.
To make the area accessible to the various inhabitants of the neighbourhood, it was decided to insert a car park under the buildings.
As regards the green system, it was decided to reduce the waterproofed ground - improving the permeability of the soils - and the ground occupied by cars, and to separate the whole area from Via Cristoforo Colombo with a green filter that protects the area from both air and noise pollution. To enhance the greenery, it was decided to plant various trees on the paths and include pocket parks and parklets for the new residences and along the new and existing buildings that can create occasions for sports and physical activities, breaks, conviviality and socialization for all and with games for disabled and elderly people.
As regards the system of mobility to improve the proximity: the new path which connect the new area should include a pedestrian and bike lanes; Via Cristoforo Colombo should be decreased in terms of car lanes substituting these with trees and green spaces; all the existing transversal streets should be improved as regards the quality of the materials and furniture; new or recovered path should be designed to both connect the built environment with the different services and the green spaces of the study area with those of the surrounding and to realize a real continuity between new and old; and billboards and signs should be inserted for a suitable orientation. Finally, artistic elements during the path which connects the sequence of spaces of the area should be realized in the framework of laboratory of community with materials coming from dismissed pavilions of the former fairs and graffiti parts of the wall with borders the former fair, creating a further element of identity connection with the place and attachment from the inhabitants.

The proximity Charter

As a results of the process of participation and of both the analysis and proposed design interventions, the Charter of proximity was carried out by the author. This was presented at the 6° Biennial of Public Space titled Proximity and public spaces, that was held in Rome in May 2023. Objectives of the following Charter are to constitute a flexible, inclusive and updatable tool and become a sort of guideline for all interested to verify or realize proximity in public space. These objectives are important as cities change always more rapidly, and the 25 principles Charter has to be updatable accordingly. Also, the flexibility is important because not all places are the same and the principles must be adaptable to different peculiarities in an optic of inclusion.
The proximity city is a city where the main services can be reached in no more than 20 minutes on foot or by bicycle.
1) In order to create the city of proximity, places of identity continuity into which to divide it must be identified, depending on the size and organization of the territory.
Urban identity, understood as a set of characteristics that makes a place unique and recognisable, is in fact an important element so that proximity is not only related to functions but also to identity. All in reference to the size of the area it is intended to connect.
2) Urban continuity must be identified through a participatory process involving the main stakeholders of that specific place.

The participation process, as in any transformation activity, must be activated by identifying the main interested actors involved or to be involved in order that all the people who in different ways will be the users of the places and connected services can not only accept the changes but actively support these in their success.
3) The organization of proximity places must be entrusted to an organization that is the contact person for management and monitoring.
To ensure that the subjects involved in the proximity process are adequately connected to each other, it is useful constitute an organization capable of dealing with the management and maintenance of proximity spaces.
4) To facilitate the achievement of services in no more than 20 minutes, it is necessary to create or improve pleasant, attractive, healthy and liveable pedestrian and cycle paths.
To facilitate the reaching of proximity, it is not only necessary to create pedestrian and cycle connections, but to create pleasant and attractive routes connected to open spaces, squares with designs, quality furnishings artworks and equipment.
5) To allow everyone - the elderly, children, people with disabilities - to reach the services in no more than 20 minutes, the use of electric public transport must be encouraged.
In addition to creating pleasant routes, it is necessary to think about their use being as inclusive as possible, also providing routes for small electric minibuses for fragile people and children. Cycle-pedestrian connections and those for electric minibuses must be designed considering suitable separation.
6) To create proximity, it is necessary to create communities, i.e. actions, policies, projects that favour the aggregation of people.
It is also necessary to encourage the creation of actions capable of bringing people together by supporting communities of citizens who can decide together to transform small parts of territories or buildings to create reinvented aggregations.
7) Proximity must be understood from a perspective of temporal and spatial flexibility, i.e. adaptability to the peculiarities of places and changing needs and users. Proximity services concern:
8) commercial services: food shops with all categories of food, retail shops with all the main goods needed for daily living, local markets, repair and cleaning shops (laundries, tire changes, etc.)
9) health services: clinics, polyclinics, clinics, for blood tests, blood pressure measurement, medications, vaccinations, sociological consultation, and everything needed for prevention and satisfaction of the main social and health needs
10) educational services: nursery schools and schools of all levels
11) cultural services: neighbourhood libraries, pop-up reading points, small theatres, exhibition galleries
12) leisure services: attractive, liveable public spaces, with activities for all age groups and abilities
13) sports services: gyms, outdoor sports equipment, playgrounds, spaces for inclusive physical activity
14) catering services: restaurants, bars, catering places
15) leisure services for pets: off-leash and/or play spaces dedicated to dogs
16) care and well-being services: shops and/or centres for beauty and personal care
17) digital services: digital coverage of the area
18) work services: co-working spaces
19) separate waste collection services: dedicated areas that are liveable and accessible
20) worship and religion services: churches, oratories, places of worship.
Principle 7 to principle 20 concern the services to be included to create proximity. These services can be expanded or reduced, but also modified with a view to a flexible proximity over

time and adaptable to different or sudden needs. No place is the same as another, as different are populations and their needs, which are combined with those of city users, visitors and users of various types.

21) The services should be located in existing buildings with a view to regeneration and multipurpose use of the spaces.

In order to avoid land consumption, physical services must be placed in existing buildings with a view to multi-use at different times, so that a building can be used at different times of the day for different purposes.

22) The proximity of services must be combined with the proximity of greenery and open spaces

Green spaces are another important element to consider in the construction of proximity in a vision of a network between existing green spaces and the naturalization of mineral spaces to create paths attentive to the healthiness of people.

In continuity, the creation of local urban gardens should also be taken into consideration.

23) Places of identity continuity should have signs and billboards, including digital ones, indicating services, activities and points of interest to be reached within 15-20 minutes.

To facilitate orientation and offer a coordinated visual identity in the nearby city, adequate billboards and signs must be created that make the places and services to be reached in a short time immediately understandable. Digital systems such as QR codes can be integrated into the signage which provide further information on proximity services.

24) Proximity is an important factor for the valorisation of places and cultural resources from an inter-scalar and multi-scalar network perspective.

Proximity can be an opportunity to enhance little-known cultural resources, murals, small sculptures, landscapes which, crossed or flanked by pedestrian and cycle paths, could be revealed or observed with greater attention.

25) The new polarities created by proximity constitute new territorial models that will contribute at creating new urban identities capable of adequately comparing with pre-existing ones.

The paths to obtain proximity will finally create new polarities and with them new movements of people and ideas but also new identities not overlapping with the previous ones but intersecting.

Conclusions

The study - carried out in the framework of the 2020 SUMMA PRIN research project that has among the objects to create guide lines for resilient, healthy and flexible places - has illustrated the questions related to proximity regeneration both in theoretical and empirical terms. The city of proximity can be defined as a city able to offer to all its inhabitants everything they need to live, work and have fun to be reached on foot or bike in no more than 20 minutes. Strongly connected to these concepts are the flexibility, important to obtain change uses of places and buildings, inclusion, to assure that proximity is for all and in particular for fragile people and accessibility, to create a network of public spaces open and well connected.

The empirical parts were related to the study case of the former fair of Rome dismissed in 2006 and then in state of abandonment, waiting to be regenerated. The case study was illustrated in relation to: a brief history of the place, the 2011 variant of the 2008 general plan of Rome, the results of the 2015 process of participation carried out by the Rome municipality, and the 2020 agreement for the redevelopment of the former fair approved by the Municipal Assembly; and the outcomes of the analysis of place and the proposed project interventions carried out in the framework of the Urban Planning Course at DICEA Sapienza University of Rome, according to the achievements of both the analysis and the 2015 process of participation also in relation to the questions related to proximity.

In the proposed design of project interventions, it was decided to consider the 2020 municipality agreement that considers 44000 sm as a built area instead of the previous 67000 sm deliberated by the 2011 regulatory plan variant. The general idea was creating a place of identity continuity, a sort of sequence of wholly accessible open-air spaces crossed by a path that from Via di Tor Marancia to Via di Grotta Perfetta connects all the sequence of spaces. Accordingly, the idea was to create an only one area as a sort of multifunctional, inclusive and multigenerational place, - which takes into account both the urban identity, flexibility and liveability - that can change uses in different hours and in which all the necessary services can be reached in no more than 15-20 minutes by foot or bike.

As a final result, the 25 principles Charter of Proximity was illustrated, which consists in a holistic tool for design or verify proximity in an area and assure equitable accessibility.

Objectives of the following Charter are to constitute a flexible, inclusive and updatable tool and become a sort of guideline for all interested to verify or realize proximity in public space. These objectives are important as cities change always more rapidly and not all places are the same, and the 25 principles should be updatable accordingly in an optic of inclusion.

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Evaluation and Spatial Governance Strategies for Old Residential Areas' Renewal and reconstruction in Urban Downtown Districts: A Case Study of 70 old residential areas in Changzhou ,China

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Abstract

As vital components of urban renewal efforts in old city districts, old residential areas play a crucial role in rejuvenating regional vitality, enhancing residents' well-being, and fostering sustainable economic and social development in cities. Taking the example of the transformation of old residential areas in the Zhonglou District of Changzhou City over the past three years, a comprehensive assessment is conducted.By integrating the theory of a full life cycle, a holistic evaluation system for the renovation of aging residential communities is established to assess the project comprehensively. This evaluation system focuses on three dimensions: space, services, and culture, in order to evaluate overall resident satisfaction across all elements.Finally, long-term governance strategies are proposed from four dimensions: government governance, social operations, engineering projects, and economic funding.

Keywords

Old residential area,Renewal evaluation, Spatial governance

Introduction

With the accelerated process of urbanization and rapid population growth, some old residential areas face the imminent threat of decline and contraction, posing a critical issue of how to rejuvenate these communities (Schenkel, 2013). Old residential areas, integral components of urban downtown districts, need to consider various influential factors including multi-stakeholder participation (Bovaird, 2007), preservation of historical heritage (Said, Aksah, and Ismail, 2013), infrastructure upgrading and redevelopment, resident satisfaction (Gu et al., 2019), and the diverse needs of marginalized groups (Clark, Kearns, and Cleland, 2016). The renewal of old residential areas holds paramount significance in revitalizing regional vitality, enhancing resident well-being, and fostering the sustainable development of urban economics and social aspects.

On the practical front, Singapore, Japan, and Western countries initiated urban renewal projects in the 20th century, tailoring innovative transformation models to address issues such as elderly care and employment for low- and middle-income groups based on their respective development contexts. Tokyo actively engages in the transformation of old residential areas, exemplified by projects like Hanada and Takashima, leveraging both governmental and private sector efforts to create multi-party agreement platforms that ensure smooth renovation processes. Regions like Sweden, Denmark, and the Netherlands prioritize community aging adaptation and eldercare service facility configurations. In the Eastern New York Neighborhood Plan in the USA, there's an emphasis on the mixed-use of community street spaces, highlighting the shaping of public areas during transformations.

Compared to international efforts, China's old residential area renovations started relatively late. Since its initiation in 2020, significant progress has been made but challenges such as long-term operation difficulties and governance shortcomings have emerged. In July 2023, China's Ministry of Housing and Urban-Rural Development issued the "Notice on Solid Progress in the Renovation of Old Urban Residential Areas in 2023," proposing qualitative and quantitative analyses to evaluate the current phase of renovations and strengthen the analysis of experiential issues.

As phases of old residential area renovation projects are complete, many Chinese cities are evaluating and providing feedback on completed work at the district level. The Ministry of Housing and Urban-Rural Development surveyed residents of old residential areas in eight pilot cities in Shandong, Zhejiang, Shanghai, and Suzhou in 2022, focusing on residents' subjective satisfaction. Cities like Tianjin's Binhai New Area, Ningbo's Fenghua District, and Nanchang's Donghu District are conducting annual performance evaluations of old residential area renovation projects. Changzhou, as one of Jiangsu Province's pioneering cities in old residential area renovations, has numerous typical samples for evaluation, aiding in systematically addressing issues and demands during renovations and improving management methods and resource allocation for future projects.

Literature review

Research on the renovation of old residential areas mainly includes aspects such as policy analysis, renovation models and strategies, and community governance. In terms of policy analysis, some scholars analyze the advantages and disadvantages of policy samples through textual analysis of renovation policies and quantitative evaluation (ZHANG et al., 2022); while others analyze the policy systems and implementation measures for the renovation of old residential areas in domestic and foreign cities (Lu , 2023). In terms of renovation models and strategies, scholars usually conduct research around a certain element involved in the renovation of old residential areas, such as spatial renovation(MA et al., 2021), sponge-city transformation (LI, GU and WANG, 2019), funding input (LI and ZHANG, 2019), etc.; or from the perspective of micro-renovation (CAI , YANG and LI , 2017), community renewal (Dai , Wang and Dong , 2019), etc., exploring the content and countermeasures of renovating old residential areas. In terms of community governance, some scholars analyze the conditions for social forces' participation and the ways of benefiting, constructing a community governance system for social forces to participate in the renovation of old residential areas (XU and XU, 2020); or from the perspective of resident participation, analyzing the paths and strategies that promote resident participation in governance in the renovation of old residential areas (LI, GU and ZHU, 2020); there are also scholars exploring informal governance models based on communities from the perspective of community administration (ZHAO , LIU and WEN , 2023).

Research on the evaluation of renovation projects for old residential areas is still in its early stages. Researchers usually evaluate the implementation effects of renovating old residential areas from a specific perspective, with significant differences in indicator selection. Some papers have evaluated the effectiveness of renovating old residential areas in a specific aspect

from perspectives such as environmental suitability (LI and WANG, 2016), aging-friendliness (HU, MA and HUANG, 2021), comprehensive environmental improvement (ZHANG, LI and GU, 2021), material space renewal (WEI, 2022), etc.; while others have started from the perspective of project performance evaluation (LI, SI and BAI, 2021), analyzing the comprehensive benefits and outputs of renovating old residential areas.

Through a review of existing theoretical research, it becomes evident that the evaluation of renovation projects in old residential areas encompasses various dimensions. Nevertheless, a comprehensive evaluation system addressing the entire project life cycle remains absent, with a limited number of studies offering comprehensive reviews and summaries of renovation efforts in old residential areas. Drawing upon existing research and practical experiences, this study examines the renovation of old residential areas in Zhonglou District, Changzhou City, employing life cycle theory to develop an evaluation system and establish an evaluation framework at the district level for such renovations. Subsequently, empirical research is conducted.

Research Demands and Objectives

Research Demands

1. The renovation of old residential areas is influenced by various factors such as the scale of construction, construction era, construction subjects, personnel composition, spatial location, and more. It is urgent to propose classified and graded renovation and optimization strategies through scientific evaluation. Effectively enhancing residents' satisfaction is one of the important goals of the renovation work.

2. The factors influencing satisfaction are diversified, including the cultural atmosphere of the community, the organization of activities, personnel composition, and the situation of residents' families. To more effectively guide future work, it is necessary to conduct scientific and systematic research to accurately identify the core contributing factors that enhance residents' satisfaction before and after the renovation, precisely match residents' needs, and effectively improve their satisfaction.

Research Objectives

Based on the two core demands mentioned above, this study aims to establish an evaluation framework with the following objectives:

Incorporating the concept of a full lifecycle, this study comprehensively considers the types of renovation and facilities involved in the renovation of old residential areas. It evaluates the entire renovation process from multiple dimensions, including the output of renovation projects, the quality of renovation works, the management of renovation operations, and the comprehensive benefits of renovation. This evaluation framework encompasses multiple stakeholders, such as residents, community (street) leaders, property management companies, and construction companies.

Furthermore, this study aims to verify the accuracy of the evaluation results by surveying residents' satisfaction after the renovation. Through questionnaire surveys comparing

satisfaction levels before and after the renovation, as well as satisfaction with individual elements and among key demographic groups, this study aims to scientifically identify the proportion of satisfaction improvement brought by the renovation of the community. This will provide sufficient data support for the implementation of future work.

Finally, based on the evaluation content and results of these two parts, this study aims to summarize the experiences and issues encountered during the renovation process and propose long-term governance strategies for community renovation from multiple dimensions.

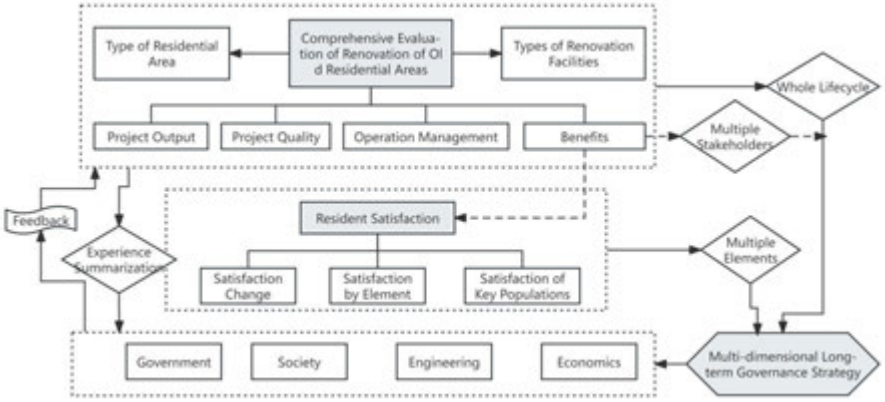


Figure 1 Research Framework

Research Design and Methodology

Construction of a Comprehensive Evaluation System for Renovation

The concept of the whole lifecycle, originating from project management science, is used to describe the various stages of a project from its inception to its completion. The application of the whole lifecycle theory to the evaluation of renovation projects in old residential areas helps align the evaluation chain with the various stages of the renovation project. This approach establishes a comprehensive evaluation process that integrates problem identification, resource allocation, implementation planning, supervision and feedback, as well as summary and improvement. It avoids issues such as incomplete element selection and biases in evaluation focus, providing a basic framework for the implementation, management, and evaluation of future renovation projects in old residential areas.

In light of the planning and construction characteristics of renovation projects in old residential areas, the whole lifecycle of these projects can be divided into four main stages: pre-decision stage, implementation and renovation stage, operation and maintenance stage, and benefit evaluation stage. By further aligning the evaluation process with each stage of the whole lifecycle, an evaluation system for renovation projects in old residential areas can be constructed (Figure 2).

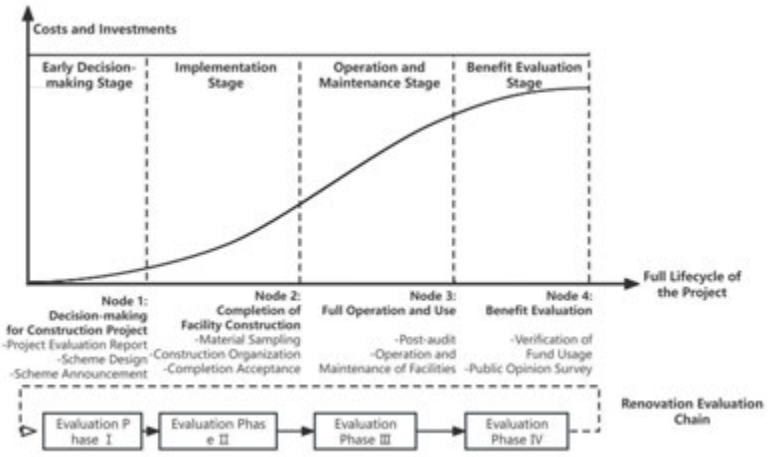


Figure 2 The lifecycle stages of renovation projects in old residential areas

(1) Early Decision-making Stage

Prior to the design of the renovation scheme, it is necessary to conduct a physical examination and assessment of the current operational status of the old residential areas to identify the main issues they face. During this stage, various methods such as field research, interviews, and big data analysis are typically employed to comprehensively evaluate the internal and external environments of the old residential areas. A comprehensive project evaluation report is then formulated. Next, based on the results of the physical examination and assessment, a list of renovation projects for the corresponding old residential areas is compiled. By considering residents' renovation preferences and funding estimations, renovation projects with urgency and feasibility are reasonably selected. This ultimately leads to the formation of a planning and design scheme with clear objectives, reasonable implementation plans, and high recognition among the residents. The indicators of this stage reflect the completeness of the physical examination and assessment results as well as the renovation project list.

(2) Implementation Stage

The implementation stage of the renovation of old residential areas involves multiple aspects such as authorization, execution, supervision, and management control of the renovation projects. During the implementation process, apart from focusing on the completion of construction objectives and the engineering benefits generated by the project, attention should also be paid to residents' satisfaction with the construction progress and the collection and feedback of public opinions. Residents should be encouraged to participate in supervising the renovation process. At the end of the implementation stage, acceptable renovation results should be achieved, with the project accounting settled and residents' feedback addressed appropriately. The indicators of this stage mainly focus on the engineering construction progress during the renovation process as well as the construction status of various facilities at key completion milestones.

(3) Operation and Maintenance Stage

The operation and maintenance stage of the renovation project for old residential areas is a crucial part of the entire lifecycle. At this stage, the spatial renovation and facility configuration for the old residential areas have been fully completed. It is necessary to establish corresponding operation and maintenance institutions or organizations and establish a long-term management mechanism for the residential areas to ensure the sustainable operation of the renovation projects. The quality of operation and maintenance is directly related to whether the project can effectively radiate and drive surrounding areas, and it also influences residents' evaluation of the project. The indicators of this stage assess the operational management status of the old residential areas based on the completeness of institutional systems and actual communication.

(4) Benefit Evaluation Stage

For the completed renovation of old residential areas, a "looking back" process should be implemented. Through the evaluation and measurement of the project's implementation benefits, a comprehensive understanding of the actual outcomes of the project's implementation should be obtained. Incorporating the evaluation and analysis of the renovation benefits of old residential areas into the lifecycle stage of the renovation project helps the government to make a deeper judgment on the social and economic benefits generated by the renovation project. The indicators of this stage demonstrate the benefits brought by the renovation project from both economic and project recognition perspectives (Table 1).

Table 1 Comprehensive Evaluation Index System for Renovation of Old Residential Areas

Primary Indicators	**Secondary Indicators**	**Explanation of Indicators**
Early Decision-making Stage	Type of Residential Area	Proportion of improvement and upgrade renovation projects among the types of community renovation projects
	Types of Renovation Facilities	Whether the types of renovation are comprehensive
	Number of Renovated Facilities Produced	Output of renovation and construction of facilities in old residential areas
Implementation Stage	Civility in the construction process	Whether the implementation process of the project construction meets relevant safety and civilization management regulations
	Qualification rate of renovation works	Operational and maintenance status of completed renovation projects
Operation and Maintenance Stage	Completeness of Management Organization	Whether the organization and business management system of the project implementation unit is sound
	Effectiveness of multi-stakeholder communication	Whether the communication channels between residents, construction parties, and the government are complete
Benefit Evaluation Stage	Project recognition	Residents' recognition of the project
	Efficiency of economic investment	Whether the improvement in residents' satisfaction is proportional to the capital

	investment per unit of renovation area in the community

Satisfaction Evaluation System and Questionnaire Design

Based on the "Technical Guidelines for Renovation of Old Residential Areas in Jiangsu Province (2021)"(jsszfhcxjst.jiangsu.gov.cn, n.d.) and the "Technical Guidelines for Renovation of Old Urban Residential Areas in Jiangsu Province (2022)" (jsszfhcxjst.jiangsu.gov.cn, n.d.), this article draws on the widely referenced evaluation systems for physical spatial environment and public service levels in existing research . By combining emotional value evaluation methods based on residents' perceptions, a comprehensive satisfaction evaluation system encompassing three dimensions of "space + service + culture" and 22 indicators is constructed. The Likert five-point scale is adopted to collect and analyze data on a per-element basis.

Among these, satisfaction with the spatial environment is the most obvious and intuitive aspect of the renovation of old residential areas, and it is also the core content of the early renovation work. Satisfaction with supporting services involves various aspects such as hygiene, parking, elderly care, property management, and safety, reflecting the comprehensive renovation level and humanistic care. Cultural satisfaction covers content such as cultural atmosphere creation, information communication, and dispute resolution efficiency, demonstrating the fine level of renovation and the changes in life brought about by the renovation. In addition, further attention is paid to changes in satisfaction before and after the renovation, as well as the impact of the renovation on surrounding areas and residents' activities (Figure 3).

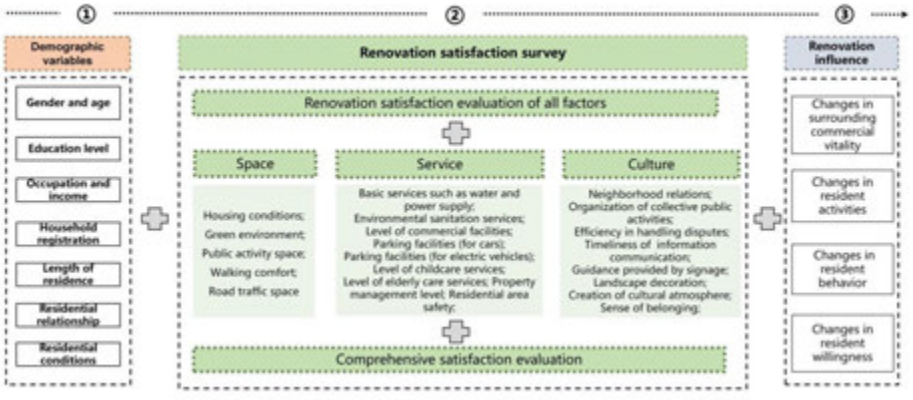


Figure 3 Questionnaire Design and Evaluation Indicators

Research Objects and Data Processing

The Zhonglou District of Changzhou City, located in the central area of Changzhou City, Jiangsu Province, is a core urban area with a long history. In recent years, some old urban residential areas in Zhonglou District have faced issues such as aging infrastructure and incomplete facilities, necessitating renovation and upgrading works. The renovation projects for old residential areas in Zhonglou District of Changzhou City are carried out on a street-by-

street basis, with the old residential areas within the area being classified into two types: improvement type and upgrading type[1].The research objects of this study are 70 old residential areas in Zhonglou District of Changzhou City that started renovation and upgrading from 2020 to 2022 (all built before 2000). More than 90% of them are located in the old city revitalization demonstration area of Zhonglou District, covering both the inner and outer parts of the old city of Changzhou. From 2020 to 2022, a total of 49,126 households were covered by the renovation, with a total building area of 4.0386 million square meters.

Through a comprehensive survey of the implementation of renovation in 70 old residential areas in Zhonglou District, Changzhou City, 1200 valid resident questionnaires and quantitative data on capital investment and engineering construction in each residential area were obtained. Among them, a judgment matrix (see formula 1) was constructed, and the 1-9 scaling method was used to compare the relative importance between renovation evaluation indicators. A questionnaire for judging the importance of indicators was designed. Experts from planning institutions, universities, and street management departments were invited to score the importance of the indicators. Decision-making expert Meta-decision software Yaaph was used to process and analyze the data, obtaining the weight values of the renovation evaluation indicators（Table 2）.

$$A = (a_{ij})_{m\times n} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix} \quad (1)$$

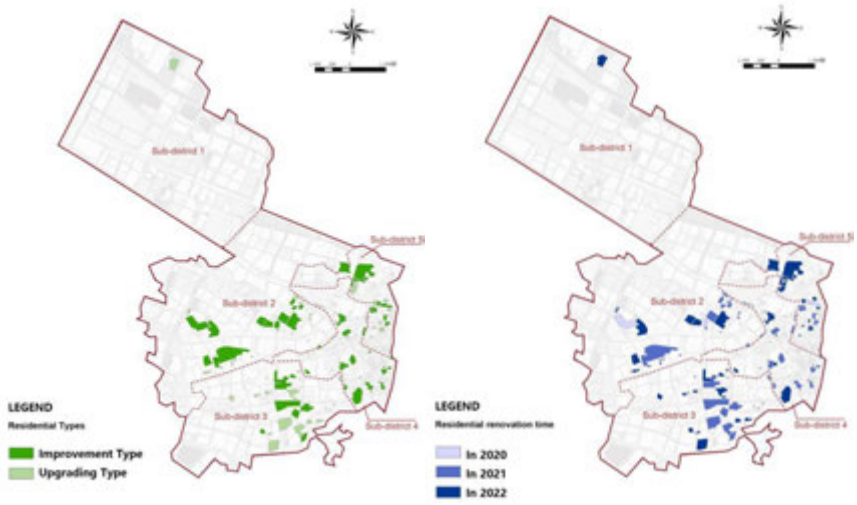
Note: a_{ij} represents the ratio of importance between row factor i and column factor j. When a_{ij} is 1, the two indicators are equally important. The larger the number, the higher the importance of row factor i compared to column factor j.

Table 2 The weight of the evaluation index system

Primary Indicators	Weight Values	Secondary Indicators	Explanation of Indicators
Early Decision-making Stage	15.48%	Type of Residential Area	7.79%
		Types of Renovation Facilities	7.69%
Implementation Stage	39.22%	Number of Renovated Facilities Produced	16.29%
		Civility in the construction process	10.86%
		Qualification rate of renovation works	12.07%
Operation and Maintenance Stage	15.55%	Completeness of Management Organization	10.53%

[1] According to the "Technical Guidelines for Renovation of Old Residential Areas (Creation of Livable Residential Zones) in Jiangsu Province," improvement-type renovations emphasize improving residents' daily lives and enhancing the environmental facilities of the community, while upgrading-type renovations focus more on improving social service provision and enhancing the quality of life.

Benefit Evaluation Stage	29.75%	Effectiveness of multi-stakeholder communication	5.02%
		Project recognition	9.92%
		Efficiency of economic investment	19.83%



(a) (b)

Figure 4 Spatial layout of the old residential areas

(a. Residential Types, b. Residential renovation time)

Results

Comprehensive Evaluation Results of Renovation

In accordance with the performance scoring and rating method outlined in the "Measures for the Administration of Performance Evaluation of Project Expenditures" issued by the Ministry of Finance , the total evaluation score is set at 100 points and divided into four tiers. Specifically, a comprehensive score of over 90 points is considered excellent, 80-90 points is considered good, 60-80 points is considered passable, and below 60 points is considered in need of improvement. For the secondary indicator level, the weights of each indicator are converted into specific scores based on a hundred-point system, and the scoring criteria remain consistent with the comprehensive scoring standards. Based on the comprehensive evaluation results of the renovation, the residential areas can be divided into four categories: demonstration communities with excellent renovation results, communities with good evaluation results, qualified communities with one or two shortcomings, and general communities whose evaluation results need to be improved. Figure 5 displays the comprehensive evaluation results of the four types of communities. It should be noted that some scattered residential buildings, due to the limited scope of renovation and the lack of representative data results, are not included in the evaluation results indicated on the map.

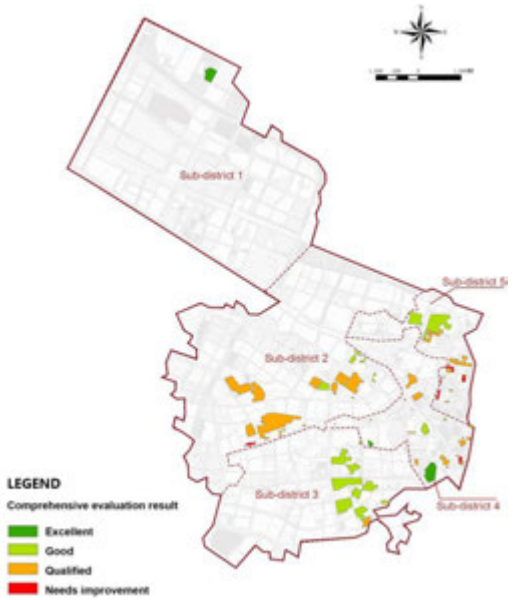
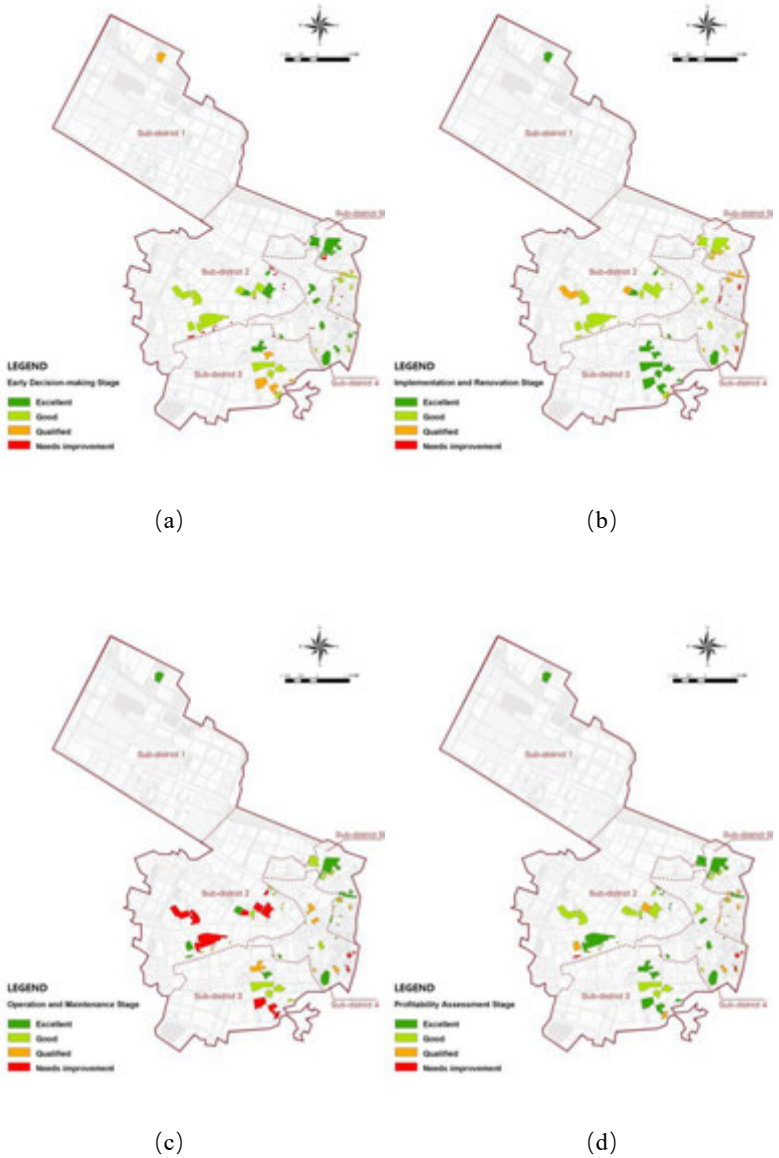


Figure 5 The comprehensive evaluation results of the renovation project

Based on the scoring results of each stage of the life cycle of each residential area, it is found through comparison that:

(1) Excellent and good demonstration residential areas in renovation have made sufficient preparations in terms of preliminary scheme design, engineering construction organization, and later operation and maintenance. Moreover, the construction units have also adopted finer manufacturing techniques, optimized construction methods, and more durable construction materials during the construction process to ensure the effectiveness of various facilities.

(2) For the old residential areas with problems, the main issue is that the effect of the renovation project is difficult to meet various requirements throughout the renovation process of the old residential areas. For example, in terms of building construction, some apartment blocks in some residential areas have issues such as peeling walls and balcony leakage, which have not been promptly addressed during the renovation; in terms of additional parking spaces, some residential areas are limited by their own site conditions and need to vacate parking spaces by reducing green activity spaces, leading to conflicts among residents of different ages; in terms of landscaping, due to the lack of professional greening management teams or property companies, the greening management and maintenance work after the renovation of old residential areas is difficult to carry out in a timely and effective manner; in terms of facility renovation, some old facilities in some residential areas have not been replaced in time, and there are also phenomena of secondary damage after replacement.



(a) (b)

(c) (d)

Figure 6 Evaluation Results for Each Lifecycle Stage

(a. Early Decision-Making Stage, b. Implementation and Renovation Stage, c. Operation and Maintenance Stage, d. Benefit Evaluation Stage)

Evaluation Results of Residents' Satisfaction

The evaluation results indicate that since the renovation of the old residential areas in Zhonglou District, the satisfaction of the residents has significantly improved, with an overall increase of 21.87%. Specifically, the satisfaction levels in the spatial dimension, service dimension, and cultural dimension have increased by 25.32%, 21.44%, and 19.78% respectively (Figure 7). Among the single factors, the improvement in walking comfort stands out the most, as the partial separation of pedestrians and vehicles, road hardening, and the improvement of public spaces have significantly enhanced the quality of daily life for residents. Additionally, through the renovation, most of the residential areas have added access control and garbage classification facilities, leading to a notable increase in satisfaction with environmental hygiene and community safety. Furthermore, the integration of cultural elements of some neighborhoods with wayfinding signage design during the renovation has been widely recognized by residents.

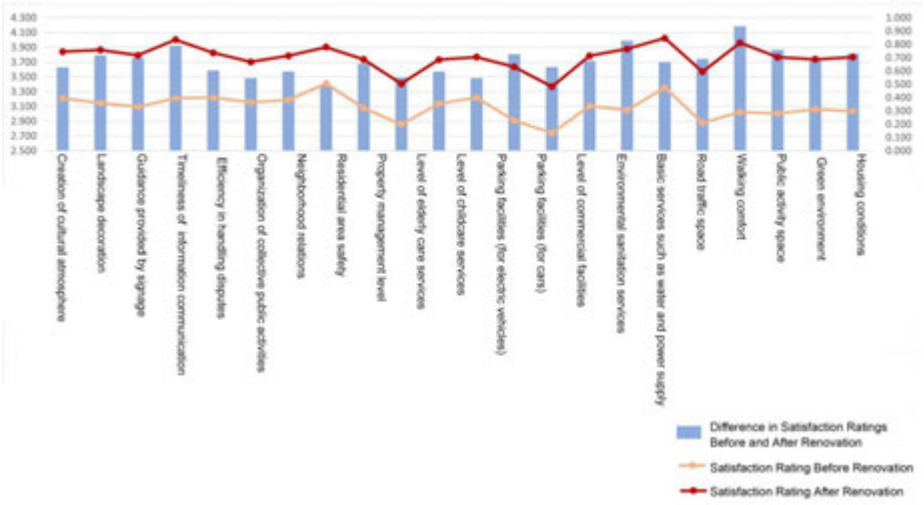


Figure 7 Changes in Satisfaction Ratings for Different Factors Before and After Renovation

However, the difficulty of parking for motor vehicles remains the most prominent issue in old residential areas. Additionally, problems such as inadequate property management, a shortage of human resources, and insufficient introduction of property management companies in old residential areas have generally affected the satisfaction ratings for property management.

The proportion of elderly individuals in the renovated old residential areas is generally high, and whether their living needs have been met during the renovation process has become an important factor influencing satisfaction. The changes in satisfaction among the elderly population towards various facilities before and after the renovation are basically consistent with the overall situation. However, satisfaction levels in areas such as elderly care, parking, and greening are relatively low (Figure 8). The focus on elderly care facilities during the renovation process was not high, and the main renovation content involved elderly canteens and meal assistance services. Although some neighborhoods provide elderly canteens and meal

assistance services on a community-basis during the survey, this service has not yet been popularized in all residential areas. Furthermore, the elderly population often has a high demand for green environments, which conflicts with the demand for parking spaces among other younger and middle-aged groups. The improper management of parking spaces by property management companies later on has led to chaotic parking, which not only encroaches on the activity spaces and green spaces of the elderly but also poses safety hazards for their travel.

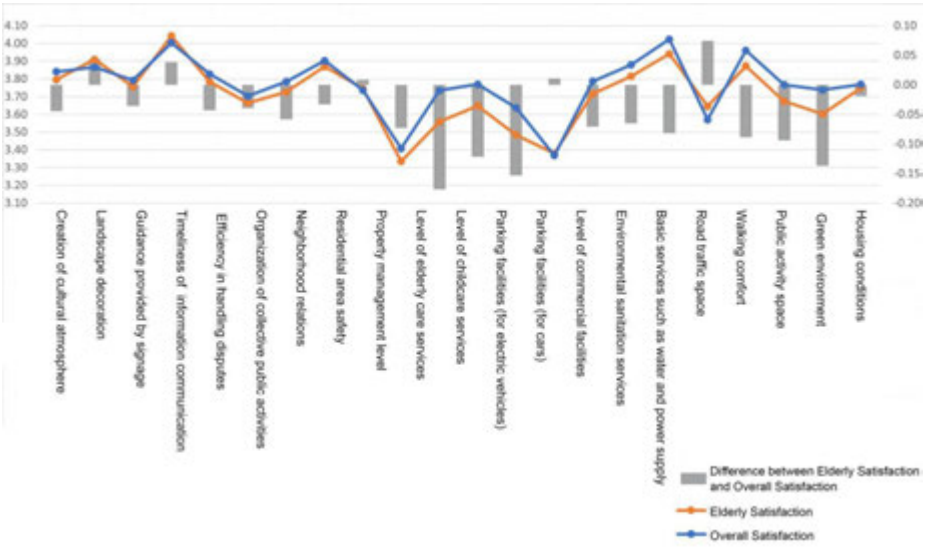


Figure 8 Comparison between Satisfaction of Elderly Groups and Overall Satisfaction

Summary

In recent years, the number of old residential areas included in the renovation scope in Zhonglou District has continued to increase, with the renovation involving a wider range of diverse content and increasingly rich connotations and levels. Through a comprehensive assessment, it can be found that the current core contradiction mainly manifests as a focus on renovation over management. Particularly, difficulties in introducing property management after renovation and the lack of flexibility in using remaining funds have led to a large number of issues arising in the later stages of the residential areas. These issues include patches of bare soil in the green spaces, unmanaged parking spaces, inadequate garbage classification, and difficulties in rapidly accessing firefighting facilities. These problems have seriously affected residents' evaluation and satisfaction with the renovation results.

Suggestions

Based on the analysis of existing issues and the interpretation of relevant policies, this paper draws on the experience of old residential area renovation from both domestic and international contexts to propose targeted long-term governance strategies for the renovation of old residential areas from four dimensions: government, society, engineering, and economy

Dimension of Government Governance: Improving Long-Term Management and Emphasizing Multi-Dimensional Linkages

Optimize the long-term management mechanism, advocate a multi-party co-governance system, and establish a governance system with the participation of grassroots party organizations, community residents' committees, owners' committees, and property management enterprises. Strengthen the leading role of grassroots party organizations in party building and coordinate the handling of various mass affairs; stimulate the supervisory role of owners' committees and actively participate in the follow-up management and effect feedback of the renovation plan; promote cooperation between property management enterprises and party organizations to jointly promote community governance activities. Provide multiple information transmission channels and combine online platforms to timely report community governance information and ensure the right to know for residents in the community. Establish long-term management evaluation standards, normalize the work of conducting "look-back" assessments on the renovation of old residential areas, and conduct graded and categorized acceptance inspections on the management effectiveness of renovated old residential areas.

Dimension of Social Governance: Encouraging Multi-Party Participation and Implementing Classified Management Models

Encourage property management enterprises to actively participate and explore diversified property management models. Research a trinity model combining government underwriting and trusteeship, residents' self-management, and property enterprise management based on the principle of "one community, one policy." For communities that do not meet the conditions for introducing market-oriented property management, an owner self-governance management model can be adopted. For communities that already have property management enterprises, it is necessary to actively promote service upgrades to meet residents' high-quality needs and stimulate enterprise enthusiasm through market-oriented means. Reduce property management costs and minimize "small, scattered, and isolated" communities through management models such as "connectivity, merger, and trusteeship."

Dimension of Engineering Governance: Addressing Facility Shortcomings and Promoting Facility Upgrades

Regularly conduct self-inspections of infrastructure renovation projects, coordinate with communities, and organize construction units to actively make rectifications to ensure smooth and level roads and unobstructed drainage systems in the community after renovation, safeguarding residents' basic daily travel environment. Enhance the quality of housing through improved technological processes, promote the adoption of technologies and materials that are innovative, mature in process, meet quality standards, and have controllable costs, maintain the unity of styles and materials for the renovation of old residential areas in different districts, and achieve organic integration with the cultural heritage and stylistic characteristics of the community. Scientifically assess and accelerate the updating of infrastructure pipelines and ducts with potential safety hazards such as water supply and heating systems, and strengthen the supporting infrastructure for fire safety.

Dimension of Economic Governance: Innovating Financing Models and Using Special Funds Flexibly

Innovate pilot fund sharing and sharing mechanisms, improve fund allocation rules, and raise renovation funds through general public budgets and government bonds. Pilot the introduction of a flexible fund use mechanism, where a smaller proportion of land transfer income from newly added residential land can be extracted as special funds for the renovation of old residential areas, with the remaining portion allocated according to regulations. Increase government financial support, attract market forces to participate, encourage qualified state-owned enterprises to participate in the renovation as scaled implementation and operation entities, and further explore various funding methods.

Conclusion

Based on the concept of a full lifecycle, this article constructs a comprehensive evaluation system for the renovation of old residential areas, aiming to provide a scientific and reasonable evaluation standard for relevant departments to accurately grasp the issues and contradictions in the renovation of old residential areas. An empirical analysis of the renovation of 70 old residential areas in Changzhou City shows that there are still core issues such as insufficient public participation, prominent contradictions in the needs of different groups, inadequate facility maintenance, and a lack of long-term management mechanisms during the renovation process of old residential areas. In the future renovation of old residential areas, it is necessary to further combine the characteristics and needs of the renovation of old residential areas in the region, identify the positioning of the management subject, straighten out various relationships, strengthen the multi-level linkage management model of district-street-community, focus on establishing corresponding operation and management organizations or platforms at various stages of the project's full lifecycle, and explore the formation of sustainable renovation and management models for old residential areas.

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Women's Participation in the Context of Urban Renewal in China: A Case Study of Yulin Community in Chengdu

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Abstract

As one of the main concerns of urban studies, more and more scholars have paid attention to the interaction of the government, community, residents and other stakeholders in the process of urban renewal, as well as the significance of participatory planning for the sustainability of cities. Strikingly, however, there are few studies on the gender dimensions of participants. In fact, in an urban renewal project in Yulin Community of Chengdu, I observed that women were the major participants in the process. Therefore, this study uses the theory of intersectionality to analyse the three different female groups in this urban renewal project, including professional women, female community workers and female resident activists. The diverse rights, knowledge, ethics and other backgrounds held by different female groups led to complex participation motivations, processes and outcomes, to fill the research gap of the gender dimension in the participation process.

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Abstract

As one of the main concerns of urban studies, more and more scholars have paid attention to the interaction of the government, community, residents and other stakeholders in the process of urban renewal, as well as the significance of participatory planning for the sustainability of cities. Strikingly, however, there are few studies on the gender dimensions of participants. In fact, in an urban renewal project in Yulin Community of Chengdu, I observed that women were the major participants in the process. Therefore, this study uses the theory of intersectionality to analyse the three different female groups in this urban renewal project, including professional women, female community workers and female resident activists. The diverse rights, knowledge, ethics and other backgrounds held by different female groups led to complex participation motivations, processes and outcomes, to fill the research gap of the gender dimension in the participation process.

Key Words

Urban renewal; Women's participation; Intersectionality; Feminism; Space power relation

1. Introduction

In China, urban renewal is mainly carried out through a "top-down" model, in which the central and local governments are responsible for renewal projects and make most of the investment (Ma et al., 2021). However, with the prosperity of social economy, the development of urban diversity and the awakening of civic awareness, the traditional "top-down" planning method is no longer applicable to current urban renewal processes in China (Li et al., 2019). Urban renewal has to pay more attention to the needs of multiple stakeholders. Since 2007, the Law of the People's Republic of China on Urban and Rural Planning introduced by the Central Government of China has clearly stipulated the basic requirements for public participation in planning processes, and vigorously advocated public to participate in the process of urban planning. Public participation is considered as an effective method of urban regeneration, which can play a crucial role in sustainable urban development (Hui et al., 2021, Li et al., 2020). Therefore, in current Chinese government-led renewal projects, "participation" involves not only the government participation represented by the project working group entrusted by the local government, but also includes the public participation of the residents' committee of the community and the homeowners (Ma et al., 2021). Existing research on urban renewal participation also mostly focuses on the interaction among stakeholders such as governments, project working groups, communities and residents and their influence on the final results of urban renewal (Tan and Altrock, 2016, Zhai and Ng, 2013, Zhang and Li, 2016).

In the 2023 urban renewal project in Yulin Community in Chengdu launched by the Ministry

of Housing and Urban-Rural Development, which I participated in as an intern, I found that women's participation is obviously higher than that of men, and they also maintain an absolute advantage in quantity. 1 As the working group of this project to undertake government work, our working group was entirely composed of women. 2 The staff of the community neighbourhood committee were mostly females. 3 Female residents, such as housewives and female art workers, generally had more positive attitudes towards urban renewal than male residents. Women played an irreplaceable and important role in urban renewal. In fact, there have been several scholars demonstrating the importance of female participation in community development through studies of female staff of the community residents committee (Yingjie Wang, 2023, Yinxu, 2022), and female residents activists (Yinxu, 2022). But their research objects are mostly confined to specific female groups, and there are very few systematic discussions of the three different groups of women in the participation process.

Therefore, this paper tries to fill the research gap on the gender dimension of the participants in the process of urban renewal in China from the perspective of feminism. Taking the renewal project in Yulin Community as an example, this study tries to use the theory of intersectionality to analyse the three different female groups: professional women in the working group, female staff in the community and female resident activists, which is aimed to integrate the seemingly "loose" involvement of women in the renewal project and analyse the oppression and empowerment of ethics and power involved behind various female participants, so as to try to answer the following questions. Why most involved in the urban renewal project are women? What are the motivations and processes for women to participate in urban renewal projects? What are the potentials and limitations of female participation?

This paper is structured as follows. In Section 2, it will briefly introduce the case of Yulin Community in Chengdu, China; in Section 3, it will outline the methods and analytical framework of this study; in Section 4, it will analyse the dynamic path of women's participation in detail taking renewal as an example; in Section 5, it will discuss the impact of these women's participation on urban renewal and feminism, as well as the possible future development direction of women's participation. At the end of this article, Section 6 draws a brief conclusion and the significance of this study for women's rights and gender-equal urban development.

2. Case Study

Taking Yulin Community in Chengdu as an example, we try to analyse the reasons, processes and results of women becoming the main force of public participation in urban renewal projects.

Yulin is located in Wuhou District, Chengdu, which is a typical old community in the centre of Chengdu (Figure 1). Most buildings in the community were built in the 1980s, and most of them are walk-up buildings on six to seven floors. With the collapse of the unit system, the general ageing of buildings, the imperfect infrastructure, the growth of the urban floating

population and other practical reasons, Yulin started to show signs of decay (Chen, 2023). According to the data of the seventh national population census in 2020, there are more than 21,000 people in Yulin, among which the ageing population (the population over 65 years old) accounts for 15.8 percent, while the ageing population in Chengdu only accounts for 13.6 percent. The ageing situation of the community is pretty prominent. How to rebuild the cohesion of Yulin and make up for the shortage of infrastructure has become an urgent problem to be solved.

In addition, Yulin Community has a unique background characteristic. In 2016, Yulin was unexpectedly exposed to the wider public for a folk song called "Chengdu". Yulin has overnight become the most famous living area in Chengdu, the cultural image of Chengdu and well-known in China. More and more artists and musicians come to the community. They buy or rent apartments in Yulin and turn them into studios. The various small bars, coffee shops and tea houses located in the community have become a gathering place for all kinds of art circles. It is no exaggeration to say that Yulin can be called the cradle of modern art in Chengdu now.

In 2017, Yulin Community officially launched an urban renewal project. In 2023, Yulin was listed by the Ministry of Housing and Urban-Rural Development as one of the first 10 pilot cities to "deepen the pilot system of Urban (Health) Check-up". As one of the key steps of urban renewal in China, the main task of Urban (Health) Check-up is to conduct a comprehensive investigation of the real situations of the community infrastructure and the built environment, so as to lay a solid foundation for the more targeted implementation of urban renewal and transformation in the future.

In one sense, as the designated pilot community of the central government's urban renewal project, Yulin is a very representative case of urban renewal in China, which can reflect the overall trend of the renewal process of old communities in Chengdu, China. Moreover, under the unique background of Yulin, the influx of artists challenges the social stereotype of women, promotes a more diverse and inclusive social development, and stimulates the change in the community, which is crucial to promoting the development of feminism.

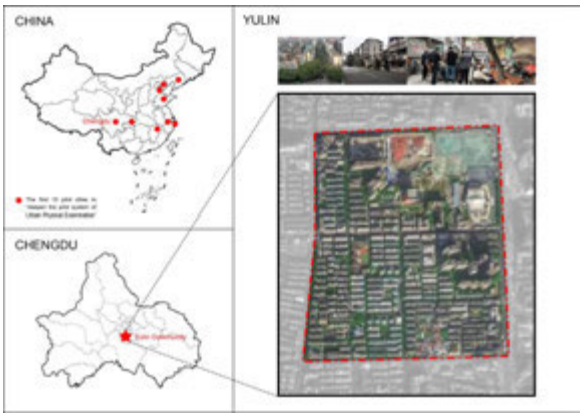

Fig. 1. Location of Yulin Community

3. Methodology

Intersectionality, as an important analytical framework in gender studies, was proposed by Kimberle Crenshaw (Crenshaw, 2013a). By discussing the unique experiences of black women, Crenshaw illuminates their intersecting causes of inequality, particularly along race and gender lines (Crenshaw, 2013a, Crenshaw, 2013b). Intersectionality emphasizes the interrelationship of multiple factors in individual identity, such as gender, race, class, etc., which are intertwined to form unique social status and experience, thus revealing the multi-level inequality and inequality that exists in different social groups. Discrimination. For Chinese society, the intersectionality derived from the black feminist movement shows a strong focus on the oppressed and effectively resists oppressive forces such as capitalism, patriarchy, racism, heterosexism, etc., which can preserve vulnerable groups and marginalized groups to provide powerful weapons (Sun, 2023). It is of great significance to the improvement of Chinese feminism and the development of social and spatial justice in China.

Therefore, in order to answer the questions raised above, this study uses the intersectionality theory to analyse the three female groups, including working women, female community workers and female resident activists, observed in the field during the process of Yulin Renewal Project in August and September 2023. The diverse rights, knowledge, ethics and other backgrounds held by different female groups lead to complex participation motivations, processes and outcomes. In particular, in Chinese social culture, structural factors such as state power and grass-roots organizations cannot be underestimated or ignored (Sun, 2023). A deep understanding of the dynamic participation paths of women of different social identities in urban renewal projects can help identify inequalities and make recommendations for improving social systems and spatial planning.

4. Result

4.1 The Working Group Was Entirely Composed of Professional Women.

The four members of 2023 Yulin Urban Renewal Project's working group were all women. This may be the result of unequal power structure in the workplace and gender inequality in planning sectors. Cities are often planned and designed by male dominance, and women are underrepresented in the planning industry (McDOWELL and Walkerdine, 1969). Male planners tend to be more easily responsible for large urban planning projects, such as urban general planning projects, while female planners are in a relatively weak position and can only work for small urban renewal projects. In addition, because of China's current diverse and complex planning realities, the project working group must pay more attention to the link of public participation (Hui et al., 2021). It is widely believed that women can better coordinate the complex interests in the urban renewal process in a more delicate and gentle communication way than men. Therefore, female planners are generally considered to be more conducive to urban renewal projects than male planners.

Therefore, as members of the working group, professional women have the expertise in urban renewal. We were involved by the "institutional arrangement", which has a certain passivity. After informing the community neighbourhood committee about this project, they organized relevant activities, such as indoor lectures, pilot project seminars, etc., to the neighbourhood committee staff and homeowners introduced the purposes, processes and needs of this project, and guided them to participate in the subsequent activities of urban renewal. In general, the working group, as a representative of state power, not only needed to be responsible for various negotiation work related to the grassroots neighbourhood committee and homeowners, but also was required to be responsible for the results of the final urban renewal project.

4.2 The Staff of the Community Neighbourhood Committee Was Almost All Female.

It was observed that only two of the more than ten staff members of Yulin Residents Committee were men. The personnel composition of the community neighbourhood committee is largely regulated by the traditional ethics in China, which affects the behaviour, attitudes and choices of different gender groups (Sun, 2023). On the one hand, community work is favoured by women because of its stability and proximity to home; on the other hand, men have to try their best to leave this low-income industry because of great life pressure.

The staff of the community neighbourhood committee directly facing the homeowners, needed to keep in touch with the masses. At the same time, they also had to help the government to complete good community management and service, like reducing the contradiction between owners and between owners and the working groups. They obtained professional knowledge training by participating in the indoor lectures organized by the working group, thus assisting the working group to better carry out the project and encouraging the owners to participate in relevant seminars. As a grass-roots organization, the community neighbourhood committee helped to improve the quality of local urban

governance and alleviate the social conflicts in urban renewal at the micro level.

4.3 Most of the Owners Involved in the Renewal Project Were Women.

In this project, female residents tended to be more actively involved in community activities. According to the data of the fourth Chinese Women's Social Status Survey in 2021, women are still the main force of family activities in China, and undertake the main internal family labour such as caring for children and supporting the elderly. They use the community space and play an important caregiver role in society more often than men, so they need planned urban projects to support them in this role (Ortiz Escalante and Gutiérrez Valdivia, 2015). Particularly, in the Chinese patriarchal context, the women outside governments' system as the marginalized social groups, such as housewives, are restricted by the traditional social ethics. They intentionally use institutional paths to express their interests, improve their status in the community, and alleviate the inequality of power in the male-dominated state (Guan and Liu, 2021). Not only that, a large number of female artists in Yulin also pay more attention to gender equality and female power than ordinary property owners. They are more active in expressing their desire for women's voice, challenging the traditional gender ethics, and calling for women's equal society through various media. Naturally, they didn't want to miss the opportunities and channels to participate in such public affairs as urban renewal, play a role at the level of community, and strive for gender equality. Feminism grew in the community and in the city.

Therefore, female residents, artists, etc sought possible ways to express their spatial demands by actively participating in relevant activities organized by the working group. For them, their competition for space was their right to be seen, be heard and have a direct impact on the country and society (Mitchell, 2003). Public participation in urban renewal projects could be seen as a powerful weapon against gendered cities by vulnerable and marginalized women.

5. Discussion and Conclusion

5.1 The Motivations of Different Groups of Women Who Are the Main Population Involved in Urban Renewal Are Complex Due to the Intersection of Identities.

The professional women in the working group are passive participants due to gender inequality in the workplace and specific gender role stereotypes; while community female staff and female resident activists who are influenced by social ethics and avant-garde artistic atmosphere, are active participants in order to work more stably or to improve their status in the community and alleviate the inequality of gender power.

5.2 Women's Participation in Urban Renewal Has Significant Advantages.

5.2.1 Women's Participation Means the Spatial Empowerment of Individuals and Collectives of Women, Especially Marginalized Housewives.

They exercise their civic power by participating in the process of urban projects. Collective empowerment can make the knowledge and experience of women, especially marginalized women, visible and provide a platform and space for them to have a voice for themselves (Ortiz Escalante and Gutiérrez Valdivia, 2015). In a patriarchal society, public participation, as a political and social channel, can be used by marginalized female social groups to express their reasonable demands, give more autonomy to manage their lives, and improve their status in the community. Women's participation alleviates the traditional male-dominated spatial power relations to some extent.

5.2.2 Women's Participation Is Conducive to Building More Inclusive and Gender-equal Cities.

Traditional "top-down" urban planning generally considers the interests and needs of men, but rarely considers the special needs of women (Beebeejaun, 2017, Garcia-Ramon et al., 2004). Women participate in urban renewal projects by virtue of their gender advantages, so as to strengthen the public's attention to spatial deprivation in women's daily lives and make up for the neglect of urban renewal under the traditional "male perspective" or "asexual perspective" theory on the needs of female groups, who account for half of the total population. Therefore, we can pay more attention to the voices of women, fill the gap in gender knowledge, and make the city more inclusive and equal.

5.3 Women's Participation in Urban Renewal Has Certain Limitations.

5.3.1 Women's Participation Only Provides a Repair Reference for Urban Renewal, but Cannot Directly Influence Urban Decision-making.

Public participatory planning for urban renewal in China is still at the initial stage (Hui et al., 2021). Even though there was a participatory shift happened in China emphasizing the importance of public participation, the impact of communities and homeowners in the statutory planning process is still limited (Beebeejaun, 2017, Guan and Liu, 2021). Although most owners are positive about government-led urban projects and keen to participate, they cannot fully participate because the process setting is not carefully designed (Ma et al., 2021). Almost all public participation activities are distributed in a variety of disconnected, unrelated and fragmented environments. This hinders the formation of inter-community and inter-regional coordination and the emergence of awareness beyond the local environment (Guan and Liu, 2021). This also results in participatory activities in China largely disconnected from political decision-making (Beebeejaun, 2017, Guan and Liu, 2021). Moreover, as mentioned above, urban space is usually designed and planned by men, and women have insufficient representation and leadership in the urban planning sectors (McDOWELL and Walkerdine, 1969). This has led to the planning departments and local governments being ostensibly open to supporting the principles of powering women and potentially accepting the idea of their involvement in consultations on important issues in a particular location. However, in a patriarchal society, men have political and economic power that women do not access, and use this power to create a male-dominated ideology. They are

often more reluctant to commit to incorporating women's views and ideas, let alone allowing women to intervene directly in actual changes in the city (Ortiz Escalante and Gutiérrez Valdivia, 2015).

5.3.2 Women's Participation Strengthens the Stereotype of Gender Roles to Some Extent.

Judith Butler's gender performativity suggests that gender is not an inherent identity, but a social construct that is constantly realized through action. Gender performance may reinforce stereotypes ideas and social expectations (Butler, 2020). The involvement of professional women in the working group adhered to traditional gender norms and expectations that women are more advantageous in negotiations, thus fuelling the perpetuation of traditional gender values. This reinforcement of stereotypes due to performativity further negatively affects individuals, which can limit women's work choices through harmful gender norms.

5.4 The possible future direction of women's participation.

5.4.1 Change the Unequal Power Structure of the Workplace.

In the workplace, continuous efforts can be made to address the power imbalance by subverting traditional gender norms and gender role stereotypes. By guaranteeing gender quotas, diverse training and flexible work arrangements, we can drive dynamic changes in power in the workplace and create an equal and inclusive working environment.

5.4.2 Change the Male-dominated Social Structure.

Formal and informal training on urban planning from a gender perspective is an important strategy to overcome the gender inequality barriers encountered in urban transformation (Ortiz Escalante and Gutiérrez Valdivia, 2015). It helps to make more planners aware of the need to engage women actively in urban renewal projects. This strategy requires a stronger political commitment at the institutional level to enable structural changes to promote gender equality.

5.4.3 Expand the Influence of Public Participation.

The main problem with China's participatory planning is that the existing participation does not fully receive public opinions. In particular, the perceptions of the government are consistent with the professional views of the private sector like the working group, but are far from the perceptions of the citizens, which ultimately leads to the neglect of the public voice (Liu et al., 2022). According to Bingsheng Liu et al., in the performance evaluation, the stakeholders should be required to measure the level of public participation in China's urban renewal projects, so as to overcome the problem of insufficient influence of public participation (Liu et al., 2022).

6. Conclusion

This paper explores the dynamic path of Chinese women's participation in urban renewal based on observations and secondary resources. In order to protect the rights and interests of participants in this urban renewal project and avoid possible sensitive information involved, this paper mainly uses existing literature and research results to conduct an intersectional analysis of the phenomenon of Chinese women becoming the main participants in urban renewal. This allows for a broader understanding of the complex motivations, processes and outcomes involved in participation behind the phenomenon. However, it must be acknowledged that the use of limited primary data may result in the reliability and accuracy of this study being affected by the researcher's subjectivity.

However, the above research still has certain potential and significance. By using an intersectional approach to study the relationship between gender, power, space and knowledge behind different female participating groups in the Yulin community renewal project process, it explains the role of women in urban renewal in China. phenomenon of the main actors in the process. (1) Due to the unequal power structure and gender role stereotypes in the workplace, the project working group was forced to be composed entirely of professional women. As representatives of the government, they led the entire urban renewal project; (2) Influenced by traditional social ethics As a result, almost all the staff of community residents committees are women, and most of them actively join this industry; (3) More female residents actively participate in the urban renewal process and seek opportunities to voice their demands for women's space.

Female participation in the urban renewal process has alleviated the traditional male-dominated spatial power relationship to a certain extent, helped planners fill the gaps in gender knowledge, and made the city more inclusive and equal. However, it has to be admitted that women's participation provides more of a patchwork reference for urban renewal, but cannot directly influence urban decision-making, and to a certain extent strengthens gender role stereotypes.

But this does not mean that women's participation is useless and unimportant. Urban planning and renewal from a gender perspective is a necessary means to eliminate gender discrimination in cities and ensure women's empowerment. This study critically reflects on women's participation in urban renewal practices not only as a conscious and purposeful questioning of the male-dominated planning industry and participatory planning, but also as a way to provide adjustments from a gender perspective for the sustainable development and stability of cities. Urban renewal not only requires the active participation of more women, but also requires more profound structural changes at the social level to promote gender equality.

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Temporal Evolution and Conservation of Urban Morphology in Harbin with Space Syntax

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Abstract (up to 125 words)
Harbin is a city historically shaped by its railway heritage. The construction of the Chinese Eastern Railway, a railway linking Europe and China, has rapidly transformed Harbin from a fishing village to an international metropolis in just half a century. The railway brought expatriates to Harbin, as well as European planning concepts to China. In the process of rapid modernization, Harbin's unique urban form is based on a Western urban texture, overlaid with localized planning ideas. Thus, understanding the historical development and preserving the spatial morphology of Harbin's historic core are key research goals. This research employs the spatial syntax framework to decode the urban axis model of Harbin across four distinct developmental epochs. By quantifying the local integration indices of these axis models, our investigations divulge that the burgeoning expansion of Harbin's urban footprint and the establishment of novel districts have not fundamentally disrupted the historical urban axes. This study contributes to our understanding of urban adaptation and suggests ways to preserve these unique urban features.

Keywords:
Urban morphology, Urban evolution, Space syntax, Characteristic conservation strategy, Harbin historic area

Full text

1.Introduction

For a long time, the protection of cultural heritage and urban development have been in a contradictory, opposing and complex relationship. How to balance development and conservation is an important issue in urban planning and heritage conservation. In 2011, UNESCO formally adopted the Recommendation on Historic Urban Landscapes (HUL), which proposes to perceive the heritage objects from the perspective of value linkage and historical stratification. It expands previous perception of heritage and points out a new direction for historical conservation.

Historic districts are predominantly situated in city centres, reflecting the unique interplay between natural geography and the city's historical and cultural traits. These districts embody the tangible results of social change, economic growth, and local cultural developments.

Consequently, an in-depth exploration of the laws governing the amalgamation of urban space and its evolutionary traits is crucial for the preservation of historical continuity and the scientific protection of historic urban areas.

Since the advent of typomorphology, urban characteristic studies have embraced spatial and temporal dimensions. Spatially, it is posited that complex urban spaces are composed of specific morphological units. Analyzing these units from local to global scales provides insights into the structure and characteristics of the space. Temporally, emphasis is placed on the evolutionary processes of phenomena, deconstructing the relationships between space and societal and cultural dynamics through a historical lens. This approach helps reconstruct the logic of fragmented forms to elucidate the historical evolution of urban spaces.

The theory of space syntax, pioneered by Professor Bill Hillier, is instrumental in quantitatively analyzing urban space networks. This theory uses the human aspects of urban spaces as a lens to assess the connectivity and integration of these spaces, thereby enhancing our understanding of the relationship between societal structures and spatial layouts. Applying space syntax in preserving historic areas and their morphologies is an effective method. Time is a critical element in analyzing regions' characteristics and developmental patterns.

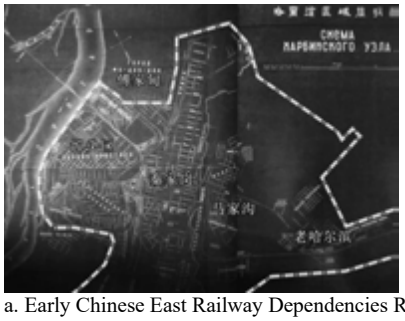
This study employs the space syntax methodology in the historic district of Harbin, which exhibits distinct spatial morphology characteristics. The research questions are: 1) What are the urban morphological characteristics of Harbin with the logic of historical time? 2) What are the evolutionary laws of spatial morphology at different historical stages under the quantitative model? 3) In the face of the existing urban morphology, how should future urban planning be controlled to protect the spatial characteristics of the city?

2.Methology

2.1 Site and case

Harbin, located in the north-east of China, is a city born because of the railway, and it took only 50 years for Harbin to become an international metropolis from a small fishing village. The spatial structure and form of Harbin reflects the modern international planning ideas and strong colonial atmosphere, which is a historical witness of the vicissitudes of the city and a typical practice of modern planning concepts.

The scope of the study is the historical urban area of Harbin (Fig 1) . It is a area that reflects the city's early planning and construction idea This also covers the "Historic District" as defined in the Harbin Historic City Protection Plan.



a. Early Chinese East Railway Dependencies Range

b.gaze to the research scope

Fig.1 Research case

2.2 Historic urban morphology materials

The construction of the CER in 1898 was an opportunity for Harbin's urban development. Many foreign engineers and workers gathered here to form the first urban area. Since then, the prototype of Harbin's modern city began to unfold. Subsequently, multiracial people gathered here and constructed their own ideal space, forming a unique urban form and architectural style, which made Harbin win the "Paris in the East" titles.

According to the historical news and the ownership of the city management, the urban development of modern Harbin can be divided into "1898-1932: the period of Tsarist construction and influence", "1932-1945: the period of Japanese construction and management", "1945 to the present: the period of modernisation and development". Therefore, based on the available historical map resources, 1932, 1946, 1975, and 2018 were selected as four-time slices to quantify the urban form.

Fig2 City maps of four development periods

2.3 Data collection

A line shape file is created in ArcCatalog, and the roads are extracted from the planning drawings or satellite maps of the four periods to form the axial maps of each period as the primary data of the model. In this paper, the DepthMap software platform is used to analyse the spatial shape, and the spatial shape features are discovered through the statistical analysis of several parameters, such as connection value, integration degree, comprehensibility and synergy degree.

3.Results

3.1 Characteristics of early urban planning

Streets are an essential part of urban space. Its planning and construction not only reflects the development stage of the city, but also influences the organisation of social activities and residents' way of life. The form of Harbin road network is influenced by planning ideas and regional functions, adopting an ideal and existence of regular geometric form, common layouts are square grid type, circular, radial.

In the early period, port area road construction in line with the Songhua River and railway line alignment, the formation of diagonal grid layout. After the opening of the port, Qinjiagang in the new railway station lot formed a combination of square grid, radial and fan-shaped network of road forms, baroque formalism style. During this period, the city was divided by the railway to form clear zones, and the road construction within each zone was gradually improved.

The structure formed during this period was the prototype and foundation for the formation of the city of Harbin. The railway station is located in the city's centre and connects the two districts. The city's landmarks and churches control the centre of gravity of the two zones. The urban planning was based on the railway, with clear functional zoning, centred on St. Nicholas Square in Qinjiagang (now Nangang District), with Dazhi Street and Hongjun Street as the cross-axis, of which Hongjun Street extends southwards to connect with Old Harbin (now Xiangfang District). In the port district (now Daoli District) to the Jingwei Street as the central axis connecting the dock and railway station, and derivatives of the branch to the riverside for the secondary axis, the Central Avenue. The axes of the two districts are linked by the railway station, reflecting the main nature and function of Harbin in the city's early days.

Fig.3 Characteristics of early urban planning

3.2 Evolution of urban form

From the quantitative results of the spatial syntax, the axes of the historical urban area are stably inherited and prominent (fig.4).

Referring to the topological principle, the local integration degree of the urban axis model is calculated by the spatial syntax to extract the axes of the urban area at four different development stages. The results of the analysis show that the expansion of the city and the construction of new districts did not have too much impact on the axes within the historic urban area and that Nangang District developed east-west at the beginning of the construction with Dazhi Street as the central axis, and then gradually added several roads perpendicular to Dazhi Street as the auxiliary axes of the spatial development structure. The spatial axis of the historical urban area in Dori is stable, with Jingwei Street and Central Avenue, and the commercial activities in the urban area are carried out accordingly. The urban axis's stability reflects the spatial pattern's stability to a certain extent.

The results of the spatial syntax analysis show that since the Japanese colonial period, the degree of integration of the north-south axis of Hongjun Street has gradually weakened. In contrast, the east-west axis of Dazhi Street has strengthened. At the same time, the degree of integration of the road appears to be higher in the west and lower in the east, which shows that the city of Harbin has leapt forward to the west in the direction of development. From the colonial period to the eve of reform and opening up, Nangang and Dawri historical city roads in the average integration of a significant increase in urban axes also occurred a reasonable increase, which is Harbin in the "First Five-Year Plan", "Second Five-Year Plan" period of the country's key industrial projects, the city to the industrial as an opportunity for development and construction. Industry as an opportunity for development and construction is closely related. After entering the modern period, the city expanded around the central city in a dense and orderly manner. The large-scale road grid surrounded the historical city. Nangang District increased the number of sub-axis perpendicular to Dazhi Street, such as the education street, Haicheng Street, Gogol Street, etc., which is closely related to the construction of large-scale municipal facilities such as bridges and underground passages.

Secondly, the planar texture of the landscape corridor is preserved, but the sense of spatial place is weakened, and genes are hidden. In the process of urban modernisation and development, a large number of high-rise buildings have changed the spatial scale of the original streets, lacked a sense of order and blocked the view corridors so that these contrasting spaces are not well presented and have a low recognition in the urban structure, such as the contrasting corridors of the Beixiu Square and the railway station. In addition, the destruction of landscape nodes and the change of function also led to structural invisibility, such as the disappearance of St. Nicholas Church and the change in the functional nature of the Correctional Square, which weakened the structure of the triangular-shaped square in Nangang District.

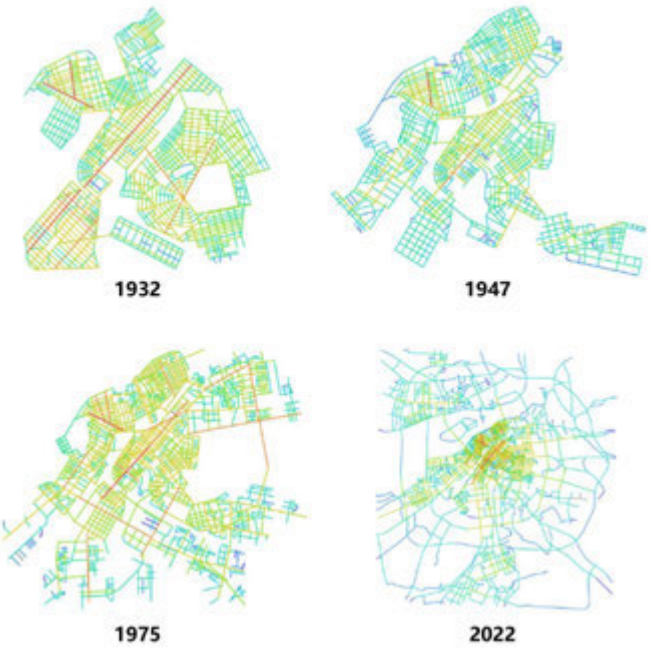


fig.4 Evolution of urban form

3.3 Urban planning control strategies

The planning idea of Harbin's early garden city and the unique form of the road network have created a wide variety of view corridor in the city. The recognisability of the linear pattern in the city usually comes from the spatial perception of the residents. Therefore, the protection of the axes and corridors in the historic urban area should be based on visual guidance, construction control, restoration and shaping of a distinctive urban image.

The linear pattern of the Harbin Historical Centre is preserved, and the form of the city roads and squares is still present, which provides the basis for strengthening its spatial characteristics. The enhancement of the linear pattern in the city is divided into two aspects: one is to control the capacity of the historic city based on the visual landscape, focusing on the visual landscape of the central historic nodes and the visual landscape of the axial roads.The other is to sort out the street interface of the axial space, including the improvement of the street façade and street greening. It is expected that through the combination of the two, the urban axes and landscape corridors will be clarified to enhance the recognisability of the spatial characteristics.

In terms of architectural capacity control, through the study of the different psychological feelings generated by different visual distances and angles between people and the built environment, the height of the background environment of the architectural groups at the central historical nodes and the height of the buildings on both sides of the axes and roads are controlled, to shape the landscape characteristics of the historical space. First of all, when

viewing architectural details, the angle of elevation of 45° is the best viewing angle; when viewing architectural groups, the angle of elevation of 18° is the best viewing angle, which is projected to meet the D/H≤1 and D/H≤5 spatial scales of the street when viewing historical buildings and groups of historical buildings, respectively (see Figure 5-b). For example, when controlling the capacity around Central Avenue, in order to strengthen the architectural form of the axial interface, the background height should satisfy H ≤ D. The red line of Central Avenue is 15m, so the height of the new buildings along the street should be lower than 15m in principle, and the height of the background buildings should be increased according to the distance from the centre line of the road. Secondly, according to the scale of the street outline in the urban area, the building height restriction conditions outside the road red line are determined (see Figure 5-c). On both sides of the urban main road, the upper limit of height control is 16m in the range of 100m outside the red line of the road; the upper limit of height control is 24m in the range of 100-200m; and the upper limit of height control is 50m beyond the range of 200m. On both sides of the urban secondary road, the upper limit of height control is 12m in the range of 50m outside the red line of the road; the upper limit of height control is 24m in the range of 50-100m; and the upper limit of height control is 50m beyond the range of 100m. In summary, the above analysis results in the building height control map of the historic urban area (see Figure 5-a).

Regarding street interface management, the control of the road red line is changed to the overall management of street space. Existing planning, design, and specifications for the road red line within the cross-section, municipal and landscape requirements, and the lack of both sides of the building interface and open space are the overall considerations. Therefore, based on restricting construction activities within the red line of the road, the building interface should be regulated, including all kinds of illegal private construction and plaques protruding out of the road, to ensure the smoothness of the sight line within the corridor. Coordinated planning of street green space facilities, open space, activity facilities, etc., to meet the traffic capacity demand and promote the integration of street and neighbourhood development. Restore the early Harbin street greening forms, such as street gardens, courtyard greening, etc., beautify the axes and revitalise the corridors to achieve the role of pedestrian flow guidance so that the connecting paths of the historical elements in the urban areas of the recognisability of the overall linear pattern to strengthen the overall pattern.

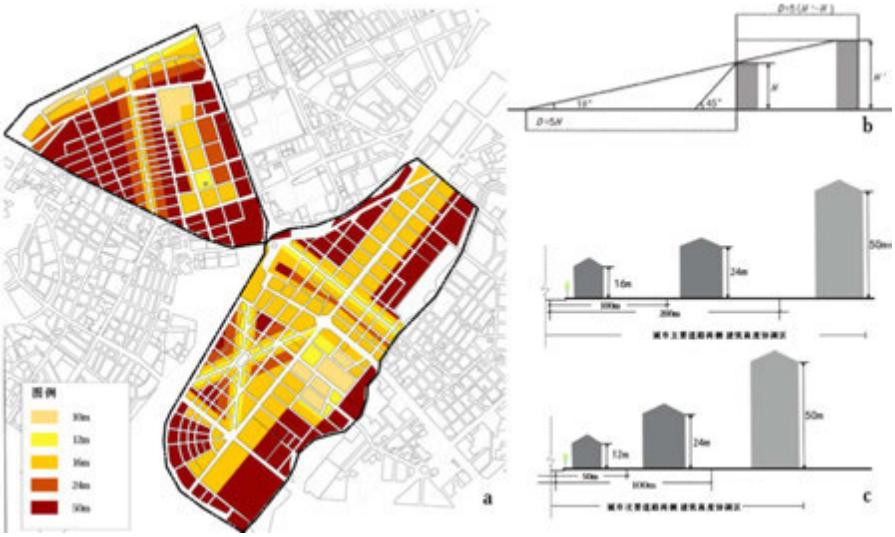


Fig.5 Urban controlling stratigies

4.Conclusion

Spatial characteristics in historic districts represent the systematic combination of spatial elements, shaped by historical stratification and embodying profound spatial meanings. This paper adopts a historical perspective, using space syntax as a quantitative tool to analyze Harbin's urban morphological characteristics and evolutionary patterns. Given the current urban form, this study suggests focusing on two main aspects for future urban planning and preservation: controlling the intensity of building constructions and clearing streets.

The proposals aim to achieve a scientific and sustainable approach to the preservation of the spatial characteristics of historic districts. By employing space syntax, we can effectively quantify and understand the complex interplay between Harbin's historical timeline and urban space, offering a strategic basis for preserving the city's unique architectural heritage and texture. This approach not only ensures the protection of significant historical elements but also facilitates the functional modernization of the city, balancing heritage conservation with contemporary urban demands.

Inhabiting the rural space. Reflections on the housing emergency of seasonal workers in agriculture

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Abstract
The intensification of migratory movements towards the European context from the global South is a clear sign of the unstoppable prospect of international mobility, legal and illegal, of populations as a result of changed geo-political conditions, environmental crises and disasters, poverty and economic uncertainty (Blasco, et al., 2023). These dynamics produce reverberations in terms of demographic transition, imbalance in local economies towards parallel and opaque labour circuits, and spatial transformations in the territories where refugees reside and transit. The contribution intends to focus on the informal settlement of Borgo Mezzanone, where about 4,000 migrants reside on a temporary and permanent basis, engaged in the activity of harvesting agricultural products according to the cyclical nature of the agri-food chain. The contribution is the result of the action-research work carried out by the ArCoD Department of the Polytechnic of Bari for the technical-scientific support of the Apulian Municiities beneficiaries of Measure 5C2 investment 2.2 Integrated Urban Plans for the overcoming of illegal settlements to combat the exploitation of workers in agriculture.

Keywords: informality, migration, housing policy

The presence of migrants, increased by the intensity of legal and illegal flows along maritime and land routes in the Mediterranean basin (Zupi, 2023) (Eurostat, 2023) (IOM, 2024) (Fondazione ISMU, 2024) (Frontex, 2024), imprints on the territories signs, movements and changing transitional practices due to the variety of legal conditions of individuals (asylum seekers, migrants under international protection, refugees, deportees awaiting repatriation), the diversified needs, including labour needs, that underlie as many life projects. These factors are also associated with the ineffectiveness of migrant reception and integration policies in guaranteeing indispensable rights, today still oriented towards emergency, securitarian and incongruous approaches concerning the minimum standards expected (ISPI, 2018) (Caritas Italiana, 2022).

The conditions of arrival in first landing territories such as Italy, often with illegal landings (Frontex, 2021), together with the scaled-down institutional response, trigger a short-circuit such that migrants without legal status have limited access to fundamental civil and social rights, finding in 'opacity' the adaptive survival solution. This opacity can be recognised in the inscrutability of informal settlements and in the separateness of the lives migrants lead within them, far from the urban space of rights; together with the unpredictability of individual choices and paths, these are the conditions that determine a state of resistance and protection of identity from the outside. The same legal-administrative indeterminacy that ousts migrants from the rule of law persists despite the relevant traces they produce in the territories to satisfy their needs (housing, work, social), and it is what allows them to disregard hetero-imposed orders and preserve individual integrity and autonomy (Glissant, 2019) (Rondot, 2022).

In rural contexts, the self-construction of shelters and shacks with makeshift materials reduces 'hyper-visibility' (Cancellieri & Ostanel, 2015) and inserts migrant workers into circuits of labour exploitation in the fields. The state of housing uncertainty and precariousness (Cannari et al., 2000) is thus catalysed by the demand for work in the agricultural economy to which they respond to an attempt - in vain - of self-determination and acquisition of autonomy concerning a system that offers them limited possibilities of social mobility and improvement of their quality of life (Doctors Without Borders, 2018) (Osservatorio Placido Rizzotto FLAI-CGIL, 2022) (Directorate General for Immigration and Integration Policies, 2023). It is a complex phenomenon, which has acquired relevance and public, as well as political, domain following the first extensive survey on the phenomenon of squatter settlements in Italy returned in the Research Report on The housing conditions of migrants working in the agri-food sector (Giovannetti, Miscioscia, & Somai, 2022), carried out by the Ministry of Labour and Social Policies and ANCI in collaboration with Cittalia[1].

The survey provides a nationwide cognitive framework of the housing conditions of migrant workers and, as the results show, it challenges the widespread belief that exploitation of migrants in agriculture is a stigma of the South; rather, it highlights how it also affects northern agricultural districts, according to product harvesting cycles and the periodic mobility of workers (Placido Rizzotto FLAI-CGIL Observatory, 2022). This aspect is not secondary in the phenomenon representation, usually polarised in circumscribed geographical areas and through defined settlement categories that reduce the spatial domain in which migrants act and normalise the repertoire of produced housing practices. The report provides a new snapshot of the housing vulnerability of migrant workers engaged in agriculture, although it is affected by partiality and incompleteness because it is built on voluntary participation by municipal administrations in completing the administered questionnaire[2]. Furthermore, the choice to consider the municipal administrative dimension for studying the phenomenon and the subsequent allocation of the NRRP resources to Municipalities with settlements in critical conditions overlooks both the observation of the phenomenon on a large scale, where the dynamics of migrant mobility in rural areas emerge, from settlements to agricultural fields, and the regional institutional level in defining territorial strategies with the integration of actors, assets, and local resources.
Thus, if the survey methodology at the municipal scale made it possible to obtain the precise location of settlements and the indicative presence of habitual residents, neglecting the periodic fluctuations towards productive enclaves along the national territory, the empirical survey[3] is

[1]On 29 July 2021, the Directorate-General for Immigration and Integration Policies of the Ministry of the Interior signed an agreement with ANCI for the implementation, in collaboration with Cittalia, of an «Action Plan to support local authorities in the processes of inclusion of foreign citizens and interventions to combat labour exploitation in agriculture and caporalato», which provides for among other things, the creation of a national mapping of the presence of foreign workers employed in agriculture, with a focus on precariousness and housing hardship, in order to provide the cognitive basis for the adoption of the ministerial decree of distribution in fulfilment of the specific NRRP Measure, discussed below.

[2] From October 2021 to January 2022, the survey aimed at mapping was conducted by administering a questionnaire to all 7904 Italian Municipalities, of which 3,851 Municipalities responded, with an average participation rate of 48.7%. In the South, the participation rate stands at 45.1%. Out of the total surveyed, only 608 Municipalities reported the presence of migrant workers employed in the agri-food sector. It is noteworthy that about 70% of the municipalities where the workers' presence had been identified in previous research and had already been recipients of specific interventions and policies (the so-called Super-Priority Municipalities) responded to the questionnaire (Giovannetti et al., 2022)

[3] In the absence of detailed information, the questionnaire administered to the Municipalities provided a numerical figure «that roughly takes into account the fluctuations of the phenomenon over the course of the year» (Giovannetti et al. 2021; p.39).

imprecise, also about the variations of seasonal residents and the social (singles, families with children present) and legal (regular/irregular status) composition of the subjects.

The municipal dimension is limiting and reductive concerning the complexity of the dynamics taking place in rural territories, moreover, precisely in the institutional perspective of defining public policies (social, housing and labour) for migration management and the provision of resources to overcome the usual emergency and discontinuous responses over time.

From these general reflections, the contribution focuses on the Apulian regional territory, where the case study under consideration is geographically placed and concentrates on possible operational modalities to respond to the condition of absolute housing emergency (e.a.a.) (FEANTSA, 2005) of migrant workers by assuming informality as a condition to define a new settlement strategy.

How to overcome illegal settlements of migrant workers in agriculture

It is relevant to recognise that the opportunity offered by the NRRP with Measure 5C2 investment 2.2 *Integrated Urban Plans for overcoming illegal settlements to combat the exploitation of workers in agriculture* is the first national policy oriented towards the problem of settlement and labour illegality, which allows to use of funds to prepare solutions for improving housing conditions and exiting the circuits of illegality for seasonal workers[4]. The Measure effectly finances an ambitious housing policy, which, while ignoring the complex legal status of the target subjects (asylum seekers, refugees and displaced persons), is aimed at recognising the 'right to housing' within a regulatory and institutional framework that is indifferent to the construction of labour, social and migration policies. This action marginally addresses the issue of immigration, since actions to overcome illegal settlements and combat undeclared work provide a response circumscribed only to the housing and employment problems that concern migrants in the process of integration into the new society. Therefore, the first critical issue concerns the migration policies underlying this measure, traceable in subcategorical form to the investment axes with which the plan is organised, but vague in focusing on the social target of these interventions, consisting to a significant extent of irregular migrants, whose number has increased due to the rigidity of the Bossi-Fini Law of 2002 (Caritas Italiana, 2022). The indistinct treatment of individuals with different personal situations, united by the double condition of immigrants and workers, in addition to eluding systemic ways to address the issue, complicates the implementation of interventions with respect to the variability of numbers between regular and irregular migrants and therefore between those entitled and those not, according to the Italian legislative statute. A second critical aspect is given by the institutional and territorial level assumed for the interventions, which are attributed to the competence of the municipalities benefiting from the resources due to the location of the illegal settlement, without taking into account the movement flows to reach the neighbouring countryside, where the migrants work[5], as well as the procedural and spatial complexity of

[4] Out of a total funding of 200 million euro, about 96% of the amounts are destined to the South of Italy where agriculture and product processing are the driving economic sectors that have absorbed a substantial share of human resources of foreign origin who have arrived in Italy and are included in irregular labour circuits (Leogrande, 2008) (Macrì, 2022). See the distribution table annexed to the Ministerial Decree of 29 March 2022, no. 55, Decreto di Riparto Risorse relativo all'intervento M5C2 Inv. 2.2, GU Serie Generale n.108 del 10-05-2022, available at the link: https://www.gazzettaufficiale.it/eli/gu/2022/05/10/108/sg/pdf

[5] In the case of Borgo Mezzanone, an administrative offshoot of Manfredonia in close relation with the Municipality of Foggia, workers' movements are of the order of tens of kilometres to agricultural fields in

exceptional works, which are therefore of supra-local rank, connected to the construction of large numbers of beds, to be carried out in a shorter time than the ordinary administrative procedures, interacting with other institutions (*primarily*, the public housing authorities)[6].

In this perspective, the overcoming of informal settlement, understood as the spatialisation of survival using 'dwelling wiles', in contrast to regulatory systems and shortcomings in the externalisation of reception management (Rahola, 2003) (Ippolito et al., 2021), tries, with the limits already outlined, to define a condition of entitlement given by two prerequisites: the allocation of housing and the support of social infrastructures to overcome the state of segregation. Therefore, the terminological choice of characterising migrant workers' settlements as 'squatters' seems inappropriate, as it associates this phenomenon with the practice of uncontrolled building that has been inverted in the Italian context since the Second World War. Connoted in the disciplinary literature as a practice of necessity in response to housing hardship in the post-war years and subsequently speculative in areas of scenic value, squatting, as a mode of individual self-determination, constituted the initial spontaneous response of the less well-off classes to social fragilities and the ineffectiveness of housing policies, then the pervasive individualisation of valuable coastal areas (Chiapperino, 2023); it was carried out in contrast to regulatory and urban planning regulations and availed itself, above all, of political connivance, manifesting an evident concurrence of guilt between individuals and institutions (Clementi & Perego, 1983) (Cremaschi, 1990) (De Lucia, 2006) (Zanfi, 2008) (Curci et al., 2017). The settlements of migrant workers in rural spaces, although the outcome of spontaneous construction production outside of regulatory apparatuses, encapsulate an attempt at survival and resistance to the formalised system of rights and norms that has sclerotized the residents' condition of subordination and segregation. In contrast to the contexts of building squatting dominated by individualism expressed by one's housing unit, ghettos constitute collective spaces of coexistence of informal practices (Laguerre, 1994) (Roy, 2005), with a flexible and adaptable character even in accommodating temporary residents, and forms of resistance to rigid institutionalised statutes. In recognising multiple points of contact and overlap between the concepts 'informal' and 'abusivo'[7], often used as synonyms ascribable to the sphere of 'everyday life'[8], it is possible to trace informality as a broader and more capacious field in holding together not only the building and housing dimension but also the cultural and social one, also because it better represents the precariousness and instability (physical, temporal) of migrant workers' existence.

The belief, based on what has been said previously, is that an effective project for overcoming migrant workers' squatter settlements should assume two conditions: i) improving settlement

other Municipalities; in the absence of private and public means of transport, recourse to forms of subordination to the 'caporale' is the practice.

[6]In addition to the criticalities highlighted above, the national programme has a strong constraint, dictated by: (i) the timeframe of the NRRP, which envisages in 3 years the implementation of the planned and financed interventions, (ii) the limitations related to the institutional process initiated, which was initially very rigid also about (iii) the objectives and expected results that over time have become somewhat blurred, given the cancellation of the mission unit initially identified and the uncertain transfer of the management of the programme from the competence of the Ministry of Labour, (probably) to the Ministry of the Interior or perhaps Defence (with an obvious shift to the security dimension), both equally lacking in adequate competences in the field of public works.

[7] These two conditions also differ in their treatment in the literature; in fact, squatting has a clear geographical connotation in the Italian and Mediterranean context and affects the building process. The informal is investigated in the territories of the Global South characterised by poverty and backwardness as a condition that permeates different aspects of existence.

[8] The sociology of everyday life, of which de Certeau is one of the main exponents (de Certeau, 2010), recognises practices in social existence that escape legal and institutionalised orders.

conditions by identifying housing solutions that facilitate processes of 'familiarisation with "diversity"', ii) pursuing legalisation processes by avoiding the extensive elimination of any non-institutionalised form; that is, preparing to experiment and test the negotiation spaces currently allowed by informality to subjects caught in the grip of the migrant category.
Unfortunately, the rigid target and milestone architecture of the NRRP, necessary to define a *timeline* governed by relevant national and European goals, has projected the settlement solutions project from preparation to implementation, avoiding relevant intermediate phases of sharing (on technical solutions, on the process) with the super-ordinate bodies (Region, Superintendence, Basin Authority), and on the real needs with the third sector associations active in the squatter settlements, the trade unions constantly engaged in integration actions and support to labour regularisation (in particular FLAI CGIL), and the representatives of the slum residents. The absence of a process aware of the plurality of issues at stake and stakeholders and, due to the tight timeframe of the Plan, the preclusion of opportunities for mutual listening between those implementing the intervention, migrant workers and settled communities does not allow for the triggering of integration processes that could on the one hand avoid the abstention of participants, and on the other the triggering of social conflicts (Annese et al., forthcoming).

Action-research for Borgo Mezzanone: spatial and settlement strategy

In this framework, there is the contribution of the three regional universities (Polytechnic of Bari, University of Bari, University of Foggia) involved in a framework agreement for the technical-scientific support to Apulia's local administrations, beneficiaries of resources for overcoming informal settlements of migrant workers, in the definition of Local Action Plans (LAP)[9]. The work, initiated at the intermittent urging of the Apulia Region and the Prefectures, was addressed to four municipal administrations and continued only with the Municipality of Manfredonia[10]; from the outset, it aimed to develop a territorial strategy coordinated by the Municipality of Manfredonia (FG) itself, which was entrusted with 54 million euro resources, but oriented towards investments and transformations in the territory of the Municipality of Foggia. The primary objective was to intercept the dynamic dimension of the settlement phenomenon and its territorial fluctuations with the strategic vision of supra-local sectoral plans, thus increasing the complexity of the process, but aiming at the valorisation of an already existing heritage and the underlying territorial system. The experience has represented an opportunity for synthesis between wide area objectives and the local dimension of the problem, as in the practice already established by the new territorial management tools defined in Apulia since 2001 (Apulia Region, 2007).

[9] The Local Action Plan thus foresees a share of residences (infrastructural part) to be realised as new construction but also conversion of existing under-utilised assets (equal to 70% of the funding) and intangible actions (social integration, provision of services and forms of community welfare, equal to 30% of the funding) to support populations. Subsequently indicated LAP.
[10] As a result of the technical round table with the beneficiary Municipalities of the NRRP Measure in question, the support of the ArCoD Department of the Polytechnic of Bari was provided to the Municipality of Manfredonia and for the initial application phases of the Municipalities of the Capitanata of San Severo and Cerignola and Turi in the Bari area. This is a significant figure when compared to the size of the economic resources allocated by the distribution these are Municipalities with highly critical situations and huge and exceptional funding compared to the technical capacity of the municipal offices. The Municipalities benefiting from ordinary amounts operated autonomously, often in continuity with previous actions, such as the Municipality of Carpino.

The consultancy work carried out from 2022 to the present[11], identified the key elements of the vision, expressed in the infrastructural and non-infrastructural components, for overcoming the informal settlement located along the disused runway of the former military airport of Borgo Mezzanone, seeking to provide a housing, employment and social integration response to the migrant workers living there.

Thanks to the support of the most committed forces on this front (scholars, trade unions, and the Third Sector), the references to these territorial strategies have been outlined in the candidate LAP by the Municipality of Manfredonia (FG). The informal settlement is located on the border with the Municipality of Foggia and close to one of the hamlets built during the agrarian reform of the 1930s, a strategic location concerning the Tavoliere agricultural production areas and the infrastructure network that innervates it. Along the former aeronautic runway, shacks and temporary housing modules hybridise the formal and militarised space of the CARA and the container settlement (Tarsi & Vecchiarelli, 2021) (Vecchiarelli, 2023), and, particularly during certain periods of the year characterised by greater demand for labour, arrive to host up to 4,000 foreign farm labourers, including permanent and nomadic workers. These conditions lead to phenomena of marginality, physical and social degradation and illegality, as well as fuelling the phenomenon of 'caporalato'.

The strategy, therefore, had the primary objective of proposing alternative solutions to the 'temporary' ones dictated by the emergency, in favour of lasting strategies, discarding the housing experiences so far realised in Italy of large settlements in which to 'concentrate' a large number of agricultural workers, which have often proved to be a total or partial failure (Mira, 2022), as the experience of the 'Gran Ghetto' located in this territory (between Rignano Garganico and San Severo) teaches us. The orientation, therefore, was for the identification of housing solutions distributed throughout the territory, capable of activating processes of inclusion and integration of workers that could lead them to attain the status of 'inhabitants' and 'citizens'.

The Territorial Strategy

The research action, therefore, started from the long-standing territorial structure of the Tavoliere, present in descriptive traditions, of the *Pentapolis*, centred on Foggia, which dialogues in a sort of *Christallerian* model with the *agrocities* of Lucera, San Severo, Manfredonia and Cerignola (fig.1). On this system, in turn, is inscribed the lower-ranking settlement system, also conceived 'as a crown' in the phase of populating 'the latifundial desert' of the Capitanata cereal-growing areas by the Opera Nazionale Combattenti (ONC) between the late 1930s and the early years of the new decade, at the height of the war (Pennacchi, 2010). These were small 'foundation towns', such as Segezia and Incoronata, and rural hamlets, such as Borgo Cervaro, Borgo Giardinetto, San Giusto and Arpinova, which are now underused hamlets. Designed and built as 'service centres for an agricultural community, they developed around a square, having all the features, including architectural ones, to best fulfil their function' (Pennacchi, 2010), in these settlements Concezio Petrucci and the other designers selected by the ONC emphasised as they had already experimented on a national scale in other founding villages (Aprilia, Fertilia, Pomezia) the public and collective parts (square, main street, church,

[11] Now, the strategy defined from an infrastructural point of view has not been supported by the analyses and interpretations of social and economic data, attributed to the other universities participating in the protocol.

Casa del Fascio, schools, commercial arcades) around which the city would progressively grow with its residential fabric.

Fig. 1. Territorial system, Pic by Letizia Chiapperino

This 'crown' settlement system (fig.2) was well integrated and has a strong character in the deep countryside of the Tavoliere, which led in the palate to the shared choice with local institutions, to nominate the centres built to the south of the Foggia territory in the redistribution hypothesis of the 4000 migrants of the Mezzanone ghetto. Starting from the east, these were the arch formed by Borgo Mezzanone (a hamlet of Manfredonia), Incoronata, Borgo Cervaro, Segezia and Borgo Giardinetto, later reduced in the course of the project sharing processes on national and local inter-institutional tables, to just the three centres of Segezia, Borgo Cervaro and Borgo Mezzanone (fig. 3 - 4 - 5).

Fig. 2. Territorial strategy, Pic by Letizia Chiapperino

Fig. 3. Borgo Segezia, Pic by Nicola Cavallera ©

Fig. 4. Borgo Cervaro, Pic by Nicola Cavallera ©

Fig. 5. Borgo Mezzanone, Pic by Nicola Cavallera ©

In the proposed settlement strategy, these villages constitute an important spatial capital in the deep countryside capable of accommodating new agro-urban communities, based on a polycentric system of small settlements, placed 'in proximity' to one another and related to the

Tavoliere's *agro-towns* through a dense network of roads. This system, of which Foggia constitutes the fulcrum, still retains its settlement and 'infrastructural' value, since it best interprets the Tavoliere as a plain garrisoned by a constellation of 'poles' of different rank.

This choice is not based on a banal neo-Enlightenment vision, which sees in the origin of the construction carried out by the ONC, with the cultivation and populating of the countryside, the hypothetical renewal of a strategy that is now outdated by time and history, but rather a 'patrimonialist' vision of this territorial system, neither merely historical nor aesthetic, which from the front of its proactive potential for territorial transformation can offer an answer to overcoming the ghettos, avoiding the failed experiences of the large container camps.

Hence, small foundation towns and hamlets are not a mere testimony of the past, but an important presence that establishes links between different places and times: the long life of these extraordinary urban nuclei and the tight timeframe provided by the NRRP for the implementation of the Integrated Urban Plan. Ultimately, this option looks at the heritage theme in the sense of the *Heritage of Living,* which poses the question underlying all interventions that have a relationship with the modern, questioning how, today, we can consider ourselves heirs of that season and at the same time how the notion of heritage is being rewritten, at a time when we can no longer call ourselves modern (Andriani, 2010).

This territorial strategy linked to settlements then hinges on the vast Daunia area in the great landscape enhancement design of these areas outlined by the PPTR (Regional Territorial Landscape Plan) (Apulia Region, 2015), which proposes the territorialist vision of its scientific coordinator Alberto Magnaghi, which programmatically addresses the 'regional landscape producers' and offers an open tool that goes beyond traditional reconnaissance and constraint visions to the benefit of a proactive position, which is articulated in five Strategic Scenarios as five 'Implicated Projects' of the regional landscape in strong integration with each other.

Of these Scenarios, the LAP's proposal mainly crosses two, because they are pertinent to the long-lasting settlement structure referred to in the previous paragraph: *The City-Countryside Pact* and *The Slow Mobility Infrastructural System*(Apulia Region, 2015).

The integration and overlapping of elements referable to these strategies, to their visions, to pact forms and resources put in place by the Region for the realisation of specific sectoral projects (landscape and mobility) suggest the territorial design of the new settlement system underlying the IUP instrument. The cereal-growing 'deep countryside' can be progressively transformed into 'peri-urban countryside' with the new conditions created by the necessary enlargement of the residential areas of the ONC hamlets, through specific zoning plan modifications, for a new housing offer that is structured between the extremes of new residential complexes for the demand for permanence and the bivouac of temporary and reversible dwellings for the needs of nomadism. Worker-inhabitants, in perspective, would thus be located in a diffuse way in the territory they refer to, in proximity to working contexts, in spatial conditions that can favour productive autonomy for self-subsistence as much as for proximity trade, being able to stimulate new supply chains and entrepreneurship in the space.

Indeed, the peri-urban countryside lends itself to direct and cooperative forms of cultivation, as well as the provision of new ecosystem services[12].

The slow mobility system, on the other hand, reinterprets the road connecting the three centres as an infrastructure for cycling and public transport, guaranteed by intersecting regional mobility policies (Regional Sustainable Mobility Plan, Regional Tratturi Plan). The ONC villages road starting from Segezia stops at the other end in the passenger and freight railway junction of Borgo Cervaro, and crosses the Tratturo Regio on its route, which branches off into this territorial system starting from Foggia. This is the infrastructural system that could allow new residents to reach the regional capital, as well as to join the regional rail transport system. The hypothesis of activating subsequent actions capable of making workers self-sufficient in both work and individual mobility, for example by providing bicycles or defining a dedicated bike-sharing service, also appears consistent with the hypothesis of breaking free from recourse to the Caporale, which today represents the only possibility of getting out of the informal camps for all travel needs (Tarsi, 2020).

The settlement strategy

The absence of residential heritage to be rehabilitated in the above-mentioned Hamlets ONC imposes the need to intervene with new buildings to meet the housing demand of Borgo Mezzanone's residents, who could acquire an active role in the definition of the domestic space, but above all of the relational space. This perspective stands in discontinuity with the approaches followed so far, with settlement solutions that are recurring emergency model of the camp through the use of containers, and with the modalities defined by Measure 5C2 of the NRRP, which eludes the direct and active involvement of the recipients of the interventions[13]

Within such a complex territorial system, the settlement strategy intends to measure and accommodate the informality of migrant workers' spontaneous settlements by experimenting with design flexibility as a principle of spatial organisation capable of accommodating the socio-cultural diversity and permanence/temporality needs of the inhabitants, distancing itself from hetero-imposed assertive modes, and as an opportunity to recognise the aptitude for space production, as witnessed by the different practices of living in informal slums. This perspective can be found in the reflections and experiments developed in the 1970s, by Habraken in Holland[14] (Habraken, 1974) and Maurios and Kohn[15] in France, in contrast to the city of the Modern Movement by proposing a building process that reduces the technical and formal control of the designer in favour of the active involvement of the future inhabitant (Bianchetti, 2020). This new conception, developed mainly at the building scale in the period of innovation of the construction process with prefabrication, disrupts the predetermined character of the

[12] The planned establishment of an Agrarian Multifunctional Park supports the physical and infrastructural connection of the three centres involved in the redistribution of the Mezzanone ghetto workers.

[13]This closure to opportunities for confrontation, as well as increasing the condition of *protracted displacement of* migrants forced to leave the ghetto and move to accommodation that does not meet their personal needs, could limit the effectiveness of interventions.

[14] Founder in 1964 of SAR (Stiching Architecten Research), his studies on residence according to '*support/ infill*' principles were followed up in the non-profit 'Open Building' movement that is still active today. See website:https://www.habraken.com

[15] Authors of the *Les Marelles* intervention carried out in Val d'Yerres in France used constructive experimentation to achieve maximum architectural flexibility of residences (Herrou et al., 1975).

modern space defined on «...uses corresponding to normalised groups of needs» (De Carlo, 1973) in favour of a space of relationships in which social activity and capacity for appropriation are fostered through the flexibility and modularity of spaces (Viganò, 2023). If transposed to the urban dimension, it allows the inhabitants to recognise margins of action and responsibility and to exercise claims and appropriations of space that contribute to defining the 'right to the city' in Lefebvre's conception.

The outlined elements try to clarify the directions along which the research work is trying to intervene on the condition of invisibility of workers and informal settlements. In this sense, one agrees with the thesis that invisibility is a condition, perhaps resulting from the desire for opacity, but certainly, tension is «between what one wants to make visible and what one wants or cannot but keep invisible» (Balducci, 2023:339), which shifts the responsibility for leaving subjects in oblivion into the realm of political will (and action).

The proposed solutions, on the technical-administrative feasibility of which the study will continue, try to enhance the attention and prospects for change, i.e. to offer the opportunity of the choice of solutions (housing, mobility) different from those we have had so far, which show new attention, and thus support the emergence in the visible of individuals. The research thus aims to stimulate a political culture of intervention that does not devolve to voluntary work, and which in turn can foster cultures of integration and sociability, as a tentative - but not protracted - way of responding to the problematic dimension represented by the informal ghettos of workers in the agricultural sector.

Equally, we are aware that this strategy cannot be decisive, but the governance identified is the optimal institutional condition for achieving further results, notwithstanding the need to innovate welfare and labour policies.

Attributions: although they are the result of common reflections and research work, are to be attributed to M. Annese §1, L. Chiapperino § 2, M. Annese and L. Chiapperino § 3.

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Strategies for Small Public Space to Reclaim Urban Green

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Abstract
Small public urban green space is a category of urban public space characterised by its abundant quantity and widespread distribution. In many cities, like Karaköy in Istanbul, rapid development and privatisation are impacting city dwellers' well-being and ecological health. Over the years, the current state of urban green spaces in the city are declining. We believe these small public spaces need to be reclaimed and prioritised. Through this paper, we aimed to illustrate how even small public spaces can be transformed to green space. We conducted literature review and employed Jan Gehl's observation. Our findings suggest innovative solutions maximising the usability of existing spaces, by integrating adaptable design concepts that promote community engagement and enhance aesthetic appeal within sustainable parameters.

Keywords: *reclaiming green space, community health, public spaces, small space, privatisation impact.*

1. INTRODUCTION

Green spaces are essential urban infrastructures, especially in densely populated urban areas (Verheij et al., 2023). Urban parks and green spaces provide essential ecosystem services and public benefits (Wu et al., 2023). However, the scarcity of large open spaces is a significant issue in densely populated urban areas. This shortage makes urban green spaces, crucial for sustainable development and community well-being, highly valuable especially in high density cities (Akpinar, 2016). Haase et al. (2014) highlights the significant role of these urban green spaces in contributing to biodiversity, local climate regulation, and providing recreational opportunities. Moreover, the importance of green spaces for ecological sustainability and urban biodiversity (Kabisch et al., 2016). Significance of urban green spaces in densely built environments is also highlighted, emphasising their contribution to linking landscapes and communities (Benedict & McMahon, 2006). While urban green spaces serve various functions, including social, recreational, and cultural purposes, it also provides economic and environmental benefits (Haq, 2011). In addition, urban greenery aims to boost property values by improving aesthetics and functionality (Chen et al., 2022). In densely populated cities, the positive effects of green spaces are well-studied. They help reduce stress, enhance social cohesion, and contribute to overall mental well-being (Hartig et al., 2014; White et al., 2013). With rapid urbanisation on the rise, integrating green spaces into urban planning and policymaking has become more important (World Health Organization, 2016), supporting the idea that green space is a fundamental right.

Although it is widely acknowledged that green spaces have a positive impact on urban residents, the availability of such spaces in densely built cities adds another layer of complexity. This study suggests that the provision of small public urban green spaces could be a solution to this issue. According to Fei & Mao (2020), small public spaces constitute a distinct category within urban public spaces, they are widely distributed and compact. Since 1960, an increasing number of academics have recognized the importance of small public spaces and have researched methods to examine their utilisation (Hou et al., 2020). Small public space is one of the key built environment elements that provide venues for a variety of activities, may have a major impact on the quality of people's lives, and could even potentially contribute to both the physical and mental health of residents (Gilles-Corti, 2006). Research has shown that small

public urban green spaces offer numerous benefits, including improving self-perceived mental health regeneration (Peschardt et al., 2012). However, further analysis is needed to determine whether expanding these features is an effective approach for enhancing cities' liveability (Peschardt et al., 2012). Designing and evaluating small urban green spaces can promote the development of "green cities," mitigating the negative effects on well-being caused by rapid urban development (Jia et al., 2016). Ensuring an adequate supply of public green spaces is a vital aspect of achieving densification that effectively contributes to the development of more sustainable cities. While research on Small public urban green spaces is still limited, this study aims to address this gap by examining the availability of small public spaces and their relationship to urban green spaces.

We acknowledged the benefits provided by small public urban green spaces in an urbanising world are undeniable. Our research focuses on the main question: “How can green spaces be reclaimed in small public spaces?” We aimed to understand the intricate relationship between prioritising small public spaces and maximising their availability for urban green spaces. This will contribute to more informed urban planning decisions, ultimately enhancing the quality of life in these distinctive urban settings. This approach helps understand the relationship between urban development, community health, and environmental sustainability in small spaces. The structure of this paper includes an introduction emphasising the need for and solutions to enhancing small green spaces, a literature overview, a framework for reclaiming green space in a small urban space, a methodology section, and an analysis of Karaköy's public space as a project case study. Then, the paper concludes with a discussion of these findings.

2. DESIGNING SMALL GREEN PUBLIC SPACES WITHIN DENSE URBAN CONTEXT

A comprehensive framework for such projects must consider multiple factors to ensure maximum efficiency and functionality (Xi et al., 2024). In the quest to reclaim green spaces within the densely populated area, we need to consider the relationship between design elements and the established criteria for community health. The literature underscores the value of play and relaxation areas in fostering social interaction—a key aspect highlighting the importance of inclusive play structures and restful green corners for community well-being (Francis et al., 2012). The interaction among users is another criterion that can be enhanced by the thoughtful selection of trees and plant species (Kuo et al.,1998), which not only encourages gathering but also bolsters environmental and mental health through increased biodiversity and aesthetic appeal. Furthermore, the vital role of community engagement in maintaining and enhancing these urban green spaces (Krasny & Tidball, 2012), such as leisure facilities and community gardens, plays a significant role in promoting physical health and creating platforms for community engagement in urban spaces (Holland, 2004). The design's inclusivity, ensures that green spaces are seamlessly integrated into the urban environment (Amin, 2006), offering a welcoming embrace to a diverse populace. This inclusiveness is reflected in the presence of pedestrian pathways and public seating areas that cater to various needs, resonating with Gehl's (2011) principles for successful public spaces.

Table 1: *Pillars for the design of public green space (Source: Author’s*

Reclaiming Green Space		
Research keywords	**Criteria**	**Design Element**

Community Health (Kuo et al., 1998; Francis et al., 2012; Krasny & Tidball, 2012; Holland, 2004)	• Community Engagement • Users Interaction • Leisure Facilities • Access to greenery (experimental) • Impact on Ecology Viability	• Play • Relaxation area • Trees • Plant species selection
Public Space (Gehl, 2011; Amin, 2006)	• Openness and access • Inclusive design • Integration with the urban fabric	• Community gardens • Pedestrian pathways • Public seating areas • Interactive installations
Small Space (Zhong et al., 2023)	• Efficient Space Utilisation • Open Activity and Flexible Use • Vertical space utilisation	• Micro parks • Green walls/ Vertical gardens • Multi-tiered planters
Privatisation Impact (Hou & Rios, 2003; Angotti, 2008)	• Equity in space distribution • Public vs. private space delineation • Community rights to green space	• Public space protection • Public access agreements

In addressing the challenges of limited spaces, the need for efficient utilisation of space through open activity design, echoing the versatility of micro-parks and vertical gardens in providing green relief in urban density (Zhong et al., 2023). Furthermore, the equitable distribution of these spaces ensures that they serve as public assets rather than private commodities (Hou & Rios, 2003), emphasising the importance of public space protection and accessibility agreements as noted by Angotti (2008). The literature review (Table 1) forms the basis of this framework, we summarised research keywords from different studies with the aim to reclaim green space in densely urban areas. It highlights the importance of urban green spaces for city vitality, supporting this design approach and showing the link between human well-being and urban design. This study aimed to develop a systematic framework for cities facing similar challenges in transforming small urban areas. We evaluated the reclamation green space based on four criteria: community health, public space, small space, and privatisation impact. Then, we integrated design elements based on all research keywords and criteria.

3. METHODOLOGY

3.1 Case Study: Karaköy Public Ferry Square in Istanbul

Istanbul, with the population of 15,907,951 (Turkish Statistical Institute, 2022), experienced significant transformations due to rapid urbanization and development. Although these changes have facilitated economic growth, they have also caused urban sprawl and had adverse environmental and social effects (Erbas 2013). In recent years, public spaces in Istanbul have been losing their natural characteristics at an accelerated rate compared to the past. Today, public space in Istanbul, especially those who located in the waterfronts are predominantly developed with minimal natural green spaces and parks (Turkuoglu & Secmen, 2019). Public spaces located on urban waterfronts are considered valuable and unique because they combine natural water features with green spaces to fulfil the physical and social needs of urban residents (Turkuoglu & Secmen, 2019).

While there is no doubt that green space provides multiple benefits, the green space per person in Istanbul is only 7.04 m² (IBB, 2020), significantly lower than the minimum of 15 m2

suggested by the Ministry of Environment and Urbanization in Turkey, and even below the World Health Organization's recommendation of at least 9 m2 per person. Istanbul is divided into 39 districts, and there is a noticeable disparity in green space distribution across these districts, with most districts lacking sufficient urban green spaces. In Beyoglu, the district where Karaköy is located, the rate of green space is 2.7 m2 per person (Figure 2). Recent research indicates (Figure 1) that Istanbul ranks last among world cities with a green area ratio of 2.2%. Oslo leads with the highest green area ratio of 68%, followed by Singapore (47%), Vienna (46%), Chengdu (42.3%), and Zurich (41%). Alongside European cities, Asian cities also feature prominently in the top rankings. (World Cities Culture Report, 2018).

Figure 1 International Green Space Map (Source: Istanbul Buyuksehir Belediyesi in 2018).

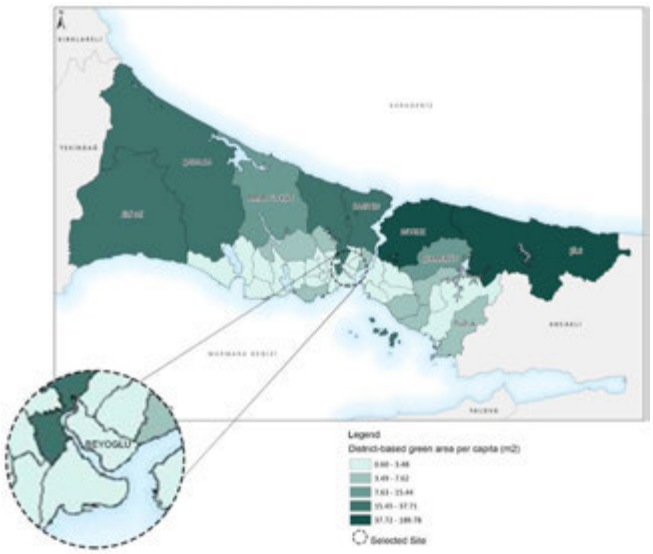


Figure 2 Istanbul's district-based green area per capita in m2 (Source: Istanbul Buyuksehir Belediyesi in 2018).

Figure 3 Beyoglu district zoning plan in 2023 (Source: Istanbul Buyuksehir Belediyesi).

Our study area, Karaköy where the ferry square is located (Figure 3), is one of Istanbul's public space waterfronts and one of the oldest and most historic districts of the city. This transformation highlights the challenge of integrating the available small public spaces within a rapidly developing environment. Karaköy is rich in heritage, balances the preservation of its historical identity with contemporary urban demands (Tepeli & Ocakci, 2017). Despite the limited size and the availability distributed in the upper-scale context, Karaköy have become vital for community engagement and cultural expression. These spaces, characterised by a blend of old and new architectural styles (Celik, 2023), especially after the redevelopment of Galataport as the major changes in the area, brought the area as a one of main public points.

Figure 4 Views from waterfront & current physical conditions of the site (e.g.: lack of seating areas, and ordinary facade designs) (Source: Author's).

The small public spaces in Karaköy, with the plan to integrate with the green spaces, play a crucial role in enhancing the urban fabric's health and vibrancy. Karaköy waterfront was specifically chosen for its status as a transient area, predominantly used for passing through rather than for specific activities, while there are more potential uses of the public square. The aim is to transform this space into a more vibrant and interactive area, encouraging community engagement and activities beyond just transit. Unfortunately, the redevelopment in Karaköy, as in many urban areas, is a decrease in green spaces due to development pressures and rapid urbanisation. Privatisation, a significant factor in this transformation, often prioritises commercial development over public spaces, impacting the availability and accessibility of green areas. Green spaces are crucial for increasing user interaction as they provide communal areas for socialising, relaxation, and engagement with nature, fostering a sense of community and enhancing the quality of urban life (Catel et al., 2008; Young et al., 2004). Integrating more green spaces in Karaköy can combat the negative effects of urban density, creating a healthier, more vibrant, and interactive urban environment.

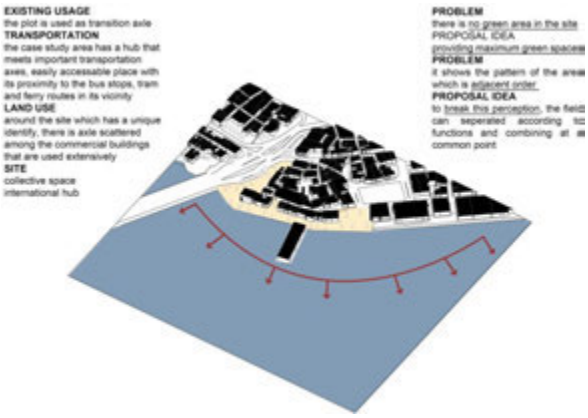


Figure 5 Image Diagram of the Site (Source: Author's).

Additionally, the specific selection of Karaköy for this study leverages its ongoing transition from a traditional to a more modernised urban area, which presents unique challenges and opportunities for green space integration. The neighbourhood's compact size and high population density make it a prime example of where small-scale interventions could have significant impacts. The transformation of underutilised or underappreciated small spaces integrated to active green areas could serve as a model for other urban centres facing similar issues of space constraints and urban densification. This approach not only aims to reclaim green space but also to redefine the function and perception of these areas to support sustainable urban living and ecological resilience.

3.2 Research Focus and Assumptions

Our research primarily concentrates on exploring how small public green spaces can be reclaimed and optimised for resident's use in dense urban areas like Karaköy, Istanbul. We formulated the following assumptions to guide our inquiry, based on the extensive literature review and observational methods by Jan Gehl:

1. Transforming small public spaces into green areas significantly enhances the ecological health and aesthetic appeal of urban environments, contributing positively to community well-being.
2. Community engagement and upkeep of urban green spaces increase their effectiveness and sustainability.
3. Adaptable design solutions that incorporate green elements, such as vertical gardens and micro-parks, are crucial in maximising the utility of confined urban spaces.
4. The integration of small green spaces into urban planning is essential for sustaining urban biodiversity and improving residents' quality of life, even in highly urbanised settings.

To substantiate these assumptions, our methodology encompasses a mixed-methods approach, employing both qualitative observations and quantitative data analysis. This methodology is implemented specifically in Karaköy, Istanbul, focusing on the detailed observation of existing public spaces and their current use and potential for transformation into vibrant, green areas.

3.3 Analysis and Synthesis

We conducted a thorough analysis of the space in the study area, and we considered the available size, location, and existing infrastructure. In this section, we present the findings of our analysis using Kevin Lynch's framework and Jan Gehl's analysis method to understand the urban design elements and the physical characteristics of the site in Karaköy, Istanbul. From the findings, we prioritised the integration of greenery to maximise the use of limited space and we proposed design aims to transform Karaköy into a vibrant and sustainable urban space, while keeping the harmony of historical preservation and contemporary urban living.

3.3.1 Site Analysis

For the site analysis, we used Kevin Lynch's framework (Figure 6) to bring forth the distinct of urban design elements in Karaköy. Lynchian techniques help create memorable and legible urban spaces, potentially enhancing residents' sense of attachment to the city (Larice & Macdonald, 2007). The Galata Port's emergence as a key node redefined the area's dynamics, overshadowing traditional squares and leading to a decline in their use. The ongoing construction nearby further impacts this landscape. This primary objective is to revitalise these public spaces, enhancing their functionality and appeal while preserving Karaköy's unique historical and cultural identity, thereby fostering a more engaging and vibrant community environment.

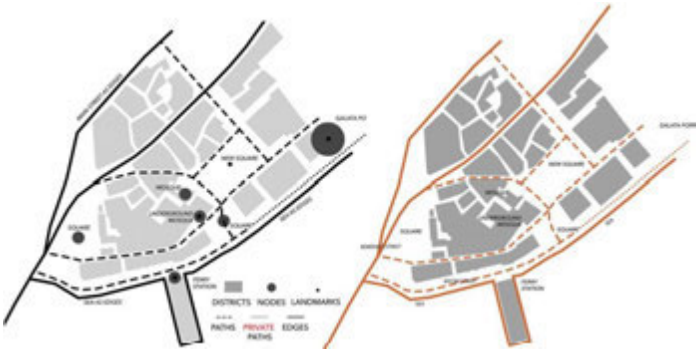


Figure 1 Lynch Analysis (Left) & Circulation Analysis (Right) (Source: Author's).

In this circulation analysis (Figure 6), this study examined the movement within Karaköy, noting its connectivity via tramway, ferry, and bus. Post-urban transformation, the focus shifted towards Galataport, leading to increased usage of the waterfront and squares primarily for transit purposes. Three potential squares were identified, and the removal of a multi-story parking area opened new possibilities for creating additional public space, further reshaping the area's dynamics, and offering opportunities for enhanced public engagement and revitalization.

3.3.2 Jan Gehl's Analysis – Physical Characteristic of the Site

Gehl (2011) analysed the relationship between urban space activities and the quality of the physical environment by categorizing activities into three types: necessary activities, optional activities, and social activities. Gehl argues that each of these types of urban space activities has different dependencies on the physical environment. We employed Jan Gehl's method for detailed observation of public spaces and human behaviour, this study gained insights into the utilisation of Karaköy's areas. We categorised activities into 'necessary,' like shopping or walking to bus stops, and 'optional,' such as jogging, sitting on benches, or fishing.

This distinction helps in understanding the engagement level in the public spaces of Karaköy. It becomes clear that while necessary activities are prevalent, there is ample scope to enhance optional activities, thereby enriching the social and recreational value of these spaces.

Figure 2 Physical Characteristics of the Site (Source: Author's).

Using Gehl's public space observation method from the questions how many, when, where, what, who, and how long, the analysis of Karaköy Square reveals that the ferry station, positioned at the forefront of the square, supports high pedestrian volume due to its 500-passenger capacity, peaking when ferries arrive, especially when ferries dock, but the train station sees less foot traffic. The square was frequented by individuals mainly aged 20-60, however as this study observed, there was a lack of family engagement. Moreover, activities range from necessary ones like transit to optional leisure pursuits, yet the space serves largely as a pass-through rather than a destination. The aim is to enhance this space's use, encouraging visitors to linger and engage more deeply with the environment.

3.3.3 Image Diagram

The detailed Image Diagram (Figure 10) provides a comprehensive look into Karaköy's urban framework. It's currently a transit route, characterized by the movement of people rather than a place where they stay and engage. Figure 8 shows the current situation of the proposed site as a hub; it has strong connections to Istanbul's public transport, making it easily accessible. The area's identity is shaped by the prevalent use of commercial buildings, which define its character. Despite being an important collective space, the issue stems from a notable lack of green areas, which are important for the quality of urban life, especially for the users. Addressing this, the proposal recommends introducing greenery to revitalize the space. Additionally, the area's spatial organization is reconsidered by the proposal, which suggests diversifying the layout to encourage various functions to integrate at a central point, fostering a more dynamic and interactive environment.

Figure 3 Current Situation of Proposed Site (Source: Author's).

~~3.~~4 DISCUSSION – A PROJECT CASE OF KARAKÖY

After analysed and synthesised the space in the study area, it reveals that the emergence of Galata Port has transformed the area's dynamics, leading to underutilized squares and a focus on transit use, especially post developments aimed at enhancing transport connectivity. The study identifies an opportunity to enhance optional and social activities within these spaces to enrich the potential of recreational value. Observations indicate that despite high pedestrian volumes at Karaköy Square, it serves mainly as a thoroughfare rather than a destination. The proposed redesign aims to introduce more greenery and reorganise the spatial layout, transforming the square into more vibrant, sustainable urban space that fosters a dynamic and engaging environment, improving the overall quality of urban life.

4.1 Discussion: A Design Approach for Karaköy Ferry Square to reclaim as an urban green space

We created a conceptual design approach along with the design program for a small public space to urban design that emphasizes the efficient use of limited space for green areas, the integration of technology for enhanced user experience, and the importance of community engagement in sustaining these green initiatives. This design approach aims to create an inclusive and dynamic environment while maintaining the density of the pedestrian flow in the area. This plan could serve as a model for other urban areas facing similar challenges of space limitation and the need for sustainable development.

Figure 4 Strategies for Design Plan & Program Diagram (Source: Author's).

Figure 5 Program Image Diagram (Source: Author's).

We emphasise the efficient use of space through a multifaceted approach to urban greenery, designed to enhance both environmental sustainability and community well-being. Firstly, the plan includes physical green environments, areas where individuals can physically interact with nature. These spaces are traditional in nature, such as parks and gardens, designed to encourage active engagement with the environment and physical activity. Next, the visual green experience (VR) zones offer a unique, sensory way to experience greenery, potentially augmented by virtual reality technologies. Visual and sensory interactions with diverse plant life can enhance individuals' preference for and satisfaction with urban environments (Horiuchi et al., 2014; Greiner et al., 2004). This innovative element aims to educate and immerse visitors in diverse plant life and ecological settings without the constraints of physical space. Additionally, the plan incorporates temporary designs & seasonal changes, which use modular and adaptable installations that can be altered according to the seasons. This not only enhances the design flexibility of the area throughout the year but also meets the changing ecological and recreational needs of the community (Siu & Wong, 2015). Vertical greenery & green facades are another aspect, where vertical and building-integrated greenery are utilized to maximize the green space without expanding the footprint. This strategy involves the use of green walls and vertical gardens that are irrigated by harvested rainwater, making it a

sustainable option for urban greening. Vertical greening systems not only improve urban air quality but also reduce the urban heat island effect, making them an essential component of sustainable urban development (Susca et al., 2022)

Lastly, the introduction of a community engagement application highlights the plan's focus on interactive and participatory urban management. This mobile application is designed to keep the community informed about local green space events and initiatives, allowing residents to participate actively in the planning and enjoyment of their environment. It serves as a platform for feedback and engagement, ensuring that the green spaces serve the needs and preferences of those who use them. Incorporating a mobile application into Karaköy's urban development plan could significantly enhance user engagement (Borchers et al., 2023), particularly among the youth. This app could provide information on events and activities in the area, fostering community involvement and interaction. Alongside temporary and portable furniture designs, such technological integration would add to the dynamic and adaptable nature of Karaköy's public spaces. These initiatives align to make Karaköy's green spaces more accessible and enjoyable and ensure a harmonious blend of historical background and contemporary urban living. However, with Istanbul's seasonal changes, it needs to be mentioned that plants are planted based on the season as an opportunity to experience a sense of green according to the season.

4.2 Strategies

As a result of these proposed strategies, innovative green initiatives are being introduced to maximise the green space within the area. This project aims to integrate a variety of green elements: physical green spaces for recreation, visually engaging green experiences for education, adaptable designs for seasonal dynamism, vertical greenery to maximise limited space, and a smart app to enhance community engagement.

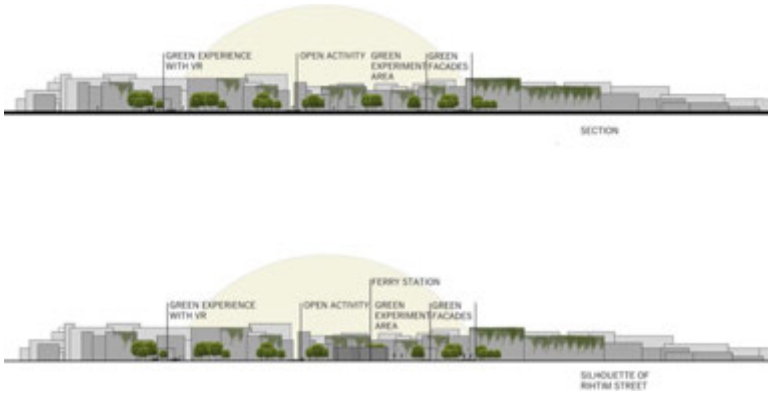
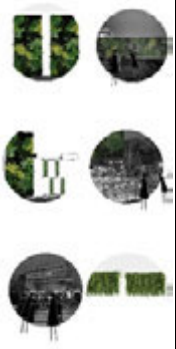


Figure 6 Section and Silhouette of the Site included with Strategies (Source: Author's).

Table 2 *Strategies for the design proposal (Source: Author's)*

Strategies	Visual	Aim	Successful Example	Expected Impact

Physical green environment		To create a tangible green environment in Karaköy that provides physical interaction with nature, enhances urban greenery, and offers recreational spaces for the community.	The High Line in New York City is an excellent example of converting an old railway line into an elevated green walkway.	-Improved air quality and provide natural shading. -Increased opportunities for physical outdoor activities, promoting health and wellness. -Enhanced green diversity and habitat provision in the urban setting.
Visual green experience		To develop an area where plant types and ecological concepts are explained through visual and sensory experiences, fostering educational engagement and aesthetic appreciation.	The Prinzessinnengarten in Berlin is a community garden where locals grow their own food and plants, fostering community interaction.	-Increased environmental awareness and education among residents. -Enhanced sensory experience, contributing to mental well-being and stress reduction. -A visually appealing urban landscape that attracts more users to visit
Temporary Design and Season Changes	 	To implement adaptable and temporary green designs that evolve with Istanbul seasons.	Nature Playground in Valbyparken, Copenhagen, which uses natural materials and encourages interactive play.	-A continuously changing landscape that keeps the urban environment fresh and engaging. -Educational insights into the seasonal aspects of plant life and urban biodiversity. -Encouragement of repeated visits and sustained interest in the green space.
Vertical Green and Green Facade		To incorporate vertical green structures and green facades in Karaköy, maximising green space in areas with limited ground space.	Bosco Verticale in Milan, Italy, integrates plants into its high-rise design, improving air quality and biodiversity.	-Innovative use of vertical space for greenery, increasing the total green area. -Improved building aesthetics.

Smart App for Community Engagement		To develop a smart application that facilitates community interaction, and participation in green space activities, and provides educational content about urban sustainability.	Love Your Park app in Philadelphia, USA. Allows residents to find local parks, learn about events and volunteer opportunities, and provides a platform for feedback and suggestions	-Strengthened community bonds through shared engagement in green initiatives. -Easy access to information and resources for sustainable urban living. -Increased participation in community events and environmental stewardship programs

4.5. CONCLUSION

The research conducted in Karaköy brings critical new insights into the integration of green spaces in small public urban areas, particularly through innovative and adaptable design solutions suitable for densely populated cities. This study breaks away from traditional urban design norms by demonstrating practical ways to transform minimal urban spaces into productive green areas. By employing micro-parks and vertical gardens, the research showcases how even limited spaces can be maximised for ecological and social utility, challenging the conventional approach to urban green spaces. One of the notable contributions of this study is its emphasis on adaptable design. The research highlights the use of modular and movable green infrastructures, such as portable garden installations and seasonal green walls. These adaptable solutions cater to the dynamic needs of urban environments and can be modified in response to seasonal changes and urban demands, offering a flexible alternative to the fixed nature of traditional green spaces. Furthermore, the study redefines the ecological role of small green spaces in urban settings, positioning them as integral elements of urban ecology. These spaces are portrayed not just as recreational areas but as crucial nodes that contribute significantly to urban biodiversity, thus enhancing their role from mere aesthetic enhancements to vital ecological assets.

The research also emphasises a community-driven approach to the management of green spaces, where local involvement extends beyond usage to encompass planning and maintenance. This participatory approach ensures that the green spaces meet the specific needs of the community and are more likely to be sustainable in the long term. Finally, the study offers new perspectives for policymaking, suggesting that urban planning should prioritise not only the inclusion of green spaces but also the incorporation of flexible designs and community involvement as central components of urban development. These insights advocate for policies that foster resilient urban environments, adaptable to both human and ecological needs, thereby enhancing the sustainability and liveability of cities.

One primary limitation is the scale and transferability of findings, as insights derived from Karaköy may not directly apply to different urban settings with varying cultural, economic, and environmental characteristics. There's a need to examine whether these design solutions can be effectively implemented in diverse urban landscapes to establish their broader applicability. For future research, comparative studies across different cities would be valuable to understand the universal applicability of the strategies developed in Karaköy. Longitudinal studies could provide data on the long-term ecological and social impacts of green space

interventions, offering a clearer picture of their effectiveness and sustainability. Furthermore, detailed economic and environmental impact assessments could elucidate the costs, benefits, and ecological impacts of these green initiatives.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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Social Media Text Mining and Flood Disaster Analysis of Small Towns in Southern Shaanxi Qinba Mountain Area Based on Deep Learning

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ABSTRACT

The advent of the dataization era has made social media a new trend and tool for analyzing and managing flood risk. This paper aims to use the BERT-BiLSTM-CRF method to analyze the information on social media such as Weibo, and extract the content related to the flood of small towns in the southern Shaanxi Qinba mountain area. Firstly, we use python crawler to crawl the text data on social media such as Weibo, and then preprocess the data, including removing stop words, punctuation marks, emoticons, etc. Secondly, we use the BERT-BiLSTM-CRF method to perform named entity recognition on the text data, identify entities such as place names, person names, organization names, etc., and annotate them in BIO format. Then, we use methods such as geodetector to geocode the identified place name entities, obtain their latitude and longitude coordinates, and match them with the flood data of small towns in the southern Shaanxi Qinba mountain area, and analyze their flood distribution and flood relationship. Finally, we use flood risk analysis methods, such as flood frequency analysis, flood depth analysis, flood loss analysis, etc., to evaluate the similarity and difference of Weibo information and urban flood risk, and explore the impact and reflection of Weibo information on urban flood risk. In addition, using the high-precision risk analysis method of social media analysis, the flood risk and danger of small towns in the southern Shaanxi Qinba mountain area are evaluated, and the potential impact of flood disaster on the spatial characteristics of small towns is analyzed. The innovation of this paper lies in the combination of deep learning methods and flood analysis methods, extracting the information related to small town floods from large-scale social media data, providing new data sources and analysis methods for towns flood prevention and disaster reduction, and considering the impact factors of flood disaster, providing reference for small town planning and development.

Keywords: Flood Disaster Analysis, climate change, Flood resilience strategies, Small Town Planning, Social Media Text Mining

1. Introduction

In recent decades, climate change has led to an increased frequency of natural disasters, posing severe threats to urban areas and resulting in significant social and economic impacts(Chang et al., 2021). Under the influence of global warming and urbanization, extreme rainfall events and the subsequent urban flooding have become increasingly common. The frequency and intensity of urban flooding in major densely populated cities worldwide are expected to rise substantially. Statistics indicate that floods account for over 30% of the total economic losses caused by natural disasters globally(Shamsuddin, 2020). Floods are among the most destructive disasters on Earth, posing a substantial threat to large populations. Due to

meteorological factors and observational limitations, traditional data sources on flood disasters are increasingly inadequate for addressing the growing frequency of such events(Chen et al., 2020).

To minimize the impact of disasters and enhance recovery, urban resilience is crucial for cities to withstand and recover from external disruptions. Urban resilience, as an advanced approach to addressing natural hazards, has become a key concept and is highly emphasized in scientific and policy discussions(Shi et al., 2021). Due to the interplay of various factors such as cultural adaptation, social, and economic development, the concept of urban resilience is complex and multifaceted, making the creation of universally applicable metrics challenging. As illustrated in the table, research on urban resilience reveals our progressively refined understanding of the concept. Holling introduced the concept of ecosystem resilience, distinguishing between engineering resilience and ecological resilience, and then applied the concept of ecosystem resilience to human social systems, proposing evolutionary resilience(Sharifi, 2019). Engineering resilience emphasizes the system's return to its original state after a disturbance, while ecological resilience prioritizes system balance. On the other hand, evolutionary resilience prioritizes learning and innovation to adapt to new environments(Liu et al., 2020). Although there is no unified definition of urban resilience in the current literature, a relatively consistent understanding exists. Urban resilience refers to the capacity of urban systems to maintain their functionality in the face of natural or unintended disasters, encompassing social, economic, ecological, and infrastructural functions. Various stakeholders implement a series of measures through learning and experience to address and adapt to current and future challenges.

Social media have already established people's connection with other people living both in and beyond the boundaries of urban areas through real-time interaction, crowdsourcing, and accessibility, which strengthens the relationships among social groups. It is a well-known fact that Weibo helps in the retrieval and dissemination of information during urban research on disaster awareness and response. Meanwhile, human behavior related to real-time disaster could be dug out, hence of critical importance under the background of social perspectives of urban resilience, compared with those from the traditional information sources. With the wide application of social media data, social media, with enormous strengths in the dissemination of information, are increasingly one important channel for disaster communication and also an important source for rapid and comprehensive disaster assessment. The use of social media data in flood risk analysis contributes a new method for disaster management. In this way, it can complement traditional flood risk assessment through real-time data and provide a basis for urban planning and disaster response. Through the BERT-BiLSTM-CRF model, flood-related information from Weibo is extracted and geocoded to allow the identification and analysis of flood events in small towns in the southern Shaanxi mountain area of Qinba, and the work shows that the combination of deep learning with social media analytics has the potential to significantly advance flood forecasting and response planning in small towns.

2. Methodology

As shown in Figure 1, This process flow chart shows extraction and analysis information in a Flooding Scenario on Weibo using the BERT-BiLSTM-CRF Model. In data collection, a crawler is used to collect text data resources on Weibo. There follows a step of text preprocessing to exclude from it the so-called "stop-words," punctuation, and other redundant information. Here, the BERT-BiLSTM-CRF method applies named entity recognition, and annotation of place names, personal names, and the names of organizations in BIO format was applied. Then, the place names are geocoded to get its longitude and latitude coordinates by the geodetector, matching with the small town-related data of floods in the southern Shaanxi Qinba mountain area. The flooding analysis in this case is the step to examine the spreading and relationships of flooding. The appraisal examines the commonalities and the disparities between the Weibo information and urban flood risk. Equally, it reflects on the implications for flood risk and hazard in small towns.

Figure 1: Weibo Flood Information Extraction and Analysis Process

2.1 Study area and data

The study area is the Qinba Mountain region of southern Shaanxi, which has a large number of rivers, including the Han River, running through southern Shaanxi. The geographical location and meteorological conditions make the Qinba Mountain region in southern Shaanxi highly prone to heavy rainfall and flooding. In July and August 2020, this region had a huge amount of rainfall, most areas were submerged in water, inducing floods. Therefore, this paper attempts to extract location and water level information related to the flood disaster in social media information. The present study was based on the spatial and temporal characteristics of the selected data after extraction, to explore the process of urban inundation in relation to exposure information. Posts published on the Sina Weibo platform from July to August 2020 had been retrieved and, as shown in this table, key fields comprise the user ID, time stamp, content, and check-in position. The direct scraping of web data removed the sources of sensitive attributes before data collection, but the fields of user nicknames and IDs had not been collected in advance in order to meet the requirements of user privacy protection. We will only collect data captured from the positions of posts on the platform using Python web scraping techniques.

2.2 Acquisition of social media data using web crawlers

The number of users of the Sina Weibo platform is the largest among social media platforms in China. The first-quarter financial report for 2023 indicates that the company had 593 million monthly active users as of March 2023, having increased by approximately 11 million compared to the same period a year earlier. Of this, 95% came from mobile monthly active users. In March 2023, the average number of daily active users was 255 million, an increase of about 3 million over the same period last year. With the so many users, this provided a strong support for this work(Wang et al., 2020).

Information on Weibo will have the characteristic of timely information dissemination. Once the public opinion event bursts, there will be an instant discussion among tens of millions of users, which may cause the hot topic to rise to the top of the headline in real-time hot search, updated once every minute. Python-based web crawlers are used for extraction of social media data on Weibo, and the target information contains user ID, account category, tweet creation time, spatial coordinates, and content information, including text, images, and videos. The timestamp of the tweet is used to classify the check-in data into several time intervals, and the spatial coordinates can be used to determine the geographical location where each tweet has been published. The text content of each tweet is examined in order to find whether the tweet is related to the research topic. In the first place, this keyword search can be an effective filter in translating unstructured data using the specific words and phrases. The approach allows for tuning to fit specific needs and objectives, which means the author can create results that can be reproduced under different sets of circumstances. Yet, if the keywords are nonsensical or sufficiently generic, then the search results can be imprecise and in some cases reflect inaccuracies, given the current need for appropriate keywords to be selected and most appropriate to be refined.

In this study, the keywords used for data crawling include location-specific terms such as "Lueyang County," "Nanzheng District," "Xunyang City," "Pingli County," "Ningqiang County," "Hanyin County," "Ziyang County," "Yang County," "Zhen'an County," "Hantai District," "Langao County," "Xixiang County," "Zhenba County," "Liuba County," "Chenggu County," "Foping County," "Shangzhou District," "Zhenping County," "Baihe County," "Shangnan County," "Danfeng County," "Zhashui County," "Luonan County," "Ningshan County," "Shiquan County," "Shanyang County," "Hanbin District," and "Mian County." Additional keywords include "waterlogging," "flooding," "water inundation," "water immersion," "water rise," "water disaster," "internal flooding," "flood disaster," and "flooding disaster."

2.3 Extracting address entities in Sina Weibo texts

2.3.1 BERT-BiLSTM-CRF model

Extracting location names from text falls under the domain of Named Entity Recognition (NER) in Natural Language Processing (NLP)(Zhang et al., 2020). NER involves identifying structured information, specifically entities with distinct meanings, from unstructured text. Compared to English NER, Chinese NER is more challenging due to issues like segmentation ambiguities and polysemy in the Chinese language. Techniques for implementing NER include

rule-based methods, unsupervised learning methods, feature-based supervised learning methods, and deep learning methods, with the latter being the most widely applied.

Recently, deep learning has achieved significant breakthroughs in the NLP field. When applied to NER, it can learn complex hidden representations without the need for elaborate feature engineering and extensive domain knowledge(Devlin et al., 2018a). For example, Mai et al. used a coupled model of BERT, Bidirectional Long Short-Term Memory (BiLSTM), and Conditional Random Fields (CRF) to identify Chinese place names, referred to as the BERT-BiLSTM-CRF model(Devlin et al., 2018b). BERT (Bidirectional Encoder Representations from Transformers) is a pre-trained model derived from the Transformer architecture, used for various NLP tasks. It operates in two main steps: pre-training and fine-tuning. Compared to traditional neural network language models, BERT has achieved state-of-the-art results in several NLP tasks, including text classification, text similarity, intelligent question answering, text annotation, and named entity recognition(Cui et al., 2021). The BiLSTM model consists of forward and backward LSTMs, allowing it to learn the structure of sequences in both directions, effectively addressing the challenge of distinguishing different sentence sequences. The input to the BiLSTM model is the word embeddings obtained from the BERT model, and the output is a score probability matrix for each label corresponding to each word. Additionally, the LSTM units comprise memory cells and three gates—input, forget, and output gates—that control their inputs and outputs. The CRF model simulates Chinese grammar through conditional probabilities, constraining the model's output to conform to grammatical rules and ensuring the accuracy of the output.

2.3.2 Extracting Process

After conducting tokenization and encoding of the text data, it is passed through a pre-trained tokenizer. The rbt6 is a pre-trained Chinese model from hfl that has been fine-tuned through training on a large Chinese corpus and shows excellent performance in Chinese text tokenization tasks. The main goal of the tokenizer is to change the raw text into a format that a model can understand, using the model language knowledge learned from a huge corpus to improve the text data's tokenization accuracy and model input normalization. A custom dataset class was defined to load and process the text data. A class with a data loading function to load and preprocess text data is able to load data from the local disk and filter data to ensure quality and high efficiency in model training. In particular, it thins out sentences with more than 512 tokens, since unnecessarily long sentences might waste computational resources and degrade the model's performance. The dataset class was written to implement the basic idx and getlen methods, which work with data loaders and, in this way, significantly increase flexibility and efficiency in data processing.

A data collation function was written to organize batch data into formats to be input into the model. Mainly, the code participated in: encoding of the input text in a way that may be further transformed into the form of tensor to perform further processing in the model; padding of the labels to assure that the length of the label is the same as the input text; forming the batch data, which will later participate in the model training and evaluation process, so that raw data is transformed into directly processable format to assure the uniformity and completeness of

data input. After preprocessing, a pre-trained BERT model as a feature extractor is used. Since the BERT model has been trained on such a humongous corpus, it generates super quality text representation. The pre-trained model loads and makes a person fully use the huge amount of linguistic representations learned from the big corpus and enhances a lot of performance for the downstream task.

A Bidirectional Long Short-Term Memory (BiLSTM) layer on top of the BERT module is then added to extract sequence features. In a BiLSTM layer, due to the characteristic of bidirectional information transfer, realizing the retention of dependencies that lie on both sides of a word corpus, so the feature representation is more abundant. A Conditional Random Field (CRF) is added to the top of the BiLSTM layer in a sequence labeling task. The major benefit of the CRF layer is that it essentially models the dependencies between the labels. Consequently, it is improving the accuracy of the label prediction. The realization of a training function, to include the following steps: First, the definition of the optimizer and loss function. Second, data are loaded in batches. Features are extracted and then input into the model to obtain the feature vector, which will be used for forward computation to obtain the prediction result. Third, calculate the loss between the prediction result and the true label and carry out back propagation to update the model parameters; finally, save the trained model parameters for subsequent test and prediction. The cross-entropy loss function, in the process of training, is adopted to compute the difference between the predicted results and the true labels. The gradient descent method is adopted to optimize model parameters, thus enhancing the model performance step by step.

3. Results

In this article, we have effectively applied the BERT-BiLSTM-CRF model for processing data on the social platform Weibo to extract information related to floods in small towns in the Qinba Mountain area of southern Shaanxi. We collected social platform text data using Python web crawlers and preprocesses this data, which includes the deletion of stop words, punctuation marks, emojis, and other non-relevant parts. The named entity recognition of the text data was also carried out to obtain place names, personal names, and organization names as entities and were annotated according to the BIO format rules. Then, the identified place name entities were geocoded for the extraction of their corresponding latitude and longitude. In Figure 1, it can conveniently be understood that flood points that were extracted from Weibo data were so successfully mapped to obtain the distribution of floods in the form of visualization.

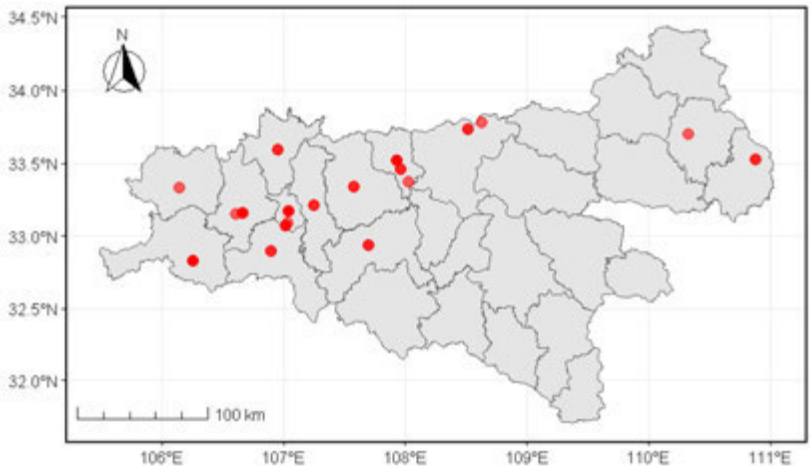

Figure 3: Flood Distribution Map of Towns in the Qinba Mountain Area of Shaanxi

We performed spatial analysis and visualization of flood points in small towns of the Qinba Mountain area in southern Shaanxi. Based on kernel density estimation on the flood data in 2021, 2022, and 2023, we presented the spatial distribution characteristics and trends of the flood points. We successfully located the flood points in these three years and extracted the flood information from Weibo. The flood information was converted into coordinate points and marked on the map. The density distribution of the flood points is represented using blue lines and filled polygons. We compared the distribution of the flood points in different years. We conducted the analysis of the spatiotemporal changes in flood risk, which provided important information for flood risk management. Figure 4 is a comprehensive map where all the kernel density analyses are combined. The red points represent filtered flood points, and the blue lines and polygons represent the kernel density estimates of flood points. This way, we are not only able to see the position of each flood point but also to understand the distribution density of the flood points in the whole area. These analyses promote our understanding of the distribution of flood points in small towns of the Qinba Mountain area in southern Shaanxi and provide a scientific basis for future flood prevention and urban

planning.

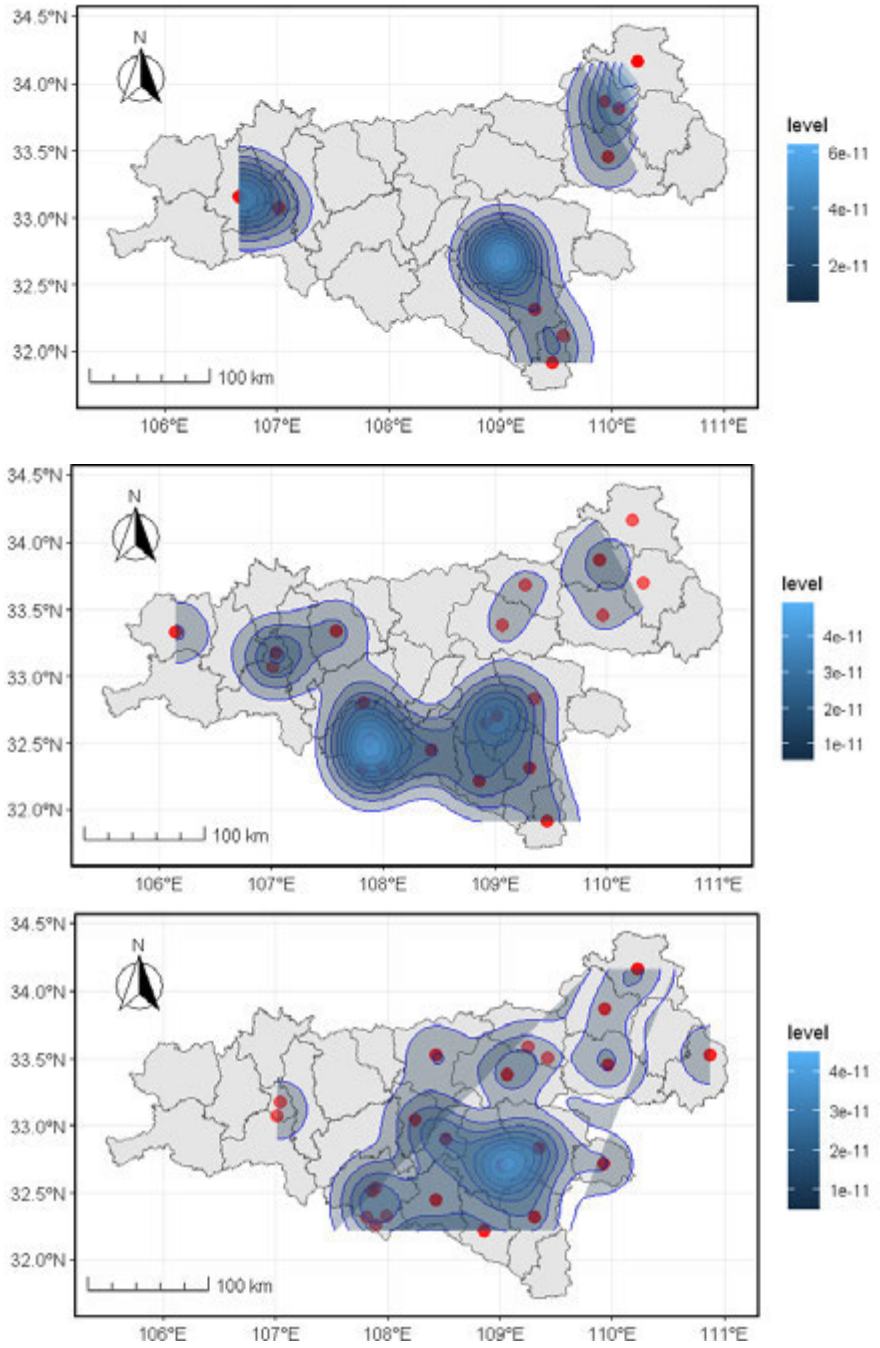
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Figure 4: Comprehensive Flood Point Distribution and Kernel Density Map in Small Towns of the Qinba Mountain Area, Southern Shaanxi (2021-2023)

We made a more detailed spatial analysis of flood points in small towns of the Qinba Mountain area in south Shaanxi. By integrating multi-year flood data, we not only counted the number of flood points in each geographic location, but also visually presented the flood point density on the map with gradient colors. We managed to read the flood point data within the three years of 2021, 2022, and 2023 and converted them into sf objects. We counted the number of flood points of each shapefile and summarized them to compare each year of data. As to the amount of flood points, we used gradient colors from yellow to deep red to present the geographical area, which is the density of a number of flood points, and contribute to an intuitive risk assessment. We made a full-map visualization with all the shapefiles merged in which the distribution of the flood points could be read from the fill colors. Figure 5 provides a comprehensive visualization of the flood point density in small towns within the Qinba Mountain area of southern Shaanxi from 2021 to 2023. Using gradient colors ranging from yellow to deep red, the map highlights the varying density of flood points across different geographical areas. Each color represents the density level, with yellow indicating lower density and deep red indicating higher density.

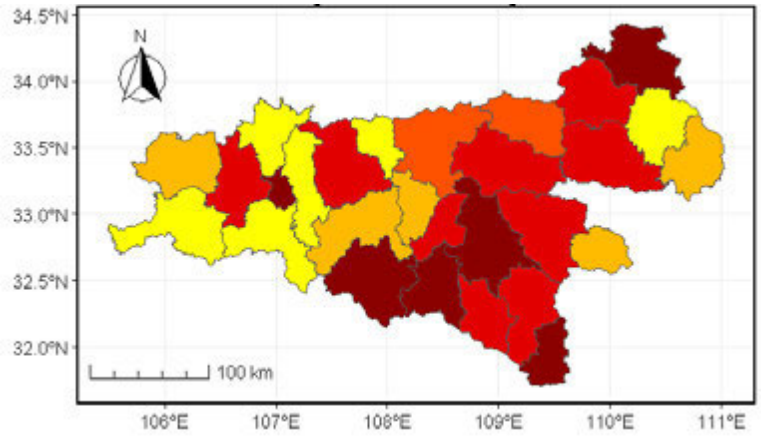

Figure 5: Gradient Map of Flood Point Density in Small Towns of the Qinba Mountain Area, Southern Shaanxi (2021-2023)

This is more reliable for the monitoring of the risk of floods in the small towns in the Qinba Mountain region of southern Shaanxi, and it can offer compelling data arguments for the flood prevention measure and the urban planning provided in the later sections.

4. Conclusion

This research has pioneered a novel way of urban planning and disaster management by combining the analysis of social media information with advanced deep-learning methodologies to evaluate flood risk in small towns of the Qinba Mountain region in southern

Shaanxi. We have effectively extracted and processed the flood information through Weibo with the BERT-BiLSTM-CRF model and thereby obtained a comprehensive understanding of the spatial distribution and features of flood events in this region. Our approach was to gather large-scale social media data using Python web scrapers and then pre-process the data carefully by filtering out irrelevant data. The BERT-BiLSTM-CRF model was used to extract and categorize named entities of place names, which were then geocoded to extract their actual latitude and longitude. With the help of this, the spread of floods in small towns over a few years could be visualized and interpreted to extract meaningful insights into the temporal and spatial patterns behind the flood risks.

The results showed that the use of deep learning and its combination with social media analytics was possible to realize real-time flood risk assessment and urban planning. The spatial analysis and visualization of the flood points played an essential role in managing flood risk and urban resilience planning. The combination with the multi-year flood data enabled us to assess the population density and distribution of the flood points, thereby providing a scientific basis for the formulation of effective flood prevention measures and urban planning policy. This research also demonstrates the necessity to incorporate social media data in the disaster management system, as it provides a comprehensive and real-time source of data that supplements the traditional approaches. The incorporation of advanced computational methods and multi-objective optimization algorithms in urban planning could help to improve the accuracy and reliability of flood risk analysis as well as enable urban development, which is more robust and sustainable.

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Renewing the city towards a linear attractors frame. Fuor cases in Iraq.

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Abstract

The article discusses Iraq's historical cities facing challenges of reconstruction amidst large-scale destructions, emphasising the complexity of contemporary urban redevelopment, exacerbated by climate change. It proposes a replicable planning approach employing adaptable modelling strategies tailored to each city's needs, allowing for independent implementation by local administrations. The progressive strategy, adaptable to specific characteristics, uses tools like linear attractors and matrices. These tools facilitate the design of repeatable solutions and rule-based urban transformations, ensuring a balance between public-private spaces and green areas. The approach aims to create resilient, climate-responsive urban environments, tested in four northern Iraqi cities, to foster positive transformations and mitigate climate impacts. Ultimately, the proposed scenario seeks to cultivate urban environments that thrive amidst evolving climate conditions while ensuring community well-being.

Keywords

Climate change adaptation, settlement scheme, climate justice, resilience.

Introduction

Iraq hosts some of the oldest continuously inhabited cities in the world. The historical significance of its urban areas is enormous, representing millennia of human civilisation and cultural heritage. However, the Iraqi territory has recently borne the brunt of extensive destruction, leaving its cities in ruins. The devastation wrought by conflict, warfare, and natural disasters fully displays the task of rebuilding and revitalising these once-thriving urban centres. Moreover, the increasing impact of climate change compounds the urgency of reconstruction. As temperatures rise and weather patterns become progressively unpredictable, the country must confront new challenges that threaten to worsen existing vulnerabilities. Addressing climate change issues is not merely an option but necessary for Iraq's future prosperity and resilience; local authorities must devise a series of strategies tailored to the specific needs of each city, recognising that more than a one-size-fits-all approach will be needed in the face of such diverse urban landscapes. Indeed, from the ancient city of Babylon to the modern metropolis of Baghdad, each urban centre in Iraq possesses unique characteristics, vulnerabilities, and opportunities. Rebuilding and adapting these cities to withstand the impacts of climate change requires a nuanced understanding of their contexts (Berke and Campanella, 2006). In cities where the ruins of ancient temples and palaces stand as a testament to the city's

storied past, reconstructions must incorporate heritage preservation alongside climate resilience.
Furthermore, efforts to improve water management and conservation are essential to ensure the sustainability of Iraq's cities in the face of dwindling water resources. This may involve the implementation of rainwater harvesting systems, the restoration of wetlands, and the promotion of water-efficient technologies (Al, 2022). This requires investment, especially in green infrastructure, to mitigate the urban heat island effect and provide natural cooling solutions (Quigley et al., 2018). Ultimately, the reconstruction of Iraq's cities in the wake of large-scale destruction and the face of climate change is a significant task that requires a multifaceted approach (Birkmann and Von Teichman, 2010). Based on these assumptions, the research seeks to identify a replicable approach for effecting urban transformation across various scales, which aims to uncover a framework that can be adapted and applied across diverse urban contexts (Burkhard et al., 2012). The strategy uses linear attractors, such as rivers and roads, as pivotal elements driving development and transformations. These linear features serve as the cornerstone of the approach, intersecting with different types of urban fabric within the chosen contexts. Linear attractors and fabric types converge in a matrix, representing a design code's structure based on forms and parameters. Seeking to overcome a colonialist approach, the research outcomes were directed towards a flexible strategy that can be interpreted according to local design cultures. At the same time, flexibility makes it possible to imagine a system that can be adapted to different needs from time to time, making it easier to combine mitigation, adaptation, and resilience-building measures to address these numerous challenges.

Case study

The research outlined within the article specifically targets four cities in northern Iraq, designating them as the primary focal points for investigation and analysis.
The first city selected is Al-Dour, part of the Saladin Governorate, located on the Tigris River's left bank. The city is between Samarra and Tikrit and lies near Baghdad's main road with Mosul. Regarding the connection with the major regional/national transport network, Al Dour lies along the main road that connects Tikrit to Samarra, on the eastern bank of the Tigris River, and it could represent a crucial traffic point for the future development of the area; tourism, agricultural activities, and industry are the main sectors of the City. Al Dour is located rightly along the primary road running along the eastern bank of the Tigris River, which is the junction point towards the road that leads eastward to Tuz. The City's geographical location represents an important node for the movement of passengers and goods on the vertical axis, which links Mosul and the southern governorate. The city's university campus is vital to the regional and national educational system. Also, the tourism potentiality of Al Dour includes many natural areas along the river Tigris, archaeological sites which give the city touristic importance, and increased economic potential by providing rest and food stations for tourists, shops and coffee shops and recreational areas serving this purpose. (Figure 1)

The second city is Al-Sharquat, located in the Saladin Governorate on the west bank of the Tigris. It is one of the oldest cities in Iraq, and being in ancient times, the center of the Ashur Empire played a fundamental role from the archaeological perspective at the national level. The city of Sharquat lies 13 km east of the main road connecting Baghdad with Mosul, almost 320 km north of Baghdad. Two main roads run along the eastern and western banks of the Tigris River, linking the area to Samarra. In contrast, another main highway between the capital of Tikrit and Tuz covers the east-west axis. Regarding the connection with the major regional/national transport network, Sharquat is less than 15 km from the main road linking

Mosul to Baghdad, and it could become a crucial centrality for the area's future economic development, primarily associated with touristic historical and natural attractions. Sharquat district is historically significant because it was the ancient capital of the Assyrian empire. In the district, there are 272 surveyed archaeological sites. Those sites go back to different historical periods, mainly from the Assyrian period, with some historical sites belonging to the Islamic period. The most important is the Ashur Castle, even if the site needs more basic infrastructure and services to fulfil its full touristic potential. The Castle has been on the World Heritage List UNESCO since 2003, and due to the lack of maintenance, the recent armed conflicts, and the proximity of the construction of a dam entailing partial flooding and seepage, the settlement has been on the List of World Heritage Dangers. (Figure 2)

The third one is the city of Bajii, which is located on the west bank of the Tigris and in the Saladin Governorate. The city is considered a connection point between North and South, located 50 km north of Tikrit, the District capital, and 210 km north of Baghdad in the middle of the way to Mosul. The city is a critical junction of the national railway network. This makes the city an important transportation hub and a resting place for travellers between south and north. Baiji is crossed by the railway line connecting the town with the Sharquat district, Mosul to the north, and Tikrit, Samarra, and Baghdad to the south. Also, another railway line connects Baiji with Kirkuk to the east. This line is currently out of service, but if it is reactivated, it will promote the transfer of goods between Baiji and Kirkuk, contributing to the region's economy and reducing heavy vehicle traffic between Baiji and neighbouring cities. The city represents a crucial traffic point for the area's future development; tourism, trade, and industry are the main sectors in the city positively affected by the location of Bajii along this critical way of traffic. Baiji has the largest refinery in the whole country and is the most industrialised city in the Saladin Governorate. Its industrial compound, one of the largest in Iraq, made the city known as the “Industrial City of Iraq”. The presence of big factories and a good transportation connection ensures the city has a dominant position at the Governorate and national level. Thanks to its economic and strategic significance, Baiji plays a vital role at the Governorate and national level. (Figure 3)

Figure 1. The city of Al-Dour

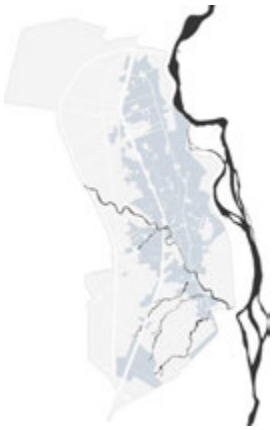

Figure 2. The city of Al-Sharquat

Figure 3. The city of Bajii

The last city selected is Mosul, the capital of the Nineveh Governorate. Mowṣil is the name the Muslim Arabs gave to ancient Nineveh, the capital of the Assyrian Empire, one of the oldest cities in the world. The site of Nineveh is located on the eastern bank of the Tigris River, while Mosul was built on the western bank. Rich in history and traditions, Mosul is a crossroads of trade and cultural exchange. It has witnessed over time the alternation of different civilisations and has been emblematic of the peaceful coexistence of other cultures in the same country, Iraq. Arabs, Kurds, Armenians, Turkmen, Christians and Syriacs coexist harmoniously. In the contemporary period, Mosul has seen its population grow impetuously, making it the third largest city by population in Iraq, after the capital Baghdad and Basra. A fertile agricultural region surrounds it, and some oil fields are nearby. A commercial centre of upper Mesopotamia, favoured by the railway linking Basra and Baghdad with the Turkish rail network, it has considerably developed its industrial sector: a refinery, cement, and textile and food factories. In the three years of occupation by the Islamic State, which had chosen it as its capital, the many battles fought left behind physical, cultural and social rubble. The war left the city with massive destruction in the infrastructure and with around 1M displaced, with an urgent need for reconstruction, in particular the housing sector (Saeed et al., n.d.). Since February 2018, UNESCO has been promoting several initiatives involving the reconstruction and rehabilitation of some of the city's sites with the support of the Iraqi government and the UN Secretary-General. The initiative aims to reconstruct its monuments and historical sites and focuses on empowering the population to change the city's fortunes through culture and education. The action, therefore, develops on a double track: on the one hand, the restoration and rehabilitation of cultural assets, and on the other hand, the revival and strengthening of educational institutions and cultural initiatives.

In conclusion, the chosen cities have the right characteristics to be used as test sites. Furthermore, considering the use of linear attractors as the main design tool, described in the following paragraphs, the four cities are most suitable for the purpose of the research. On one hand, the selected cities follow one another along the Tigris River's banks, one of the country's major historical and cultural landmarks. The Tigris and the Euphrates formed the landscape of ancient Mesopotamia, which was the cradle of Western civilisation in the past. The banks of the Tigris are characterised by a fertile agricultural landscape that, at the same time, is home to significant natural sites and some of the country's major archaeological sites. On the other hand, they follow each other across the main road and railway connecting the capital, Baghdad, with the north of the country. These two linear elements hold, in the first case, historical-cultural, social, and environmental importance, while in the second, they are strategic and commercial. For this reason, these linear elements have been identified as the major factors governing the principles of transformation.

Theoretical framework

To address a complex issue that requires a multidisciplinary and multi-scalar approach, we have relied on several topics that allow us to see the urban transformation from several points of view. Considering four Iraqi cities as test sites, the need to look at the transformation of urban space in a decolonial way was explored as a first issue. From the perspective of containing neo-colonial approaches, we referred to the research of Danielle Emma Johnson, Meg Parsons, and Karen Fisher. Their consideration was considered to help reframe and decolonise climate adaptation in line with local communities' experiences. The authors promote adaptation that draws on Indigenous capacities and aspirations for self-determination and cultural continuity, trying to mitigate the risk of maladaptation and avoid entrenching inequitable power dynamics (Johnson et al., 2022). Furthermore, reference was also made to the work of Ugo Rossi about

what is defined as 'Western urbanology' and a possible revision of the role of contemporary urbanism in economic development processes (Rossi, 2020).
Regarding the role of local communities in climate change adaptation processes, it is essential to mention the work of some authors, such as Fiona Miller and Linda Shi, who promote equitable adaptation and explored how communities and governments might anticipate and resolve some of the humanitarian, livelihood, and ecological challenges associated with resettlement in an increasingly risky climate future (Miller, 2020; Shi, 2021).

Secondly, it was essential to consider the research of some authors on Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA), assuming that the current urban model will necessarily be outdated due to climate change, favouring a long-term vision (Bertin et al., 2019). It also suggested integrating the DRR and CCA cultures to promote economic security and social inclusion for physical and social resilience. This approach can lead to a more radical consideration of climate change issues in local government, fostering new awareness and practices of care of the regional territory (Bertin et al., 2020). Following the authors, it is crucial to understand the value of uncertainty in local recovery planning to design the plan's capability to deal with a future disaster scenario in which it is also necessary to repair the social fabric (Bertin et al., 2024).

The city evolves linearly according to various statistical surveys. However, the evolutionary processes that produce the city are neither linear nor continuous (Aquilué Junyent and Ruiz Sánchez, 2021). This aspect is progressively increasing due to climate change, and uncertainty is drastically rising in environmental and urban dynamics. This makes it necessary to come to terms with a further theme: complexity. Territorial and urban systems, however anthropised, are complex systems (Ruiz Sánchez and Musco, 2021). In mathematical terms, complexity is nothing but the capacity of the system to reach a wide range of unpredictable possible futures. Consequently, the complexity of the urban form appears to stem from accepting a high level of uncertainty and contemplating adaptation at an urban scale, which is the need to recognise uncertainty as a fundamental aspect. To navigate this challenge, one approach is to encourage cities and territories to embrace increased complexity, which does not refer exclusively to diversity but to the ability to access diverse future states (Ruiz et al., n.d.). In building new cities, it's also crucial to recognise our limitations, understand what we don't know and avoid nostalgia for unattainable security (Ruiz Sánchez and Aquilué Junyent, 2023).

These considerations finally bring us to the territory that is the subject of the research proposed in this article. Deconolisation, climate change adaptation, and urban complexity are joined by thoughts and considerations about the Tigris Valley and the environmental, social and economic impacts transforming its territory. In fact, climate change is affecting the Tigris and Euphrates River basins similarly to all other parts of the Middle East and the East Mediterranean region. This is manifested in increased temperatures, reduced precipitation, erratic weather patterns, and decreased annual stream flow of the two rivers (Adamo et al., n.d.). Studies led by Nasrat Adamo and his group revealed that severe shortages occur over the five basins, water resource elements will occur, and the Tigris River stream flow will significantly decline. This situation demands that water and soil management practices be improved to reduce the expected damage (Adamo et al., n.d., n.d.). Droughts are a regular regional feature and have significant social, environmental, and economic impacts. Therefore, there is an urgent need to build riparian areas' resilience and adaptive capacity, focusing on innovative regional-based drought and agricultural investment strategies in the Euphrates and Tigris basins (Özgüler and Yıldız, 2020). As a result of these considerations, it is fundamental to consider the river as the heart of the

proposed plan. The following section describes the approach outlined by the research and the role of the Tigris River in the urban settlements considered.

Methodology

The strategy proposed in the article adopts an adaptive and progressive approach that aims to support the development of city transformation masterplans through an evolutionary model tailored to each town's unique contexts, challenges, and opportunities. By embracing complexity and uncertainty as inherent features of urban form, the strategy ensures that the masterplan remains responsive to dynamic urban landscapes, capable of flexibly accommodating diverse needs and evolving characteristics over time. Central to this approach is the recognition that one-size-fits-all solutions may be unsuitable for addressing the multifaceted complexities of urban environments. Instead, the strategy advocates for a deep understanding of each town's needs and characteristics, allowing for tailored interventions that maximise impact and relevance. Also, a flexible model enables continuous refinement to iterate and adapt strategies in response to emerging challenges and opportunities.
The proposed approach also prioritises adaptability to diverse local design cultures and boasts replicability, allowing local administrations to implement the plan independently. This replication aspect is crucial, as it empowers communities to take ownership of the strategy's implementation process, fostering sustainable and long-term results. By providing a framework that can be readily replicated across various contexts, the research endeavours to catalyse meaningful change at the base level, amplifying the impact of its outcomes. At the same time, while a rigid and colonial approach may be rooted in historical precedents, a flexible methodology seeks to overcome this tendency. It aims to establish an open and adaptable system that empowers planners and administrations to embrace the diverse project cultures inherent in local contexts. By fostering interpretability, a flexible approach strives to cultivate a more inclusive and collaborative environment where local traditions are valued and integrated into the planning process. Through this approach, the research endeavours to navigate from colonialist paradigms towards a more responsive framework for development and decision-making. This approach will apply three main tools, each with a particular role within the overall strategy: the linear attractor, the settlement block, and the matrix.

Using linear attractors as a main design tool is related to their prominent presence within the morphological fabric of urban landscapes. The selection of these elements as focal points stems from the geographical features characterising the chosen cities. For instance, the positioning of these cities along the banks of the Tigris River and adjacent to one of the country's major highways and railways, connecting Baghdad to the northern regions, emerges as crucial factors shaping their urban form.
The river and the transportation routes serve as movement channels and embody multifaceted significance. The Tigris River’s historical, cultural, social, and environmental importance is profound, acting as a conduit for trade, culture, and community life throughout the region's history. Moreover, its presence often defines the cities' spatial organisation and cultural identity along its banks. Similarly, the strategic placement of these cities along key highways and railways underscores their importance as hubs of commerce, transportation, and connectivity. These linear infrastructural elements facilitate the movement of goods and people and serve as nodes for economic activity and urban development. Their strategic significance extends beyond mere transportation routes, influencing the spatial distribution of settlements, industries, and commercial centres along their trajectories. The research recognises and harnesses the inherent value of these linear attractors, endeavouring to leverage their spatial potential in the

design process. These elements can catalyse urban development rooted in their cultural and geographical context through thoughtful integration and reinterpretation.

The settlement block as a tool is related to a widespread feature characterising most Iraqi urban areas: a settlement scheme formed by recognisable blocks. For this reason, the scale of the urban block should be taken as a starting point for developing the transformation strategy. The main goals of an approach based on a settlement block concern the relationship between public and private spaces, between open and built spaces and their possible evolution. A recurring size of blocks allows us to think of a limited number of repeatable solutions that can be combined to meet, whenever, different needs. The scale of these urban blocks plays a crucial role in determining a neighbourhood's overall character and functionality (Figure 4). Larger blocks may accommodate higher-density development, while smaller blocks may prioritise pedestrian-friendly design and green spaces. By carefully calibrating the size and configuration of blocks, it is possible to strike a balance between density and liveability, ensuring that each neighbourhood meets the diverse needs of its residents.

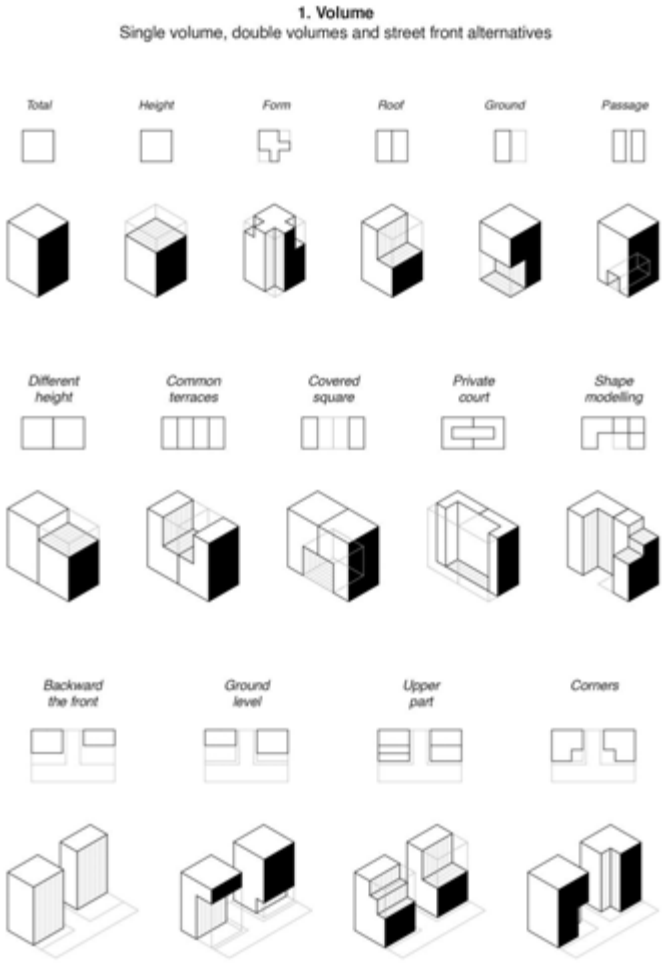

Figure 4. Abacus of volumes

In addition to physical design considerations, the settlement block approach encompasses social and cultural factors, promoting diversity and inclusivity within neighbourhoods. This may involve incorporating affordable housing units and community facilities within the fabric, fostering a sense of belonging and social cohesion. Furthermore, the settlement block approach recognises the importance of adaptive management in urban planning. Cities are dynamic, evolving entities shaped by social, economic, and environmental issues. The strategies involved must be flexible and responsive to changing conditions, allowing for iterative adjustments. Adopting an adaptive management framework makes the proposed tools continuously relevant and practical amid uncertainty and complexity.

This is strongly related to the third tool: the matrix. The matrix proposed combines the most common urban types with the main linear elements of metropolitan areas: the Tigris River and

the main road axes. Integrating a matrix that combines various urban typologies with key linear elements offers a comprehensive framework for organising and synthesising various urban typologies and spatial elements, recognising that cities are composed of diverse land uses, from residential and commercial areas to parks and transportation corridors (Figure 5). By categorising these elements according to their functional and spatial characteristics, it is possible to identify synergies and trade-offs between different components of the urban landscape. One of the key advantages of the matrix approach is its ability to facilitate integrated decision-making, developing more integrated and sustainable solutions to complex urban problems by considering the interdependencies between land uses and infrastructure systems. Moreover, the matrix approach enables planners and local authorities to explore alternative scenarios and evaluate the potential impacts of different planning decisions. By manipulating the variables within the matrix, such as land use mix and density levels, the effects of various development patterns on key performance indicators, such as traffic congestion, air quality, and social equity, may be simulated.

	Industrial	Old town	Residential Low density	Residential High density
Base	A1	A2	A3	A4
Main commercial street	B1	B2	B3	B4
Main street	C1	C2	C3	C4
River	D1	D2	D3	D4

Figure 5. The matrix proposed

Finally, indicators will be used to monitor and evaluate the performance of urban interventions. Indicators provide quantitative measures of progress towards predefined goals and objectives, allowing planners and administrations to track the effectiveness of their strategies over time. Indicators play a crucial role within this approach by providing tangible evidence of the impact of interventions on various aspects of urban life. Planners can make informed decisions and adjust their strategies by establishing clear metrics for assessing environmental, social,

economic, and policy outcomes. In addition to providing valuable insights for decision-making, indicators also serve as a communication tool for engaging stakeholders and the public. By presenting data in a clear and accessible manner, it is possible to foster dialogue and collaboration around urban issues and build support for their initiatives.

Results

The results of the methodology described above unveil a comprehensive understanding of development strategies. A first application hypothesis of the proposed approach has emerged, capitalising on the chosen cities' similar geographical and settlement characteristics. This similarity facilitated the identification of a singular initial proposal, applicable uniformly across all four cities but firstly tested in Al-Dour (Figure 6), Al-Sharquat (Figure 7) and Bajii (Figure 8). Central to this were the linear attractors identified, notably the Tigris River and the principal road and railway networks. The arterial highway linking Baghdad to Mosul, alongside significant trade routes within each city, emerged as the primary consideration. These routes, influenced by traditional Arab commerce and possessing intrinsic cultural and historical significance, also held strategic importance within each city.

Figure 6. Linear attractors for Al-Dour

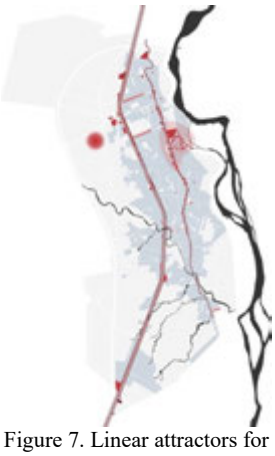

Figure 7. Linear attractors for Al-Sharquat

Figure 8. Linear attractors for Bajii

Further analysis revealed the predominant urban typologies suitable for this approach. These included the residential fabric, characterised by varying densities, the expanding industrial zones crucial for economic growth, and the cherished historical centres steeped in cultural heritage.
Consequently, a matrix emerged, integrating these elements into a clear urban development framework. The Tigris River and primary thoroughfares formed the basis of linear attractors, while residential, industrial, and historic fabrics delineated the identified urban typologies (Figures 9, 10, 11). Each intersection within this matrix was assigned an identification code as a reference point for subsequent planning endeavours.
The formulation of formal rules and parameters, alongside the establishment of abacuses of potential solutions, provided a structured approach to city transformation and development. These regulations encompassed various aspects, including building form and volume,

interventions such as green roofing, street design, and integrating green and public spaces. Additionally, considerations were made for ground floor usage and delineating buffer zones near watercourses, ensuring sustainable and resilient urban environments.

Figure 9. Different urban types for Al-Dour

Figure 10. Different urban types for Al-Sharquat

Figure 11. Different urban types for Bajii

Several considerations emerged in every city, laying the base for a comprehensive urban transformation development. Firstly, in all cities, the Tigris emerged as a complex system composed mainly of public green areas, orchards, cultivated fields, wetlands and protected areas of high landscape value (Figures 12, 13, 14). Associated with this system of green areas is the system of archaeological sites that are often located along the river. Historical city centres also stand along the banks. The city's landscape, particularly the meandering river, coupled with its strategic positioning adjacent to a major thoroughfare, signifies the potential growth across tourist and commercial sectors. Prioritising waterfront revitalisation, the urban plans emphasise the development of the different riverfronts, envisaging the creation of new tourist attractions, recreational facilities, and green spaces along the banks of the Tigris River.

Figure 12. River and green system of Al-Dour

Figure 13. River and green system of Al-Sharquat

Figure 14. River and green system of Bajii

Secondly, a strategic approach to city planning envisions the development along the central spine, primarily the main road, a common and robust urban element for all the cities considered. This structured expansion aims to optimise spatial utilisation and accessibility. Recognising the pivotal role of main roads, master plans allocate commercial zones along these arteries, capitalising on their inherent connectivity and visibility. To alleviate traffic congestion and enhance circulation efficiency, the proposal includes the implementation of a bypass strategically positioned in zones, diverting traffic away from the city centre to permit the transformation of many car-based streets into cyclo-pedestrian paths.

Lastly, formulating rules, parameters, and proposed abacuses represents a pivotal step towards envisioning a transformative system for built space. This system enhances diversity and complexity within various urban areas and serves as a cornerstone in the broader context of climate change adaptation and urban redevelopment. In the face of escalating climate challenges, prioritising complexity in urban design and planning becomes increasingly apparent. Furthermore, recognising complexity as a fundamental tool in urban transformation underscores the importance of adopting an interdisciplinary approach to city planning. The emphasis on complexity in urban transformation represents a paradigm shift towards more inclusive, adaptive, and sustainable urban futures by embracing the intricate web of interactions and interdependencies inherent in urban space. (Figures 15, 16, 17)

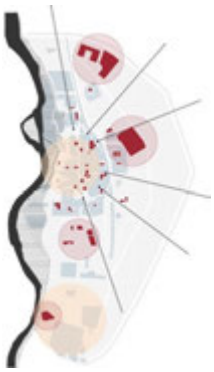

Figure 15. Strategic masterplan of Al-Dour

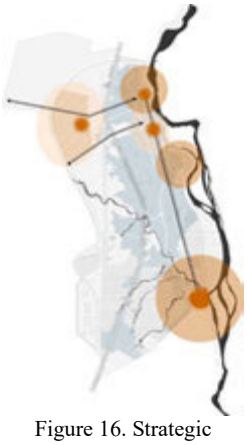

Figure 16. Strategic masterplan of Al-Sharquat

Figure 17. Strategic masterplan of Bajii

Conclusions

In conclusion, the article describes the steps of the research conducted, where the work carried out within the three minor cities emerged as a pivotal pilot experience that will feed into Mosul's transformation and reconstruction plan. Focusing on tailored strategies for each urban centre, the research underscores the potential to unlock these cities' changes while preserving their rich cultural heritage, aspiring to unearth a blueprint that can be customised and implemented in varied urban landscapes. Recognising the urgency for transformation, the study advocates for a comprehensive approach to rebuilding Iraq's cities. Additionally, departing from a colonialist approach, the research outcomes were geared towards a flexible approach tailored to embrace

local planning cultures. Simultaneously, this adaptability fosters envisioning a system amenable to accommodate varying, facilitating the encounter of mitigation, adaptation, and resilience-building measures to address today's challenges.

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Actors, Collaboration, and Conflict Dynamics in Local Governments' Urban Regeneration Incentive Strategies

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Abstract

Urban regeneration entails navigating complex opportunities and challenges for local governments. It involves collaborative efforts among public, private, non-profit organizations (NGOs), and civil society stakeholders to address community needs through regeneration policies and practices. Incentives play a pivotal role in fostering cooperation and acceptance of regeneration initiatives. This paper examines the effectiveness of urban regeneration incentives in promoting collaborative planning in Zeytinburnu, Istanbul. Zeytinburnu, a significant player in Istanbul's regeneration scene, has extensive experience with incentives. The study examined collaboration and governance strategies in the incentive process through a set of in-depth interviews with key stakeholders, and the hypothesis coding method for analysis. Findings reveal shortcomings in stakeholder involvement, transparency, and expectation fulfillment. Feedback mechanisms highlight conflicts and the need for continuous improvement. Transparency, participatory frameworks, comprehensive stakeholder involvement, justice, and conflict resolution emerge as crucial for successful regeneration initiatives. These insights contribute to urban regeneration management and societal endorsement of constructive incentives regeneration schemes might offer.

Keywords: Urban regeneration incentives; local stakeholders; collaborative planning; governance; Istanbul

1 Urban Regeneration Incentives as a Collaboration Tool

Urban regeneration represents a complex domain wherein local governance entities navigate a myriad of multifaceted opportunities and challenges. Local governments must consider various aspects to ensure cities develop physically, socially, and economically while also prioritizing livability. As a result of its multidimensional nature, urban regeneration necessitates collaboration and coordination among various stakeholders. However, the term urban regeneration did not emerge immediately within the historical process. With the emergence of urban redevelopment concepts in the 1980s, there has been a concurrent shift towards a multi-actor framework. Particularly after the 1990s, the notion of urban regeneration has underscored collaborative processes among stakeholders. These processes aim to foster regeneration policies, practices, and strategies tailored to address the diverse needs of local communities (Roberts, Sykes and Granger, 2017; Wang et al., 2021).

Urban regeneration incentives are crucial for promoting collaboration among stakeholders and securing their support for regeneration efforts (Hanson and Rohlin, 2021). Urban regeneration incentives serve as catalysts for collaborative efforts, promoting synergistic engagement among stakeholders and driving the success of urban regeneration initiatives. However, the issue of how incentives are carried out and how they affect cooperation is an area that has generally not been researched in Türkiye. Therefore, this study provides an important opportunity to understand how Türkiye's urban regeneration incentives contribute to cooperation. The implications for the successful realization of urban regeneration initiatives that emerge from the case study revolve around the imperative of prioritizing transparency, nurturing participatory frameworks, ensuring comprehensive stakeholder involvement, steadfastly upholding principles of justice, and proactively addressing any conflicts. These insights, while contributing to existing scholarly perspectives, can serve as prescriptive benchmarks for the proficient management of urban regeneration and the cultivation of a broad-based societal endorsement. By untangling roles, deciphering initiatives, and examining conflict dynamics, the study may contribute to furthering collaboration and governance dynamics in urban regeneration schemes across and beyond Istanbul. For this reason, with collaboration being crucial for ensuring the applicability and sustainability of incentives provided by central and local governments, this study examines the effectiveness of formal urban regeneration incentives offered by local governments in promoting collaboration in the case of Zeytinburnu, Istanbul.

1.1 Spatially and Economically Targeted Incentives

The influence of globalization and neoliberal policies has prompted significant shifts in urban regeneration practices, with a notable transition from public to private sector involvement in regeneration initiatives (Türkün, Aslan and Kaya Erdoğan, 2014). During this process, regeneration projects have shifted from the public sector to the private sector; factors such as changes in housing values and commodification have played a central role in attracting national and international capital, particularly since the 2000s (Akman, Can and Yalçın, 2018). Urban regeneration incentives, which vary in names and objectives, are diversifying and being implemented across a wide spectrum. The present study undertakes an analysis of the multifaceted landscape of urban regeneration incentives, characterized by a plethora of terminologies and objectives. These incentives are methodically classified into two primary categories: those oriented at spatial targeted and those aimed at economic targeted (Figure 1). This broad variety of incentives aims to provide a comprehensive perspective on stakeholder structures and impact mechanisms.

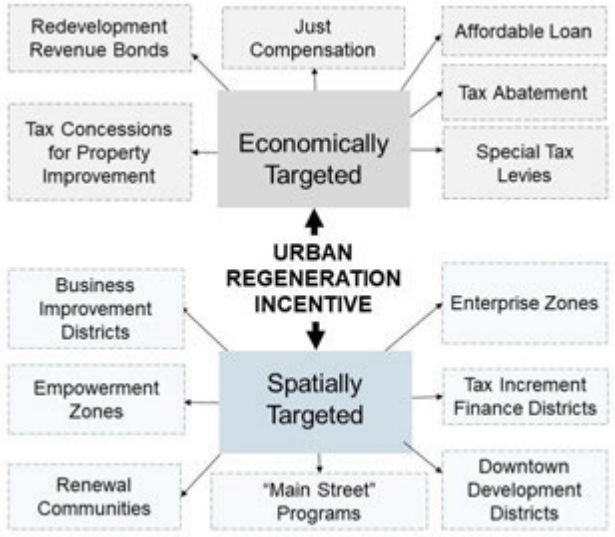

Figure 1. Implementations of urban regeneration incentives around the world (Adapted from Bartosiewicz and Pielesiak, 2019; Chignier-Riboulon and Hall, 2013; Hanson and Rohlin, 2021; Lum, Sim and Malone-Lee, 2004; Slayton, 1960; Tang and Tang, 1999; Williams, 2006)

Spatially targeted incentives encompass measures aimed at promoting the regeneration of a specific region or area, revitalizing economic activities, attracting investments, or enhancing the quality of life in the area. These incentives typically focus on a targeted geographical region or a specific group of people residing within the designated area (Hanson and Rohlin, 2021). Various incentive methods such as (1) *Enterprise Zones*, (2) *Tax Increment Financing Districts (TIF)*, (3) *Business Improvement Districts*, (4) *Empowerment Zones*, and (5) *Main Street Programs* are implemented to provide support for urban regeneration projects across different geographic regions and countries. For instance, *enterprise zones* represent a policy approach employed both in the US and the UK. Initially introduced by individual states in the US and subsequently involving federal government participation, these zones aim to stimulate area-based economic urban regeneration through diverse incentives, including tax exemptions and investment credits. Particularly notable is the collaboration between local and federal authorities, as seen in Illinois, where *enterprise zones* benefit from incentives such as tax relief and expedited bureaucratic procedures (Illinois Department of Commerce, 2014). In the UK, *enterprise zones* offer businesses financial incentives alongside streamlined urban planning processes, thus not only bolstering urban regeneration efforts but also enhancing the efficacy of planning procedures (Ward, 2023). Another incentive, *TIFs* are seen to directly support urban regeneration projects in Chicago (Figure 2). In this context, TIFs provide a significant source for local development efforts and contribute to the realization of urban transformation. In summary, all spatially targeted urban regeneration incentives are closely associated with supporting urban regeneration

by aligning with local needs, embracing strategies tailored to local requirements, fostering effective local participation, and focusing on sustainable development goals. The adaptability of these incentives to the regeneration needs in urban areas in a flexible and suitable manner is crucial for enhancing the success of urban regeneration efforts.

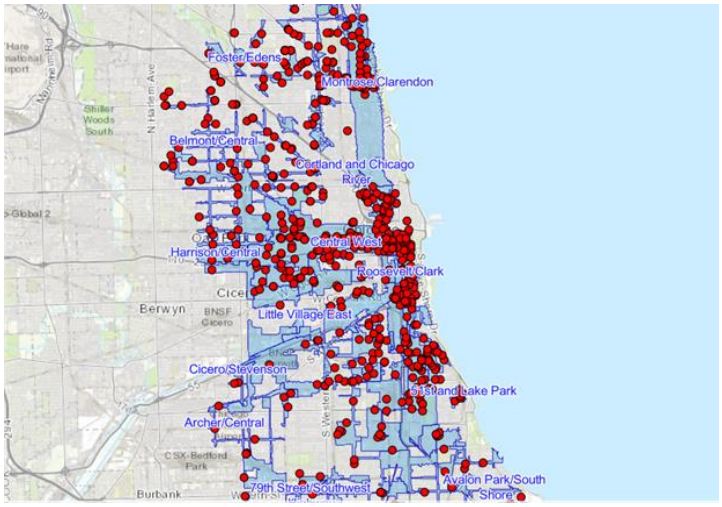

Figure 2. Geographic locations of tax increment financing districts and urban regeneration projects in Chicago (Adapted from Chicago TIF, 2023)

Economically targeted incentives in urban regeneration emphasize two key economic approaches globally: *just compensation* and *affordable loan*. In this context, these economic incentives can serve as effective strategic tools not only to facilitate physical regeneration in cities but also to address income inequalities and promote social justice by focusing on the goal of providing economic incentives. *Just compensation* generally refers to the situation of displacement arising from compulsory processes such as urban regeneration and expropriation by public authorities for public benefit purposes, which is typically described in the literature as the concept of "compensation" (Kelly, 2006). *Affordable loans*, also known as low-cost loans, are utilized by central banks to stimulate economic activity and facilitate the revitalization of vacant or dilapidated areas (Alexandre, 2008). For instance, in Italy, the European Investment Bank has provided over €12 billion in financing between 1995 and 2002, primarily to support urban transformation, construction and rehabilitation of public spaces, social housing projects, and urban infrastructure improvements (European Investment Bank, 2002).

Consequently, spatially targeted incentives target specific regions, while economically targeted incentives are provided by both central and local governments regardless of location. Slayton (1960) emphasizes the pivotal role of local governments in promoting urban regeneration,

particularly through economic incentives. He suggests that local governments can incentivize urban regeneration through aesthetic, zoning, and management strategies. Despite potential barriers posed by zoning regulations, flexible planning tools can mitigate limitations. Effective leadership and coordination by local governments are crucial for enhancing urban regeneration incentives.

1.2 Local Context: Türkiye and Zeytinburnu

With the rapid urbanization process in Türkiye, there has been a need for urban regeneration to cope with issues such as migration, illegal and unhealthy construction, urban decay in city centers, and earthquakes (Özden, 2016). In contrast to the international context, Türkiye's initial experience with urban regeneration took place in *gecekondu*[1] areas. (Uzun, 2006). Following efforts to upgrade *gecekondu* areas in major cities, there has been a frequent occurrence of initiatives aimed at identifying risky areas and reconstructing them through state and public-private partnerships. Since the implementation of the Gecekondu Law (No. 775) in 1966, efforts have been made to establish a legal framework for urban regeneration and incentive policies. Today the legal framework for urban regeneration and incentive policies is primarily established by Law No. 6306, enacted in 2012, titled "Law on Regeneration of Areas under Disaster Risk". This law, aimed at areas prone to earthquakes and disasters, grants authority to the Housing Development Administration of the Republic of Türkiye (TOKİ) and Republic of Türkiye Ministry of Environment, Urbanization, and Climate Change (TMUCC) for its implementation. It also defines the institutions responsible for identifying risky structures, evaluating objections, and conducting demolition processes. The qualifications of engineers appointed to assess risky structures and the oversight processes are elaborately outlined. Procedures and conditions for identifying reserved housing areas and risky zones are also specified. The required information and documents for identifying reserved housing areas, as well as the documents and processes for identifying risky zones, are detailed within this law. Incentives are provided to support urban regeneration projects and to persuade stakeholders to participate and collaborate in urban regeneration. While local governments primarily focus on services that affect and improve the daily lives of local residents, central governments provide services on a national scale targeting the entire population. The situation regarding urban regeneration incentives in Türkiye is similar.

At the national level, various incentives are provided and continuously improved within the framework of Law No. 6306 and its implementation regulations. Among the economic-targeted incentives primarily include rental assistance and interest support. Additionally, the "Half is Offered by Us" incentive, established in 2023, is gradually finding implementation opportunities. Temporary housing or workplace allocation and rental assistance are provided to the owners of structures vacated through agreement or to occupants residing in these structures, whether they are owners, tenants, or holders of limited real rights. For rental assistance, a one-time payment of a specified amount is made to owners monthly, and to tenants and holders of limited real rights once (Akman, Can and Yalçın, 2018). Rental assistance fees are updated every year (Table 1).

[1] The term "*gecekondu*" refers to illegally constructed housing units, typically built without permission and in a haphazard manner, often found in rural areas of Turkey.

Table 1. Rental assistance amounts by province in Turkey, 2023 (TMEUCC, 2023b)

City Name	Owner (Monthly)	Tenant (One-time)	Holder of Limited Real Rights (One-time)
1. İstanbul	3.500 ₺	7.000 ₺	17.500 ₺
2. Ankara, Antalya, Bursa, İzmir	3.000 ₺	6.000 ₺	15.000 ₺
3. Adana, Aydın, Balıkesir, Denizli, Diyarbakır, Erzurum, Eskişehir, Gaziantep, Hatay, Kahramanmaraş, Kayseri, Kocaeli, Konya, Malatya, Manisa, Mardin, Mersin, Muğla, Ordu, Sakarya, Samsun, Şanlıurfa, Tekirdağ, Trabzon, Van	2.500 ₺	5.000 ₺	12.500 ₺
4. Other cities	2.000 ₺	4.000 ₺	10.000 ₺

Interest support is provided for loans obtained by owners from banks for regeneration projects, to be covered from the special account for regeneration projects. Citizens have the right to benefit from only one of rental assistance and interest support programs. Following the earthquakes in Kahramanmaraş on February 4, 2023, there have been updates in the support amounts to accelerate urban regeneration efforts. In 2022, the credit limit was increased from 600,000 ₺ to 1,250,000 ₺. Additionally, it has been announced that interest support will be provided for a total of 48 months, including a 12-month grace period for repayment (TMEUCC, 2023a). And also, the protocol will be signed for the buildings deemed suitable by the ministry upon application from property owners for the support of "Half is Offered by Us" initiative, and the project phase and permit acquisition processes will commence. During these stages, property owners will be provided with a relocation assistance of 10,500 ₺ and a monthly rental support of 5,250 ₺, as stated. It is also indicated that the housing to be built within the scope of this project is expected to be completed within two years, among other conditions (TMEUCC, 2023a).

Spatially targeted urban regeneration incentives are provided through the designation of two areas defined by the law: risky areas and reserved areas. The declaration of these areas is authorized by TOKİ, TMEUCC, and other relevant administrations (both central and local governments). Risk areas and reserve building areas, greater financial incentive is provided compared to other areas. For instance, while rental support extends for 18 months for risky structures, it spans 48 months for property owners in both risky and reserve building zones. Additionally, there are various advantages such as the preparation of area-specific urban regeneration projects, acceleration of bureaucratic processes, and utilization of tax incentives.

At the local level, urban regeneration processes are regulated and delegated authority to local governments through laws such as Law No. 5393 on Municipalities and Law No. 5216 on Metropolitan Municipalities. These legal frameworks govern urban regeneration processes, granting powers to local administrations. These legislative enactments confer upon municipalities and metropolitan municipalities the authority to strategize, execute, and oversee urban regeneration initiatives. Concurrently, they impose upon local administrations responsibilities such as promoting citizen engagement, facilitating the rehabilitation of high-risk areas, and ensuring environmental sustainability. Incentives extended by local authorities are disseminated through zoning ordinances and regulatory frameworks established by district municipalities. However, the nature and scope of these incentives are contingent upon the unique requirements and dynamics of each province, district, and locality.

The selection of Istanbul's Zeytinburnu district as the focal point of this study is underscored by the intricate interplay between the distinctive needs and dynamics inherent to various provinces, districts, and localities. Since the enactment of Law No. 6306, which marked a pivotal juncture in urban regeneration legislation, Istanbul has emerged as a focal point for such endeavors in Türkiye, given its substantial identification of 70 high-risk areas, 152 reserved building areas, and around 84.000 structurally compromised buildings (Istanbul Planning Agency, 2023). Consequently, Istanbul assumes a central role in driving urban regeneration practices nationwide. Within this context, Zeytinburnu stands out as a significant player within the Istanbul metropolitan area and across Türkiye. Its designation as the pilot area for the EU-supported Matra REGIMA project, aimed at enhancing institutional and community capacity for urban regeneration, underscores its extensive two-decade-long experience with regeneration initiatives and associated incentives (Ozcevik, Beygo, and Akcakaya, 2010). Moreover, ongoing efforts by the Zeytinburnu Municipality focused on incentivizing urban regeneration highlight its proactive stance in addressing these critical issues.

Urban regeneration incentives in Türkiye are not fully aligned with principles of collaborative planning. The relevant legislation lacks provisions for public and stakeholder participation, particularly Law No. 6306, which allows the progress of the process based on the approval of a majority of property owners rather than unanimous consent. This may pave the way for the displacement of unwilling property owners. Additionally, the implementation regulation of incentives lacks a system through which property owners can monitor and evaluate the process, including identifying the responsible authority and determining the amount of compensation. For instance, the notification period for property owners to vacate their structures after a decision on risky buildings is issued does not commence until all property owners receive the notification. Property owners must personally inquire at the relevant authority or institution to learn about this period. Transparent monitoring platforms are absent. Consequently, ineffective participation of stakeholders, inadequate monitoring and evaluation mechanisms are observed. Prioritizing effective stakeholder collaboration, transparent communication, sustainability, and consideration of long-term impacts are crucial steps to ensure the future success of urban regeneration incentives.

2 Case Study Design and Methodology

The Zeytinburnu district serves as a pivotal case study, exemplifying significant urban regeneration incentives provided by both central and local authorities over an extended period, alongside witnessing ongoing developments. This case study aims to assess the urban regeneration incentives within the context of cooperation, actor relations, and conflict dynamics prevalent in Zeytinburnu. The case study comprised two stages. The first stage involved the design of the in-depth interview method, which included determining the sample, preparing specific interview guides for stakeholder groups, inquiring about interviewer preferences, conducting interviews, and transcribing them. The second stage focused on the analysis of the interviews, encompassing coding of the discussions and conducting content analysis of the coded data.

Constructing the in-depth interview method: The selection of interviewees was based on purposive or judgment sampling and snowball sampling methods to ensure the comprehensive coverage of the research and the inclusion of diverse perspectives. These methods were combined to maximize the breadth of viewpoints and enhance inclusivity. Participants for in-depth interviews were chosen according to their sectoral affiliations and specific objectives. Local government officials involved in the production, implementation, and approval processes were interviewed. Private sector representatives were selected from architectural, engineering, and contracting firms actively engaged in urban regeneration projects in 2023. NGO stakeholders included representatives from relevant professional associations, local grassroots organizations, and foundation representatives actively involved in urban regeneration efforts at the provincial level. Local community representatives comprised individuals seeking information from urban regeneration offices, operating under association umbrellas, actively participating in urban regeneration activities, and those willing to share opinions despite not directly benefiting from incentives. The interviews aimed to uncover relational dynamics beyond desk-based research, diversify participant profiles, and enrich the study's depth. It employs qualitative research over 37 interviews with key stakeholders, including representatives from the local and central governments, civil society organizations, private sector entities, and the local community (Figure 3).

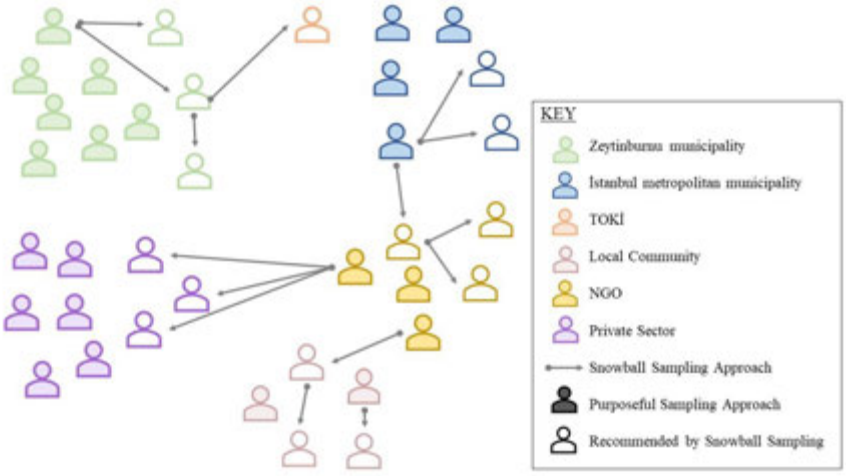

Figure 3. Stakeholders interviewed and sampling methodologies

In terms of interview preparation, informed consent forms and relevant questionnaires were emailed to participants upon accepting the interview invitation to ensure their comprehensive understanding of the research. Interviews were conducted through face-to-face meetings (65%), teleconferences (5%), and video calls (30%) according to participant preferences. Audio and video recordings were obtained with consent, while notes were taken for those declining recording during the interview, totaling 13 participants. Transcribing recorded audio files by the researcher aimed to enhance data familiarity. Transcription facilitated the conversion of interview content into text format for easier comprehension and analysis.

Analyzing the in-depth interviews: The interview data has been systematically coded under specific themes to facilitate structured analysis and determine the frequency of relevant criteria quantitatively. Hypothesis coding method has been preferred for coding. This method enables the analysis of the developed code list by the researcher within a hypothesis framework (Saldana, 2016). Additionally, sub-codes identified during the coding process have been added to the codebook. For the coding process, Google Sheets and MAXQDA software were utilized. The interviews were meticulously examined through content analysis method. As Neuendorf (2017) suggests, this analysis involved a detailed examination and interpretation of the data obtained from the interviews. The aim of this analysis was to identify elements such as conflict and interrelations among actors in the urban regeneration incentive process in the Zeytinburnu district, aiming to better understand the shortcomings in this process.

3 Results and Discussion

3.1 Actors and their Involvement in the Process

The Zeytinburnu district is an important example where various stakeholders are involved in the implementation process of urban regeneration incentives. According to representatives of both central and local governments, the participation of local stakeholders varies in this process. For instance, a representative from TOKİ, who played an active role in the risky area project in the Beştelsiz Neighborhood, stated that they are only one actor in the urban regeneration process, while it has been observed that the Istanbul Metropolitan Municipality (IMM) develops university and international collaborations and involves NGOs in the process. However, it is noted that the Zeytinburnu Municipality does not have established relationships with these actors and that its own units are more involved in the process. This indicates differences in participation processes among local governments and different implementations of collaborative planning criteria. The participation of the local community in the urban regeneration process in the district is also crucial. However, what has been emphasized in the interviews is that the local community only has the opportunity to provide feedback and is not adequately involved in the production process. On the other hand, the Zeytinburnu Municipality officials have made efforts to ensure the active participation of the local community in some important decision-making processes. For example, with some decisions taken by the Zeytinburnu Municipal Council, efforts have been made to protect the property rights of neighborhood residents and alleviate potential conflicts concerning. Another important actor is civil society organizations. However, it is observed that, apart from the local association operating in Zeytinburnu, NGOs are not adequately involved in the process. This indicates the ineffectiveness of civil society organizations in the urban regeneration process. Finally, the participation of the private sector in the process should also be evaluated. The private sector is generally involved in the implementation phase of the urban regeneration process. However, it has been emphasized in the interviews that the private sector should take a more active role as part of the feedback and implementation stages of the process. This indicates the need to develop more effective communication and collaboration mechanisms to encourage greater participation of the private sector in the process.

In order to determine the level of participation in urban regeneration incentives according to the perspectives of stakeholder groups, participation steps were determined based on the IAP2 spectrum (Figure 4)[2]. While the IMM plays a role at the level of involvement and collaboration, the Zeytinburnu Municipality is positioned more between involvement and consultation stages. According to NGOs, the private sector, and the local community, the urban regeneration incentive process does not go beyond informing and consulting.

[2] IAP2 is an organization that provides guidance on the Public Participation Spectrum, which defines the role of the public in community engagement programs and suggests different levels of participation based on goals, time frames, resources, and levels of concern in decision-making processes (International Association for Public Participation Australasia, 2016).

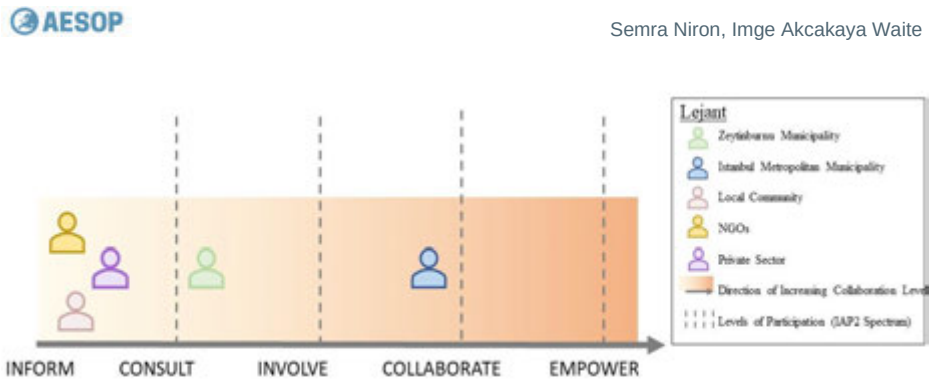

Figure 4. According to the perspective of stakeholder groups, the position of stakeholders in the participation steps based on the IAP2 spectrum in urban regeneration incentives

According to an urban planner from the İstanbul Yenileniyor Platform[3] the process involves informing the citizens, consulting, and decision-making stages at the beginning, but during the collaboration phase, apartment owners expressing negative views are not offered the option of being bought out by other property owners. This situation does not fully align with the IAP2 collaboration understanding, indicating the difficulty of achieving 100% consensus and highlighting the discrepancy between academic ideals and practical implementation. A similar situation exists for the Zeytinburnu Municipality. Local governments evaluate the collaboration and consultation stages with the public as an agreement stage in urban regeneration projects, considering it as an agreement on what they will receive in exchange for their apartments. However, it has been observed that there is a consensus system without active mutual communication and collaboration in this process.

Participation methods that support the collaboration process and encourage creative thinking are generally implemented through meeting methods at both central and local government levels. The IMM employs various implementation methods, including surveys, focus group studies, and workshops, to encourage participation. In this process, local urban regeneration offices and relevant local municipal directorates also play an active role as actors. In particular, subsidiary companies play an important role in obtaining field opinions and conducting transparent discussions. However, it is emphasized that the approach of senior-level officials and political authorities in the management is important. It is stated that the perspective of the management is critical in the formation and design of participation methods. Although in-depth discussions with central government representatives have not been conducted in large numbers, the methods used by the central government and their involvement are described as certain meetings and workshops. In conclusion, the participation methods described by the participants play an effective role in the implementation phase of urban regeneration and incentives. These methods include the opinions and contributions of stakeholders during the implementation of incentive policies, thus ensuring effective implementation of the feedback mechanism.

[3] İstanbul Yenileniyor Platform is a coordinated initiative led by subsidiary companies (i.e. İmar A.Ş., KİPTAŞ, and İŞAT) under the umbrella of the IMM.

3.2 Mediation and conflict resolution measures

The measures for mediation and dispute resolution in the district play a significant role in preventing potential conflicts of interest among various stakeholder groups. However, according to the discussions, there are different perceptions regarding the effectiveness and utilization of these mechanisms. The local residents perceive mediation and intervention during the process as inadequate. On the other hand, other stakeholders refer to various actors, stating that specific technical practices play a preventive role in conflict resolution. In this context, the transfer of knowledge and experience throughout the process is seen as a critical step for subsequent projects. While the local residents and the private sector express that such a process is not being conducted, it is indicated that consultations are held among central government institutions to share information. Additionally, civil society organizations actively participate in the process through their own educational programs and meetings.

According to representatives of the IMM, efforts are made to balance the level of information through education and capacity-building initiatives, as well as through sub-institutions such as the Istanbul Planning Agency (IPA) and the Urban Regeneration Office. Measures such as mobile applications on earthquake awareness and disaster preparedness training are also taken. During reconciliation processes, the importance of empathizing with citizens and conveying accurate information is emphasized. Members of the Zeytinburnu Municipality conduct various internal activities to balance the level of information, including technical staff training, education and information sessions for stakeholders, and informative work such as the Urban Planning Commission. In this way, they contribute to strengthening communication among stakeholders and resolving conflicts.

4 Conclusions

The findings from the discussions reveal significant challenges in ensuring effective stakeholder participation and meeting stakeholders' expectations at various stages of the urban regeneration process. The IMM's approach of involving stakeholders to a greater extent and fostering collaboration allows for the representation of various stakeholder groups and consideration of their views, demonstrating a participatory approach. However, the positioning of the Zeytinburnu Municipality more in the consultation phase indicates limited active participation of local stakeholders, with the process generally not surpassing the stages of informing and consulting. These findings underscore the need to strengthen stakeholder participation in the urban regeneration process and to manage it in a more equitable and inclusive manner. Particularly, the use of more diversified communication tools to ensure effective participation of local residents and adopting more inclusive methods to increase the participation of vulnerable groups are crucial. Additionally, more effective mechanisms should be developed to involve stakeholders more actively at different stages of the process and to consider their feedback. In this way, the urban regeneration process can be managed in a more sustainable and socially acceptable manner.

The involvement of various stakeholders in the urban regeneration process, particularly in the Zeytinburnu district, highlights the complexity and importance of collaborative efforts in urban development initiatives. The varying levels of participation observed among different stakeholder groups underscore the need for tailored approaches and strategies to ensure inclusive decision making and effective implementation. Despite efforts by both central and local governments to engage stakeholders, there are evident disparities in the extent of participation and the effectiveness of mediation and conflict resolution measures. While some stakeholders perceive these measures as inadequate, others recognize the role of technical practices and collaborative efforts in mitigating conflicts of interest. To enhance the effectiveness of participation and conflict resolution mechanisms, there is a clear need for improved communication, capacity building initiatives, and stronger partnerships between stakeholders. Additionally, ensuring transparency, empathy, and active engagement with local communities are essential for fostering trust and promoting meaningful dialogue throughout the urban regeneration process.

Overall, addressing the challenges and complexities associated with urban regeneration requires a holistic and inclusive approach that prioritizes the voices and concerns of all stakeholders. By fostering collaboration, enhancing communication channels, and implementing effective conflict resolution measures, urban development initiatives can achieve greater success and create more sustainable and inclusive communities. Various concrete steps can be taken to enhance stakeholder engagement. Firstly, organizing neighborhood meetings and online surveys can facilitate direct input from the local community. These gatherings and surveys can enable a better understanding of the residents' needs and concerns, fostering more effective participation in the decision-making process. Additionally, practical approaches to mediation and conflict resolution should be adopted. For instance, establishing neighborhood mediation services can ensure fair and effective resolution of disputes among neighbors, promoting a culture of mutual understanding and collaboration. Furthermore, the feasibility and cost-effectiveness of proposed solutions should be taken into account. The time and resources required for initiatives such as establishing new communication channels or providing neighborhood mediation services need to be clearly determined. Most importantly, local authorities should construct a collaborative framework as the dominant authority to support this process effectively.

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Urban compounding: Housing what is and what could be

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Abstract
This study examines the organic transformation of the South African version of the Victorian/ Edwardian bungalow from a free-standing house into a courtyard form of building – seen as a bungalow 'compound' - as part of wider city-making processes, in a context of rapid urbanisation and continental migration. Based on architectural practice-led research, the study claims that the knowledges embedded in the adapted bungalow properties can significantly contribute to context appropriate planning of lower cost accommodation and emerging mix use. As a result, while associated with connotations of illegality and 'slum life', the study coins the bungalow compound as an 'aspirational house' in the transforming African city, an undercover game changer developing plot-by-plot on an emerging spectrum of housing *what is* and *what could be*.

Keywords: courtyard morphology, compounding aspiration, plot by plot, African urbanity

Introduction
Johannesburg 2024. Hidden behind walls of buildings made in another time and for different people, hundreds and thousands of beds accommodate Johannesburg's post-1990, transitional, multinational population, many of them in rooms on private properties with formerly freestanding bungalows from the Victorian/ Edwardian period, in the inner city belt. The rule of law treats the mainly non-formal[1] appropriation of the buildings, and more importantly, their yards (that is, the open space on the plot), as a spatial illegality. In their official accounts, the City continues to record the current multi-unit room arrangements as the former single-family houses. As a result, it identifies them as inefficient in terms of numbers of occupants – and consequently requiring replacement vis-à-vis desired densification (City of Joburg, 2016).

At the same time, the properties – if recorded 'as built[2] and as inhabited' (as in this study) – suggest a form of occupation (in terms of quantity, costs, diversity of functions and residents) that the city is actually attempting to achieve in the well-located areas with very limited amount of affordable accommodation offered by the state (Dormann, Mkhabela, 2019). They are also lucrative investments and incorporate multiple providers of other services. Mostly, but not entirely operating 'off the record', the multi scalar networks that run through these spaces have created their own 'infra-economy' of material life in the shadows (Braudel, 1981:24) as a form of the everyday that might seem challenging to administer but will nonetheless, most probably, continue to exist.

Contextually, the study focuses on changes of bungalow properties in two central neighbourhoods bordering the inner city, Yeoville and Rosettenville, established at the beginning of the 20th century, for nuclear families of a white, privileged minority. After the official abolition of Apartheid in the early 1990s, these areas have been almost completely re-populated with immense socio-cultural changes – and intensely densified. Much is assumed about the changes, and few of these are considered 'good' by the planning authorities but in

[1] Non-formal implies some form of limitation of applying " regulation" – but does not automatically see this as negative – instead, the capacity to regulate is limited. (Jenkins 2013). Nagati describes this condition as non-binary, on a "spectrum of negotiation and contestation," between not requiring but not negating formal structure (Nagati, 2016:33).
[2] As built: A key architectural instrument to document existing buildings. As-built drawings commonly show changes on-site to original construction plans using redline drawings. Measured drawings are prepared to represent the situation *as is.* Final record drawings "as-built" are typically prepared for submission to the council, incorporating the changes of the red line drawings.

fact, too little is known or understood about how these residencies are being transformed inside out (Charlton, 2019). The metanarrative of crisis and slums that Nuttall and Mbembe (2008) critiqued as dangerously one-sided still prevails here. The study's accounting suggests a grey area between official recordings and lived realities as driver to identify what appear to be misconceptions as actual potential for change.

Methodolgically, the focus turns on the properties themselves, as emerging epitomes of house lives/home spaces (Heer, 2019; Jenkins, 2013), as knowledge sources and as developing citational grounds in a field around the planning of urban accommodation in precarious contexts that is understudied. The approach considers the bungalow compound as an epistemic object (Cetina, 2001; Rheinberger, 2005; Lurry, 2021) that can manifest as a problem space across multiple themes, scales, and contexts. In doing so, the study addresses the misconception of architecture as a finished product and appropriates essential incompleteness as a device to locate relevant knowledge(s). It considers the inevitable lack of complete evidence as an opportunity to understand the documentation of these emerging dynamic 'house worlds' as readings of *what is* and *what could be*, a concept Simone and Pieterse (2017) refer to as the process of *re-description*. The study examines the bungalow compounds via a case study approach, as particularly complex category of 'as built' documentation with the aim to render the, at times, contested spaces, into valid forms of city building. Within theme and context of the conference, this working paper focuses on the transforming residential typology and its morphological connotations as forms of *urban compounding* – a process that operates on a complex spectrum of, at times self-regulated, urban change, and places itself at the intersection of architecture, urban design and planning.

The text is organised into seven sections. The next section introduces the house as a knowledge object as central premise of an approach. Then conceptual model of the "shaering layers of change" (Brand, 1994) are explored as visual, analytical frame to argue for a multi scalar reading of typological change from the ground up. This is followed by methods and results, and then discussed under the premise of new orders. The conclusion reflects on *urban compounding* as a process and product, of housing what is and what could be, in uncertain times.

The house as epistemic object, exclusive knowledges

The work starts from the premise that the house knows, and we as professionals don't, in many occasions. A house is a basic architectural element that is a part of people's everyday lives and also a basic unit of urban morphologies. As private property, it plays a significant role in the planning paradigm of South Africa's historical urban development. It has been argued, that domesticity is as much personal as it is politically, socio-culturally, and economically rooted and legally laid out (Chakravartty & Silva, 2013). The idea of the 'house' is a contested space in South Africa[3], as much as the land it stands on (Braun, 2015) – and indeed, therefore, in terms of its architecture. Architectural practice here (as elsewhere) has long been complicit in the production and reinforcement of social bias and discriminating spatial arrangements (Bhandar, 2018: Aureli, 2012; Weizman & Carlo, 2010). Within this system of unequal distribution of resources, the planning and design professions have inevitably assisted to "craft and spatially define asymmetry" (Aureli & Tattara, 2013).

[3] The study refers to the 'house' as a form of domesticity that was envisioned and designed as a social construction in line with a clear cultural binary. Archival and legal documents (e.g. the Report of the Johannesburg Housing Commission (Chas. Lane Sansom, Chairman, 1903), Black Housing, The Key to a Stable Black Society (The National Development and Management Foundation, South Africa, 1978) Native Housing in South Africa (Calderwood, 1952) and the Minimum Standards of Housing Accommodation for Non-Europeans) display clearly separated strategies and predictions for housing requirements of black, white or coloured people.

Institutionalized and systematically organized, the domestic geometries thus created often appear as the translation of legislation laid out in the past yet retaining some shadow validity as a blueprint in the ground. Within all of this, the City continues to ask for the application of, at times, outdated building codes and regulations, drawing on architectural tropes. Additionally, it does not seem to be able to engage with the physical structures as they are – as built – and hence to accommodate the real-life changes which these cater.

Despite this basis in a form of architectural and morphological 'blindness,' some buildings/properties have managed to help themselves in certain ways – they have learned after they have been built (Brand, 1994)[4] and make most of the opportunities for change. They have, one could say, "the capacity to aspire" (Appadurai, 2004:59; Appadurai, 2003), and their representations are, in many ways, aspirational maps. Here, the architectural structure, as built, turns into a blueprint of people's visions of how they would like to live within the choices they are privileged to make, overwriting previously set times and boundaries.

The history of their transformation can be seen to be embedded in their physical form as traces of an ongoing negotiation between economical, juridical and socio-cultural dynamics (Chakravartty & Silva, 2013). The house thus turns into a knowledge object and a source when zooming out of the wider urban morphology and a socio-economic construct of material civilization across time[5] (Braudel, 1981) – even when zooming into the anatomy of its own materiality (Brand, 1994; Duffy, 1990). Both ends of the spectrum deal with change over time as a response to context on different scales, sometimes to the extent that it becomes a new form of context – as boundaries between house and context merge, and those relations also become a rich knowledge base.

Accessing such 'inner' spatial knowledge is not easy in the areas under investigation due to a high degree of non-formal activities, with a number of them potentially deemed illegal, and a general rise in lack of safety and security. Here we encounter Braudel's' material life (1981) at eye level, " a shadowy zone often hard to see for lack of adequate […] documents," something he calls the "infra economy, the informal other half of economic activity, the world of self-sufficiency and barter of goods and services within a very small radius" (Braudel, 1981:24) People in the 'shadowy zone' are understandably cautious with whom they share what, and access to these intimate forms of knowledge is inevitably limited to some degree. This is more so when, legally, the private properties have the right to exclude. The governing structures do not seem to have resources or a feasible strategy of how to enter or, to look for, in these admittedly complex, dynamically changing territories This increases the exclusivity, and (according to market rules) the value of the embedded knowledge – and, in fact, of the properties, likewise.

Shearing layers of change and red line drawings

[4] Brand discusses the knowledge of buildings from a material perspective and deconstructs the house made of components across six shearing 'lifetime layers' of change further explored in Chapter 4.

[5] Braudel' s (1981) material civilisation is the second layer of a triple division of economic realities. He introduces A) the market economy as "transparent, visible realities […] and easily observed" in the centre, underneath which B) a "shadowy zone often hard to see for lack of adequate […] documents" plays out "elementary basic activity that went on everywhere […] a rich zone, like a layer covering the earth […] called material life or material civilization" In lack for an appropriate word he calls it the "infra economy, the informal other half of economic activity, the world of self-sufficiency and barter of goods and services within a very small radius." The third zone C) is placed above, and even more invisible than the below, and directed by "certain groups of privileged actors' who "could manipulate exchange to their advantage and disturb the established order. In their desire to do so […] they created anomalies, 'zones of turbulence' and conducted their affairs in a very individual way, [operating] from a distance." (Braudel, 1981:23-25). At the time (15th – 18th century) it included the dealings of foreign exchange, linked to distant trade movement and complicated credit arrangements, was transnational and operated upon principles of monopoly (Braudel, 1981). In the bungalow compounds under investigation material life relates to the composite of formal and non-formal activities (and structures) that govern their everyday.

To access these exclusive knowledges, and to understand the role of the house – and what it is housing in a complex and opaque urban context - as architectural element and equally as planning paradigm, the work has developed a particular approach and proposed an analytical format of undertaking and presenting the empirical research work. It so follows Simone and Pieterse's (2017) call for re-description methodologically, by employing the professional format of red line drawings, in combination with analytical layering. The intention is to 'un-see' the house, to make way for new patterns to visually emerge. 'Un-seeing' the house is to view it as if it did not exist as a pre-classified entity through deconstructing the plot and the compound into its elements – identifying the 'small spaces' (Chattopadhyay, 2022) that make everything work in order to reach a better understanding of its workings as an emerging morphology working through **layers of change**.

The study borrows the principles of Brand and Duffy (1990, 1994) to read transformations in buildings through *shearing layers* to analyse the morphological changes – and illustrate new, evolving patterns in compound lives. The research customizes these author's terms of use, making these particular to the place of investigation. Brand's *shearing layers of change* (Brand, 1994) start from Duffy's premise that 'there is no such thing as a building' (Brand, 1994: 12). His concept looks at structures in terms of building components and their ability to adapt or change across different time spans. The term was originally coined by Duffy (1990) as a form of facility management related to costs and life span, which he separated into shell, services, scenery, and set. Brand extended Duffy's concept into six layers that have different times of change and possibilities of adaptation: site, structure, skin, services, space plan, and stuff (Fig 1).

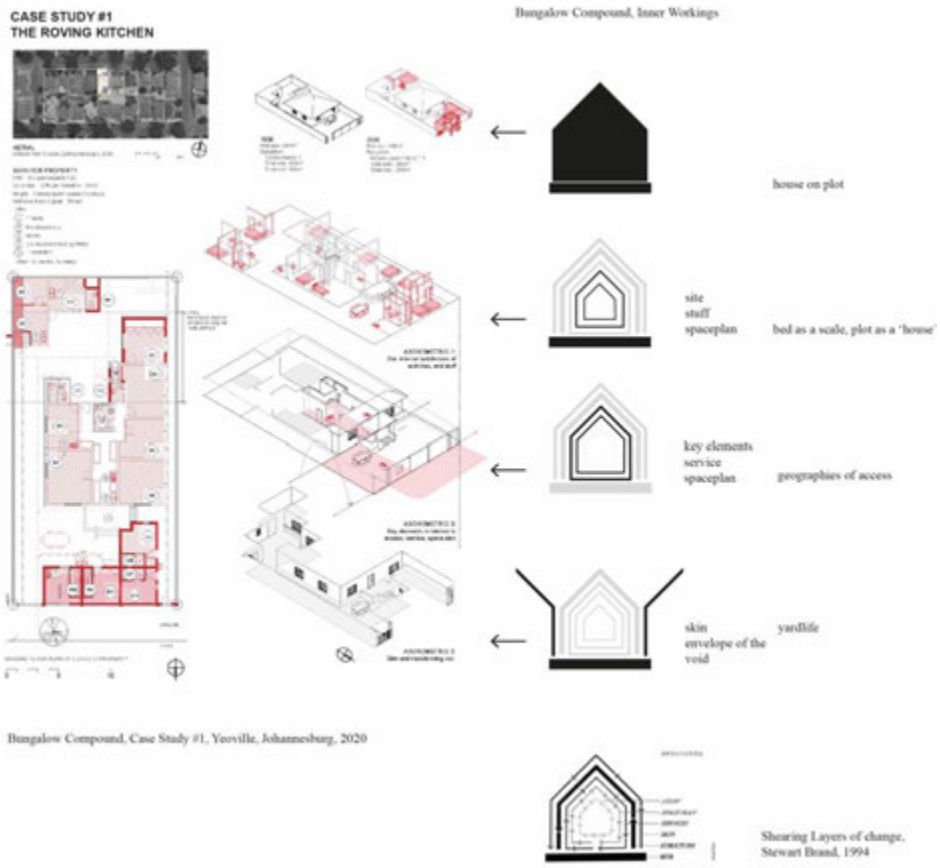

Fig 1: Bungalow compound, analytical layers, appropriated from Brand (1994) (author's own, with S de Villiers 2023)

This study is particularly interested in the role of *site* and *stuff* in the context of the bungalow compound. These two layers seem to have a particular deterministic role in Brand's set-up at each end of the timeline, one being eternal and the other one in constant change or motion. However, due to radical changes in forms of agency that are embedded in both *site* and *stuff* in the Johannesburg samples, they seem to be of high significance for what Duffy calls *use potential* (Duffy, 2009) when applied to the transforming bungalow properties.

The bungalow plot is the unit of analysis taken as the base across an amended version of Brand's shearing layers (Brand, 1994). The "layers" analysis permits the addressing of the gap that "will inevitably occur between developing requirements and the residual long-lasting building shell" (Duffy & Hutton, 2005:40, 1998) – and the "[interesting] absence of fit, that is 'slack'" (Duffy & Hutton, 2005:39, 1998) – as multiple versions of potential and aspiration have been materialised across time.

The empirical part of the study interrogates the material footprint of selected properties across three registers.

- As a **series of spatial patterns** translating social, economic and legal (political) values and related regulations over time.
- As **a transforming building type** with architectural elements transforming in the context and circumstances, reversing an understanding of solid and void/individual and shared spaces.
- As a composite of the above through different **figurings and forms of occupation**, measured in programme, density and infrastructure.

The bungalow compound's changing layout and organisational structure describe the basic shift from the house on the plot to the plot as a compound house and **merge interiority with exteriority,** and the architectural type with urban morphology, by shifting from prescribed functionality to sequences of previously defined elements such as walls, rooms and corridors. The bungalow compound anatomy is then represented in three layers:

- **stuff** on **site**, looking at the **emerging space** plan through domestic practice,
- **services, space plan and key built elements** to interrogate the role of 'small spaces,' and the repurposing of the initial double life of *served* and *serving,*
- **skin** and **boundary wall** as the envelope of **the void,** to explore the form and significance of the emerging void, the courtyard.

The foundation method of the empirical work was initially randomly sampled, that turned purposive on a 'plot by plot' basis[6], unpacking and mirroring the transformation practices of the bungalow properties themselves. This method mimics a practice of city-making termed "plotting urbanism" (Karaman *et al*., 2020), which describes a process of urban development that works incrementally, from property to property, in rapidly urbanising cities in the Global South and beyond. The concept permits us to deal with overlapping forms of formal and non-formal urban growth through repeated and similar incremental building activities on private properties in low-income, highly dynamic neighbourhoods, such as in this study. The above authors use this term to describe how forms of ownership vary, how preferred typologies are linked to the commodification of existing houses, how change is a response to the speculative land market (supply on demand) plus landlords, and how tenants often have social relationships that are governed by physical proximity (Karaman *et al*., 2020).

The Making of the Catalogue, Comparing Unfinished Objects

In order to be able to illustrate the selected bungalow compounds as exploratory 'samples' in a systematic way, on the plot, as part of a block, and along a street in one of the neighbourhoods under investigation, the initial medium that allowed the bungalow's enourmous reach and multiplication – the pattern book – is revisited as a trope to develop an alternative (research) catalogue of properties. A layout template was developed, to capture relevant and available information – as much as the lack thereof (reminding the reader that "lack of" is important as discussed previously). Within its comparative set up, the catalogue of the case study properties is as organic as the changing layout of each plot, and the information collected is as temporary as it differs from sample to sample. While the analysis shows that there are clear patterns in the original layouts, appearances, and materialities – as much as there are in the amendments made over time – it also shows inconsistent, incomplete, and (at the time of thesis submission), already partly outdated data, at least in parts. The study takes

[6] The bungalow compounds were investigated on site from 2018 to 2020.

advantage of this condition and interprets the incongruence of forms and figures as layouts of *aspiration*. The research refers to those as *plot holes.* In fiction, a plot **hole** or plot error is a gap or inconsistency in a storyline that goes against the flow of logic established by the **story's** plot. Such inconsistencies include things as illogical, unlikely or impossible events and statements or events that contradict earlier events in the storyline (Dormann *et al*., 2020). In real life, such narratives challenge our assumptions. This is because in any situation, although we might not understand what happened – yet it did happen – this probably made sense to someone for some reason.

The *plot holes,* figuratively speaking, consequently place the outcome of research on the spectrum between the **forensic** and the **imaginary**. The work thus proposes consideration of potential intersections of the forensic and the imaginary as readings of, at times, diverging and shifting **aspirations** (Appadurai, 1986; Appadurai, 2003; Appadurai,2004). Aspiration looks at the properties as commodities with social lives whose multiple value is determined "by a judgement made about them by subjects" (Appadurai, 1986:3). This means personal interests in the compounds determine their transformation – and their divergent futures. Aspiration is also considered an ability to do something or take action regarding something and relates to the context required to enable these actions. Common aspirations, or re-occurring plot holes, may indicate a trend that is relevant for future urban development, and currently overlooked in the larger narrative.

While the bungalow compounds have been investigated on a case-by-case basis, the research is further interested in what the properties do as a collection. The study considers the sum of what happened in any individual bungalow compound as a basis for the configuration of emerging typicalities as a developing urban register. 'Typicality' (as opposed to typology) encompasses experiences and local practices that are linked to a particular – typical – spatial configuration that hold morphological connotations (Dovey & King, 2011). Following the most common distinctions in typological classifications that have been based on use (programme) and/ or morphology (layout) of the architectural object (Forty, 2000), the *compound typicalities* are based on what happens on **and** with the properties, e.g. as mixed use places of accommodation and business, as neighbourhood networks, as investments on the property market, as infrastructural objects.

They are thus approached as performative and relational forms of temporary categorisation, in a spatial and regulative context. The following section is a transition between methods and findings, or maybe in itself a comment on the finding of methods in contexts under development, in order to outline the emerging typicalities and their various scales, It begins with an assessment of multiple interests, that have resulted in infinite variations of transformation, to conclude with the need to reconfigure existing categories when dealing with cultures of conversion.

Emerging Typicalities: Compound Interests: Multiplying value

Compound interest is commonly understood as a form of long-term (slow) yet exponentially growing financial investment, where interest gathers interest in addition to the principal capital. It describes a multiplication of the principal investment through the accumulation of interest as a most effective principle of exponentially added value to capital.

Architecture, as a practice that designs space to accommodate people and their everyday activities, can frame forms of life and determine values of space, people and their interests as manifested in daily practices – through layout, materialities, sizing, and access to views, and light, services among other things. Like property or real estate, it is also an investment that can gain or lose value over time (see Fig.18 for the transactional history of the case studies). As real estate, property is generally considered an investment with slow but steady returns and low volatility, according to a popular online platform (The Investopedia Team *et al*., 2022), at least in areas of relative political stability.

This study draws an (admittedly blunt) parallel here to the compounding of architectural interests and attempts to translate the principles of financial investment (monetary compound interest) in the context of small-scale owners/landlords of bungalow compounds in the selected focus areas in Johannesburg. While compound interest is a calculable relationship between time and money, the study of existing bungalow plots as DIY development adds 'space' as the third critical factor in the perpetual negotiation of property value – with intended profit figures being often pushed upwards through the highest feasible density at the lowest cost in the shortest turnaround.

To achieve this, the post-1994 bungalow landlords of Yeoville and Rosettenville are compounding the capital output of their properties through **subdivision** (of space) and **multiplication** (of people and use): broadly speaking, the transformation of the one-family house into multiple households organized in rooms, additions of rooms along the boundary walls, the absorption of supplementary programmes, and the **activation of the yard** as productive void, in between space and **outdoor rooms.**
Compounding here is thus also used to mean 'adding to' increasing of' as well as the process of combining more than two different elements. The added value thus could commonly be understood as the accommodation of additional uses and increased densities resulting in more rental income and more relatively affordable places to stay in prime urban locations. Compounded interest, however, also included the need to absorb vehicles, keep up maintenance of the street and its sidewalk, and expand infrastructure and services such as water, electricity and waste removal at the most basic. The growth and value of the single property can be influenced by – as much as it is a contribution to – the neighbourhood's overall condition, its accessibility, cleanliness, safety and security. The plot compounding process is such an urban-level project.

The analogies of compound interests suggested here in the bungalow context are plural and complex, as they are operating with different measures, and this study follows the intersection of the juridical, economic, and ethical as extracted knowledge layers of the physical blueprint. If the traditional economic understanding of compound interest lies in the multiplication of financial value, the bungalow compounds are dealing with division as another form of multiplication, through a number of measures: use, households, income, space per person, forms of business, as well as practices of sharing – resources, relations, space. Plans for contemporary forms of life appear inconsistent in different degrees and configurations. Yet it convinces (some) through its persistent and resistant performance via the organic transformation from the free-standing, single-family house to a rooming courtyard arrangement: that is, urban compounding.

The sum of the single property descriptions presented through the fieldwork is a provisional catalogue of realities, as much as a collection of temporary possibilities. The implicit uncertainty of this phrasing is considered appropriate here as a retainable (urban) quality,

referring back to Lury's notion of incompleteness (2021) and the process of re-description (Simone, Pieterse, 2017). The 'as built' representations are analyses of the spatial configurations of people's everyday lives in an African metropolis, layering visuals that are the product of complex economic transactions, cultural practices, legalities, political 'plotting' and imaginaries. They **reveal** the multiple pieces of knowledge (or parts thereof) that are embedded in the ongoing transformation of bungalow properties. Their visual reconstruction is based on the finding of material 'things' in particular arrangements on each plot. In the attempt to account for their meaning and purpose in context, these relations are illustrated through compound anatomies across three sets of appropriated *shearing layers*. The fieldwork sample illustrations are complemented by single plot descriptions that portray their 'behaviour' in detail through the lens of legalities, forms of aspiration and values, and evolving geometries.

These self-centred objects have extended themselves to the property's boundary line as a network of layers and, ultimately, a system of spaces, integrating (or confronting) lived experience and local practice with institutional/regulatory frameworks. While the 'Victorian' life of other days is still shining through cracks in remaining pressed ceilings and air bricks, the current versions of the bungalow properties share more qualities with the complex compound composites of Ghana and Nigeria than with their original lookalikes in Carshalton, Surrey (Philips, 1926:60). In general, Johannesburg's 'verandah house' (Hindson, 1987) has blended with its yard and its extensions into an ever more "unsettling hybrid structure" (Chakravartty & Ferreira, 2012) – or rather, many variations of these, including doubtless imports for the wider African region.The subsequent section looks at **different aspects of compounding** of the series of case studies and goes on to conclude with a summary of tendencies as overall findings. One case study #1 is subsequently presented as an illustration of the detailed catalogue.

Before and After Physic
'Before and after' illustrations have been used to merge information from council plans and current satellite imagery, both sourced from the CoJ as hard copies and online, on site recordings, as well as information from other publicly available information visible in computer programmes such as Google Earth, Google Maps and Apple Maps. Overall, these drawings show a significant increase in coverage of built form with a 'before' ratio of circa 1:2 (built : unbuilt) as a common proportion on a 495 plot, but the 'after' ratio averages approximately as 1:1 (built : unbuilt) and is, in some cases, more often a relation of 3:2 (built : unbuilt).

Compounding Density, Rooms and People
The density calculations of the bungalow compounds propose to use the single room as a dwelling unit, whether inside or outside the original house. This proposition is based on the recordings of everyday practices across the case studies and the areas under investigation at large. The average number of dwelling unit rooms on the properties lies around 11 to 12, with slightly more of these within the house – a constant of six. The calculation of the amount of people per property is based on a usual standard of two, sometimes three people, per room across the sample. It is also the usual occupancy per room that was found on adverts, repeated in verbal rental, or booking agreements, and supported by real life documentation on site.
As a relative measure, space (floor area) is often set in relation to occupation (demographic / number of people), with varying cultural and geographic understandings of what constitutes a dense urban area (Jenkins & Mottelson, 2020).

A key measure, internationally, is also the house or dwelling unit and its occupants – sometimes defined as households. The bungalow compound negotiates density measurements around a spectrum of variables with one constant: the built structure in the centre of the property, numerous rooms inside and additional rooms outside. In the current bungalow compound context, little is established about how to measure or even define what is a 'household'. Numerous non-typical household compositions have been recorded across the single case study series in Yeoville and Rosettenville, as is often the case in African urban areas (Jenkins, 2013). In average this is an increase of population per plot of 400 to 500% in relation to the original planning. While this sounds like a drastic change - which it indeed is – one must not forget that the inner city suburbs under investigation were kept at an extremely low density as white middle class residential areas, compared to international urban standards.

Compounding Programme

The activities on the case study properties are multiple and mostly mixed. All but two properties have a dominant residential component, that is either short– or long-term rental, or the owner and/or their household resides on the property (or a mixture thereof). The other two non-residential properties offer parallel services only, both educational, to children and women. One property is also a place of (commercially oriented) worship. Overall, only 8% of the properties are solely used as they started off – as a private residence for one family. More importantly, approximately 90% of the properties are income generating, in one way or another, and most rent out rooms on the property for that purpose, and these cover from 10-100% of the available usable built space. However, approximately 50% of the case studies offer additional programmes in addition to any form of dwelling and accommodation.
This change and variety in programme alerts to the biggest change in the properties being an economic one: the **switch** from what can more easily be described as **owner use value to owner exchange value**. In the large majority (92%) of the case studies the purchase serves **income (rental) generation in the everyday use,** as opposed to its original purpose as a **family home**. All the while, nearly all (94%) of the 'exchange value' properties still offer the use value of a home to residents (albeit more and usually unrelated tenants). In one-third of the cases, the owners share the property with tenants who run businesses or live on the premises. However, two-thirds of these properties are purely income generating by offering residential accommodation of different sorts – and other options to conduct business.
Financial profit as a driver for ownership of these transformed bungalow/urban compounds moves one part of the compounded aspirations into the field of **transactions**. It feeds into the basic unit of 'rooms as (urban) currency,'[7] from a commercial, or monetary, and a socio-cultural[8] perspective.

Compounding Scales

Stuff and Internal Subdivisions : The most common objects that move in and out of the bungalow plots are **beds**, double and queen size, to accommodate more than one person if needed. They dominate the internal layout of the properties and are a vital possession of the tenants. They are also the main income generation measure of the landlords, when number of beds equals number of rentable rooms. While bed spaces change at times rather fast, with moving tenants, they are then replaced with copies of the same, hence, somehow constant.

Key elements: The key elements of the bungalow compound form part of a "**geography of small spaces**" (Chattopadhyay, 2022) that participated in the production of the "colour line"

[7] Currency being understood as a standardized medium of exchange that indicates (monetary) value.
[8] David Graeber speaks of forms of 'social currency' and 'human economy' at the intersection of exchanging material goods, services and transforming social relationships (Graeber, 2012).

(Chattopadhyay, 2022) with **political and cultural connotations** beyond served and serving spaces concerning people, across all the scales of plot, block, and city. This role of material parts (the verandah, the stoep, the corridor, the boundary wall) and infrastructural components (the stove and the water tap) has been included in the fieldwork and analysis from a contextual methodological and typological perspective. The drawn analysis has looked at such elements in relation to access, services, and space plan. The resulting figures are complex and, nearly in every case, highly individual, overlaid by information of socio-cultural and economic practices on the plot.

- The **verandah** as part of the entrance sequence has been **closed,** in full or partially, in one-third of the case studies. This happened mostly before 1990 and was often linked to the extension of the room bordering it or making space for a garage, for example.
- The **corridor** has remained unchanged on most properties and is the element that permits the **subdivision** of the house into rooms as single units. It is the **lifeline for internal adaptations**, and at the same time, provides **room for flexibility**, that is, the set-up of different physical arrangements (Rabeneck, et al., 1974; Schneider & Till, 2005). The circulation space is centrally positioned (Fig. 29) and slightly larger in size to allow for a smooth transition to an **internal service spine** or a series of bathrooms and kitchens. This setup also enables the rooms of the freestanding single-family house to become independent entities as units that can be accessed from the outside.
- The **boundary wall** has been undergoing the biggest transformation over time, as visualised in the 'before and after' drawings, and places itelsef at the intersection of planniong, urban design and architecture. From a simple demarcation of land as 'one's own,' as requested per original deeds, and providing some privacy, it has extended in height and depth. It is now a three-dimensional structure with different thicknesses that are in parts inhabited or activated with other programmed activities. The extruded boundary wall turns into the compound version of double (sided) skin has two outsides, and deals through a public service programme (like an eatery) with the sidewalk and also the internal courtyard.

Forms of Flexibility and Adaptability: New Typicalities, Complex Structures

The study suggests that the empirical findings, as a catalogue of possibilities, hold relevant concepts of development in the making. As 'life after on (or in) what was before' they deal with appropriation and adaptation as knowledge from the ground, imaginaries tested in the everyday – that in turn might be worthy of being appropriated in the architecture of future planning and urban accommodation, in these areas or similar applicable contexts.

What has been introduced in this study as forms of flexibility and adaptability that exceed the house as an 'object' and transcend the old social-spatial hierarchies on the plot to create alternative ways of arranging and sharing spaces. This profiles the bungalow compounds as architectures that "compounded" challenge the city in terms of its restructuring. The properties' operations are addressing new forms of production and institutional orders through modes of cultural and physical appropriation and often share wider economic interests. The question of type enters the realm of urban morphology, as a developmental strategy on private properties that is only very partially orchestrated by the public sector.

The analytical drawings recorded transformation from inside out beginning with *"stuff on site makes space plan."* The findings suggest that the *site* can behave as ephemeral as buildings, when the outline of the plot turns into the circumference of the 'house.' At the same time, the

same property line remains inviolate as a legal entity. The convulsion of slow = persistence of site, and fast = change of space plan and arrangement of stuff, collides at the boundary and so changes its nature as a building element, from primarily excluding to potentially accommodating. *Stuff***, on the other hand,** can retain a status of permanence and serve as an evaluating device. While keeping its ability to move, it is simultaneously turned into a constant of the transforming bungalow properties. The bed, as the smallest common denominator, operates as the basic compound scale for measuring room sizes 130, densities, and financial profitability. It is also the valuable possession of every single proprietor and the centrepiece in each room called home.

Dissolving Existing Incongruences: Guiding New Orders

The study started from empirical engagement with the properties studied in context, on a plot-by-plot basis, on a random selection with two defined areas of urban interest. The initially inductive aspect of the research made use of the knowledge embedded in the buildings, the spaces between them, and their transformation. The aim was to understand more about the social, economic and juridical entanglements of 'the house' over time, as accommodation of private lives, and as part of the city. While it has been hard not to notice, the change of the freestanding family home to a multi-unit compound / courtyard arrangement has remained somehow elusive, and unregistered. It seemed important to provide 'proof of life' of their existence 'as built'. As a prerequisite to argue for the legitimacy of the undocumented, and to underline their worthiness, the study developed drawings of the properties with nearly forensic detail, and analytical layers to represent the emerging typological change. As the subsequent more deductive case studies and their history have shown, these recordings deal, on multiple scales, with complex dynamics of recognition (Povinelli, 2011). The findings have shown that the bungalow compounds now are in a deficit of authorative approval – but potentially raw material as samples of popular production, and 1:1 visualizations of aspirations for an updated version of emerging patterns of urban life. This means, from the perspective of design research, there is empirical evidence of the knowledge embedded in the bungalow transformations as a valid contribution to the discourse around the design of urban accommodation provision and a conceptual understanding of the value of the urban compound as a transforming type – but normative references that could apply in a potential process of implementation are missing. The implications here may be to turn to what Carl calls the "topography of praxis" (Carl, 2011). He describes it as "the structure of involvement with people and things that comprise urban praxis" (Carl, 2011), or typicalities, as embedded within constituencies – the particular culture of a place as the basis for bottom-up guidance as opposed to standard generalizations implemented from 'above.' In the case of the bungalow compounds in Yeoville and Rosettenville (and similar places like these two areas), this could result in taking advantage of the density of ownership and start working plot by plot on guiding the diversity as embedded quality, and the transformation processes as forms of low-cost built environment efficiency- as the basis for maintaining and improving.

Such a "guidance" process would imply some form of technical/legal involvement to manage overall and assist in improving the product, directing the discussion towards a professional vacuum (gap) that has been detected in the study. The involvement of the professionals that usually prepare the making of built structures and sign off on them, responsible for their safe and adequate performance – such as architects and engineers – seem notably absent in the world of transforming bungalows. As are the city regulators and their service providers. The profession as a technical provider and city council as a regulating entity appear to lack the capacity to deal with either the administration of 'life on the ground' in the way both

institutions have been doing it, 'traditionally' – or change the format of engagement from prescriptive to proscriptive (Tipple, 2000).

Unexpected Collaborations

The study of the transformed bungalow in the context of urban densification comes at a time when its existence faces major challenges but also explicit opportunities. In the light of manifestations of both urban management and housing crisis in the inner city (Zack et al., 2010), there is a high demand for affordable accommodation, yet little knowledge about space-sharing practices on private properties (Charlton, 2019). The mere recognition of the 'bungalow compound' as a unit in official documentation could support the understanding of their potential within the urban context. But is this enough? Or how would we get there? What does a process of recognition entail that actually works in practice and not only on paper? We should recall that we are dealing with an "unsettling hybrid structure […] a juridical-economic-moral entity that, as *property*, has material (as asset), political (as dominium), and symbolic (as shelter) value" (Chakravartty & Silva, 2013:2). In the case of the bungalow compound, this is a 'house' that currently works in the shadows – and not too badly for the many involved in its manoeuvres.

In coming close to an ending, the question that hovers over this work – as in the life of 'the house' – is: what needs to be done? The research has identified what has been termed compound *doings* as the main drivers for compound operations. As some sort of hypothetical question turning recommendation, what about considering the compound *doings* not solely as drivers for **wha**t happens within the transformation of the properties but equally as ways to deal with these in a more appropriate, supportive way – from a professional, from an institutional, and from a knowledge perspective. This thesis potentially leads to some form of "knowledge transfer" – from the bungalow/compounds and their actors – to the professionals, regulators, financiers, and urban modellers. This could then, in turn, modify the action of these so-called "higher order" entities engaging with the emerging and positive values identified, while mitigating the negative – making all of this more visible.
The curation of knowledges that are embedded in the transforming bungalow compounds addresses the need for the *merging* of disciplines and working in inter-disciplinary or trans-disciplinary ways. Architecture, planning, and urban design are all shifting practices that have not found their role in areas under investigation or similar neighbourhoods. Their active involvement is an exception rather than the norm.

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Research on Urban Sharing Linear Space Design Based on Walking Experience

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Abstract

As urbanization accelerates, addressing the basic walking experience needs of citizens in urban spaces becomes increasingly crucial in urban planning and design. This study focuses on the walking experience during the design of urban spaces, with special attention to the sharing design in linear spaces. The paper focuses on the urban mobility space in Shanghai, China, and employs field research, morphological typology, and ethnographic research to study spatial typologies, and categorises it into five spatial forms and three functional types. The study then proposes five elements and corresponding design strategies for the sharing design of urban linear spaces from the perspective of walking experience, including path networks, spatial interfaces, landscape nodes, sharing spaces and social feedback management. The study hopes to optimise the design of urban linear spaces to make walkable urban spaces, enhancing the walking experience shared by all and promoting the sustainable development of the urban environment.

Keywords: Urban Mobility Space, Linear Space, Walking Experience, Sharing Design, Walkablity

1. Introduction

1.1 Background And Motivation For The Study

1.1.1 Informatisation Development Drives New Demands For Urban Walking Experience

In the context of the information age, urban life and the way of using space are undergoing profound changes. The global connectivity of the Internet, the instantaneous communication of electronic media, the in-depth insights of big data and the accurate predictions of artificial intelligence are technological innovations that have not only changed people's lifestyles, but also redefined the way urban space is used and its social functions. In this process of transformation, people's concept of space use is gradually shifting from the traditional mode of private and exclusive use to a new form of mutual use and sharing.

This shift has further increased the demand for people to experience urban space, driving the sharing development of urban walking. Walking is both a mode of transport and a vehicle for physical activity and social interaction, a fundamental form of behaviour (Garau, Annunziata and Yamu, 2024) . The development of information technology has brought new opportunities for people's walking experience in cities. By using modern information technology such as big data and the Internet of Things, real-time monitoring and data analysis of the walking environment in urban space can be achieved, providing walkers with a more convenient and comfortable walking experience. Functions such as route planning by intelligent navigation systems and information updating by real-time environmental monitoring systems, for example, have optimised people's walking experience in urban spaces and promoted the development of urban linear spaces.

Driven by the wave of information technology, the walking experience in urban spaces is no longer limited to the simple process of walking, but needs to incorporate more sharing elements to meet the growing and diversified needs of people. Cities need to provide sharing public spaces and facilities to

facilitate communication and interaction between different groups, as well as policy support for co-management to maintain the sustainability of sharing spaces. With the dissemination of information and the sharing of resources, not only can people's walking experience in cities become more free and inclusive, but they can also improve the effectiveness and utilisation of space and enrich the urban environment.

1.1.2 The Existence And Development Of Urban Linear Space From Ancient Times To The Present Day

Linear space has its roots in the development of cities since ancient times. The existence of linear space in ancient cities is mainly reflected in buildings and structures such as palaces and city walls. For example, the Palace of Versailles in France and the Forbidden City in China both adopt a rigorous sequential linear layout, presenting a strict order and hierarchy, reflecting the authority of the ruler and the stability of the society, and forming a clear spatial order and visual orientation. This linear spatial layout is based more on the ruler's power and the need for social hierarchy than on the individual's need to move.

However, with the rise of the modernist movement, the concept of the layout of architectural space produced a radical transformation. After modernism, more attention was paid to individual mobility and spatial variability, emphasising the openness and inclusiveness of space. For example, in Corbusier's plan for the city of Algiers, buildings in the city unfolded along with major traffic routes, and the centre of the capital relied on ground transportation such as the automobile to keep expanding, creating the idea of the new modernist city.

And in today's information age, the concept of the sharing economy has reshaped people's understanding and use of space, and people's demand for the walking experience has given new life to linear space in cities. Cities should respect people and urban spaces should serve people (Li, 2020), which is no longer just a symbol of power or a bearer of planning concepts, but is transformed into a dynamic vein connecting people to people, activities to activities, and a new spatial strategy to support diversified uses and social interactions. In this way, linear sharing space has become an indispensable and important element of modern urban space, and its potential to improve the efficiency of space use and promote social interaction is gradually being developed and recognised.

1.1.3 Urbanisation Drives New Uses Of Linear Space

Urbanisation is an important symbol of the development of modern society, which brings about population concentration, industrial concentration and infrastructure improvement. However, as the scale of cities continues to expand, problems such as traffic congestion and environmental pollution are becoming more and more prominent. In this context, how to effectively utilise the limited space in the city, improve the efficiency of its use, improve the quality of life of the people and promote social interaction has become an issue to be considered. At the same time, human scale has not been given the appropriate attention in modernist design, especially in public spaces such as gatherings and pedestrian events (Gehl, 2011) . These issues have fuelled a rethinking of the question of how to make better use of urban public space.

Linear space is the very backbone of urban public space, and public transport and pedestrians are important components of linear urban space. In urban planning, the two important concepts of mobility and walkability of urban space revolve around the notion of providing healthy communities, reducing car dependency and raising awareness of people's health (Ar Romel, 2019) . Urban mobility and walkability are important for the overall image of the city and the quality of life of its citizens. Excellent urban space is not only able to provide citizens with a comfortable and convenient walking environment, but also able to show visitors the characteristics and charms of the city, which is of great research significance.

As the demand for urban renewal increases, linear sharing space can not only regenerate old neighbourhoods and revitalise abandoned sites, but also maintain the continuity of urban culture and local characteristics. At the same time, as an important channel connecting different areas of the city, the organisation of traffic and pedestrian flow in linear space has a significant impact on the operational efficiency and development status of the city. Research on urban linear space not only needs to explore how to optimise the traffic and flow organisation of the space and increase the diversity of functions within the limited space, but also discuss how to promote green travel and ecological diversity to enhance the quality of urban life and ecology. Linear space in the city is no longer a carrier of a single function, but has become a new spatial pattern that is multidimensional, dynamic and able to adapt to the needs of future urbanisation.

1.2 Purpose And Significance Of The Study

Walkability has increasingly been recognised as an important factor for sustainable urban development (Zhang et al., 2019) . This study hopes to analyse the key factors affecting the walking experience by investigating the current situation and problems of walking experience in urban linear space. Through investigating the current situation and problems of walking experience in urban linear space, this study hopes to analyse the key factors affecting walking experience, further explore the spatial elements of urban linear space, and propose design methods that can promote the optimisation and enhancement of urban space, as well as possible future urban travel modes. It will provide theoretical support and practical guidance for urban planning and design, and provide scientific basis and technical support for improving the walking experience in urban linear space.

2 Methodology

2.1 Choose Urban Linear Space In Shanghai As The Research Object

2.1.1 Urbanisation And Spatial Development Characteristics Of Shanghai Municipality

Shanghai is one of the most representative metropolises in China, and its urbanisation process and spatial development have typical characteristics. Since the reform and opening up, Shanghai has experienced a rapid urbanisation process, with an expanding city scale, growing population and increasingly perfect urban functions, which is of great research value and significance in the context of contemporary urbanisation development.

[1] As one of China's national centre cities, Shanghai connects internationally and serves the whole country (Wu et al., 2013) , and is one of the largest metropolitan areas in the world. Since becoming an open commercial port in 1843, Shanghai has grown rapidly to become the largest city in the Far East. The spatial structure of Shanghai includes various types of historical and cultural districts, modern business districts, industrial parks, and dense residential areas, etc. The evolution and interaction of these spaces show the diversity and complexity of the city. At the same time, the urban spatial development of Shanghai is deeply influenced by the two main river axes, the Huangpu River and the Suzhou River, which form a unique ribbon urban form and have a profound impact on urban mobility.

Urbanisation in Shanghai has shifted from monocentric agglomerative development to polycentric and multicore. However, the population distribution and economic activities still maintain a clear monocentric pattern (Zhou and Chen, 2015). The significant agglomeration effect of the central city has led to high density pedestrian activities in the central city. Shanghai has implemented a series of advanced explorations in urban planning and design of the central city, such as "Low Traffic Neighborhoods" and "15-minute Community Living Circles", which provide important practices for sustainable urban development. The city's sustainable development has been recognised as an important practice.

Therefore, this study chooses Shanghai as a typical research object, through in-depth study of its urbanisation process and spatial development characteristics, it can deepen the understanding of China's urbanisation process, explore the impact of urban spatial structure on walking activities, and draw on its practical experience to provide reference for optimising urban spatial layout.

2.1.2 Shanghai Urban Space Design Practices

With the concept of "people's city for the people[1] " deeply rooted in people's minds, Shanghai, an international metropolis, is actively responding to the new urbanisation strategy of the new era, and has put the idea of "people-oriented" into all aspects of urban planning and construction. Especially in the design of urban space, not only focusing on the physical form of the space, but also attaching more importance to the actual impact of space on the lives of citizens, it puts forward the development vision of "buildings can be read, neighbourhoods are suitable for strolling, and the city always has a temperature[2] ", aiming to create a modern city that is suitable for living, working and travelling. On this basis, Shanghai has developed a series of advanced practices in urban space design.

·Creating pedestrian-friendly cities: By adopting a development strategy that prioritises public transport and is friendly to slow-moving traffic, actively building infrastructure such as walking paths and cycling lanes, and optimising the walking environment, such as installing additional resting seats and lighting, the accessibility and comfort of walking in the city has been greatly improved.

[1] During a visit to Shanghai in November 2019, Chinese President Xi Jinping said, "Cities are the people's cities, and the people's cities are for the people."
[2] In May 2017, the report of the 11th Party Congress of Shanghai put forward the need to focus on creating a city of innovation, humanism and ecology, in which it was specifically proposed that "buildings can be read, neighbourhoods are pleasant to walk, and the city always has a temperature".

·Continuity design of urban space: By organically connecting various areas of the city and forming a continuity of urban space, it breaks down the compartmentalisation and restrictions of traditional urban space. On both sides of the Huangpu River and along the Suzhou Creek, Shanghai has built a large number of green spaces, parks and other open spaces, integrating the urban landscape and public space, and providing citizens with more places for leisure, entertainment and interaction.

·Coordinated development of urban transport: Through the establishment of a diversified transport network, basically full coverage of rail stations has been achieved (Shanghai Municipal Bureau of Planning and Natural Resources, 2018), providing citizens with convenient ways of travelling. At the same time, measures to reduce the use of private cars and encourage low-carbon travel through traffic and number restrictions have effectively improved the urban traffic situation and promoted the flow and vitality of urban space.

Through in-depth study of walking experience and urban linear space in Shanghai, it can provide useful reference for the design of walking space and urban planning in other cities.

2.2 Research Methodology

This research proposes to study urban linear sharing spaces and walking experiences using four methods: documentary research, fieldwork, morphological typology, and ethnographic research. These interdisciplinary research methods complement each other and can provide multi-dimensional perspectives and in-depth analyses for the study.

2.2.1 Fieldwork And Literature Research Of Related Cases

As the skeleton of urban public space, urban linear space has always been in the position of being valued in urban construction, and there have been more successful practice cases, which can be used as the case base for related research. This study will collate the relevant literature of Shanghai's excellent urban linear space cases to clarify the development of urban linear space. At the same time, based on the information obtained from the field survey and cross-referenced with the literature, we can analyse the design techniques and strategies in more detail.

2.2.2 Analysing Linear Spatial Types By Morpho-Typological Methods

Morphological typology derives from the concept of biological taxonomy (Zhu, 1992), which refers to the formation of categories according to the common nature and characteristics of things. Architectural typology is an important branch of morphological typology, represented by scholars such as Rossi, which emphasises the concern for urban space and attempts to solve the urban problems brought about by modernism through the study of types.

Architectural typology can be distinguished into two concepts: functional types, which are categorised on the basis of different functions, and formal types, which are categorised on the basis of formal characteristics and involve the study of composition, transformation and grouping forms. Through the

study of building typology, it is possible to gain a deeper understanding of the structure and evolution of urban space, as well as the impact of different types of space on the pedestrian experience.

2.2.3 Ethnographic Research To Study The Experience Of Walking In Linear Spaces

Ethnographic research originated from cultural anthropology, through in-depth field research, observation and interviews with specific groups in order to understand their behavioural patterns, perceptions and experiences. In the Internet era, "cyber ethnographic research" has become an online mode of ethnographic research, which can also be used as an important method to know and understand social and cultural phenomena (Lai, 2020).

When studying urban space, ethnographic research methods interact with pedestrians through field observations, in-depth interviews, questionnaire surveys, etc., to dig deeper into the behavioural motives of walkers, their behavioural patterns, and their perceptions and experiences in urban space, helping to understand how walkers interact with urban space, and how environmental features affect walkers' behaviour and perceptions.

3 Discussion And Results

3.1 Typologies Of Urban Mobility Spaces In Shanghai

Generally speaking, urban space can be analysed by type in terms of both spatial form and internal function. According to the morphological characteristics of the space, the flow space in the city can be classified into four types, horizontally into point, linear and network types, and vertically into a type of flow space. This study focuses on the morphological features and functional characteristics of linear spaces, as well as the role that sharing spaces play for the experience and feelings of people walking in them.

3.1.1 Classification Of Space Types

·Pointed mobility spaces: Transport hubs or transport nodes in cities, such as airports, railway stations, metro stations, bus stops, etc., are point mobility spaces. These spaces have a concentrated traffic flow and a high degree of crowd congregation, so they need to be designed and planned with efficient, safe and comfortable transport facilities and services. There are two types of points: single-point, which is a relatively single and concentrated transport hub, and scattered-point, which is distributed in different parts of the city or in localised areas.

·Linear mobility space: roads, streets, motorways and other traffic corridors in the city undertake the transport functions of vehicles, pedestrians and bicycles, etc. This urban space form is linear and needs to consider problems such as congestion and safety, as well as the living needs of the surrounding residents. According to the distribution of traffic space on both sides of the linear space, the linear flow space can be divided into three types: single-line type, fishbone type and semi-fishbone type.

The single-line type is a main passage space that cannot be penetrated through both sides. Commonly found in the interior of linear buildings, such as the Swatch headquarters building, there is only a single entrance and exit, and there is no other way to pass through both sides of the building. Fishbone refers to a traffic axis consisting of a main arterial road and side roads perpendicular to it on both sides, similar to the structure of a fishbone. This spatial type is common in cities and consists of the main urban arterial road and the roads on both sides. Semi-fishbone is a variant of fishbone, where one side of the main traffic space is impassable and the other side is distributed with branch roads. Commonly found in riverfront and riverside public spaces, the side that backs up to the waterfront extends towards the interior of the city, creating a space guided perpendicular to the waterfront.

·Networked mobility space: The transport network in the city is a networked mobility space, which connects point and line mobility spaces and provides diversified travelling paths and choices for people. Its design and planning need to consider the distribution of traffic flow, intersection design, pedestrian safety and other factors to ensure the smooth operation of the transport system and the interconnection of urban space. Among them, there is the trunk type which takes the main road as the centre and radially extends the branch roads to form a network-like layout form. When there is no clear main road in a certain area, but a traffic network composed of many interconnected roads, it is a network flow space without trunk.

·Vertical mobility space: This mainly refers to three-dimensional transport systems in cities, such as underground subways, viaducts and pedestrian footbridges, which are often used as supplements to the urban transport system and can make effective use of air and underground space, alleviate the pressure of ground-level traffic, and improve the efficiency of traffic and the utilisation of urban space. Such design and planning need to take into account factors such as land use, environmental protection and traffic safety to ensure their coordinated and integrated development with the surrounding environment.

3.1.2 Classification Of Functional Types

Urban mobility space is an area in the city for people's mobility, transport and activities, and the classification of its functions is crucial to urban planning, design and management. According to the main functions of urban mobility spaces, they are classified into the following three categories: streets and pavements, waterfront corridors, and greenways and parks.

·Streets and pavements: Streets, the most basic public goods in the city, are the most closely related public activity places for urban residents (Shanghai Urban Planning and Land Resources Administration, Shanghai Municipal Transportation Commission, Shanghai Urban Planning Design Research Institute, 2016). Streets, as the main traffic corridors in the city, carry the dual functions of pedestrian and vehicular traffic. Some streets will adopt a time-sharing approach, closing the entrances and exits to vehicular traffic on weekends or holidays, so as to allow the public to hold pedestrian activities such as street fairs. Pavements, as an integral part of the street, primarily serve pedestrians by providing a safe and comfortable walking environment. Sidewalks often share areas with storefronts on both sides of the street, providing both usable space for pedestrians and foot traffic for shops. Commercial neighbourhoods and bazaars in cities are also a type of space where people walk to experience urban public space.

· Waterfront corridors: Linear open spaces built along rivers, lakes, oceans and other waters in cities are waterfront corridors. They are close to the water and have unique natural landscape and ecological environment. Not only do they provide an excellent view of the water, but they are also a good place for public leisure, recreation and exercise. Waterfront corridors often host cultural exchange activities to promote the sharing of the waterfront by all people. The design of waterfront corridors usually focuses on coordination with the surrounding environment, emphasising ecology and sustainability; at the same time, water-friendly nodes will be considered in localised areas to provide pedestrians with an interactive experience with the water.

·Blueways and parks: Blueways are linear pathways connecting urban green spaces, parks and other open spaces, and are mainly composed of walking paths, cycling paths and so on. The park space in the city is also an important place for citizens to relax, have fun and socialise, equipped with a variety of facilities to provide walkers with a comfortable and safe walking experience. Together, blueways and parks form the city's green network and carry the city's historical and cultural memories, providing citizens with opportunities to get close to nature and enjoy outdoor life.

3.2 Current Situation And Analysis Of Walking Experience In Urban Linear Spaces In Shanghai

Through the ethnographic research method mentioned in section 2.2 and the research method of landscape anthropology, the authors visited a number of linear flow spaces in the centre of Shanghai and investigated pedestrians' experience of walking in linear flow spaces in Shanghai by means of a questionnaire. The questionnaires were used to understand people's ratings of how they felt about walking in Shanghai, as well as the strengths and weaknesses of the urban spaces they experienced while walking, and their suggestions.

Comprehensive survey results show that the majority of respondents have a high opinion of the walking experience in Shanghai, especially with regard to the spaciousness of the walking paths and the greenery. The survey results show that the majority of respondents walk for 1-5 hours per week, and that the urban linear spaces where they often walk are mainly the streets around the neighbourhoods where they live, as well as the neighbourhood parks and small-scale green spaces. Respondents rated the safety, convenience and ambience of walking in Shanghai highly, with an average score of 7.9/10. Key strengths of walkable urban spaces in Shanghai include spacious and level walking paths, abundant green vegetation, and safe neighbourhoods; however, there are also weaknesses, including crowded walking paths in some areas, and a lack of shade and shelter at times. The survey found that 76 per cent of people thought that urban walking facilities were adequate, while a small number of people suggested that urban planning and design departments should strengthen the maintenance and management of walking paths, increase the area covered by greenery, and arrange more safety measures to enhance the quality of the walking experience. These findings provide useful references for urban planning and design.

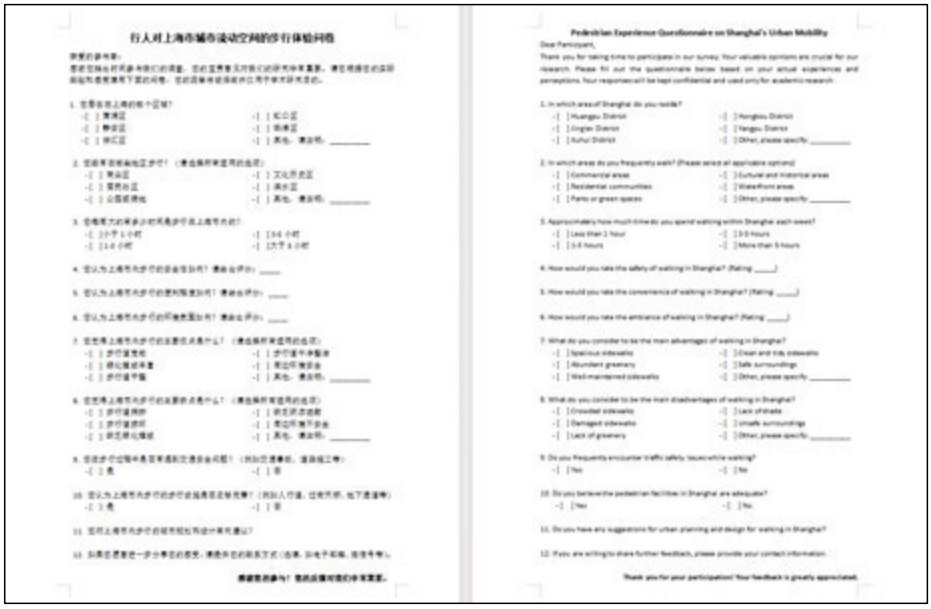

Figure 1. Questionnaire on Pedestrian Walking Experience, photo credit: Mengying Tang

3.3 Design Elements And Methods For Urban Sharing Linear Spaces

As an important part of urban planning and design, urban linear space not only carries the operation and expansion of urban functions, but also is an indispensable part of people's daily life. The acceleration of urbanisation and the change of people's lifestyles in the context of information technology have put forward higher requirements for the design of urban linear space. Referring to Kevin Lynch's five images of urban space classification (Lynch, 2002), the elements of urban linear space sharing design are divided into four elements: path network, spatial interface, landscape node, and sharing space, and also focus on social feedback and management mechanism, and design urban linear space from both physical space and spiritual space.

3.3.1 Establishment Of Path Network Connectivity

In the design of urban linear space, the connectivity of the path network is the most basic and core, which directly affects the accessibility and experience of the walkers. In the design, it is necessary to focus on the continuity and convenience of the paths, and at the same time consider the safety and comfort of the walkers.

Paths in linear space first need to ensure their accessibility, rationally plan the path network, reduce unnecessary detours and congestion, and ensure that walkers can reach their destinations efficiently and quickly. Traffic nodes, such as intersections, roundabouts, and stagecoaches, should also be reasonably set up to ensure smooth connections between paths.

When establishing a path network, multi-level path planning and node settings are required to meet the needs of different groups. For example, the Nanjing Road Pedestrian Street in Shanghai has multiple paths along both sides of the main pedestrian road, which enhances the circulation of the whole area; at the same time, the Golden Line[3] is taken as the core of the design, and multiple traffic nodes are set up to limit the dynamic and static activity areas (Zheng, Qi and Wang, 2000), which are closely connected with the surrounding commercial and cultural facilities, realising the integration of historical features and modern functions. It is also closely connected with the surrounding commercial and cultural facilities, realising the integration of historical features and modern functions.

3.3.2 Ambiguity And Transparency Of Spatial Interfaces

The spatial interface of urban linear space should be ambiguous and transparent, taking into account the openness and interactivity of the space by softening the boundaries and integrating the functions, so as to enhance the visual perception and emotional experience of the walkers, and effectively improve the quality and attractiveness of the space.

The technique of interface blurring increases the inclusiveness and openness of the space by creating a private but not closed space that interpenetrates the internal and external space. For example, Changli Garden reconstructs the community wall so that it is replaced by a fuzzy space with garden interest, expands the street space, loads the walking path, and creates a place-based linear garden (Tong and Ren, 2020).

The street interface on both sides of the pedestrian area should appropriately adopt transparent interface design to increase the sense of openness and attractiveness of the space. For example, the design of shops on the pedestrian street of Huaihai Zhong Road mostly adopts open facades and glass curtain walls, so that pedestrians can clearly see the interior of the shops and at the same time feel the vitality and prosperity of the street outside.

3.3.3 Increase Continuous Landscape Nodes for Guidance

Landscape nodes play an important guiding role in urban linear space, attracting pedestrians' attention and enriching the walking experience. Reasonable installation of landscape nodes, such as sculptures, fountains, gardens, etc., so as to form a coherent whole, can increase the walking pleasure. For example, the Sculpture Park in Jing'an District, Shanghai, has become one of the favourite parks for young people in Shanghai by taking sculpture display as its theme and interpenetrating greenery with sculpture vignettes[4] .

Through landscape design techniques, such as plant configuration, terrain changes, and repetitive elements, it is possible to link landscape nodes so that pedestrians are feeling the flow and change of space. The Xuhui Runway Park in Shanghai continues the cultural elements of the original site,

[3] Design proposal by Chartres Architects Associates La Défense Development, France
[4] https://www.jingan.gov.cn/rmtzx/003001/20221012/741c4a9b-dce0-4f09-8db8-f88ef9b7bb66.html

Longhua Airport, and guides pedestrians to fully experience the 1,830-metre-long linear park through subtle design details such as the undulation of the ground and the continuous water system[5] .

3.3.4 Creation And Design Of Sharing Spaces

The 2016 UN Habitat III Conference proposed a vision of cities for all, arguing that future cities should seek to promote inclusiveness and ensure equal access to and enjoyment of the city by all residents[6] . It can be seen that sharing space is an important part of the linear space in contemporary cities, which can promote communication and interaction between cities and citizens, and achieve a balanced use of social resources.

At the intersection of urban public street space and private space such as merchants and residential areas, part of the private space can be opened up to the outside, gaining vitality and richness while yielding space. For example, Xintiandi merchants mostly use open-air café seating, or borrow plazas, or set back their storefronts, attracting a large number of citizens and tourists to experience the neighbourhood, which is full of life.

Various activities at different times, such as cultural exhibitions, performances, bazaars, etc., can be set up in the urban linear space to attract the participation of different groups and enrich the vitality of the space at all times. For example, the Daxue Road in Shanghai organises various cultural activities and bazaars from time to time during weekends and festivals, attracting a large number of people to participate in the experience and share the street at different times.

3.3.5 Social Feedback Mechanisms And Management Policies

As urban linear spaces need to be fully engaged and experienced, it is crucial to establish effective social interaction and feedback mechanisms. By collecting and analysing feedback from walkers, we can continuously optimise design solutions, manage the way space is used and improve the quality of the walking experience.

In areas where crowd activities are more concentrated and the number of residents in the surrounding community is large, the whole process of designing a linear space requires timely information feedback. Facilities such as bulletin boards and information boards can be set up, or a platform for communication and feedback can be provided through community meetings and questionnaire surveys, etc. At the same time, a sound management mechanism needs to be set up, including personnel management and maintenance of facilities in order to safeguard the normal operation and order of the urban space. In the design of Parkview Park, the surrounding residents will participate in the process of design and implementation, guided by professional designers who will design, update and maintain the settlement space. This will not only gain residents' recognition, but also motivate them to take the initiative to maintain and self-manage the public space (Liu and Liang, 2022).

[5] https://www.sasaki.com/projects/xuhui-runway-park/

[6] The third United Nations Conference on Housing and Sustainable Urban Development, Habitat III, held in Quito, Ecuador, from 17-20 October 2016.

Table 1. Five design elements and methods for urban sharing linear spaces, photos credit: Mengying Tang

Building pathway network connectivity		
	Nanjing East Road Pedestrian Street	
Ambiguity and Transparency in Spatial Interfaces		
	Chang Li Garden	Middle Huaihai Road
Landscape node continuity guidance		
	Jing'an Sculpture Park	Xuhui Runway Park

Creation and design of sharing spaces		
	Shanghai Xintiandi	Daxue Road
Social Feedback Mechanisms And Management Policies		
	Shanghai Millennium Park	

3.4 Challenges And Prospects For The Design Of Urban Linear Sharing Spaces

3.4.1 Facing Challenges

Although Shanghai has achieved a number of success stories in the design of urban linear spaces, there are still some problems and challenges. These include the disconnection of some spaces with poor accessibility; the lack of integration of the surrounding environment; and the lack of safety facilities.

The problem of spatial disconnection sometimes arises due to historical reasons or poor planning. For example, the Suhe Half Horse Park in Putuo District has a riverfront walkway truncated by the Zhenguang Road cut-through, resulting in walkers needing to take a diversion around the footbridge to reach the other side of the road. This situation reduces spatial accessibility and requires the planning of new walkways or footbridges to improve the situation. Certain areas also suffer from environmental incongruity. For example, Shaanxi North Road, as a historical and cultural neighbourhood, the architectural style and commercial environment of some of the shops do not match the overall ambience of the street, which can cause some nuisance and discomfort to walkers. Effective urban design is needed to improve environmental integrity and enhance the walking experience. The lack of safety facilities should not be ignored. In the Suzhou River section of the East China University of

Political Science and Law, part of the section is still under construction, with insufficient lighting at night and broken roads, which increases the safety risk for walkers. The construction and management of safety facilities need to be strengthened to enhance the safety of the walking area.

Taken together, solving these problems requires the joint efforts of the government, planning designers and citizens to continuously improve the quality and experience of urban linear space in Shanghai through rational planning and scientific design.

3.4.2 Future Prospects

With the development of information technology, the construction of urban mobility space will gradually shift: from a focus on motor vehicle traffic to a comprehensive focus on human communication and lifestyles; from the control of road red lines to the control of street space; and from an emphasis on transport functions to the promotion of urban neighbourhood development. Based on this shift, the construction and renovation of streets will be mainly in the areas of integration and assistance.

Integration mainly lies in the integration of transport modes and road facilities. It is possible to articulate different modes of transport through the integration of travel modes, enhance sharing travel services, and increase cooperation with public transport agencies in order to complement the existing transport infrastructure, improve the overall travel choices of the public, and leave safer passageways for walking spaces. In terms of integration of facilities, intensive transformation of street space, intelligent transformation of existing facilities, unified transformation of service facilities such as bus stops, newspaper kiosks and telephone booths, and consolidation of fragmented street facilities such as nymphomaniacs, chairs, street signs and rubbish bins, to create an efficient and smooth traffic space.

Secondly, the goal of sharing mobility in the future also lies in travel assistance. Traffic signals, street lights, traffic monitoring systems and other regulatory systems using intelligent management transformation, such as improving the level of intelligent traffic signals, to provide time-sensitive public transport information release, by the sharing bicycle rental points to provide information on the surrounding rental points and reservation services. It should also enhance the information interaction of public service level, add intelligent monitoring that focuses on maintaining urban safety and focusing on the needs of the disadvantaged, strengthen the environmental management that detects the street environment and reduces energy consumption, and establish a safe and smooth mobility space (Shanghai Urban Planning and Land Resources Administration, Shanghai Municipal Transportation Commission, Shanghai Urban Planning Design Research Institute, 2016) .

Overall, the future of sharing mobility is expected to be characterised by innovation, collaboration and sustainability in an effort to address the current challenges facing urban mobility spaces and to create a more ACCESSIBLE, WALKABLE and SUSTAINABLE transport system for citizens.

4. Summary

Walking is a major type of transport for people to experience urban space and one of the basic human activities. Walking experience in urban linear space requires both physical space and spiritual feeling levels. This study reveals the centrality of walking experience in the design of urban spaces, with particular attention to the sharing experience in linear spaces, and explores the design elements of linear sharing spaces and their impact on walking experience. The study analyses the effectiveness and shortcomings of urban linear space design in Shanghai, and proposes corresponding strategies and suggestions, with a view to providing insights into urban planning and design.

The study firstly elaborates that, driven by the development of information technology, people's demand for walking experience in urban space has increased both qualitatively and quantitatively. Linear space has been the most important component of urban space since ancient times, and as the main spatial form for people to experience walking in the city, it is an important spatial carrier for the study of walking experience. The process of urbanisation has promoted the development of urban linear space, and at the same time generated new possibilities to create a mobile spatial experience for citizens and the city simultaneously.

The study selects the urban linear space in Shanghai, China, as the research object, and on the basis of the field survey and literature research on international excellent urban linear space cases, analyses the types of linear space with morphological typology methods, and investigates people's walking experience and usage feelings in linear space with ethnographic research and landscape anthropology methods, so as to better understand the current situation of the walking experience in urban linear space and problems.

The study classifies the spatial types of urban linear space into four types: point, line, network and vertical, among which linear space is subdivided into three categories; meanwhile, according to the type of internal function of the space, urban linear space can be classified into three categories: street, greenway and waterfront public space. Analysing the characteristics of different space types helps to systematically organise and classify urban linear spaces, and then design and use them in a targeted way. Combined with the perception and experience of pedestrians of Shanghai's linear space in the research report, the study proposes five elements and corresponding design strategies for the sharing design of urban linear space, i.e., establishing path network connectivity, focusing on the transparency and richness of spatial interfaces, increasing the continuity of the landscape nodes to guide the process, paying attention to the establishment of and interaction with the sharing space, as well as strengthening the social feedback mechanism and management, in order to solve the problems and challenges in the design of urban linear space. The problems and challenges in the design of urban linear space are solved.

It can be seen from the study that Shanghai has achieved remarkable results in terms of walking experience in urban linear sharing spaces. However, the city still faces problems such as spatial disconnection and lack of accessibility, lack of environmental integration, and lack of safety facilities. To address these problems, this thesis proposes strategies and recommendations to further optimise the design of urban linear spaces and enhance the walking experience for all. These strategies and recommendations not only guide the urban planning and design of Shanghai, but also provide important insights into the spatial design and enhancement of the walking experience in other cities.

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The conception of "axes" in São Paulo, Brasil: a mixture of travelling of managers and ideas, new urban plan methods, in an incomplete incorporation of Transit Oriented Developments (TOD) agenda

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Abstract (up to 125 words)
This article focuses on the relationship between urban planning and mobility present in the "axes" of the 2014 São Paulo Strategic Master Plan, which became zones in 2016, understanding the conceptual and theoretical origin of the idea that proposed densifying where there is public transport infrastructure. The initial hypothesis was that the inspiration for the axes came from the concept of Transport Oriented Development (TOD), but a bibliometric analysis of scientific articles and manuals, and interviews with the urban planners responsible for regulation, denied this. Urban regulation in previous decades oscillated between zones and urban design, and the axes ended up incorporating an incomplete TOD agenda without improving active mobility or the climate change agenda.
Keywords: transit oriented development; urban planning; urban design; zoning

Introduction

In the year of 2013, the city of São Paulo in Brazil was experiencing the June's Journeys, a movement triggered by the increase in transport fares that stopped the city pushing for better travel conditions and public transport services. The relationship between urban planning and mobility gained the political scene and was materialised with the strategy of concentrating densification (constructive and, in theory, of population) along high-capacity public transport infrastructures – subways, trains and bus lanes –, creating the Axes for Structuring of Urban Transformation (*Eixos de Estruturação da Transformação Urbana* – EETUs) in the 2014 São Paulo Strategic Master Plan (2014 *Plano Diretor Estratégico* - PDE), which became zones in 2016 Land Subdivision, Use and Occupation Law (2016 *Lei de Parcelamento, Uso e Ocupação do Solo* - LPUOS), as it is known and here will be called "axes".

But what was the conceptual and theoretical origin of the axes idea? The proposal for densification where there is transport is not new and can be seen in previous urban regulations, but how were the concepts and ideals appropriated in the axes proposal? To answer these questions, this article analyses how the TOD concept was disseminated in Latin America through the analysis of international manuals prepared by non-governmental organisations and financial institutions, and a bibliometric analysis of scientific articles. Semi-structured interviews were also carried out with urban managers leading the preparation of the PDE 2014

and LPUOS 2016 to understand the choices and design of regulation[1]. Finally, one table at the end of the paper summarises our main findings about the set of regulations.

The hypothesis was that axes inspiration came from the concept of Transport Oriented Development (TOD) disseminated through manuals from international organisations in Latin America, but the research denied the initial hypothesis. The conception of the axes seems to result from a mixture of: (i) experiences of managers, who participated in previous public administrations that tested some models – such as the “Curitiba model” or other bus rapid transit (BRTs) initiatives; (ii) institutional changes, which united urban and mobility planning in the same institution; and (iii) of new methods for urban proposals, such as economic-legal-financial modelling.
The urban regulation in previous decades oscillated between zones and local planes, and axes are zoning, which ended up with incomplete urban design guidelines, and not incorporating or improving active mobility, nor the climate change agenda and the reduction in transport pollution, in an incomplete incorporation of TOD agenda.

TOD in Latin America

The TOD concept has its origin in the United States in the 1990s as a way to overcome a car-centric, low housing density suburban growth. It is expected to change the model based on road transportation, as it is highly polluting and environmentally predatory, considered “distant, dispersed, and disconnected” (Evers et al., 2018) and unsustainable. The strategy is to strengthen the structure of public transport systems and, in the areas surrounding lines and stations, promote the increase of building and population density, the diversity of uses of the space, and social and housing typology diversity. These measures would generate more demand for public transportation, value active mobility (walking or cycling), and promote the building of quality public spaces (Cervero, 1993).

Through urban development that linked the built environment to the provision of transport (Carlton, 2009), the aim was to change the pattern of urban mobility, promoting compact urban environments with mixed use, which would encourage people to live close to public transport and, thus, reduce dependence on the car. In this context, some movements emerged in urban planning seeking to reverse urban sprawl based on automobiles, such as neotraditional neighbourhoods, walkable communities, pedestrian pocket and transit-oriented development (Cervero, 1993; Ibraeva et al., 2020). The dissemination of the TOD concept can be separated into 3 moments without a well-defined transition and which permeate each other: (i) the elaboration and dissemination in the Global North (1993 - 2010), the association with the climate change agenda (2007 - currently), and insertion in Latin America (2013 - current).

The first publications of the concept were ate the early 1990s by Peter Calthorpe (1993) with the book “The Next American Metropolis" and the report prepared by Robert Cervero and the Federal Transit Administration (1993) “Transit-Oriented Development in the United States:

[1] The list of manuals and academic articles researched are at the appendices. The authors' investigations used as the basis for this article are approved by Plataforma Brasil (CAAE: 73827423.9.0000.5390). The following people have been interviewed until the production of this article: the architect Fernando de Mello Franco, then head of the Department of Urban Development (2013-2016); the urban planner Kazuo Nakano, Director of the Urbanism Office of the São Paulo City Department of Urban Development (2013-2014); Nabil Bonduki, then member of the São Paulo City Council and rapporteur of the 2014 PDE (2013-2016); the architect Marcelo Ignatios, Superintendent of Project Structuring (2013-2016); the architect and engineer Alexandre Seixas, Senior Technical Advisor (2013); and the architect Tácito Pio, Senior Management Analyst (2001-current).

Experiences and Prospects” focusing on disseminating the idea and assisting in the implementation of the first experiences. Probably to facilitate the understanding for a large group, a list of six key components (Calthorpe, 1993) became three dimensions, known as the 3 Ds (Cervero and Kockelman, 1997): density, diversity and design. The first refers to housing and employment density; the second to population diversity, uses, services and facilities, and the third is related to the quality of urban design, especially for pedestrians. The idea is that working synergistically, they would bring better results. Some authors later would include “distance to transit” and “destination accessibility” considering parking supply and demographics conditions forming the 5 Ds (Ewing and Cervero, 2010).

The complexity of the variables, synergy and hierarchy between them and the particular characteristics of each territory make the concept difficult to be applied. Some authors claim that the hierarchy of most important factors for the concept to succeed are reduced travel time for public transport, followed by the presence of a job offer and then the quality of urban design (Arrington and Cervero, 2008). Others warn that the difficulty of applying the concept as a policy took to unfinished proposals (Carlton, 2009) and others alert that the implementation of the concept increases the price of land and could cause gentrification (Ibraeva et al, 2020).

In the middle of 2000s, after the Rio 92 and in face of natural disasters and the warning of climate change, the concept is linked to the climate crisis as a way to reduce the emission of CO2 from urban transport by reducing the use of motorised vehicles, the travel distance and increasing the use of active modes. The first relevant appearance is in the IPCC (Intergovernmental Panel on Climate Change) report in 2007, bringing in the chapter “Transport and its infrastructure” the need to reduce motorization through the association between transport planning and urban planning. It was not directly related to TOD, but brings references from Robert Cervero indicating an approach that effectively happens in the 2014 report appointing the concept as a solution for reducing travel distances in urban areas, approaching green urbanism or green TOD (IPCC, 2014).

In the latest IPCC report (2022), with the aggravation of the climate crisis, the concept enters a global agenda for mitigating the climate crisis, being present in the United Nations SDGs (Sustainable Development Goals) – closely related to SDG 11 of sustainable cities and communities. It is also included in the agendas of international organisations that assist cities, such as C40, which is a global network of city halls that supports cities in actions to combat the climate crisis. C40 has produced a guide to good practices and has actions related to transport planning in São Paulo, such as “Cities100: São Paulo - incentivizing Density Near Public Transit” implemented in 2015 after the 2014 Strategic Master Plan which promoted densification near the public transport, that will be explained in the next section.

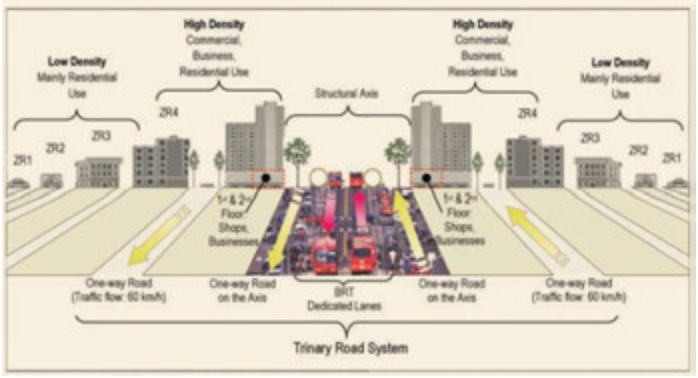
In Latin America, the concept already came with a counterpoint appeal for climate change. Its dissemination began in 2010 with a sustainable transport-oriented development manual (CTS, 2010) in Mexico, but more strongly in 2013 when manuals were published by the WBG (World Bank Group) and ITDP (Institute for Transportation and Development Policy) bringing the concept with an appeal to the sustainability agenda in urban transformations, present in the terms “Sustainable Transit-Oriented Cities”, “Toward Sustainable Urban Cities”, an example of experiences in cities in the Global South, such as Ahmedabad in India, Bogotá in Colombia and Ho Chi Minh in China (WBG, 2013) and a metric model to assess the application of the concept through urban design (ITDP, 2013).

This insertion in Latin America and the Global South was associated with experiences of implementing BRTs (bus rapid transit), justified by the speed and ease of implementing buses as public transport infrastructure compared to rail (WBG, 2013). Also associated with capturing appreciation with the objective of financing implementation, relating to the experience of RICs (Rail Integrated Communities) in Japan (WBG, 2015). The presence of JICA (Japan International Cooperation Agency) as an inducer/seeder of the Japanese concept and experience in Latin America, operating in cities such as Belém (Brazil), Bogotá (Colômbia).

When the concept was introduced in Latin America, there was a difference related to the 3 Ds because its inclusion was related to the analysis criteria as the 3 Ds to be avoided: distant, dispersed and disconnected (WRI, 2018). As a way to change urban development to a more compact, connected and coordinated one.

The Curitiba experience or “Curitiba model” appears in manuals as an example of implementation to be followed, while in academic production there are criticisms. This model is a transformation through a master plan and zoning materialised in the Structural Sectors of the 1966 Master Plan, providing for fast structural roads with an exclusive bus corridor on the central axes of the road, that is, use of the BRT, and one-way roads on the adjacency. The Structural Sectors are areas along the structural roads with greater construction potential, providing for the scaling of the maximum permitted height of buildings through taller, denser buildings close to the road axes and lower, less dense buildings in the middle of the block. Jorge Wilheim was the urban planner that idealised the 1966 Master Plan and in 2002 he was ahead of the São Paulo Master Plan. The mayor of Curitiba that implemented the bus system was Jaime Lerner (1971-1974) during his first term.

Figure 1. Curitiba’s trinary road system (WBG, 2013)



The proposal for densification in Curitiba's axes was widely disseminated as a quick solution, known as the “Curitiba model” that would articulate the expansion of segregated bus lanes, a Latin American example of the implementation of the BRTs agenda, accompanied by a zoning proposal which would allow staggered verticalization. Despite being widespread, there has been criticism since the 2000s about uneven development and deepening socio-spatial inequality

(Pilotto, 2010) with social homogenization of higher-income strata in the most vertical areas along these axes (Stroher, 2014; 2017).

The São Paulo Regulation

The city of São Paulo has historically associated urban planning and its road system, from the beginning with the first communities formed from the paths of the original peoples, which turned into streets (Nigriello, 2024) and with the implementation of road transport, the The city expanded and new communities were formed.

From the 1940s to the present, the automobile has become a protagonist of the urban environment with urban and transport planning focused on it. Some regulations relating verticalization to road infrastructure occurred during the administration of Mayor Prestes Maia (1938-1945), who argued that avenues should be the pillars of urban transformation and proposed a model combining large avenues to improve car accessibility with new occupation patterns expressing an urban design of how transformation should happen.

From the 1970s onwards, São Paulo's regulation was limited to a combination of direct plan and zoning with the first set consisting of the 1971 Integrated Development Master Plan[2] and 1972 Zoning[3]. This set of regulations proposed verticalization along existing or planned road axes to promote commercial or industrial activities close to developed poles. At the time, the city was planning the firsts public transportation with the metro's Lines 1-Blue opened in 1974 and the 3-Red in 1979, also the bus corridors Santo Amaro Avenue and Nove de Julho Avenue implemented in the late 1980s.

The Dictatorship took place from 1964 to 1985 and when the democratic period was starting the 1988 Federal Constitution and the 2001 City Statute[4] brought instruments discussed in the 1960s, such as concepts of Created Land (*Solo Criado*) and the Onerous Granting of the Right to Build (*Ortoga Onerosa do Direito de Construir* – OODC) – promoting the discussion about having one floor area ratio of one time the area of the plot for the entire city associated with the concept of Created Land.

The PDE 2002[5] and LPUOS 2004[6] are the first set of regulations formulated after the Dictatorship and the 2001 City Statute which incorporated the OODC and a more democratic process in the zoning elaboration, where each Subprefecture could discuss the densification rate in a down-top process. The densifiable areas were located near the public transport and scattered within neighbours.

The period was marked by significant advances in São Paulo's urban mobility, including the implementation of *Bilhete Único* (Unified Ticket)[7]; and the expansion of the public transportation network structure greater for bus corridors than for the subway network. Bus

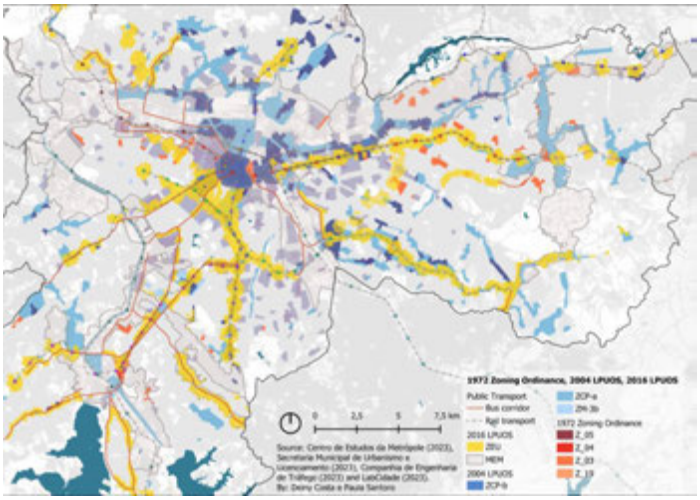
[2] Law No. 7,688, of July 4, 1971.
[3] Law No. 7,805, of November 1, 1972.
[4] Federal Law No. 10,257/2001.
[5] Law No. 13,430, of September 13, 2002.
[6] Law No. 13,885, of August 25, 2004.
[7] Card used in the public passenger transit system in the city of São Paulo that enables the integration of the public transport system.

corridors were implemented on Rebouças Avenue, Francisco Matarazzo Avenue, and the *Fura Fila* guided bus project (2007), while 8 lines of the rail system were operating.

And finally the current set in force PDE 2014[8] and LPUOS 2016[9] proposed the end of scattered verticalization by concentrating densification along the medium- and high-capacity public transportation structure network through zoning rules, called “axes,” which correspond to the Axes for Structuring of Urban Transformation (*Eixos de Estruturação da Transformação Urbana* – EETUs) in the 2014 master plan, which later became the Axes Zone for Structuring of Urban Transformation (*Zona Eixo de Estruturação da Transformação Urbana* – ZEU) in the 2016 LPUOS.

These three regulatory sets are related within the evolution of the idea of densification via zoning initially in the centralities of neighbourhoods and road axes - within a context with reduced public transport infrastructure – for densification exclusively on medium and high capacity public transport routes (Costa and Santoro, 2024).

Figure 2 – Overlap of 1972 Zoning Ordinance, 2004 LPUOS, and 2016 LPUOS



[8] Law No. 16,050, of July 31, 2014.
[9] Law No. 16,402, of March 22, 2016.

Source: Costa and Santoro, 2024.

The context leading up to the 2014 PDE is related to the protests staged in June 2013, the first year of the Fernando Haddad administration (2013-2016), as a moment when the mobility agenda, the struggle for better transportation conditions, and the public transportation and active mobility systems strongly emerged. The protests of June 2013 started with the increase of public transport fare in São Paulo city and spread over Brazil for better conditions of mobility and living conditions.

In addition to having successfully overturned the fare hike, these protests "put the transportation and overall urban mobility agenda at the centre of the conversation" (Lemos, 2021, pp. 228-229). Cycling activism had a role in this period with the cycling agenda growing and gaining relevance in previous decades, penetrating institutional structures with activist public managers, through institutional activism (Abers, Sefafim, and Tatagiba, 2014) reflected on the presence of civil society in councils, that shifts the place of active mobility to a "subaltern regime" in relation to the car-centric "ruling regime"[10] (Lemos, 2021).

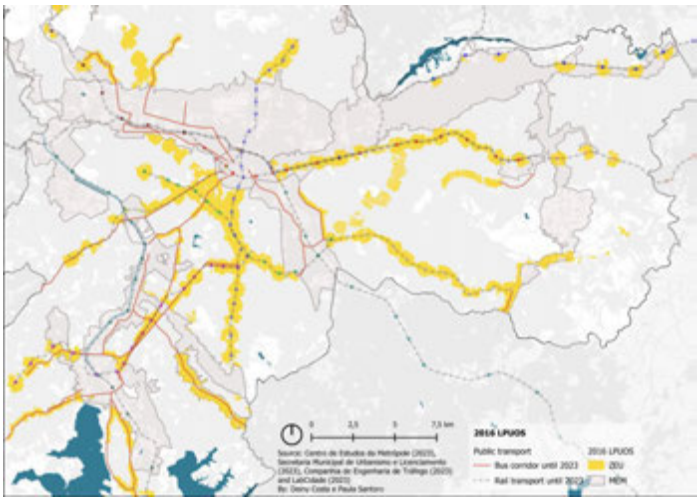
This mobility agenda was so strong that the term "axes" itself had been included in Haddad's political campaign program the year before, as he ran for mayor, in which the connection between development and mobility was being discussed[11]. This axes were designed as the ZEU in the 2016 LPUOS and with the forecast of other areas to be densified after the approval of the expansion projects for the public transport system, the Planned Urban Transformation Structuring Axis Zone (ZEUP – *Zona Eixo de Estruturação da Transformação Urbana Prevista*). The new axes implemented after 2016 are related to the construction of the Line 6-Orange, extension of the Line 2-Green and BRT Aricanduva. Alongside densification in mobility axes, the reduction of densification in the middle of the neighbourhoods, where the construction potential is at most twice the land area, worked in containing the scattered verticalization (Santoro et al., 2023).

Figure 4 – The 2016 LPUOS[12]

[10] On the dominant and subaltern regime, see Geels and Kemp (2012). According to the authors, from a niche segment in the car-centric dominant regime, pressured by protests or disruptive and counter-hegemonic actions, it eventually takes on a place in the regime, albeit subaltern.

[11] Information collected during the interviews.

[12] Map observations: ZEU means zone of urban transformation structuring with minimum FAR of 1 and maximum FAR of 4; MEM means Macro-Area for Urban Structuring with a FAR defined in later regulation. The stations have the colours of the lines to facilitate identification.



Source: CEM (bus corridors), São Paulo city government (2014 LPUOS, and main roads). By the authors, 2023.

In addition to the axes, the possible densification and verticalization in this regulatory set are in areas of Special Zones of Social Interest (*Zonas Especiais de Interesse Social* – ZEIS) and in the Macro Area of Metropolitan Structuring (*Macroárea de Estruturação da Transformação Urbana* – MEM).

Not all ZEIS have construction potential equal to that of the axes, only ZEIS 2 – unbuilt or underused lots suitable for urbanisation –, ZEIS 3 – idle or underused properties, located in regions with good infrastructure and job offer – and ZEIS 5 – these are empty or underused lots in areas equipped with urban services, equipment and infrastructure, where there is a private interest in producing popular market housing developments.

MEM is an area along the Pinheiros and Tietê Marginals and metropolitan connection roads, where land use is predominantly idle and urban transformation is desirable. In this area, densification is possible via specific regulation where urban parameters are defined and an urban design is planned, and this transformation occurs through Urban Intervention Project (*Projeto de Intervenção Urbana* – PIU) or Consortium Urban Operation (*Operação Urbana Consorciada* – OUC).

The urban design experiences in the regulation of São Paulo return to the management of Prestes Maia (1938-1945) in a combination of design for road axes with the definition of the lot's occupation pattern. In the 1970s and 1980s, the CURA Program (Urban Communities for Accelerated Recovery) enabled the transformation of territories with improvements to roads, public facilities and housing (Lucchese, 2004). An example of implementation was the

Jabaquara/Conceição Project, which combined municipal cooperation for improving roads and public equipment, with state cooperation in planning housing complexes. The program was discontinued with the end of the National Housing Bank (*Banco Nacional da Habitação* – BNH) in 1985, its main federal financier, and after unsuccessful cases, such as the Brás-Bresser Project marked by the high cost of expropriations for the construction of the avenue, canalization of streams and other equipment, and the construction of the housing complexes took place a few years later with most of the land being private areas (Anelli, 2011).

The firsts experiences with OUC was in 1997 with the OUC Faria Lima and later with the OUC Água Espraiada 2001. The OUC model was showing signs of depletion as criticism about the instrument does not involve (or has a limited character to) democratic participation and management; criticism about the interventions produced, for being elitist and exclusionary and being essentially road- and infrastructure-oriented; the cost of Certificates of Additional Construction Potential (*Certificados de Potencial Adicional de Construção* – CEPACs) compared to other areas of the city where compensation for building rights is cheaper, easier to get, and less controlled by investors (Santoro, 2021).

In the 2000s, the Urban Intervention Areas (*Área de Intervenção Urbana* – AIU) proposed by the PDE 2004 were polar areas of neighbourhood centralities or mobility hubs and linear areas of road axes capable of densification via future regulation. The idea would be urban transformation through urban design, but it was never implemented. The need for a subsequent specific law to implement land use change became an impediment to urban transformation.

Until 2023, no PIU or new OUC was implemented[13] after the promulgation of the last regulatory set, with densification and verticalization concentrated on the axes, so that zoning was the inducer as in previous regulatory sets. The choice for zoning is based on previous experiences of the urban project not being viable and also on management's choice for rapid implementation, as the possibility of self-application of zoning was an ally for management in the face of the mobility challenges that management was experiencing – in view of the political pressure around June 2013 (Costa and Santoro, 2024).

Although the transformation occurred through zoning, there was an intention to design the urban area, mainly the ground floor of the projects and the interface between public and private[14]. In this sense, the "basket of incentives" is designed to enable an urban design favourable to active modes – pedestrians and cyclists –, restriction to individual motorised modes and a design of the building's volume in exchange for greater construction potential. The items in the basket include mixed use on the ground floor, public enjoyment, sidewalk widening, in addition to restrictions imposed such as the minimum size of the active facade – restricting walls or blind walls – and restrictions on vehicle parking spaces on the facade.

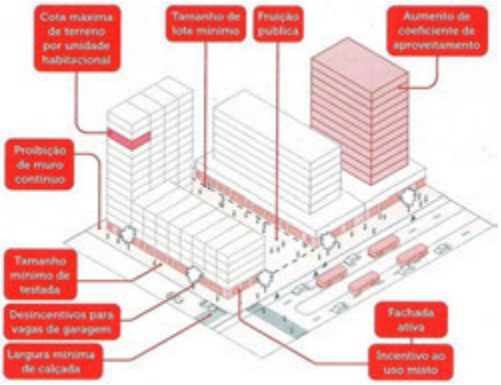
Despite the transformation not being through urban design, there was an intention to design the ground floor – and the interface between public and private – and the building volume. Through a combination of urban incentives, called by one of our interviewees as the "basket of incentives", the regulation of the axes oriented to a built-up volumetric design through non-computable built-up areas.

[13] With the exception of OUC Faria Lima, in force since 1997, and OUC Água Espraiada, since 2001.
[14] Information collected during the interviews.

This basket proposes a design for the interface between public and private areas, allowing the ground floor not to be counted as a built area if amenities were implemented for human scale, such as active façades, lot fencing restrictions, and sidewalk widening. Alongside with this "basket of incentives" the car amenities were restricted such as reduction of parking area for cars on the building facade and limited to the parking area in the garage as a non-computable area – in the previous regulations there was a limit of the minimum number of spaces per square footage or housing unit regulated.

The "basket of incentives" when combined with other instruments also determined the building volume as some areas were considered non-computable areas, such as horizontal circulation and balcony. This possibility and the lack of height limit allowed tall buildings with balconies; and when associated with the solidarity quota – which is an incentive for the real state to produce units for low income population and incentive social diversity – more construction potential is permitted.

Figure 5 - Axes incentive diagram



Source: illustrated PDE 2014.

The incentives that translate into non-computable built-up areas for the purpose of calculating the Onerous Granting of the Right to Build are not new in São Paulo urban planning – they have emerged since the 1950s plans, although restricted to some areas. The 1970s set of regulations – 1971 PDDI and 1972 Zoning Ordinance – already defined areas that would not be included in the calculations of the total built-up area of development projects[15]. The "basket of incentives" works together with the restriction of non-computable built area defined with a limit of 59% of the total built area. This restriction is new in regulation and guides businesses

[15] Defined by the dimensions of the common area of up to 4 sq.m per housing unit and a caretaker's housing unit of up to 60 sq. m. (Art. 15, Par. 4).

in choosing the combination of incentives for the design of the building's volume, such as a menu where parking areas, internal circulation areas, balconies and technical areas are considered.

This urban form was not only guided by urban parameters that had historically guided the relationship with roads – such as building heights in relation to the width of the road, setbacks, etc. –, but by using the basket of urban incentives that adopts the right to build as a “language,” as a “bargaining chip” for certain urban results (Santoro, 2021, p. 81; Stroher et al., 2023). By choosing to create zoning regulations, public managers tried to incorporate the urban design through this “bargaining chip” giving more square length in exchange for a ground floor design with widening of sidewalks, public fruition and active façade.

Advances in this regulation also include mobility by reducing the use of individual vehicles and increasing the use of active modes and public transport. At the beginning of the 2000s, urban regulation allowed up to 50% of the non-computable built area to be covered by parking spaces and garages for cars, being changed in the PDE 2014 and LPUOS 2016 by limiting 1 space per housing unit as a non-computable area. Also this regulation established for the first time a minimum rate for bicycle parking and amenities for cyclists in the garage, such as changing and repair rooms. The incentive for garage buildings close to some peripheral stations were marked in a map in a way to promote the intermodality and reduce the car use in the expanded centre of the city.

In relation to advances in the public transport system, although medium and high capacity transport has expanded, it is still below the needs of the city and the metropolis. The expansion of the bus lane system, managed by the municipality, was an agenda during the administration of Mayor Fernando Haddad (2013 - 2016) as a response to the protests of June 2013 and due to its ease of implementation, since the asphalt network infrastructure was already existing. The railway system – under state responsibility – requires more time to design and implement, and has made less progress than planned since the first lines in the 1970s. Urban regulations already provide for new axes in accordance with the planning of bus corridors and subway or train lines. Some axes already in place are related to the construction of Line 6-Orange, extension of Line 2-Green and BRT Aricanduva.

The process of preparing the PDE 2014 and LPUOS 2016 followed a top-down decision-making model, with the first bill[16] being prepared in less than a year – started in January 2014 and delivered to the São Paulo City Council in September of the same year –, and as soon as the bill was delivered, the drafting of the zoning began. The city government was very active during the discussions around the 2014 PDE law at the City Council, therefore technicians played a central role in the design of the set of regulations, and decisions were more centralised, having a different kind of public participation than the one involved in the previous set (2002 PDE and 2004 LPUOS).

The design of the bill centralised in the administrative and management body is mainly due to the possibility of implementation in a short period of time. The experience of the previous regulatory set, which took place in a decentralised way with the participation of the population through workshops in Subprefectures where urban parameters were discussed, was a long process and reflected areas with different construction potentials. Another issue for short-term

[16] Bill No. 688/2013.

implementation was the urgency in meeting the urban mobility demands of the period represented by the June 2013 protests.

The 2016 LPUOS did not start from decentralised regional plans, unlike the previous one, but rather discussed the city as a whole, in a centralised manner involving economic-financial and legal modelling made by the administrative body. The diversity in institutional structure made it possible to articulate urban and transport planning. This administration counted with a multiplicity of professionals from different specialties, such as urban planners focused in urban design or with experience in others urban planings, transport planners, economists and professionals in the legal field.

This intra-governmental integration was a cohesive and aligned group of elected and technical officials who allowed the axes to be designed in a partnership between the Secretariat of Urban Development and Transport[17] – which also prepared PlanMob 2015 (São Paulo Urban Mobility Plan)[18] – and a team from SP Urbanismo[19]. According to some of our interviewees, a group was formed to conceive urban typologies and urban design for the many different urban scales (including micro) of the axes, to be implemented especially with bus corridors – for which the municipality is responsible. This group also included "transporters", managers coming from the mobility agenda, to be involved in urban planning.

The design of the axes initially came from the desire to improve the implementation of bus corridors, mainly from the experience with the Santo Amaro Corridor with cases of being run over after implementation[20]. The impetus was for the implementation of bus lanes to create a more pedestrian-friendly urban environment, including widening sidewalks and a diversity of uses on the ground floor of the lot – avoiding the blind gables resulting from the latest regulations. This design included economic-financial and legal modelling that enabled the desired urban transformation both on an intra-urban and lot scale, involving the real estate market not only in the volumetric designs and interface between public and private, but also in the production of housing of interest. social (*habitação de interesse social* – HIS).

This production of HIS by the market takes place through the Solidarity Quota, defined by the increase in the construction potential of the project if HIS units are built on the lot itself or another lot in the city or the possibility of payment to Urban Development Fund (*Fundo de Desenvolvimento Urbano* – FUNDURB). The initial idea of the Quota was to promote socioeconomic diversity within the lot itself, but adaptations were made to the design of the regulation, distorting the instrument towards compensation possibilities beyond the lot.

[17] The drafting of the 2015 PlanMob stands out in the period. The plan provides guidance regarding actions to ensure better urban mobility conditions over a 15-year horizon and is the result of the National Urban Mobility Policy (*Política Nacional de Mobilidade Urbana* – 2012 PNMU) – Law No. 12,587 of January 3, 2012.

[18] Decree No. 56,834, February 24, 2015. The plan guides actions to guarantee better conditions for urban mobility within a 15-year horizon and is the result of the National Urban Mobility Policy (*Política Nacional de Mobilidade Urbana* – PNMU 2012) – Law N. 12,587, of January 3 2012.

[19] At the time, it was coordinated by the architect Gustavo Partezani Rodrigues (who has a background in urban and mobility design); the architects Marcelo Fonseca Ignatios (who also worked with real estate assessment) and Alexandre Seixas Rodrigues (who holds a doctoral degree in urban mobility planning); the economists Bruno Borges and André Kwak; and counsel José Apparecido, who has a background in urban design and planning.

[20] Information collected during the interviews.

The mobility crisis was not the only discussion happening at the time, the public discussion around the effects of the verticalization model sparked a massive conversation with different narratives in the media. Groups were divided by: the resistance movements formed by associations of residents of areas impacted by this verticalization accessed and would like to preserve the neighbour as it is; or groups who resisted the destruction of cultural and environmental value which are non-designated heritage assets; or movements in favour of verticalization known as YIMBY (“yes in my backyard”). More recently, another group has emerged aiming to show that, more than being on opposite sides, the ongoing discussion regarding verticalization is a fallacy, because it conceals the interests of the real estate market and finance in producing these changes (Rolnik et al., 2021).

The modelling of the axes reflected the transformation on a municipal and lot scale. This simple and unified densification rule for all public transportation axes did not take into consideration the territorial differences affected by zoning regulations[21], reflecting differences in the urban transformation along these different axes. Although there was an intention, from the beginning, to establish differences between them, as reported by some interviewees, that did not happen as there was limited time to conduct studies to draft the proposal, and it was even more difficult to do so when drafting the 2016 LPUOS, as it could mean reducing floor area ratios, a setback that would make it harder to pass the zoning ordinance law. This single rule applied to all axes reflected a different form of appropriation or abandonment of the different axes by the real estate market.

The combination of rules and incentives in the axes, such as the possibility of greater construction potential, such as the “incentive basket”, and the absence of size limits made the production of large and tall buildings viable, with some projects having 500 housing units. The concentration in one territory and size of these projects led to issues of urban infrastructure overload, production of units without thermal comfort (Viana, 2024), large buildings with a similar design (do Val, 2023) and production of units for social housing distorted from the function (Stroher et al, 2023).

Commenté [1]: seminário dos eixos

It appears that the conceptual theoretical basis of the axes is the concept of TOD through the relationship between urban and transport planning and urban mobility directed towards a modal transition from individual motorised transport to collective and active public modes – on foot and bicycle – through incentives for densification close to public transport axes and modelling of the ground floor and public/private interface. Also due to the temporal convergence of the elaboration and implementation of the PDE 2014 and dissemination of the concept in Latin America and Brazil, both in the mid-2010s. However, this hypothesis was not confirmed in the interviews, with a consensus among those interviewed that the concept was not the basis theoretical.

One of the interviewees mentions that during the discussions about the implementation and improvement of bus lanes, he remembered the concept and looked for references that could help with planning, but that it was not a topic that entered the meetings and guided the axes or the PDE 2014. There is a convergence among some interviewees that the agenda of improving

[21] A broader research hypothesis believes that a reading of location, base, and land structure, the available urban mobility structure, and real estate production, identifying different producers (real estate agents) and the different products produced by them, can be helpful to understand the differences between the proposals and what has been implemented along the axes so far.

bus corridors and the experiences of OUC Água Branca and Bairros do Tamanduateí were what drove the proposal for the axes. Other interviewees and the analysis of densification along the last three sets of regulation (Costa and Santoro, 2024) show that the idea had already been present since the 1972 Zoning, or in the PDE 2002 AIUs, or the 2004 LPUOS. The inspiration from the “Curitiba model” and 1966 PD also appeared in the interviews with a flow of actors and urban planners ahead of the drafting of regulation.

In this way, it is possible to understand that the result is exactly a combination of previous experiences in the urban regulation of the municipality itself and the flow of managers and actors in public administrations testing models and proposing discussions on forms of urban intervention.

Final Remarks

This article shows that despite the TOD concept being related to the discussion around the relationship between urban and transport planning and being disseminated in Latin America in early 2010s, it’s not the conceptual basis of the last urban regulation in São Paulo city – 2014 PDE and 2016 LPUOS.

Despite the TOD concept being disseminated in Latin America at the same period of the axes of São Paulo’s in the 2014 PDE and 2016 LPUOS, it was not a concept that influenced the design of the regulation. The interviews and analyses of institutional historical contexts, models utilised, and proposals for urban regulation lead us to our first hypothesis for this work, according to which the conception of the model that inspires the theoretical-conceptual basis of the axes may be precisely the result of a combination of circulation of actors and planners involved in the structuring of public planning agencies. The different backgrounds of the managers involved in the urban discussion and the flow of these actors into the public administrations that tested some models, such as Candido Malta, Nabil Bonduki and Jorge Wilheim. Also the migration of ideas and the “Curitiba model” brought by Wilheim after his experience in Curitiba.

A densification near medium and high capacity public transport and restriction in the middle of neighbourhoods happened, however there are some differences between the axes and the TOD concept that resulted in an incomplete agenda. The choice of transformation by zoning not by urban design, due to the political moment and the need for short-term implementation. There was a desire to promote social diversification, but the release of the obligation to carry out construction on the same lot and the distortion of the production of social housing made it unworkable. The restrictions on the car use non-computable built areas were those possible within the dynamics that already occurred and were determined in the city's previous regulations.

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Critical Urban Infrastructure Within Concept of Chrono-Urbanism

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Abstract

Urbanization has a direct and negative effect on global problems like climate change and pandemics, which makes disasters in cities more serious. To respond these problems, the concept of 15-minute cities and critical urban infrastructures have gained prominence. The main objective of this research is to assess the accessibility of critical infrastructure in İzmir and determine the equity in the distribution of critical services throughout the city and perception of people to the concept. Reaching critical services is vital during a crisis or ensuring citizens' quality of life. The study examines the conceptualization and operation of critical urban infrastructure in the context of x-minute cities, and whether critical infrastructures were accessible in 5,10,15-minutes by walk in Karşıyaka, İzmir. The findings can contribute to urban development in terms of resilient, accessible, sustainable cities and community well-being.
Keywords: Chrono-urbanism; critical infrastructure; spatial analysis

1. Introduction

The word Anthropocene defines an era characterized by the dominance of human activity, caused by the increase in population density in urban areas. This has consequences and makes urban environments more vulnerable to chronic stresses and sudden shocks. One stress is climate change, and it causes various shocks in cities. In other words, the rapid urbanization in cities causes climate change, and climate change creates crises in cities. National governments, their coalitions, and major international organizations like the European Commission and the United Nations has become more conscious of the critical role that cities play in advancing global and regional sustainability, especially in the context of climate change (Pozoukidou and Angelidou, 2022). Therefore, numerous international policy papers prioritize the issue of climate crisis. They include the Sendai Framework for Disaster Risk Reduction 2015-2030 (United Nations, 2015), New Urban Agenda (United Nations, 2017), and the European Green Deal (European Comission, 2019). Furthermore, the Global Risk Report 2023 (World Economic Forum, 2023) indicates that climate-related risks are in the top ten long-term global risks. “Failure to mitigate climate change”, “failure of climate-change adaptation”, and “natural disasters and extreme weather events” are the first three risks in the report. One more worldwide problem which happened following 2020 is the Covid-19 pandemic. The process of urbanization worsens accessibility challenges, making individuals more vulnerable to pandemic-related crisis.

Multiple strategies and research have been discussed in order to address these concerns and mitigate their impact. The concepts of critical infrastructures and 15-minute cities are two of them. The core concept of 15-minute cities is that they are "compact, complete, and connected". Active modes of transportation like walking and cycling must gradually replace vehicular traffic as the primary source of emissions (Logan *et al.*, 2022). Furthermore, improving the level of connection and accessibility to critical products and services is of utmost importance, particularly in instances with restricted access like pandemics. The 15-minute city relies on chrono-urbanism, arguing that the quality of urban life is inversely proportional to the amount of time spent on transportation, primarily automobiles (Logan et al., 2022). Furthermore, critical infrastructure has played a vital role in the literature. Various nations and organizations own distinct policies related to critical infrastructure. Systems, facilities, and networks are all examples of critical infrastructures because of their significance

to the functioning and well-being of the people. Interdependency (Rinaldi, Peerenboom and Kelly, 2001), and scale (Theoharidou, Kotzanikolaou and Gritza-Lis, 2009; Steele and Legacy, 2017) are two approaches for critical infrastructure. Scale is an essential issue because it is crucial to study critical infrastructures at local and urban scales, which are generally seen to be handled on a national scale. However, scale is mentioned in a limited way in policy documents, and research based on local scales is rare. Therefore, this is a lack in the literature. Cantelmi and others (2021) explain the importance of scale by saying that breakdown in infrastructure can be even more critical if it causes a cascade of breakdowns that have regional, national, or international scale. Besides, Steele and others (2017) ask that “critical at what scale and for whom?”. Therefore, it is imperative to carry out critical infrastructure study within the scope of the 15-minute city concept.

Considering these discussions, this study investigated whether critical infrastructures were accessible in 5, 10, 15-minutes. The main objective of this study is to examine the accessibility of critical infrastructures in Karşıyaka, and to figure out fairness in the distribution of specific critical services in the district. For the study, network analysis is conducted for transportation, and green infrastructures, and it is presented via GIS software. The paper consists of four parts. First, the theoretical framework explains critical infrastructure and the 15-minute city concept. In the methodology part, the study area, methodology, and results and discussion take part. In conclusion, results and limitations are discussed.

2. Theoretical Framework

2.1. X-Minute City Concepts

Chrono-urbanism posits that the quality of urban life is negatively correlated with the amount of time spent on transportation, particularly when relying on automobiles (Moreno *et al.*, 2021). In other words, the concept refers to “the temporal dimension of urban planning” (Moreno *et al.*, 2023). Carlos Moreno, a professor at Sorbonne University, developed this idea in 2015 (Ferrer-ortiz *et al.*, 2022). Urban and territorial proximities are facilitated by the development of polycentric cities or territories that consist of multiple "complete neighbourhoods." This approach aims to minimize daily commutes and facilitate individuals to work in close proximity to their homes (Guzman, Oviedo and Cantillo-Garcia, 2024). According to Moreno and others (2023), the concept seeks to integrate time variable along with the space in the analysis and planning of urban areas. It is important to understand “broadly how time affects urban form, infrastructure, and social interactions” (Moreno *et al.*, 2023).

The idea of x-minute cities is based on the principles of chrono-urbanism (Guzman, Oviedo and Cantillo-Garcia, 2024). In addition, it is noted that the notion of the x-minute city offers a sense of place identification through chrono-urbanism and alternative lifestyles, which reduces dependence on cars by promoting walking distances in cities (Moreno *et al.*, 2021). The x-minute city concept has received significant attention in recent years, primarily due to the urgency to address global warming and the pandemic. Those global crises require the use of different approaches to spatial organization of neighbourhoods. Accordingly, the concept of a x-minute city has a potential to provide solutions by promoting pedestrian and cycling activities to access essential goods and services. Besides, the concept has the capacity to address multiple Sustainable Development Goals (SDGs) and can be adapted to meet the

criteria specified in the United Nations-approved New Urban Agenda (Ferrer-ortiz *et al.*, 2022).

According to Allam and others (2022), 15-minute city may be valuable because of reducing car demand in cities. They indicate that most of emission in urban areas occur due to vehicular transportation. The concept may propose a solution to transportation-related problems that may contribute to climate change. In addition to reducing emissions, the concept of the x-minute city or neighbourhood concept of urban design offers a multitude of extra advantages (Logan *et al.*, 2022). Another crisis that draws attention to the 15 minutes city concept is the covid 19 pandemic. Ferrer-ortiz and others (2022) state that the COVID-19 health crisis has greatly increased interest in the 15-minute city concept. The primary cause of this phenomenon is the concentration of the people in densely populated areas, which gives rise to new challenges in urban settings. Pozoukidou and Angelidou (2022) assert that despite it was first developed in 2015, the popularity of the 15-minute city model increased significantly during the COVID-19 issue. In addition, persons in pedestrian-friendly areas tend to demonstrate a greater degree of confidence in their neighbours, thereby fostering social capital. Research has shown that neighbourhoods designed to be pedestrian-friendly have a positive impact on the well-being of both young and elderly residents (Logan *et al.*, 2022). In addition, the discussions on the concept of the 15-minute city include a fair distribution of essential services to the residents of the city. Pozoukidou and Chatziyiannaki (2021) the importance of developing a sustainable community is emphasized, which can be achieved through “equal access to facilities and opportunities, local social interaction, participation in local community activities, community stability, pride of place, sense of belonging and feeling safe and secure”. Inclusiveness encompasses basic urban services and amenities, such as access to high-quality and affordable housing, mobility infrastructure that serves to people of all ages and abilities, affordable transportation choices, equal chances for employment and education, and a right to a healthy lifestyle (Pozoukidou and Chatziyiannaki, 2021). Increasing access to urban amenities may contribute to optimal consumption achieved without limiting available resources, going beyond common quotas for population and service density. This is also related with mixed used built environment, which include residential, commercial and entertainment places (Allam et al., 2022). Moreno and others (2021) also mention mixed-used development and they indicate that engagement of inhabitants to living, working, commerce, healthcare, education, and entertainment are necessary to maintain remarkable urban life and better quality of life. Briefly, the 15-minute city concept highlights the neighbourhood as the basic component of spatial and functional organization and argues that cities should be organized into neighbourhoods where every need can be met within 15 minutes by foot or bicycle (Pozoukidou and Angelidou, 2022).

The 15-minute city concept emphasizes the accessibility of basic services within a particular time and distance by means of walking or cycling. As mentioned in Allam and others (2022a), this concept enables the strategic positioning of essential urban amenities, infrastructures, and opportunities to promote accessibility. These services are described in the plans and strategies of different cities. It found its way into universal planning practice, with Paris, Portland, Oregon, and Melbourne as the forerunners (Pozoukidou and Angelidou, 2022). One example is Melbourne 2017–2050 plan. Destinations from starting point to the destination are comprised of 800 meters of walking distance (Victoria State Government, n.d.). Education, commercial,

green, open spaces, and transportation are some services accessible within 20 minutes of walking distance (Figure 1). In addition, Ferrer-ortiz and others (2022) indicate that Plan Melbourne is based on walking, cycling, or public transport, with its 20-minute neighbourhood as a chrono-urbanism practice, and Singapore and Beijing's approach combines a more extended threshold for commuting trips (45 to 60 minutes) and a reduced threshold for local daily trips (15–20 minutes).

Figure 1. Features of Melbourne 20-Minute Neighborhood (Victoria State Government, n.d.)

Another example is the Portland Plan, which was created in 2012. A "complete neighbourhood" is defined by the plan as a place where residents may conveniently and safely access essential goods and services for their everyday lives. It involves a variety of housing options, grocery stores and other commercial services, quality public schools, open public spaces, recreational facilities, affordable active transportation options, and civic amenities (Pozoukidou and Angelidou, 2022).

Density, diversity, digitalization, and proximity are four dimensions proposed by Moreno for the 15-minute city concept (Moreno *et al.*, 2021) (Figure 2). The concept aims to shift towards a city that is more polycentric and diverse in its usage. This will be achieved by emphasizing those four key dimensions. The aim is to provide a good quality of living within short distances and reduce dependence on automobiles (Gower and Grodach, 2022). Regarding density, 15-minute city concept advocates for a compact city where people are able to sustain themselves comfortably due to the availability of resources. This approach differs from conventional urban planning concept, which only considers density based on built environment quotas (Allam, Bibri, *et al.*, 2022a). Diversity refers to the mixed-use of the built environment and multiculturality, a social mix. A mixed-built environment consists of “healthy mix of residential, entertainment, and commercial elements” and aims to maximize available spaces and promote the proximity of services (Allam, Bibri, *et al.*, 2022b). The dimension of digitization is intimately linked to the components of smart cities and is crucial in realizing three other dimensions (Moreno *et al.*, 2021). Proximity is another

dimension that aims to reach basic services in 15 minutes (Moreno *et al.*, 2021). This dimension encourages the reduction of travel time and the car usage. Vehicular transportation is a major contributor, accounting for 78% of urban emissions in urban areas. Proximity provides direct ways to reduce emissions through decreased travel requirements and short distances (Allam, Bibri, *et al.*, 2022b). Furthermore, it encourages social engagement (Moreno *et al.*, 2021). This research examines the proximity dimension as a primary dimension of the concept for analysing Izmir.

Figure 2. The 15-Minute City Framework (Moreno *et al.*, 2021)

2.2. Urban Critical Infrastructure

The term "critical infrastructure" emerged in the 1990s and has subsequently been included in policy papers and legislation. A comprehensive understanding of the concept of critical infrastructure is necessary (Henten and Windekilde, 2020). Furthermore, Setola and others (2017) state that critical infrastructures do not have a standard definition, but the main idea is that they harm society when disrupted. Critical infrastructures, in a general sense, refer to assets or systems that are essential for upholding the societal and economic operations of a community (UNISDR, 2017). Serre and Heinzlef (2018) argue that the term "critical" implies a situation where the defence and economic organization could be challenged in the event of a disruption in essential infrastructure. The Organization for Economic Co-operation and Development (OECD, 2019) provides a definition of critical infrastructures as “systems, assets, facilities, and networks that provide essential services for the economy's functioning and the population's safety and well-being”. Critical infrastructures, as defined by many systems, cultures, and professional viewpoints, are responsible for providing vital goods and services that are necessary for the ongoing functioning of society and the economy (Shen, Feng and Peng, 2016).

The perception of critical infrastructure has evolved. Initially, they were viewed as concrete and stable, like physical and information and communication technologies. Nevertheless, there has been a shift in this trend towards a more all-encompassing approach. As stated by Pursiainen (2009), critical infrastructures contain all necessary societal functions. In contrast to earlier views, Mottahedi and others (2021) argue that the human factor is important and emphasize that critical infrastructure systems include the integration of individuals, engineering systems, and ecological surroundings. Furthermore, according to Steele and Legacy (2017), it can be described

as a "multidimensional and lived phenomenon" that relates to place, space, ecology, culture, pipes, wire, and concrete, among other things.

The actual events, shocks, and stresses in cities have an important role in the evolution of debates in critical infrastructure. Even while terrorist threats are discussed in relation to critical infrastructure, this one-hazard approach was insufficient to guarantee the uninterrupted operation of the system. Consequently, the European Union embraced the concept of the "all-hazards" strategy (Pursiainen, 2018). However, climate change has become an increasingly important issue when it comes to maintaining the resilience and protection of critical infrastructure (Hawchar *et al.*, 2020; Salimi and Al-Ghamdi, 2020; Kumar *et al.*, 2021; Silvast *et al.*, 2021). Besides, COVID-19 pandemic is also taking place in discussions (Clark-Ginsberg *et al.*, 2020; Derks, Giessen and Winkel, 2020; Mcphearson, 2020).

Infrastructures have played an important effect on the formation of metropolitan regions throughout the history. Furthermore, while critical infrastructures are typically discussed on a national scale, they are a part of urban development because they both affect and are affected by urban development. Given the existence of spatial difference and sociotechnical rupture, critical infrastructures have a significant impact on “governing and contesting” of urban change (Mcfarlane and Rutherford, 2008). Technological advancements, political strategies, and economic approaches have a significant impact on the development of infrastructure, which in turn affects urban growth. Today's existing political and economic circumstances necessitate new investments in urban infrastructure. Recent political and technical arrangements in cities facilitate the development of mega infrastructure projects. There, new globalized "infrastructure practices" emerge (Addie, Glass and Nelles, 2020).

2.3. Urban Critical Infrastructures in Chrono-Urbanism Perspective

Like definition of the concept, sectors of critical infrastructure also may differ from country to country. OECD (2019), according to surveys, defines 16 critical infrastructure sectors (Table 1). According to Lomba-Fernández and others (2020), cities depend on these sectors for daily life. Some countries have different categories. The "National Strategy for Critical Infrastructure Protection, Germany" report categorizes critical infrastructures into two main groups: basic technical infrastructure (such as power, ICTs, transportation, and water) and socio-economic services infrastructure (including food, public health, emergency services, disaster management, public administration, finance, media, and cultural heritage) (CIP Strategy, 2009). As mentioned, critical infrastructures studies mainly focus on technical infrastructures. The concept of "soft capital" such as human capital and knowledge, is discussed in the literature at gradually. However, it is important to examine the "dynamics of critical social infrastructure" in order to understand their impact on community capacity (O’Sullivan *et al.*, 2013). Furthermore, the discussion surrounding ecological critical infrastructure has achieved significance in recent years. The ecological perception is particularly essential, especially regarding climate change and the pandemic. In addition to OECD, recent studies focus on green infrastructure as critical infrastructure (Derks, Giessen and Winkel, 2020; Amorim, Menezes and Fernandes, 2022). Steele and others (2017) argue that in the context of urbanization, the essential interconnections between critical infrastructure and the equity of human and natural systems highlight the critical role of infrastructure. Therefore, “soft/

green/digital infrastructure (at different scales and for different reasons) qualifies as critical" (Steele et al., 2017 p.85). Because of these reasons, green infrastructure is also considered critical infrastructure in this study.

Table 1. Critical Infrastructure Sectors (OECD, 2019; Derks, Giessen and Winkel, 2020; Amorim, Menezes and Fernandes, 2022)

Critical Infrastructure Sectors
Energy
Nuclear sector
ICT
Transportation
Water
Dams & flood defense
Food supply & distribution
Health
Finance & banking
Government
Public safety
Law enforcement
Chemical industry
Space sector
Defence industry
Critical manufacturing
Green Infrastructure

As mentioned, critical infrastructure sectors consist of technical infrastructures and socio-economic sectors. Within the scope of the x minute city concept, access to various urban services is discussed on a temporal dimension. In this context, some of the services included in x-minute city applications are critical urban services or critical socio-economic services (Table 2). An inclusive and fair distribution to critical services is essential in two ways: quality of life and accessing to services in emergency situations.

Table 2. Critical Infrastructure Sectors within Concept of X-Minute City

Critical infrastructure sectors in x-minute city concept	ICT
	Transportation
	Food supply & distribution
	Finance and banking
	Health
	Green Infrastructure

The two main concepts—urban vital infrastructure and the 15-minute city concept—are examined in the context of this study. These two concepts are often examined independently in several studies, and there is a need for a broader overview of the study on both topics in the literature. Studying these two concepts together consists of an alternative evaluation of cities in the context of resilience, sustainability, and fairness in cities. Therefore, in İzmir, the critical infrastructure sectors within the 15-minute

perimeters are examined. In the study, green infrastructure and public transportation are selected to analyse.

3. Methodology

3.1. Study Area

İzmir located in the western part of Türkiye and around the İzmir bay. It is the third biggest city in Türkiye. The city has been faced with speed urbanization for since 1960s. Also, Izmir is the 3rd city with the highest population density according to 2023 population data (TSI, 2023). The has experienced significant population increase and expansion of built-up regions, resulting in increased pressure on natural resources (Tonyaloğlu, 2020). The city has many policies and projects about both critical service sectors and micro-mobility and pedestrianization. İzmir has 30 districts, and Çiğli, Karşıyaka, Bayraklı, Bornova, Buca, Konak, Balçova, Gaziemir, Karabağlar, Narılıdere and Güzelbahçe are urban areas of the city (Figure 3).

Figure 3. Districts of İzmir

İzmir is a unique city with various strategies and policies focused on sustainable development strategies, resilience, and ecological approaches. The Izmir Metropolitan Municipality has implemented a new urban development strategy in response to the rapid urban growth and its associated ecological, social, and environmental changes. This strategy focuses on a series of projects aimed at addressing climate change (Tonyaloğlu, 2020). In addition, there are various thematic plans focusing on climate change adaptation and nature-based solutions: İzmir Green City Action Plan (İzmir Metropolitan Municipality, 2020a), A Framework for Resilient Cities To Climate Change: Green Revision Guidebook (Berberoğlu, Çilek and Ünlükaplan, 2019), İzmir's Strategy for Living in Harmony With Nature 2021-2030 (İzmir Metropolitan Municipality, 2022) and Izmir Sustainable Energy and Climate Action Plan, 2020 (İzmir Metropolitan Municipality, 2020b).

Additionally, İzmir Metropolitan Municipality has strategies and projects for various critical infrastructure sectors. For instance, the "Cittaslow Neighbourhoods" initiative aims to create neighbourhoods that are both pedestrian-friendly and supportive to a high quality of life. The Cittaslow Metropolis Project is a model developed in cooperation with the Cittaslow International Union and Izmir Metropolitan Municipality to promote the Cittaslow philosophy in metropolitan areas.[4] Sustainable Urban Mobility plan is another project in İzmir. SUMP Izmir takes a holistic approach to all modes of transportation, including pedestrian, cycling, public transport, vehicular traffic, rail and other mobility-related issues such as traffic safety, urban development, climate measures, air pollution, environmentally friendly drivers, new forms of mobility and digitalization[5]. Although the city has no official 15-minute city implementation, it has projects focus on sustainable mobility modes.

In figure 4, a 15-minute accessibility service area map for critical services is demonstrated. These services are public transportation stations, food markets, green areas and Wi-Fi points. As seen in the figure, Konak and Karşıyaka have the highest accessibility level to all critical services. Especially, public transportation stations which are metro and tramway stations are highly accessible in those areas. In this study, Karşıyaka is selected as case area because of its potential to 15-minute city concept and its dense population.

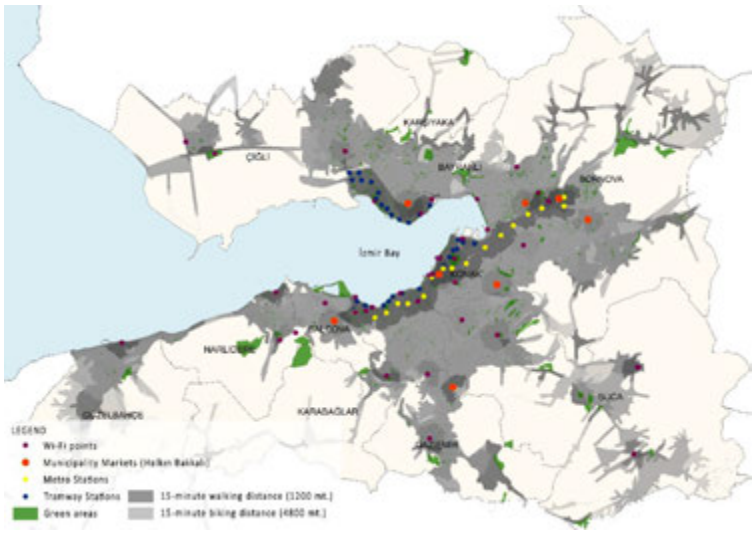

Figure 4. Green areas, metro, Wi-Fi points and tramway stations in 15-minute walking distance and biking distance (produced by authors)

Karşıyaka is located on the northern shore of Izmir Bay. The district has 341857 population, and it is the fourth district with highest population in İzmir. In Karşıyaka, the coastal road, suburban train line (Izban), Anadolu Street and İzmir Ring Road constitute the main transportation axes (Özgen and Türkseven Doğrusoy, 2020). It is

[4] https://cittaslowturkiye.org/tr/dunyanin-ilk-cittaslow-metropol-kenti-izmir/
[5] https://sumpizmir.org/#genel

observed that there are mostly residential areas in the urban structure developing between these axes (Özgen and Türkseven Doğrusoy, 2020). In Türkiye, there were a huge migration from rural to urban areas in 1950s. İzmir was also affected from this movement and urbanization rate increased in those years. As a result of this, the urban fabric in Karşıyaka also transformed, high-rise residential and commercial buildings were built instead of summer houses, the coastline was filled in and widened, the use of the sea was restricted due to sea pollution, and thus daily life changed and social life spread from the coastal area to the inland areas (Özgen and Türkseven Doğrusoy, 2020). Also, the settlement started to expand towards the north with increasing demands over time. Neighborhoods with poor quality and infrastructure problems have also become the main components of the region (Zengin Çelik and Çilingir, 2017). The district has become one of urban centres in İzmir. Easy and multi-modal transportation can be seen as one of the most important reasons for the district to create a dynamic and intense urban experience in daily life by increasing human circulation (Özgen and Türkseven Doğrusoy, 2020).

Considering these, transportation and green infrastructure are selected as critical sectors to figure out their accessibility within 15 minutes. These sectors involve publicly use services.

4. Method

The study has two parts. First, a comprehensive literature review is conducted to determine commonalities in critical urban infrastructure and the 15-minute city concept. Within the scope of this study, public transportation and green infrastructure are selected as critical sectors. Bus, tramway and İZBAN (suburban line) are analysed as public transportation stations, and parks and sport areas are analysed as green infrastructure.

This study examines the proximity component within the concept of the 15-minute city. This dimension involves to the length of travel and the accessibility to critical services. Given the objective of evaluating the accessibility of critical services within a 15-minute, the suitable dimension is proximity. Other three dimensions, density, diversity and digitalization, are not evaluated, but the case area involves them. Karşıyaka is one of high dense areas in terms of population and building. Also, it has become an attraction point in İzmir because it has various land uses such as commercial, education, health, green areas. Besides, there are some attempts for digitalization in İzmir in public transportation. These three dimensions support the research objective of the study, which is proximity. From this point of view, in the scope of the second part of this paper, the accessibility of critical infrastructure services in specific perimeters are investigated. The perimeters are based on various walking distances as 5, 10 and 15 minutes.

Various methodologies are applied throughout the accessibility analysis process. The ratio method, minimum distance model, Geographic Information System (GIS)-based spatial analysis, gravity model, and two-step floating catchment area method are common spatial accessibility methods (Song *et al.*, 2022). Network analysis in GIS refers to the examination of spatial networks, including transportation networks, utility networks, and social networks, using geographic information system (GIS) technology. Further techniques for network analysis comprise buffering and point-to-point straight-

line distance calculation. Nevertheless, these analyses oversimplify the evaluation of access by disregarding the consideration of actual access routes such as paths and roads, as well as obstacles like rivers and trains (Comber, Brunsdon and Green, 2008). In this study, GIS mapping tools and network analysis are used to generate the perimeters. Network studies have the capacity to provide answers to a diverse range of concerns regarding linear networks, including roads, railways, rivers, facilities and utilities. This method of geographical analysis involves calculating the distances between locations or nodes on a network by using network data, which often consists of linear features like roads and footpaths (Comber, Brunsdon and Green, 2008). Walking speed varies according to physical characteristics of people (i.e. age) and geographical characteristics of the area (i.e. slope and climate). Nevertheless, these characteristics are not included in this study. In the study, walking distance is assumed to be ¾ mile or 1200 meters in 15 minutes and cycling distance is assumed to be 3 miles or 4800 meters in 15 minutes (Duany and Steuteville, 2021). 5- and 10-minutes walking distances are 400 meters and 800 meters. Public transportation and green areas are important in well-being of people in their daily life or during emergency situations. Therefore, it is valuable to investigate different accessibility times to make contribution to spatial plans and decisions.

As mentioned in Fazio and others' (2023) study the use of open data can have a determinant impact in situations when resources are limited. Hence, main data source of this study is Open Street Map and İzmir Metropolitan Municipality. Data consists of the location of active green spaces metro, tramway, bus station points, and roads. İzmir Metropolitan Municipality (IMM) provides green spaces data. Public transportation stations are provided by open source of IMM. Public transportation stations are obtained from the application where the IMM shares some spatial data as open source. Roads, forests, building data are from Open Street Map. The network analysis of 5,10,15-minute periphery is based on transportation stations and green spaces as starting points.

5. Results and Discussion

In this study, the accessibility of critical infrastructure of İzmir is measured. Bus stations, metro stations, tramway stations and active green areas have been investigated by service area analysis in network analysis. Figure 5 demonstrates location of green areas (parks and sport, recreation areas, forests) and public transportation stations. Forests and recreations areas are mainly located in north side of the area, which is less dense than south part. Analyses are conducted in highly dense urban area, which is southern part of the area.

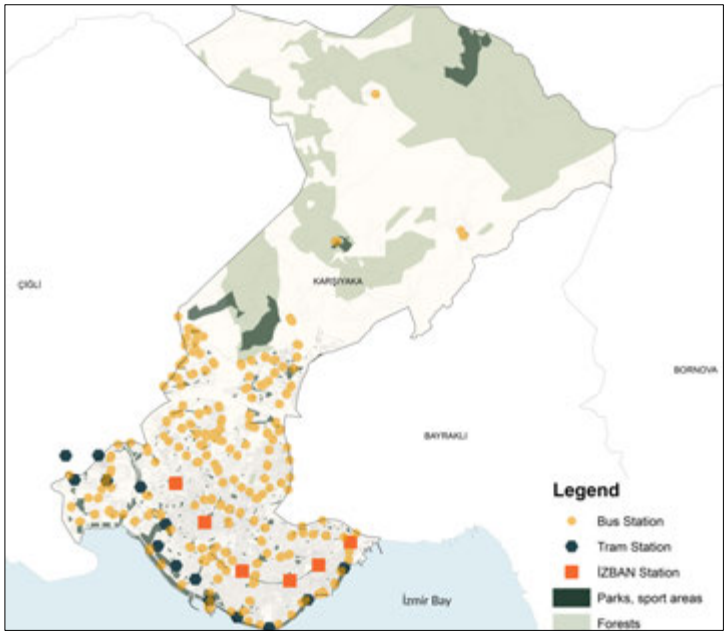

Figure 5. Locations of Green Areas and Public Transportation Stations

The first network analysis is conducted to measure green areas accessibility. In the study actively used green areas are analysed, which are parks and sport areas in 5,10, 15-minute periphery (Figure 6). As seen in the map, parks and sport areas are highly accessible in the area by walking. Most of parks and sport area are accessible in 5-minute walking distance. However, when comparing north and south parts of the area, neighbourhoods in the north have less parks and sport areas and accessibility to them. As seen in the map, shoreline has a huge potential of green areas. There is a green axis along the coast, and it serves as both parks or recreation areas and pedestrian axis. Because of uninterrupted green axis throughout the shoreline, capacity of accessibility of green areas is very high there.

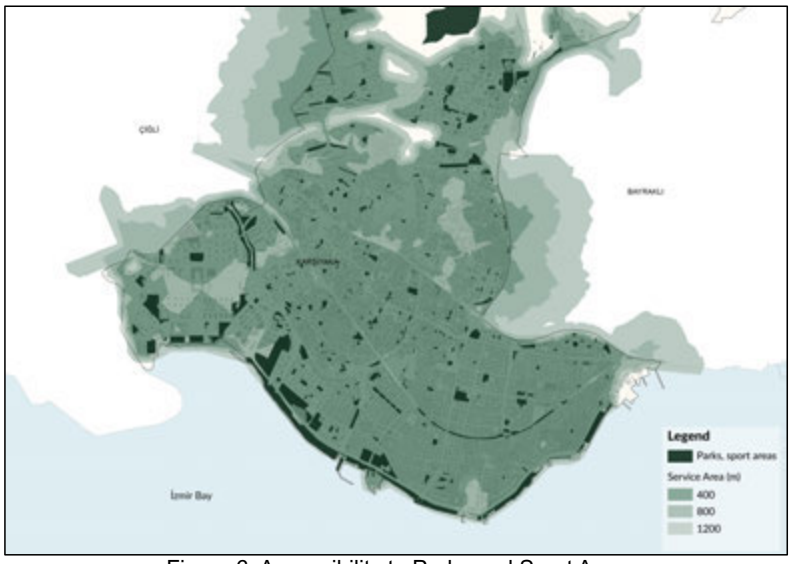

Figure 6. Accessibility to Parks and Sport Area

Compared to tram and İZBAN stations, number of bus stations is higher in the area. However as seen figure 7, they are accessible in 15 minutes, but 5-minute service is not sufficient. Some parts of the area are not served by bus station in 5-minute walking perimeter. Accessibility to bus stations is crucial in the area because public transportation is highly dependent on buses especially in inner sides.

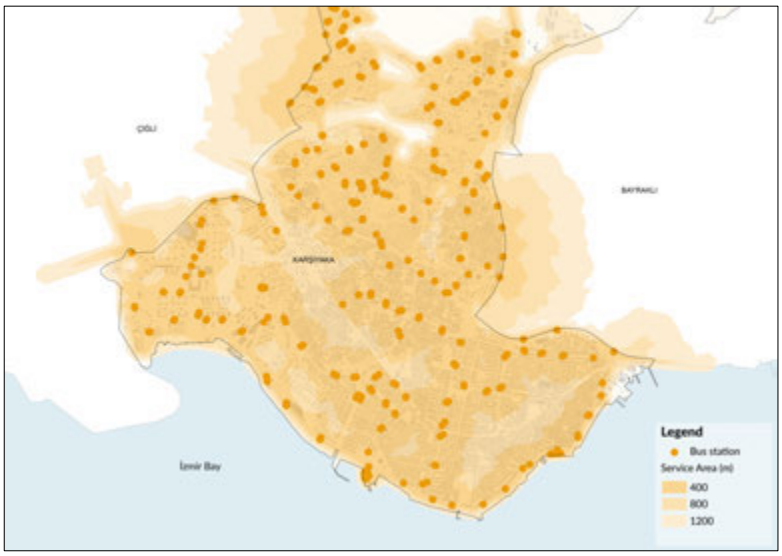

Figure 7. Accessibility to bus stations

Figure 9 demonstrates accessibility to İZBAN stations. İZBAN is a suburban line which connects the area with other parts of İzmir, therefore, accessibility to it is very important. The line connects the rural districts with urban (Figure 8). However, it serves a very limited area within walking distance. The coastal area of İzmir Bay has the most accessibility to both İZBAN and tramway stations. Those stations are accessible in 15-minute walking distance generally. Tramway stop serves along the coast north of the bay, so accessibility of them generally concentrated in these areas. (Figure 10).

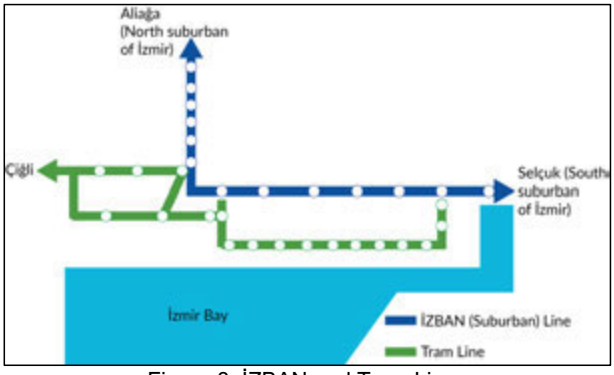

Figure 8. İZBAN and Tram Lines

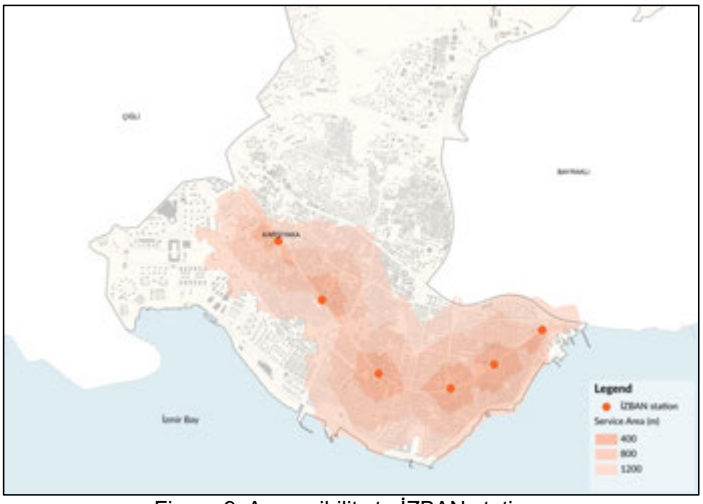

Figure 9. Accessibility to İZBAN stations

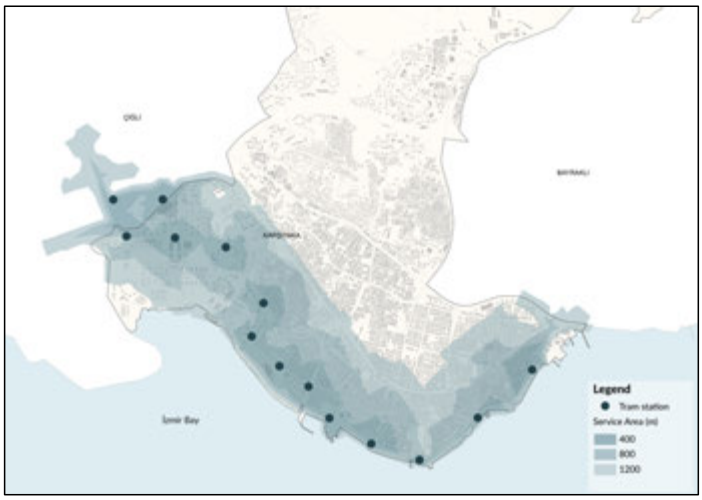

Figure 10. Accessibility and tramway stations

Figure 11 demonstrates all public transportation modes' accessibility in 5, 10, 15-minute walking distance. Coastal areas have the most accessibility for all modes of public transportation. The main reason for this is to be commercial centre of the city, and many commercial and business locates there.

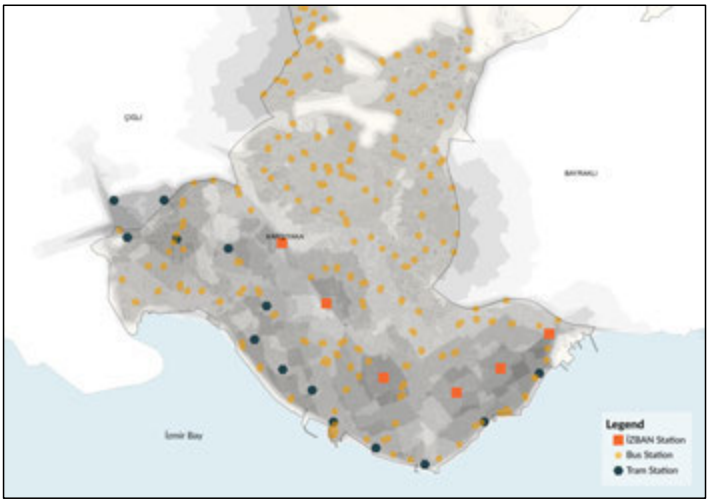

Figure 11. Accessibility to public transportation stations

Green areas and public transportation are evaluated as critical services in İzmir within the context of this study. Therefore, they need to be accessible to all. Steele and others (2017) identify criticality regarding the links between people and environments and their equality. Therefore, the study investigates the fair distribution of critical infrastructure in İzmir.

As seen in results, most of public transportation modes are in southern and coastal parts of Karşıyaka. Although, distribution of bus stations serves most of Karşıyaka district, people live in southern part have more alternatives of public transportation. Therefore, it can be said that distribution of public transportation stations is not balanced in Karşıyaka district.

6. Conclusion

Critical urban infrastructures have services sectors to ensure well-being and resilience of communities, and 15-minute cities consist of essential services accessible in 15 minutes. Critical services such as transportation, food, health, etc. should be considered in terms of accessibility. They are needed to be accessible for all within walking distance to provide resilient and fair cities. According to review on 15-minute city and critical infrastructure literature and İzmir, green areas and public transportation stations are evaluated within scope of this study.

Different approaches to critical infrastructures are necessary for more resilient and sustainable cities. While critical infrastructure studies primarily focus on technical infrastructures, it is equally necessary to include social and ecological critical sectors in cities. Reaching critical services such as education, health green spaces is necessary for quality of life of citizens. Besides, it is vital to access those services during crisis. 15-minute city concept mainly focuses on accessible to services to minimize vehicular transportation demand. However, it is also valuable considering crisis situations such as restriction in pandemics, or emergent safe places after earthquakes. Thus, critical infrastructure and 15-minute city concepts may complement each other. Also, the study of critical infrastructure on a neighbourhood scale is an important contribution to the literature because it is handled in national documents generally.

The city of İzmir does not implement the 15-minute city concept. However, this study aims to evaluate the potential to apply this concept in terms of critical services Karşıyaka. Besides, it aims to assess critical urban services in the 5, 10, 15-minute periphery by walking. Distribution of public transportation stations and parks and sport areas are evaluated. In results, especially the centre parts of Karşıyaka have accessibility in 5 and 10-minutes accessibility by walking or biking. In Karşıyaka, there is a potential to implement critical urban infrastructures in a 15-minute city concept, according to the results. However, the distribution of critical services should be more equitable through walking and biking especially in the outer ring.

The study has limitations. Firstly, geographical information such as slope is not considered, but it affects the ability and travel time of walking and biking. Also, walking infrastructure should be taken considered because there may be obstacles due to insufficient walking infrastructures. In addition, inclusive urban settings necessitate the consideration of a diverse priorities, including healthcare, education, job, and cultural and recreational amenities, during the urban planning process (Guzman, Oviedo and Cantillo-Garcia, 2024). Personal preferences are lack in the study. However, it is important to survey people their thought about accessibility to services by walking or biking.

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Poster

Research on Carbon Accounting Methods for Urban Areas Based on Spatial Data Utilization

Abstract: As climate change becomes a significant global threat, the pursuit of carbon peak and carbon neutrality is now essential for urban development in China. Carbon accounting is a crucial technical tool for monitoring urban carbon emissions and guiding low-carbon urban construction. This study, which focuses on urban built-up areas, integrates carbon accounting methods with urban spatial elements, significantly aiding the achievement of 'dual carbon' development goals in cities. Using Harbin City, Heilongjiang Province as a case study, this paper summarizes and analyzes fifteen years of data on energy and spatial usage to develop a carbon accounting system for urban built-up areas. Additionally, it formulates a carbon accounting method for urban built-up areas based on spatial usage, and validates its accuracy by comparing the results with those from energy usage carbon accounting. Based on these findings, the study proposes pathways for predicting urban carbon neutrality and specialized assessments for low-carbon construction, thus supporting the 'carbon neutrality' goals in national spatial planning.

Keywords: Carbon Neutrality Goals; Built-Up Area; Spatial Usage Activity Data; Carbon Accounting; Application Pathways

1. Introduction

To address global climate change risks, China announced at the 75th United Nations General Assembly its commitment to reach carbon peak by 2030 and achieve carbon neutrality by 2060. Cities, as hubs of human activity, are major contributors to high energy consumption and carbon emissions, accounting for over 80% of global greenhouse gas emissions (Lynn and Peeva, 2021a, Dhakal, 2009a). Research indicates that strategically arranging and coordinating urban spaces effectively reduces regional carbon emissions (Li *et al.*, 2022a, Newman and Kenworthy, 1998). Therefore, developing a low-carbon, sustainable urban strategy is crucial for achieving carbon neutrality goals.

With the complete implementation of national land and spatial planning, supporting carbon neutrality goals and fostering urban low-carbon development have become key objectives in urban construction (Xiong *et al.*, 2021b, Zheng *et al.*, 2022b). Currently, urban carbon accounting methods are crucial technical tools in low-carbon urban planning research (Ye, 2009b, Zheng *et al.*, 2021c, Chen *et al.*, 2022c). However, current carbon accounting methods face challenges such as poor integration with spatial elements, and their scope often misaligns with the national land and spatial master plans at the central city level. To enhance the role of urban carbon accounting in supporting land and spatial planning, this study develops a built-up area carbon accounting system based on space use activities, following the "accounting system - benchmark formulation - method construction - result verification" framework. Harbin City is used as a case study to validate the method's accuracy. Building on this, the study proposes an application pathway for this carbon accounting method in territorial spatial planning.

Currently, urban carbon accounting is categorized into production-based methods (PBA), which utilize energy use data, and consumption-based methods (CBA), which rely on economic input and output data (Peters, 2008, Guan *et al.*, Wiedmann, 2009c). The "IPCC National Greenhouse Gas Inventory" is a production-based carbon accounting model developed by the Intergovernmental Panel on Climate Change, established by the World Meteorological Organization and the United Nations Environment Program. It is an important tool for countries and cities around

the world to establish greenhouse gas emissions. The more authoritative approach to the inventory process (Chen, 2011). This method categorizes regional carbon emissions into four sectors: energy activities, industrial processes, agriculture and forestry, and waste disposal. Energy activity data is used to calculate the carbon emissions of each sector and summarize them step by step, and finally calculates regional greenhouses. Gas emissions. Its global use in climate monitoring has led many cities and regions to adopt this model for calculating urban carbon emissions and compiling greenhouse gas inventories. Urban policymakers and researchers can use these accounting results to assess the impacts of energy use changes on carbon emissions and monitor shifts in the city's emission structure. Therefore, this method has become the most commonly used urban carbon accounting technology in the field of urban planning (Steininger *et al.*, 2014a, Lin and Sun, 2010, Chen *et al.*). Despite its advantages, the integration of energy-based carbon accounting with urban spatial elements is poor, negatively affecting urban planning due to low correlation between results and spatial factors. Insufficient feedback, interaction and support (Zheng *et al.*, 2021c, Xu *et al.*, 2022d, Chen *et al.*, 2022c).

Enhancing the correlation between carbon accounting results and urban spatial elements has emerged as a crucial research direction (Su *et al.*, 2014b). Scholars have utilized nighttime light data to analyze the temporal evolution and spatial distribution of urban carbon emissions, initially establishing a coupling relationship with urban spatial elements (Meng *et al.*, 2017, Shi *et al.*, 2016, Lv *et al.*, 2020, Ao *et al.*, 2022e). In-depth research into the emission reduction mechanisms of urban and rural spatial development has led to the establishment of a "land use-carbon emission" correlation framework, based on classifications, inventory divisions, and emission reduction paths. This approach has been applied in cities like Beijing and Shanghai, with urban elements as core components of the carbon accounting method (Jiang *et al.*, 2013a, Ju, 2013b, Li and Ren, 2019). Currently, the urban spatial elements used in research are relatively simple, primarily involving data on land use scales and average activity levels, with some key activity data being difficult to obtain. Scholars have proposed a universal carbon accounting method for urban spaces that uses the national greenhouse gas inventory framework to integrate energy consumption data with urban land use, establishing a research framework focused on industry, construction, transportation, and carbon sinks (Wang and He, 2015, Xu *et al.*, 2022d). Building on this, scholars have developed a carbon assessment framework for municipal master plans that incorporates all natural resource elements, using Wuhan as a case study for validation (Luo *et al.*, 2023). Currently, there has been progress in developing carbon accounting methods for urban spaces, although these methods typically focus on entire cities and account for all urban space elements' carbon emissions. This approach is particularly effective in urban areas characterized by extensive construction and high development intensity. However, this method often yields inaccurate results for cities dependent on agriculture and mineral resources, failing to accurately reflect their development and construction levels. Additionally, this method provides limited guidance for comprehensive land and spatial planning at the central urban level.

In summary, the prevalent method of urban carbon accounting based on energy data is widely utilized. However, its integration with spatial elements is inadequate, and its results provide limited support for spatial planning. In urban planning, considerable research has focused on refining carbon accounting systems for urban spatial elements. Yet, the scope of most studies does not align with central city planning, leading to significant discrepancies in the accounting results for resource-dependent cities and limited feedback on spatial changes in urban areas. Consequently, it is crucial to develop an urban carbon accounting method that aligns with municipal planning scopes and focuses on urban spatial activity elements.

2. Methodology

2.1 Establishing a carbon accounting system for urban built-up areas

To improve compatibility and support between urban carbon accounting results and central urban master planning, a universal carbon accounting method for urban built-up areas needs to be established. During this process, a carbon accounting system tailored for urban built-up areas should be established, utilizing energy activity data to calculate their carbon emissions. This establishes benchmark data and lays the groundwork for the methods detailed in subsequent sections. This system will also set standards to validate the results.

The "IPCC National Greenhouse Gas Inventory" is the principal method for preparing greenhouse gas emission inventories globally, recognized for its high authority and scientific rigor. As a method for carbon emission accounting across municipalities and larger regions, this approach provides a comprehensive and generalized division of accounting categories. However, within the smaller scope of urban built-up areas, this method includes carbon emissions from non-built-up sectors like agriculture and forestry in the energy and waste treatment calculations, complicating data acquisition. This study adapts the carbon accounting framework from the "IPCC National Greenhouse Gas Inventory". It reclassifies carbon emission categories to suit the specific characteristics and research requirements of urban built-up areas, as shown in Figure 1. The changes in accounting scope mean that the carbon accounting system for urban built-up areas differs from the IPCC guidelines. Specifically, carbon emissions from electricity in urban built-up areas are allocated to the electricity use processes across different sectors. To prevent double counting, it excludes carbon emissions from electricity production in industrial and mining sectors. Additionally, as urban built-up areas exclude agricultural land, agricultural carbon emissions are omitted from the accounting. This adaptation links the urban built-up area carbon accounting system with the "IPCC National Greenhouse Gas Inventory", setting the stage for further development of carbon accounting methods.

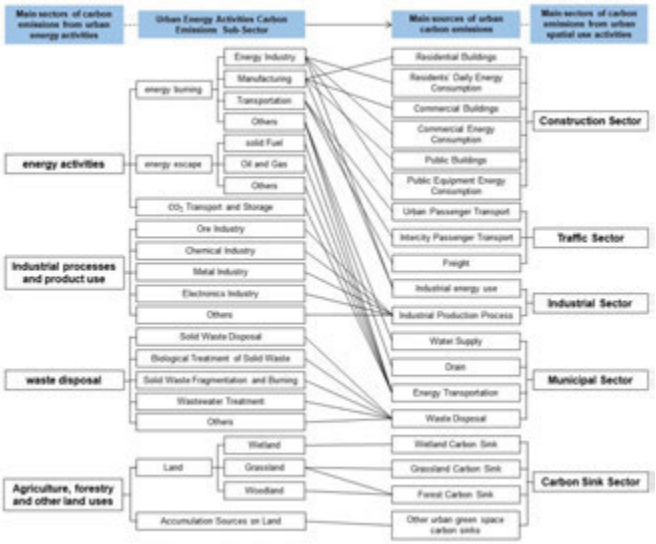

Figure 1 Carbon accounting system for urban built-up areas

2.2 Developing benchmark data for carbon accounting in urban built-up areas based on energy activity data

To establish accurate benchmark data for verifying carbon emissions in urban built-up areas, detailed calculations for each emission category should be performed using the most commonly used energy activity data. Changes in accounting entities necessitate adjustments to the specific accounting processes. Consequently, this study employs the IPCC model within the urban built-up area accounting system to calculate carbon emissions across various sectors, thereby developing an energy data-oriented carbon accounting method for urban built-up areas, as detailed in Table 1. Using this method, energy activity data for urban built-up areas is sourced from resources like the Urban Statistical Yearbook and the Urban Energy Statistical Yearbook. Furthermore, using energy conversion tables, challenging-to-calculate energy data (like raw coal, coke, gasoline, diesel) are converted into standard coal equivalents. Building on this, carbon emission coefficients for electricity, standard coal, and other energies are derived from provincial and national greenhouse gas inventory guidelines, leading to the development of a carbon accounting method tailored for urban built-up areas.

Table 1 Carbon accounting method for urban built-up areas based on energy activity data

Sectors	City Energy Activity Data	Data Related to Carbon Emission Calculations	Data Sources	Calculation Method
Construction Sector	residential electricity consumption of urban residents, electricity consumption in commercial and service industries, gas consumption in residential and service industries, energy consumption in the construction process of new buildings, and energy consumption in maintenance of old buildings	electricity carbon emission coefficient, natural gas carbon emission coefficient, liquefied petroleum gas carbon emission coefficient, unit standard coal energy consumption carbon emission coefficient	City Statistical Yearbook, City Energy Statistical Yearbook, Provincial Greenhouse Gas Inventory Preparation Guide, National Greenhouse Gas Inventory Guide	$C_b^c = \sum E_{electricity}^i \times f_{electricity} + \sum E_{gas}^i \times k_{gas}^{tce} \times f_{tce} + \sum E_{LPG}^i \times k_{LPG}^{tce} \times f_{tce} + \left(E_{tce}^{construction} + E_{tce}^{maintenance}\right) \times f_{tce}$
Industrial and Mining Sector	in addition to electricity production, energy used in industrial production (including raw coal, coke, natural gas, gasoline, crude oil, kerosene, diesel, and electricity)	standard coal conversion coefficient for various types of energy and carbon emission coefficient of energy consumption per unit of standard coal	City Energy Statistical Yearbook, Standard Coal Conversion Reference Coefficient Table for Various Energy Resources, National Greenhouse Gas Inventory Guide	$C_i^c = \sum E_i^{industry} \times k_i^{tce} \times f_{tce}$

Municipal Sector	public utility electricity consumption, domestic waste treatment capacity, domestic sewage treatment capacity, heating steam heat, heating hot water heat	electricity carbon emission coefficient, unit waste treatment electricity consumption, unit sewage treatment electricity consumption, thermal energy conversion coefficient to standard coal, unit standard coal energy consumption carbon emission coefficient	City Statistical Yearbook, City Energy Statistical Yearbook, Various Energy Standard Coal Conversion Reference Coefficients Table, Provincial Greenhouse Gas Inventory Preparation Guide, National Greenhouse Gas Inventory Guide	$C_m^c = E_{electricity}^{public\ utilities} \times f_{electricity} + \left(V_{waste} \times k_{waste}^{electricity} + V_{sewage} \times k_{sewage}^{electricity}\right) \times f_{electricity} + \left(V_{steam}^{central\ heating} + V_{hot\ water}^{central\ heating}\right) \times k_{heat}^{tce} \times f_{tce}$
Traffic Sector	transportation electricity consumption, transportation gasoline amount, transportation diesel amount, transportation kerosene amount, transportation natural gas amount	standard coal conversion coefficient for various types of energy and carbon emission coefficient of energy consumption per unit of standard coal	City Statistical Yearbook, City Energy Statistical Yearbook, Various Energy Standard Coal Conversion Reference Coefficients Table, Provincial Greenhouse Gas Inventory Preparation Guide, National Greenhouse Gas Inventory Guide	$C_t^c = \sum E_i^{traffic} \times k_i^{tce} \times f_{tce}$
Carbon Sink Sector	woodland, grassland, wetland, urban green space area, water area	carbon sequestration coefficients of woodlands, grasslands, wetlands, urban green spaces, and water bodies	City Statistical Yearbook, Provincial Greenhouse Gas Inventory Compilation Guide	$C_s^c = \sum A_i \times c_i$

C_b^c is the building sector's carbon emissions; $E_{electricity}^i$ is electricity consumption of class i buildings, i is various urban land building types, including residential buildings, commercial buildings, and public service buildings; $f_{electricity}$ is the carbon emission coefficient per unit of electricity use; E_{gas}^i is the amount of natural gas used in class i buildings; k_{gas}^{tce} is the unit natural gas conversion standard coal coefficient; f_{tce} is the carbon emission coefficient per unit of standard coal; E_{LPG}^i is the amount of liquefied petroleum gas used in type i buildings; k_{LPG}^{tce} is the liquefied petroleum gas conversion coefficient to standard coal; $E_{tce}^{construction}$ is the standard coal usage converted from energy in the construction process of new buildings; $E_{tce}^{maintenance}$ is the energy−converted standard coal usage in the maintenance process of old buildings; C_i^c is the carbon emissions of the industrial and

mining sector; $E_i^{industry}$ is the energy usage of category i in industrial production processes above regulations except for electricity production. i represents various energy types, including raw coal, coke, natural gas, gasoline, crude oil, kerosene, diesel, electricity, etc.; k_i^{tce} is the standard coal conversion coefficient of type i energy; C_m^c is the carbon emissions of the municipal sector; $E_{electricity}^{public\ utilities}$ is the electricity consumption of public utilities; V_{waste} is the amount of solid waste discharge; $k_{waste}^{electricity}$ is the electricity consumption per unit of solid waste treatment; V_{sewage} is the amount of sewage discharge; $k_{sewage}^{electricity}$ is the electricity consumption per unit of sewage treatment; $V_{steam}^{central\ heating}$ is the central heating steam usage; $V_{hot\ water}^{central\ heating}$ is the usage of central heating hot water; k_{heat}^{tce} is the coefficient of conversion of unit thermal value to standard coal; C_t^c is the carbon emissions of the transportation sector; $E_i^{traffic}$ is the energy usage of category i in the transportation sector, where i represents each energy type, including raw natural gas, gasoline, kerosene, diesel, electricity, etc.; C_s^c is the carbon absorption amount of the carbon sink department; A_i is the area of type i land, and i represents various types of land that can provide carbon sinks, including woodland, grassland, wetland, urban green space, and water area; c_i is the carbon sink coefficient of various land uses;

2.3 Establishing an urban built-up area accounting method oriented to space use activity data

To strengthen the integration of carbon accounting methods with urban spatial elements, we investigated how to extract human activity and space use data within urban built-up areas. Using the urban built-up area carbon accounting framework that relies on energy data, we replaced energy use data in each department with space use activity data, establishing a new carbon accounting method centered on urban spatial elements.

Using the urban built-up area carbon accounting system, this study calculates carbon emissions for each sub-sector using urban space use activity data, and develops a spatial activity data-oriented accounting method, as detailed in Table 2. In this method, basic urban space and space use activity data are sourced from planning documents, texts, and statistical yearbooks, while data on the average annual travel distance of private cars is derived from urban traffic surveys or questionnaires. This provides a method to obtain necessary data. Compared to energy data-based methods, this approach reduces reliance on energy data for carbon accounting in urban built-up areas, utilizing spatial activity data to produce more timely results. Additionally, the results clearly illustrate the impact of changes in urban spatial development and activities on carbon emissions, supporting low-carbon urban spatial planning.

Table 2 Carbon accounting method for urban built-up areas based on space utilization activity data

Sectors	Urban spatial basic data	Space utilization activity data	Data related to carbon emission calculations	Data sources	Calculation method
Construction Sector	residential building area, commercial service facility land area, public management and public service land area, new building area	residential vacancy rate	residential energy consumption coefficient per unit building area, energy consumption coefficient for commercial and service facilities per unit land area, energy consumption coefficient during	provincial energy statistical yearbook, city statistical yearbook, standard coal conversion reference coefficient table for various energy sources,	$C_b^c = \left(S_{residence} \times r_{vacancy\ rate} \times k_{residence}^{tce} + \sum A_i \times k_i^{tce} + S_{new} \times k_{new}^{tce}\right) \times f_{tce}$

			construction process per unit building area, and carbon emission coefficient for energy consumption per unit standard coal	national greenhouse gas inventory guide	
Industrial and Mining Sector	industrial and mining storage land area	average industrial output value	energy consumption per unit of industrial GDP, carbon emission coefficient of energy consumption per unit of standard coal	Provincial Energy Statistical Yearbook, City Statistical Yearbook, National Greenhouse Gas Inventory Guide	$C_i^c = A_m \times p_m \times k_m^{tce} \times f_{tce}$
Municipal Sector	heating building area, water supply pipeline length	population, per capita garbage collection volume, harmless garbage treatment rate, per capita sewage discharge	energy consumption per unit of garbage removal, energy consumption per unit sewage treatment, electricity consumption per unit length of pipeline water transportation, energy consumption per unit heating area, carbon emission coefficient of unit standard coal energy consumption, electricity carbon emission coefficient	Provincial Energy Statistical Yearbook, City Statistical Yearbook, City Energy Statistical Yearbook, Provincial Greenhouse Gas Inventory Preparation Guide, National Greenhouse Gas Inventory Guide	$C_m^c = L_{water} \times j_{water}^{electricity} \times f_{electricity} + (P \times \mu_{waste} \times r_{harmless} \times k_{waste}^{tce} + P \times \mu_{sewage} \times k_{sewage}^{tce} + S_{heating} \times j_{heating}^{tce}) \times f_{tce}$

Traffic Sector	average annual travel distance of private cars, total freight distance, and total passenger distance	number of private cars, electrification rate of residents' travel, total freight volume, total passenger trips	energy consumption per unit turnover, electricity consumption per unit travel distance, electricity consumption per unit travel distance of new energy vehicles, energy consumption of fuel vehicles per unit travel distance	Urban Traffic Survey Report, Urban Statistical Yearbook, Urban Energy Statistical Yearbook, Provincial Greenhouse Gas Inventory Preparation Guide, National Greenhouse Gas Inventory Guide	$C_t^c = L_{private\ car} \times C_{private\ car} \times r_{electrical} \times j_{new\ energy}^{electricity} \times f_{electricity} + L_{private\ car} \times C_{private\ car} \times (1 - r_{electrical}) \times j_{fuel}^{tce} \times f_{tce} + \sum L_i \times T_i \times k_{turnover}^{tce} \times f_{tce}$
Carbon Sink Sector	woodland, grassland, wetland, urban green space area, water area	—	carbon sequestration coefficients of woodlands, grasslands, wetlands, urban green spaces, and water bodies	City Statistical Yearbook, Provincial Greenhouse Gas Inventory Compilation Guide	$C_s^c = \sum A_i \times c_i$

C_b^c is the carbon emissions of the construction sector; $S_{residence}$ is the residential building area; $r_{vacancy\ rate}$ is the residential vacancy rate; $k_{residence}^{tce}$ is the energy consumption per unit residential building area (converted in standard coal); A_i is the area of type i urban land, including land for commercial service industry facilities, public management and public services; k_i^{tce} is the energy consumption per unit area of type i land (converted in standard coal); S_{new} is the new building area; k_{new}^{tce} is the energy consumption per unit of new building area (converted in standard coal); f_{tce} is the carbon emission coefficient per unit of standard coal; C_i^c is the carbon emissions of the industrial and mining sector; A_m is the area of industrial and mining land; p_m is the average industrial output value; k_m^{tce} is the energy consumption per unit of industrial GDP; C_m^c is the carbon emissions of the municipal department; L_{water} is the length of the water supply pipeline; $j_{water}^{electricity}$ is the electricity consumption per unit water supply distance; $f_{electricity}$ is the carbon emission coefficient per unit electricity consumption; P is the population; μ_{waste} is the average garbage removal volume; $r_{harmless}$ is the harmless garbage chemical treatment rate; $k_{waste}^{electricity}$ is the energy consumption for harmless treatment of garbage; μ_{sewage} is the per capita sewage discharge; k_{sewage}^{tce} is the unit sewage treatment energy consumption; $S_{heating}$ is the central heating building area; $j_{heating}^{tce}$ is the energy consumption per unit heating area; C_t^c is the carbon emissions of the transportation sector; $L_{private\ car}$ is the average annual driving distance of private cars; $C_{private\ car}$ is the number of private cars; $r_{electrical}$ is the electrification rate of private cars; $j_{new\ energy}^{electricity}$ is the electricity consumption of new energy vehicles per unit travel distance; $f_{electricity}$ is the unit electricity consumption carbon emission coefficient; j_{fuel}^{tce} is the energy consumption of fuel vehicles per unit travel distance (converted to standard coal); L_i is the transportation distance of type i, i represents the type of transportation, including passenger transportation and freight; T_i is the transportation volume of type i, among them, freight is the freight volume, and passenger transportation is the converted passenger volume; $k_{turnover}^{tce}$ is the unit turnover energy consumption; C_s^c is the carbon absorption amount of the carbon sink department; A_i is the I type land area, and i represents the various types of land that can be provided the types of land used for carbon sinks include woodland, grassland, wetland, urban green space, and

water bodies; c_i is the carbon sink coefficient of various land uses;

3. Case study

Based on the carbon accounting method described earlier, this study calculates carbon emissions for various sectors in Harbin's built-up areas from 2007 to 2021 using energy activity data, establishing this as benchmark data (see Figure 2). The accounting results indicate that total carbon emissions in Harbin's built-up areas have generally increased. Specifically, the industrial and mining sector, which contributes over 50% of the emissions, displays a fluctuating but overall upward trend. However, as urban development and industrial transformation progress, its share of total emissions has gradually declined. In contrast, the transportation sector is the only one showing a downward trend in emissions. This decline is attributed to the growing electrification of transportation, leading to a decrease in gasoline and diesel use and an increase in electricity consumption each year. Due to the lower carbon emission coefficient of electricity compared to other fossil fuels, emissions from this source are decreasing. The carbon accounting results from energy data clearly illustrate changes in emissions within the urban built-up area and accurately analyze the impact of energy use changes on these emissions. These results have gained broad recognition in the academic community. Using these calculation results as benchmark data provides solid support for verifying accuracy in subsequent analyses.

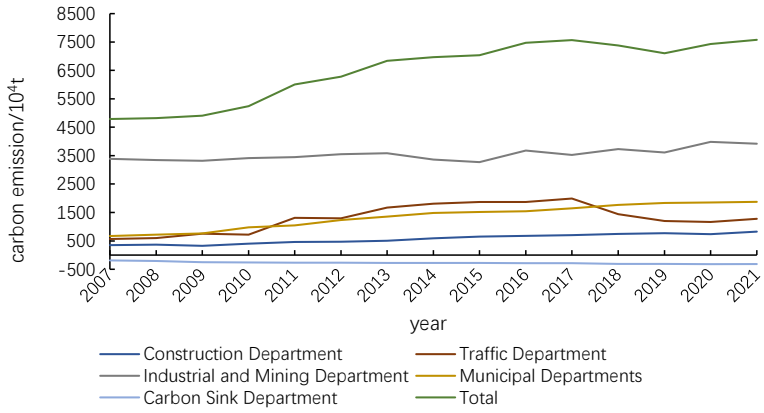

Figure 2 Harbin built-up area carbon accounting benchmark data for energy activity data

Utilizing the space use activity carbon accounting method, we analyzed statistical yearbooks and traffic survey reports to gather basic spatial and activity data for Harbin. We then calculated total and departmental carbon emissions in built-up areas. These results were compared with those from energy use activities, as detailed in Figure 3. The overall accounting results closely align with those derived from energy data. Specifically, the construction sector shows similar trends in both sets of data, though there are some differences in the values. The transportation department's accounting results from 2012 to 2017 show significant differences, primarily due to estimations based on per capita travel expenditure and survey data, leading to substantial discrepancies. For other years, data from urban traffic surveys provide more accurate results, resulting in minimal discrepancies in the accounting.

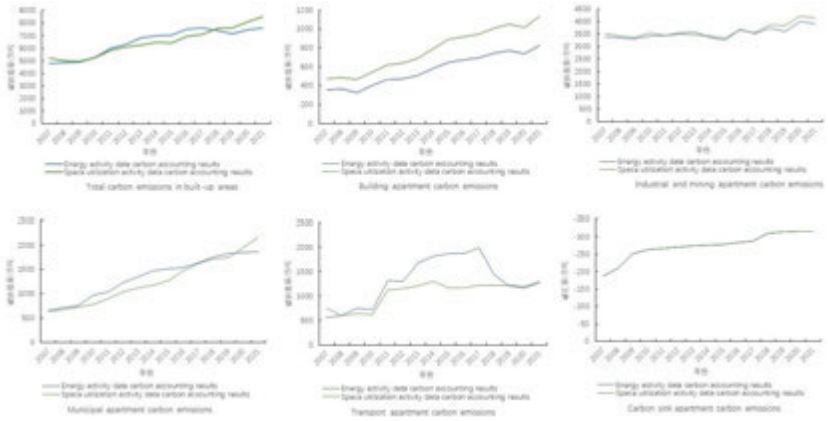

Figure 3 Comparison chart of dual method calculation results

To scientifically validate the accuracy of the carbon accounting method for space activities, we employed regression analysis to compare the results of space use activities with those from energy activities. The findings are presented in Figure 4 and Table 3. The verification indicates a high correlation of 99.2% between the two methods, with a standard error of 256.7, suggesting significant model reliability. These results confirm the high accuracy of the carbon accounting for space use activities, with minimal discrepancies compared to energy use results, demonstrating practical application value.

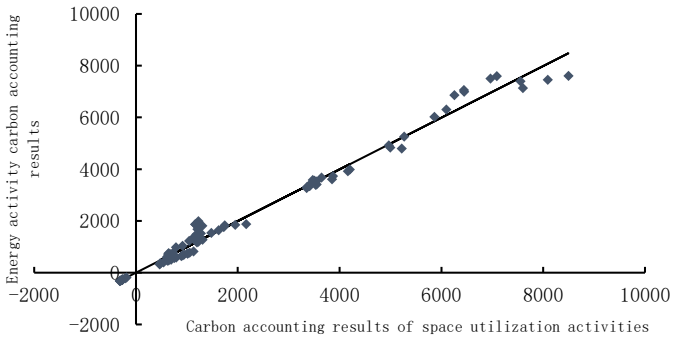

Figure 4 Dual method accuracy verification results

Table 3 Regression model statistics table

R	R^2	Adjusted R^2	Standard Deviation	Significance
.996	.992	.992	256.697	0.000

Unlike the energy-based method, the carbon accounting method for space use activities calculates emissions within built-up areas based on the city's spatial characteristics. In particular, the construction sector's results are heavily influenced by the accuracy of data on building vacancy rates and energy consumption per unit area. Accurate statistics ensure that carbon accounting for space use activities aligns closely with energy-based results. In the transportation sector, the accuracy of private car travel data significantly influences accounting results. However, statistical

yearbooks rarely contain official data on this. This data must be compiled from urban traffic surveys or questionnaires, potentially introducing errors. For other sectors, data from statistical yearbooks and greenhouse gas inventories ensure highly accurate accounting results. Overall, the results from the space use activity method are numerically close to those from energy methods, with simpler data acquisition and broad applicability. Additionally, this method's close link to urban spatial elements allows for real-time adjustments to the accounting results based on spatial changes, enhancing its flexibility and scalability. In summary, developing a carbon accounting method based on space usage activity data is crucial for achieving dual carbon goals and supporting the creation of low-carbon cities through land spatial planning.

4. application path

As the carbon accounting method for urban built-up areas, based on space use activity data, is refined, it can be integrated into the preparation, monitoring, and evaluation phases of the central city's national land and space master plan. During the planning phase, this method can predict the carbon reduction potential of development plans and support decision-making in building low-carbon cities. In the monitoring and evaluation phase, this method enables the establishment of low-carbon city evaluation indicators, facilitating the use of scientific and technological approaches to assess low-carbon city development.

Urban carbon emission prediction is a crucial technical tool for guiding low-carbon city construction and forecasting urban development trajectories. Current methods generally use data on urban population, energy consumption, and economic growth to simulate and forecast city-wide carbon emission changes. However, these data can be difficult to acquire, often show weak correlation with urban spatial elements, and do not allow for periodic adjustments based on urban development. As carbon accounting for urban built-up areas expands to include spatial usage data, a time series prediction model using neural networks can be developed to estimate emissions more precisely. This model integrates closely with spatial usage activities in urban built-up areas, enhancing its relevance and accuracy. It enables real-time predictions of carbon emissions based on changes in land use and urban spatial planning, clearly demonstrating the impact of these strategies on carbon reduction. Additionally, the model incorporates multi-scenario simulation and prediction to evaluate different urban development scenarios—baseline, low-carbon, and high-carbon—and to establish respective carbon emission forecasts for various urban spatial strategies.

To ensure steady progress in low-carbon city development and the achievement of dual-carbon goals, my country has initiated several low-carbon city pilot projects and continuously evaluates their progress. A key tool in this effort is the special assessment of low-carbon city construction, which supports planning decisions and ensures the implementation of carbon reduction strategies. Within the carbon accounting framework for urban built-up areas based on space use data, the LMDI decomposition method measures the contribution and sensitivity of each element by analyzing changes in their carbon emission impacts. The contribution reflects the influence of various factors on the rates and amounts of carbon emissions and absorption, while sensitivity indicates the efficiency and effectiveness of these factors in reducing emissions and enhancing carbon sinks (Luo *et al.,* 2023). By identifying key factors, we can pinpoint the most impactful elements of space use activities on urban carbon emissions and develop a specialized evaluation index system for low-carbon cities based on carbon accounting. The introduction of this indicator system offers quantitative standards for monitoring and evaluating urban planning, and provides technical support for optimizing low-carbon urban spatial resources.

5. Conclusion

Currently, China's strategies for achieving carbon peak and carbon neutrality have introduced

new requirements and visions for urban planning. Developing carbon accounting technology that integrates urban spatial elements and aligns with central urban areas' master plans is crucial for advancing low-carbon city construction and achieving the carbon neutrality goals. Accordingly, this study uses Harbin as a case study, following the “accounting system-benchmark formulation-method construction-result verification” approach to develop a carbon accounting method for urban built-up areas based on space usage activity data. This method transforms the carbon accounting process in urban built-up areas from relying on energy data to focusing on urban spatial elements. The results more accurately demonstrate how urban planning and changes in urban space affect carbon emissions. Building on this, the study proposes using carbon accounting methods to predict urban carbon neutrality and conduct specialized assessments of low-carbon city construction. This supports comprehensive urban planning in central areas aimed at achieving carbon neutrality.

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Investigating the carbon elements based on remote sensing, UAV oblique photography, and AI technologies: A case study of Nanhui New Town, Shanghai

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Abstract: This study investigates carbon dynamics within Shanghai's Nanhui New Town, exploring the intricate relationships among land cover, climate factors, and carbon sequestration processes. Utilizing advanced methodologies such as remote sensing, UAV, and AI technologies, we conduct a thorough assessment of carbon sinks and emissions, with particular emphasis on the contributions of vegetation and water bodies. Our analysis highlights the importance of integrated land management strategies in optimizing carbon sequestration potential and mitigating emissions. Furthermore, we discuss Shanghai's proactive initiatives towards peak carbon emissions and carbon neutrality. Overall, this research offers valuable insights into carbon management strategies for sustainable urban development, contributing to efforts aimed at building resilient and low-carbon cities in the face of climate change.

Key words: carbon assessment, carbon neutrality, sustainable development, AI

1. Introduction

The pursuit of sustainable urban development has become increasingly urgent in the face of climate change and environmental degradation. Cities, as centers of economic activity and human habitation, play a critical role in shaping a sustainable future (Wang et al., 2023). One key aspect of this endeavor is the transition towards low-carbon cities, which prioritize reducing carbon emissions and promoting environmental sustainability. This transition aligns with broader global efforts towards carbon peaking and carbon neutrality, integral components of the Paris Agreement's goals to limit global warming (Colona, 2023).

Shanghai, China's economic powerhouse and a sprawling metropolis, exemplifies the challenges and opportunities inherent in this transition. With its dense population and rapid urbanization, Shanghai faces pressing environmental issues, including air pollution and carbon emissions. However, the city has also demonstrated a strong commitment to addressing these challenges through ambitious targets for carbon peaking and carbon neutrality.

2. Sustainable development, low-carbon city and carbon neutrality

The concept of sustainable development, first defined in the Brundtland Report of 1987, emphasizes the importance of meeting current needs without compromising the ability of future generations to meet their own (Li et al., 2023). This principle was globally embraced at the 1992 Earth Summit in Rio de Janeiro, where the Agenda 21 program was launched to foster sustainable development through global cooperation, marking a significant milestone in the integration of environmental and developmental concerns (Zou et al., 2023).

Building on the foundation of sustainable development, the movement towards low-carbon cities gained momentum as an essential strategy for mitigating climate change (Andrews et al., 2023). These cities aim to reduce their carbon footprints by integrating sustainable practices such as enhancing energy efficiency, broadening renewable energy use, promoting green urban planning, and improving public transportation systems. The success stories of cities like Copenhagen and Stockholm have illustrated the potential of urban areas to lead in reducing

greenhouse gas emissions while enhancing the quality of urban life. These cities serve as living laboratories, showcasing effective strategies for sustainability that can be replicated and adapted elsewhere.

The concepts of carbon peaking and carbon neutrality further define the trajectory towards sustainable urban development. Carbon peaking occurs when a city or country's carbon dioxide emissions reach their highest point before subsequently declining (Lijun et al., 2023). This is a crucial target for countries committed to reversing the trend of rising greenhouse gas emissions, such as China, which aims to reach carbon peak by 2030. Following this, the goal of carbon neutrality involves balancing emitted carbon with the amount removed from the atmosphere, achieving a net-zero carbon footprint. This ambitious objective is central to the Paris Agreement, encouraging nations to set and pursue strategies to neutralize their carbon emissions by mid-century.

The interplay between sustainable development, low-carbon cities, carbon peak, and carbon neutrality is integral to modern environmental strategy. These interconnected concepts create a comprehensive approach to tackling climate change, promoting economic stability, and ensuring social equity (Ran et al., 2023). The transition to low-carbon cities embodies the practical application of sustainable development principles, directly contributing to the broader goals of carbon peaking and neutrality. Each city’s efforts to reduce emissions and implement sustainable practices contribute cumulatively to national and global targets.

Moreover, the shift towards these sustainable models stimulates innovation in technology and infrastructure, fostering economic opportunities and job creation in new sectors such as renewable energy and energy efficiency (Shi et al., 2023). This holistic approach not only addresses the pressing issue of climate change but also promotes a sustainable economic model that integrates environmental, social, and economic goals.

Thus, the global commitment to sustainable development through the implementation of low-carbon cities and the pursuit of carbon peaking and neutrality represents a forward-thinking approach to ensuring a balanced coexistence with our planet, aiming to secure a viable and prosperous future for all generations.

3. Decarbonization and carbon neutrality of Shanghai

Shanghai, as China's economic hub and a densely populated metropolis, has been actively addressing the challenges of climate change and environmental protection (Terhaar et al., 2023). To combat global climate change, the Shanghai government has set a series of targets for peak carbon emissions and carbon neutrality, while also initiating the construction of a carbon financial market to promote the development of a low-carbon economy. Firstly, Shanghai's peak carbon emissions target aims to reach the peak of carbon dioxide emissions by 2030, followed by a gradual reduction. This commitment is a significant part of Shanghai's efforts to combat climate change and is aligned with China's broader efforts to reduce emissions globally. To achieve this goal, Shanghai has implemented a series of measures, including improving energy efficiency, increasing the use of clean energy, and promoting the optimization of industrial structures. Additionally, Shanghai has set an ambitious target to achieve carbon neutrality by 2060. Carbon neutrality refers to reducing carbon emissions to zero or balancing emissions with carbon absorption, thereby achieving climate neutrality. Shanghai's carbon neutrality target means that by 2060, all economic activities in the city will no longer produce carbon emissions, or emissions will be offset through carbon compensation and carbon absorption. To achieve this goal, Shanghai will continue to intensify emission reduction efforts,

promote green technological innovation, and strengthen carbon trading and carbon market construction.

Fig.1 Shanghai's carbon peak and carbon neutrality goals and plans

In addition to setting peak carbon emissions and carbon neutrality targets, Shanghai has also begun constructing a carbon financial market to promote the development of a low-carbon economy. A carbon financial market refers to a financial market centered on carbon emissions rights, promoting carbon trading, carbon quota allocation, and carbon financial products to facilitate carbon emission reduction and carbon marketization. The construction of Shanghai's carbon financial market mainly includes the following aspects: Firstly, establishing a carbon trading platform. Shanghai will establish a dedicated carbon trading market or platform to provide carbon emissions rights trading, carbon quota allocation, and carbon trading services. This will provide enterprises and institutions with a convenient channel to participate in carbon market transactions. Secondly, promoting the innovation of carbon financial products. Shanghai will encourage financial institutions to innovate carbon financial products, including carbon emissions rights futures, carbon trust funds, and carbon asset securitization, to meet the needs of different market entities. Thirdly, strengthening carbon market supervision. Shanghai will establish a sound carbon market supervision system, strengthen supervision and management of carbon trading, carbon reporting, and carbon auditing, to ensure the fairness, transparency, and effective operation of the market. Lastly, promoting international cooperation in the carbon market. Shanghai will actively participate in international cooperation in the carbon market, strengthen cooperation with international carbon trading platforms and institutions, and promote the interconnection and cooperative development of global carbon markets.

Overall, Shanghai's targets for peak carbon emissions and carbon neutrality, as well as the construction of a carbon financial market, demonstrate the city's proactive exploration and efforts in addressing climate change and promoting the development of a low-carbon economy. With the continuous improvement and implementation of relevant policies and measures, Shanghai is expected to become a leader in low-carbon transformation, making greater contributions to global sustainable development.

4. Carbon elements assessment based on big data

In the five new towns of Shanghai, we have conducted carbon assessment work, primarily focusing on evaluating carbon emissions and carbon sinks. To achieve carbon neutrality at the scale of the new towns, which entails no net carbon emissions from the new towns externally, it is essential for the quantity of carbon emissions to be equivalent to that of carbon sinks within the new towns. Carbon emissions refer to the carbon produced by various elements and human activities within the urban space. This includes carbon dioxide emissions from energy consumption, transportation, industrial production, as well as emissions of other greenhouse gases. On the other hand, carbon sinks are natural or artificial systems within the urban space capable of absorbing and storing carbon, such as forests, wetlands, vegetation, and soil. By assessing the carbon emissions and sinks of the new towns, we can gain a better understanding

of their carbon footprint, providing a scientific basis for implementing emission reduction measures and enhancing carbon sinks.

Taking Nanhui new town as an example, we conducted a series of assessment. Nanhui New Town, situated at the juncture of the Yangtze River estuary and Hangzhou Bay, exhibits diverse land cover types, with arable land comprising the majority at 54.93% of the total area. Forest land, grassland, wetland, water bodies, and built-up land are also notable components of the landscape. According to the land use data from 2020, the town features 5.11% forest land, 0.43% grassland, 0.08% wetland, and 5.53% water bodies, with built-up land accounting for 33.70% of the area. Analysis of river network density reveals a value of 1.62 km/km^2 for Nanhui New Town, with the southern region exhibiting a slightly lower density of 1.34 km/km^2. Additionally, meteorological data indicates an average annual sunshine duration of 2114.8 hours and an average solar radiation total of 4793 MJ/m^2, contributing to favorable conditions for carbon sequestration.

The carbon assessment employed a comprehensive methodology integrating remote sensing analysis, meteorological data evaluation, and carbon modeling techniques. Remote sensing data facilitated land cover classification and mapping, allowing for the identification of carbon-rich ecosystems such as forests and wetlands. Meteorological data, including precipitation and solar radiation, provided insights into climatic conditions conducive to carbon uptake and storage. Carbon modeling techniques were then employed to quantify carbon stocks and fluxes, including emissions from anthropogenic activities and sequestration by natural ecosystems.

Quantitative analysis revealed significant carbon stocks and fluxes within Nanhui New Town. The predominant arable land presents a substantial carbon sink potential, with estimates suggesting carbon sequestration rates of up to 62.7 metric tons of CO_2 per hectare annually through improved agricultural practices and afforestation initiatives. However, the uneven distribution of forest and grassland areas poses challenges to optimizing carbon sequestration across the landscape. The presence of water bodies contributes to carbon storage through aquatic ecosystems, with estimates indicating carbon sequestration rates of 34.2 metric tons of CO_2 per year. Furthermore, river network density influences carbon cycling dynamics, with higher densities facilitating the transport of organic carbon and promoting carbon storage in aquatic environments.

In conclusion, the carbon assessment highlights the complex interplay between land cover, climate, and carbon dynamics in Nanhui New Town. The findings underscore the importance of implementing integrated land management strategies to enhance carbon sequestration potential and mitigate carbon emissions. Targeted interventions, including reforestation, wetland restoration, and sustainable agricultural practices, are essential for maximizing carbon sinks and achieving carbon neutrality in the region. By leveraging quantitative analysis and advanced modeling techniques, this study provides valuable insights for informed decision-making and the development of effective carbon management strategies in Nanhui New Town.

Fig.2 Land Spatial Distribution of Shanghai's Nanhui New Town

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Using data from Gaode Maps Points of Interest (POI), we conducted a comprehensive analysis of carbon emissions associated with power sources in Nanhui New Town. The integration of Gaode Maps POI data allowed us to capture a detailed understanding of the spatial distribution of carbon emissions within the area. The resulting heat map provides a visual representation of the concentration of carbon emissions, particularly highlighting the significant clustering observed in the southern region of Nanhui New Town (Figure 3). Upon juxtaposing this data with land use maps, a striking correlation emerged, indicating that areas designated for construction purposes coincide closely with high levels of spatial carbon emissions. This correlation underscores the impact of human activities, particularly those related to urban development, on carbon emissions within the region. Further analysis revealed that the primary contributors to point-source carbon emissions are buildings, factories, and clusters of human production activities. The utilization of Gaode Maps POI data not only facilitated the

identification of these emission sources but also provided valuable insights into the specific industries and infrastructural elements driving carbon emissions in the area. In addition to traditional data analysis techniques, we leveraged advanced methodologies such as Geographic Information System (GIS) technology and spatial data mining algorithms. These sophisticated approaches enabled us to extract actionable insights from the vast amount of spatial data available, ultimately informing future urban planning initiatives and the development of targeted carbon reduction strategies for Nanhui New Town.

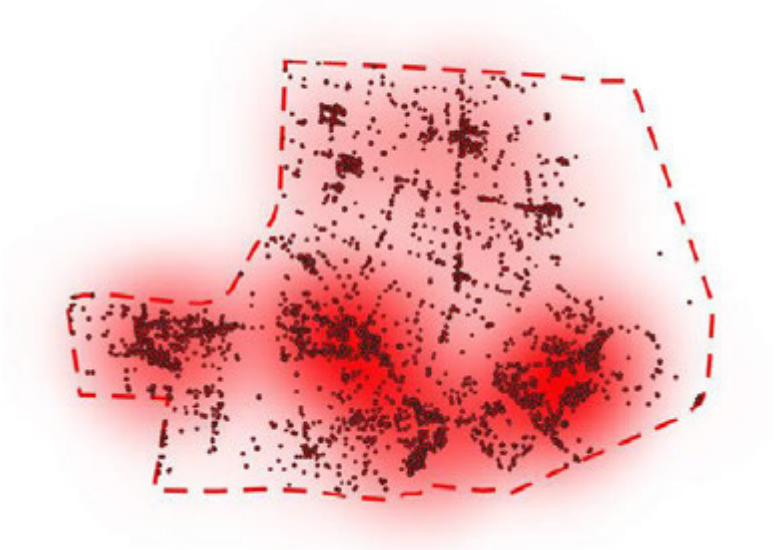

Fig.3 Point-source carbon emissions heat map of Nanhui New Town

5. Carbon sink evaluation based on Remote sensing

In order to comprehensively understand the distribution of vegetation and its role in carbon sequestration within the five new cities of Shanghai, our research utilized satellite remote sensing data and synthesized Net Primary Productivity (NPP) data for analysis and estimation. NPP, which represents the amount of energy or organic matter fixed by plants per unit area over a specific period, serves as a primary indicator of vegetation growth and is a crucial parameter in terrestrial ecosystems. Widely acknowledged in Earth sciences, NPP plays a significant role in delineating ecosystem functionality and productivity.

By examining satellite remote sensing NPP data covering the primary urban areas of Shanghai, our objective is to delve deeper into the dynamics of vegetation growth and the spatial distribution of carbon sinks. The acquisition of NPP data relies on the utilization of light energy and its conversion efficiency by vegetation through photosynthesis. This process is integral to the global carbon cycle, wherein plants assimilate carbon dioxide (CO_2) from the atmosphere during photosynthesis, convert it into organic matter, and store it within plant biomass or soil organic matter.

The relationship between NPP and carbon sequestration is inherently linked to vegetation's ability to absorb atmospheric CO_2 through photosynthesis and retain carbon within biomass and soils. As NPP reflects the net carbon uptake by plants, it serves as a key determinant of ecosystem carbon storage capacity. High NPP values indicate robust vegetation growth and

increased carbon fixation, thereby enhancing the carbon sequestration potential of ecosystems. Conversely, regions with low NPP may indicate limited vegetation productivity and reduced carbon uptake, potentially leading to decreased carbon storage capacity and elevated atmospheric CO_2 concentrations.

Furthermore, understanding the spatial distribution of NPP offers valuable insights into regional carbon dynamics and ecosystem services. Areas with dense vegetation cover and high NPP values often exhibit greater carbon sequestration potential, contributing to climate change mitigation efforts as carbon sinks. Conversely, regions characterized by sparse vegetation and low NPP may act as carbon sources, releasing stored carbon back into the atmosphere through processes such as deforestation or land degradation.

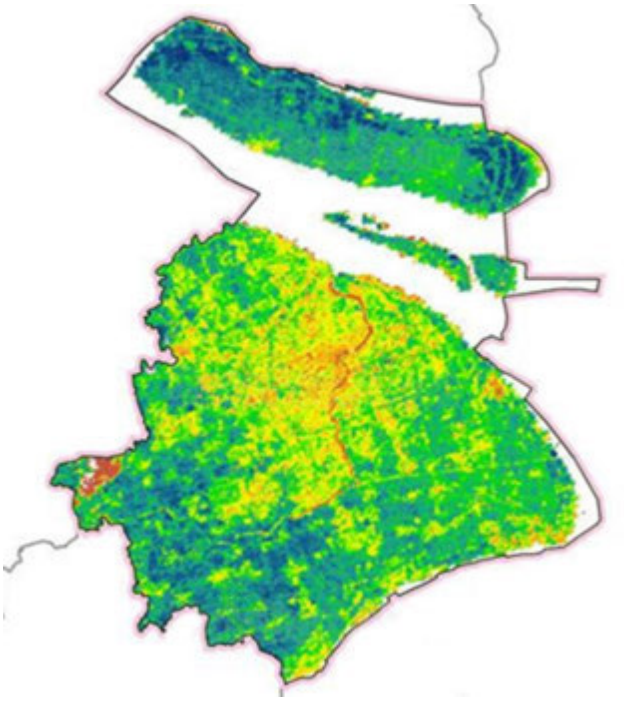

Fig.4 NPP map of Shanghai

In summary, the analysis of NPP data provides a comprehensive perspective on vegetation dynamics, carbon sequestration potential, and ecosystem health. By elucidating the intricate relationship between NPP and carbon sequestration, our research aims to contribute to the sustainable management of ecosystems and the mitigation of climate change impacts at a regional scale. Expanding upon this, our study delves into the nuances of NPP dynamics across different vegetation types and land-use patterns within the urban context of Shanghai's five new cities, offering insights into the efficacy of carbon sequestration strategies and informing decision-making processes for sustainable urban development.

6. Carbon sink evaluation based on UAV and AI

At the microscale, we have developed a method for calculating urban carbon sinks based on UAVs and AI. To investigate vegetation carbon sinks at the microscale, we have advanced a workflow primarily comprising "UAV scanning and model cleaning - extraction of vegetation

physical characteristics - deduction of carbon sink logic". We employ quadcopter UAVs equipped with image sensors to scan on-site scenes and utilize the structure from motion (SfM) algorithm to construct three-dimensional scene scan models. Following manual and intelligent algorithmic repairs to these models, we utilize artificial intelligence image recognition algorithms to extract urban green vegetation from the models and identify vegetation types. Based on the physical characteristics of various types of vegetation, such as vegetation height and crown diameter, and biological properties such as chlorophyll content per unit volume, we compute the carbon sink value of urban green vegetation. Through this methodology, we achieve a detailed understanding of carbon sequestration dynamics at the microscale, providing valuable insights for urban planning and environmental management strategies.

Fig.5 UAV 3D modelling and carbon sink assessment

As shown in the figure, we have established a 3D model of a park area in the new city through UAV scanning and modeling. Using AI, we automatically extract vegetation and calculate the vegetation carbon sink. The calculated carbon sink generated by this park is 30,041 tons per year. Our approach is highly suitable for precise carbon sink measurement at the microscale, complementing the assessments discussed earlier at larger scales. This method provides detailed insights into carbon sequestration dynamics at a localized level, offering valuable supplementary information for comprehensive carbon accounting and environmental management strategies.

7. Conclusion

In conclusion, our study offers a comprehensive analysis of carbon dynamics in Shanghai's Nanhui New Town, emphasizing the pivotal role of vegetation and water bodies in carbon sequestration. By employing advanced methodologies such as remote sensing, UAV, and AI technologies, we have identified significant carbon stocks and fluxes, providing valuable insights for informed decision-making towards achieving carbon neutrality and promoting sustainable urban development. Shanghai's proactive measures towards peak carbon emissions and carbon neutrality, alongside the establishment of a carbon financial market, underscore the city's commitment to addressing climate change and fostering a low-carbon economy. Overall, our research contributes to advancing our understanding of carbon dynamics in urban environments and provides a foundation for implementing effective carbon management strategies to build greener, healthier, and more resilient cities.

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REFLECTION ON THE TRANSFORMATION OF TIRANA'S ARCHITECTURAL SPACES

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ABSTRACT

The architectural spaces that form the function of the main squares and bazaars are often considered the best place to understand the history of the city due to their many layers of construction. These areas, as the first urban core of the city, represented a meeting place for people, a place of recreation, and a place where people could discuss politics. This research presents the transformation of two of Tirana's public spaces that have had interventions, as illustrated by the cases of Skenderbeg Square and Tirana-Old Bazaar, which is significant and almost prophetic for the understanding of a country such as Albania. The goal of this study is "participatory architecture," which regenerates infrastructure and public space. These interactions have recently been facilitated by the use of physical and digital planning production through analysis. This method stimulates innovative design, economic growth, cultural heritage activity, and greater tourist coherence.

Keywords: architectural square, bazaar, participatory architecture, digital-realistic models, community voice.

Historical city background

Every political regime tried to leave their mark on each city, often by constructing a building and often by destroying one from a previous regime in the process. Tirana started as an organic settlement at the beginning of the seventeenth century (Frashëri 2004, p. 17), at which time this part of the Balkan territory was dominated by the Ottoman Empire. The beginning of the construction of modern Tirana started in the 1920s, when it became the capital of Albania. It remained a small and insignificant centre until 1920. Historians and other scholars agree that the first urban nucleus in the Tirana valley emerged close to the Lana River, at the intersection of the commercial routes emanating from the more important regional centres of the time (Fig. 1).

During the seventeenth century and until 1912, the urban structure of Tirana was underpinned by Muslim propaganda. Tirana's predominant ideology and culture were dictated by the Ottoman Empire, which sought to expand its territory on the Balkan Peninsula and beyond. Over time, the sociological units, or community clusters, merged into a dense urban core centred on the most important public buildings of the time: the Old Mosque and the Old Bazaar.

Fig.1 The city of Tirana, at the beginning of the 1920s. Source: National Technical Archive

Fig.2 Street of Durres and Kavaja, New boulevard of Zogu i Pare. Tirana, 1920.
Source: National Technical Archive

King Zog prepared the first projects of European-style urban design and architecture for the city centre, including a big new boulevard. The new square was symbolic and functioned as a conciliation space between the inherited organic city and the new modern Tirana. (Fig.2). The most significant project was the ceremonial complex of the ministry square and the central axis of the new boulevard, first designed by the Italian architect Armando Brasini in 1925. This project was highlighted as the most important element and the symmetric axis of Tirana in both the regulatory plan of 1929 formulated under King Zog and the regulatory plan of 1939–1943 formulated during the Italian Fascist occupation. After the Second World War, Tirana underwent the simultaneous clash and intertwining of drastically different cultures, as reflected in many aspects of daily life, where the anthropology of space represented at once or separately the Ottoman and Western civilizations. However, between 1944, when the Communist dictatorship was installed in Albania, and 1991, other important changes occurred in the structure of the city. Architecture and urban planning became ideological instruments for the so-called progressive transformation of the country and the creation of a new physical and social reality. Despite the isolation that dominated this period, Albania followed a similar track to other Eastern Bloc

countries in terms of architecture and urbanism, albeit within the framework of a struggling economy, a lack of technology and know-how, and aggressive ideological pressure and dogmatic irrationalities.
The architectural heritage of Albanian cities today is mostly composed of a long tradition of Ottoman buildings, a short but impressive period of Italian and fascist constructions, four decades of socialist planning, and newly incorporated post-socialist and post-modernist structures. If somebody visits Albania today, they can inspect some elements very similar to those of the former Soviet countries; others can be very similar to Turkish traditions; and the overall impression is an organised urban chaos of the post-Soviet cities, which is also reflected in their daily lives.

Understanding the transformation of two public spaces in Tirana city

This research presents the transformation of two of Tirana's public spaces that have had interventions and promoted new forms and functions of cultural and environmental tourism, as illustrated by the cases of Skenderbeg Square and Tirana-Old Bazaar, which is significant and almost prophetic for the understanding of a country such as Albania, whose destiny is suspended between East and West: "two circles, one with Tirana at its centre and a radius equal to the distance between Rome and Tirana, and another with the same radius yet with Istanbul at the centre, which meet at the eastern border of Albania."
The city squares were the first to be subjected to democratic changes, although they were constructed for different purposes. Their initial construction was for public manifestations supporting the regimes. Regularly organised demonstrations backing the system, meetings, gatherings, and marches created demand for spacious streets and squares, which were very important modes or axes of spatial organisation in socialist cities and were distinguishable and particularly visible in large and small cities. (Fig. 3)

The transformation of Tirana's central square (Skenderbeg Square) in nearly a century demonstrates the main ideological purposes of two different totalitarian regimes, fascism and communism, as well as the post-Soviet urban developments. After communists came into power, the idea of city and public space didn't change so much. Totalitarian regimes all meet in relation to questions that have to do with monumentality and huge urban scale. Both fascists and communists agreed on the form, size, and use of public space. In Albania, officially, the main idea was to use them for manifestations and grand marches of workers and military officials

During the years of socialism from the 1960s to the 1970s, further interventions were implemented to permanently define the shape and size of the main square. These interventions consisted of the demolishment of the Old Bazaar in order to build a huge Palace of Culture that was inaugurated in 1966. During the years of socialism from the 1960s to the 1970s, further interventions were implemented to permanently define the shape and size of the main square. These interventions consisted of the demolishment of the Old Bazaar in order to build a huge Palace of Culture that was inaugurated in 1966. (Fig. 4)

Fig.4 The city of Tirana,

Skanderbeg Square during 30s
Source: National Technical Archiv

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The formation of Skanderbeg Square is in itself a product of an imposed ideological process, mostly created by authoritarian regimes, although that method is rarely a linear one. We seem intermittently aware of the layering of history that the city represents, with its manifestation of political conflicts and changes. This happened until the great protests of the 1990s against the communist regime, when plazas and Grand Boulevard became fighting areas.

Fortunately, there are still some places in Tirana that show a degree of identity continuity, and these are not the squares any more. The main heritages of Tirana from the Ottoman Empire period were the Old Mosque, the Mosque of Ethem Bey, the Tirana clock tower, the old bazaar, et cetera. The first and last of this list were destroyed by the communist regime soon after it was raised into power, while the Mosque of Ethem Bey and the clock tower still remain today the most iconic buildings of the city.(Fig. 5)

After the fall of communism, the square became the arena of people's free will and expression, the symbol of change, and the space where the voice of everyone could be heard. At no other time, like in the 1990s, has the Scanderbeg Square served its purpose as a "positive space.".

Before 2003, Tirana's central square was a relatively simple transit open space and had never been a place for people to meet; it was rather a place for traffic regulation and

Fig.5 Old Bazaar The city of Tirana,
1930 Source: National Technical Archive

authorised political meetings and/or protests. (Aliaj et al., 2003) A city's main square can be understood as a type of urban landscape, and this can be understood not only as the built morphology of the city—its urban tissue, outlook, and layout—but also as a complex set of meanings, representations, and values. Places, such as urban squares and bazaars, have no inherent identity. Identity is a mental quality; it is constructed by human behaviour in reaction to places. It is a reciprocal relationship—people produce places, and they derive identities from them. Identity may be given to a place by a government, but whether this identity is embraced by the people is a different matter. Places are both material and social in the sense that they provide space people use for all kinds of activities. Celebrating the victory of a team, organising an urban protest, a president speaking to a crowd, etc., all signify the identity activities of groups, between groups, and institutions like government.

Theoretical background: Understanding Participatory Architecture Approach

During the 1970s and 1980s, political agendas in Europe also promoted participatory planning and community-led architecture [Luck, 2018, p.144]. Yet in the 1990s this support disappeared alongside funding and PA turned into a minority practice. However, from the mid-2000s onwards, a revival of PA emerged from practices such as Aravena's Elemental on affordable homes in 1994-; atelier d'architecture autogérée (2001); "The sooner the community becomes involved in the planning process the better–ideally before any planning has been done," as Kathy Madden and Fred Kent emphasis in the book How to Turn A Place Around. "And people should be encouraged to stay involved throughout the improvement effort so that they become owners or stewards of the place as it evolves."

The voice of the community should be taken more seriously since any decision could affect their lives. The public has the right to know on what is happening in the surrounding environment and the right to get involve in decision-making process which particularly affect them in places where they live and work.

Participatory architecture. Methodology and projects review.

The research is focused on questions related to the context, methodology, engagement method, processes of participation, and the successes within their projects. All two projects operate at diverse scales of intervention, which represents the new wave of PA practices in Tirana after 2000s. This analysis was guided by the notions of strategies and tactics, and observations from field visits in some of the locations where the projects were taking place.

Fig.6 Tirana Old Bazaar 1920

Fig 7 Tirana New Bazaar 2017

Source: Municipality of Tirana

Case study Tirana New Bazaar

The New Bazaar was built, in 1931 at the same place where the historic Old Bazaar were built, the latter extending up to present day Skanderbeg Square. It is located east of the central boulevard. It forms part of the Old Town of Tirana and is one of the oldest areas of the city. However in 2017, the bazaar were renovated and reconstructed. (Fig. 5,6)

The project was effective in giving architects an opportunity to appreciate the importance of considering traditional architectural solutions in their future designs. The real model introduces the application of approaches representing various dimensions of revitalizing architectural design studios and learning with the aid of information and communication technologies. This scheme has been facilitated by the use of engineering techniques, as scanning and surveying technologies, simulation purposes in symmetry, building facades, colours, space, and meditation in the interior in the urban landscape of New Bazaar in Tirana. Knowledge is retrieved both from the model as well as from its examination and analysis. An example of undirected production is the modelling process that supported the design of the New Bazaar in Tirana.

The project is designed to get continuous feedback from stakeholders throughout this process. Across the administrative areas, which have been part of the journey from the very beginning, have developed a series of public hearings from citizens, architects, engineers and MT's [Tirana Municipality] planners. It is to be appreciated that some of the proposals and suggestions of

stakeholders have enriched the project and contributed to refining and implementing the idea on the detailed design. The project was effective in giving architects an opportunity to appreciate the importance of traditional architecture. Preserving shapes of vernacular house. Considering the traditional solution. Integration of historical Tirana to a Modern City. Testify spiritual and Traditional effect. Transforming a Memory place to a Livable Space.

The PA tactics consisted of (a) visiting residents separately; (b) developing a personalized inventory to understand the residents' lifestyles and needs, and to consider the work and renewals that had already been carried out; (c) setting up a community hub. The objective was to reconnect the residents with new area, markets, buildings, and then invite them to go outside and take care of immediate surroundings.

They prepared a participatory community process, through developing series of public hearings with citizens, informal meetings between different groups; architects, engineers and MT's urban planners; several round table discussions, by spreading information in the media, by advisory committees and coordination bodies.

Case study: Tirana's Skanderbeg Square

In 2003, an international design competition organised by the Municipality of Tirana resulted in a winning design by 51N4E architecture studio, Belgium, but it was only in 2017 before it was implemented.
This phase of intervention proposals has a more ideological approach. It consists of a constant search for the dematerialization of the true nature of the original square and somehow its decomposition. Now the dominant transformation factor is not an economic one but a social one. The citizen is placed in the centre of the idea of the square. So much is evaluated about the role of a single citizen, and only one can perceive the square at a time, as the pyramidal square arises from the ground. Even with this proposal, the space is "controlled," but in this case, the centre of the control system is not the totalitarian ideology nor the market economy, but the citizen. Symbolically and as a modern open society approach, the proposition has many positive aspects in relation to finding a way to represent the new Albanian society as free and in control of itself, but at the same time fails in relation to staying true to the context. (Fig. 7,8)

A new main square, in fact an empty space, has been given integrative symbolism. It has a focus on the future. The national symbol, the statue of the national hero Skanderbeg (a warrior on a horse as a defender of Christianity and Europe), is no longer the focal point of the square; it has become peripheral. The emptiness of the square and the topography of a low pyramidal shape oppose the monumentality of existing classic and modernist architecture.

The proposed change was radical, and mass opinion and civil society never fully supported the winning propositions of both phases. It showed that the projects did not achieve reconciliation with the social approach and the memory that society had for the square. Protestors point at legal and procedural mistakes, lack of involvement, participatory architecture, and the destruction of urban heritage, all for the sake of modernization, which is at the cost of democracy and respect for the rule of law. The new square is a multisensory experience; next to the visual experience and pyramidal topography (a three-sense symbol for Albanians because of the 'Pyramid', a mausoleum structure in honour of the past dictator), there are fountains with light arrangements, bikers playing, visitors making selfies, or just transit walkers passing. While the appearance is new, the critical question is about its value: will the citizens of Tirana, Albania, attach importance to this new space? Will they develop a form of place attachment? The administration of the local government made possible the implementation of the project in a short time and even added to the original project design a large underground public parking space. The Skanderbeg square is identified as the most important public space in Tirana and is still perceived as the most representative plaza in Albania.

Fig.7 The historical center of Tirana was almost entirely erased. New Skanderberg Square ≈1980 [39] Palace of Culture Source: National Technical Archive

The totalitarian squares in Albania present aspects of a lack of adaptability and flexibility overtime. In the absence of a dominant political power, these squares, in their bigness, are often mute and full of solitude, testifying to the heavy historical failures that influenced urban radicalism and city-making. On the other side, central space, with its rich history, gives us as architects and planners the eternal lesson that these spaces first need to be understood if we tend to intervene on them. This process can only be achieved through deep knowledge of the history that made them and which they help to make.Tirana's main square project intends to enact a new image and a new identity for the city and the country. The new square was not a popular demand but rather the perception of the political.

Photo 8:

Skanderbeg Square (Facebook Edi Rama, public realm)

The participatory process was structured based on the spatial practice's strategies:

(a) not seeking consensus but rather opening a citizen debate via community engagement (b) a non-prescriptive, open-ended, and responsive process of participatory events—each event informed the subsequent ones based on the connections, interactions, and assemblage of actors; (c) open-ended and emergent outputs; a decision-making process rather than a voting process; (d) generating initial design ideas by responding to community feedback; (e) consulting on these design ideas with local community stakeholders (including the landowners and its residents); (f) providing the vision for the community; (g) negotiating with the citizens, including community members, musicians, teachers, and local authority representatives, who were ceremonially given the keys to the school building.

Discussions

Regarding the analysis of the context of two case studies of the PA projects, we can appreciate different urban situations that vary in types and levels of participation. Both projects illustrate strong connections with PA historical practices and evolutions of participatory tactics and strategies. The cases are aligned with the types of participatory planning defined by [Guedes, 2019]: formal participation (initiated by public authorities), and community-led participation (driven by communities).

The New Bazaar project, is the only project instigated by the local communities and Tirana Municipality and greatly diverse community groups, who approached the PA.

New Bazaar project where architects had a more intimate engagement approach with the community and the proposed engagement process was centered on the citizens' needs using a personal, empathetic, and ethnographic participative approach, which ensured the participation of low-income communities and residents during the process, and Skenderbeg square, where participants adopted passive or consultative roles, describing more controlled strategies and tactics, with architects mediating and filtering the design outputs. Similarly to co-design, PA is

not possible without building trust and relationships among architects, residents, and stakeholders [McKercher, 2020].

In practice, the combination of PA strategies and tactics allows architects to develop workable participatory methodologies to build a bridge between citizens and the public sector. This combination helps to flatten pre-existing power structures and hierarchies, facilitating collaboration between diverse groups, enabling them to become active agents in architectural processes. Although strategies and tactics are usually identified as separate concepts, in both projects reviewed, it is clear they actually work in unison, and often the lines between strategy and tactic are blurred. New Bazaar project set up tactics for engagement of the physical lab – engaging local community in urban actions to prototype the ideas generated using from digital lab and Skenderbeg square, school set up tactics for the digital lab – engaging young architects and practitioners to promote a global debate, but also generating a vessel for international concepts, which was simultaneously a tactic and a strategy;

Looking across the PA projects, the following common strategies and tactics must be identified:

Build trust and meaningful relationships; encourage citizen participation and tactic as: each resident's situation needs to be considered differently and give them the freedom during the process while trying to develop a sense of the collective good rather than just an individualistic viewpoint.

Conclusons:

In conclusion, this visionary model may help in the encouragement of PA and serve as a model for further collaborative processes between different stakeholders. This paper introduces PA as a strong alternative to overcome the issues associated with conventional approaches to architecture that exclude people from the design process. None of these two projects have directly led to immediate wider societal changes, which indicates that there is a need to evaluate PA approaches and track the impact of PA over time. Today we live in a period that needs deep and rapid transformations, where research on PA is highly required to adapt our environments to sustainable ways of living and to address the upcoming climate changes. Good communication between the local authorities and the community is necessary, not only in terms of use but also in the terms of design, and this will be the real regeneration of educational and social infrastructure and the key to a healthy and participatory democratic political culture.

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Assessing Public Sentiments in Post-Urban Regeneration: A Location-based Analysis of the Karaköy Salıpazarı, İstanbul

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Abstract

The historical Karaköy, Salıpazarı District in İstanbul, with its rich urban heritage, has undergone significant transformation catalyzed by the implementation of the Galataport urban regeneration project. This urban endeavor, while aiming to revitalize the waterfront area and enhance the connectivity, has prompted concerns about its impact on the social, physical, daily life practices and the overall identity of locale. Focusing on the social context of urban regeneration, the study aims to discover public attachment patterns in Karaköy Salıpazarı district post urban regeneration

Utilizing Location-Based Social Media data, the study conducted sentiment analysis based on Google Maps reviews published in the last year. The data underwent Neuro Linguistic Programing (NLP) process within Microsoft Excel Azure Add-in, and subsequently mapped by employing spatial interpolation methods in ArcGIS. In conjunction with the hot spot analysis of overall ratings and review density heat map, the study claimed that the regeneration efforts in area do not fully align with the needs of city dwellers.

KeyWords: Urban Regeneration, Sentiment Analysis, GIS, Istanbul

1. Introduction

Urban regeneration initiatives worldwide have become prominent in academic discourse, not only due to their impact on physical structure of cities but also with their social contributions to daily life experiences of urban habitants. To achieve successful urban regeneration endeavors, scholars emphasize the imperative of considering social aspect, and suggest that such projects should aim to integrate the city and its dwellers by taking daily life dynamics of local residents into account (Karslı,2015). In the cases where the social dimension is not adequately addressed, urban areas and their component parts experience the emergence of new social memory and identity pressures within the region. This circumstance is highly observable with the tendency of contemporary urban regeneration practices to impose popular culture on urban life, particularly in areas of historical significance (Creve and Beaverstock, 1998).

Although the social integration was highlighted as one of the primary aspects in urban regeneration (dos Santos Figueiredo et. al., 2022; Heat et. al., 2017; De Rosa and Di Palma, 2013), it might be challenging to make definitive assumptions regarding social effects of regeneration projects. Herein, revealing the existing community sentiment patterns can serve as a valuable social-spatial source to observe symbiotic relationship between human and their environment (Yang et. al., 2022).

The challenge of understanding social patterns of community necessitates use of advanced methodologies. In this regard, Geographic Information Systems (GIS) emerge as a quite beneficial tool for socio-spatial analyses of specific districts. Particularly, utilizing public sentiment analysis based on location-based social media data in ArcGIS environment enables to comprehend social spatial dynamics of specific district.

Within this theoretical framework, the study approaches the social dimension of urban regeneration through the case of Karaköy Salıpazarı district. The intricate urban regeneration process of the area and implementation of the Galataport Complex within the historical

landscape of the Karaköy area has recently raised criticism and became one of the central subjects in urban research. While several researchers and urban practitioners criticize the project for its perceived deficiency in social integrity and responsiveness to the historical characteristics of the site (Korkut and Nalbantoğlu, 2023; Karslı, 2015; Köksal, 2012; Durmuş, 2009), the current literature fall behind to provide a perceptible claim about the socio-spatial transformation experienced by the site. The stated gap in the literature makes it crucial to investigate transformative power of Galataport urban regeneration project on the socio-cultural fabric of the locale as well as its associated reflection on public sentiments.

Following this objective, the study investigates public sentiments arising from post-urban regeneration in the Karaköy Salıpazarı area. By implementing sentiment analysis techniques applied to Google Maps data via Geographic Information Systems, the study not only achieves to discern the accuracy of criticized aspects of Galataport Complex, but also reveals social engagement patterns of the public in the context of post-urban regeneration. In the conclusion part, the reader is invited to the discussion about the integration of urban planning tools into the urban regeneration process that could provide successful impacts on public sentiments and enhance the level of social integration.

2. Urban Regeneration Dynamics and Public Sentiments

2.1. Urban Regeneration of Historical Landscape

Urban regeneration is a multifaceted endeavor requiring theoretical insight and solid strategies encompassing economic, physical, environmental and social issues regarding urban environment (Chen et. al., 2012, cited in Lak et. al., 2020;). For many scholars, successful urban regeneration projects distinguish themselves by transcending mere physical transformation and advocating for a holistic approach including diverse dimensions (Güzey, 2009; Turok, 2004; Atkinson, 2004; Roberts and Sykes, 2004). In particular, the importance of social dimension is underscored

as such projects serve to public, who has no chance to live without them. Considering the social aspect emerges as an integral part of urban regeneration, only could be achieved by improving the quality of life and social relations, improving the access to public services, decreasing the crime rates, overcoming social exclusion and so on (Güzey, 2009).

Contemporary urban regeneration initiatives, as criticized by several researchers, associate success only with an added income, and exhibit noticeable deficiency in addressing these social concerns (dos Santos Figueiredo et. al., 2022; Boussa, 2017; De Rosa and Di Palma, 2013). This critique becomes particularly notable in the context of historical landscapes, where urban regeneration initiatives display a complex dilemma. Justifying public interest by recovering architectural heritage (Couch et. al., 2002) and representing new economy and consumption demands of the middle-high classes (Zukin, 1998), contemporary implications often cause consequential challenges in strategic urban areas such as displacement of existing populations (Heat et. al., 2017), erasure of city identity (Boussa, 2017), heightened spatial segregation (Marcuse, 1998).

To eliminate this consequences, it is deemed important to elucidate the social psychological processes involved in the establishment of social cohesion, and impact of these processes on public engagement patterns (Heat, 2017). While solid definition of ‘social’ element in the urban planning and regeneration processes remains challenging (Chatfield and Reddick, 2016), improvements in technology and the prominence of social media offer promising paths for the observation of evolving social patterns.

2.2. User-Generated Data in Understanding Urban Dynamics

In the contemporary era of Information and Communication Technologies (IoT), widespread technology, and the rise of social media usage facilitate cities to be contributed both by human and machine intelligence. This assembly not only enables public to actively contribute and receive information from the urban space but also encourages a socially informed urban environment (Crooks et. al., 2016). In this regard, the integration of Location-Based Social Networking (LBSN) data in urban studies plays a crucial role in understanding social dynamics of urban landscapes. The imperative of this integration lies in its potential to reveal the values of the public in relation with their location (Ilieya and McPhearson, 2018). According to Crooks et. al. (2016), urban research is bound to explore the relationship between physical spaces, perceptible spaces and the linked spaces through the interconnected nature of social media. Several researchers contributed urban research utilizing from this type of data in diverse topics covering urban mobility (Mohammadbagherzadeh and Terzi, 2022; Oven, 2017), public health, economic development (Hong, 2015), urban green spaces (Chen et. al., 2022; Ghahramani et. al., 2021; Kovacs-Györi et. al., 2018), urban activity patterns (Üsküplü et. al., 2019; Agryzkov et. al., 2016) and human environment relationships (Huang et. al., 2021; Hasnat and Hasan, 2018; Marine-Roig and Clave, 2015).

LBSN data, a product of millions of users worldwide (Hu et. al., 2015) constitutes a valuable resource in contemporary academic research, representing user's voluntarily published perceptions, interests, needs, and behaviors specific to urban locations (Estrada & Nolasco-Cirugeda, 2019). Collection of this type of data is facilitated through three types of social media platforms: Microblogs (i. e., Twitter, Facebook), Photo/video sharing (i.e., Flickr, Instagram, Youtube), and Point of Interest (POI) platforms (i. e., Open Street Map, Foursquare, Google Places) (McKitick et al., 2023). Variety of Location-Based Social Networking platforms provide researchers with a comprehensive understanding of urban dynamics, behaviors and social interactions.

2.3. Public Sentiment Analysis

For a comprehensive exploration into the interconnected psychological relationship between individuals and their environment, Location-Based Social Network data presents valuable opportunities. In particular, the investigation of community attachment patterns to specific urban areas can be accomplished through the utilization of sentiment analysis, which asses the individuals' emotional states according to their written statements in social platforms (Lopez-Mosquera and Sanchez, 2011). The analytical process requires the application of Neuro Linguistic Programming (NLP) methods, categorizing individuals' statements as indicatives of positive, neutral or negative emotions.

In the context of urban research, sentiment analysis proves a valuable social-spatial reference dataset in monitoring and investigating human-environment relationship in various aspects. Firstly, providing a broad social layer to smart city governance, it contributes a shift from a single government-centric paradigm to a data driven, multi-stakeholder mode (Meijer & Bolivar, 2016). Moreover, sentiment analysis is seen beneficial for disclosing the local daily life and embedded social and cultural context that were usually overlooked by authorized official data. (Yang et. al., 2022). In these ways, the analysis is considered as an active instrument in terms of urban governance, by monitoring public response, evaluating urban facilities and well-being, and promoting smart city approach (Yang et.al., 2022).

Several researchers have contributed urban research analyzing public sentiment patterns of distinctive case areas. By utilizing the sentiment analysis, these scholars provided valuable

information to the literature about broad range of topics covering urban identity (Hang, 2015), activity patterns (Yang & Dvale, 2021; Üsküplü et. al., 2021), social spatial interactions (Yang et. al., 2022; Chen et. al., 2022; Gyori et. al., 2018; Stojanarski et. al., 2016), urban street networks (Agyzkoo et. al., 2016, 2017), and green spaces (Kovacs-Gyori, 2018). The source of the LBSN data is mainly observed as Twitter platform within the studies investigating social spatial interactions while Foursquare platform is used in research focusing on urban identity, urban street network and urban activity patterns (Table 1). However, new data sharing policies of these platforms highly restricted the LBSN data based research in current situation.

Table 1. Contribution to Public Sentiment Research in Urban Environment

Author	Year	Data Source	Research Context	Methodology /Visualization
Hang	2015	Foursquare	Urban Identity	Sentiment HeatMap
Stojanarski et. al.	2016	Twitter	Socio-Spatial Interactions	Sentiment HeatMap
Agryzkoo et. al.	2016	Foursquare/ Twitter	Urban Street Network	Network Analysis
	2017	Foursquare	Urban Street Network	Network Analysis
Kovacs-Gyori et. al.	2018	Twitter/ OpenStreetMap	Urban Green Space	Spatial Distribution/ Natural Breaks
Gyori et. al.	2018	Twitter	Socio-Spatial Interactions	Hot Spot Analysis
Üsküplü et. al.,	2020	Foursquare	Urban Activity Pattern	Hotspot Analysis/ Spatial IDW
Yang & Dvale	2021	Foursquare	Urban Activity Pattern	Network Analysis
Chen et. al.	2022	Twitter	Socio-Spatial Interactions	Spatial Distribution/ Natural Breaks
Yang et. al.	2022	Twitter	Socio-Spatial Interactions	Spatial Distribution/ Average Density

Specific to the context of research, these studies conducted various methodologies such as Hot Spot Analysis, Network Analysis, Spatial Distribution, Spatial Interpolation and Sentiment Heat Map techniques utilized in ArcGIS environment. To identify the clustering of positive and negative sentiments, Hot Spot Analysis and Spatial Interpolation methodologies are highlighted in public sentiment studies.

2.4. The Study Area

The study area is located in the southern part of Beyoğlu, one of the crowded commercial districts of Istanbul (Figure 1). This area particularly is considered as a significant part of the city, characterized by a mixed used of opportunities within its historical fabric. Karaköy Salıpazarı district, the focus area of the study, represents the modern and bohemian characteristics inherent to the city of Istanbul.

Figure 1. Location of the Study Area

2.4.1. Historical Development

Due to its strategic location, the Karaköy area has functioned as a port center with commercial characteristics since early ages. Following the 19th century, numerous banking headquarters and large companies started to be located in the district. Over time, Karaköy gained the characteristics of a city center, accommodating financial, commercial, and transport facilities (Karslı, 2019).

Physical and social changes in the area has started in 1950s, prompted by new zoning plans suggesting the construction of higher buildings and larger roads. Consequently, the historical landscape of the area underwent inevitable disruptions due to new road arrangements and construction activities (Ocakçı & Tepeli, 2017). Following the 1980s, the relocation of banking headquarters and large scale companies to the new Cetral Business District (CBD) of Istanbul, Zincirlikuyu-Maslak area. In this way, the area became a secondary center, losing its commercial significance. Also, the introduction of inappropriate functions and workshops catalyzed extensive changes in both social and physical landscape of the area (Korkut & Nalbantoğlu, 2023; Karslı, 2015).

2.4.2. Implementation of Galataport Complex

The strategic location of the Karaköy Salıpazarı area and its historical texture have given not only a commercial characteristic to it, but also substantial potential as a touristic attraction. Inevitably, tourist attraction to the area hasincreased and overlapped with daily lives of habitants (Korkut & Nalbantoğlu, 2023). Catalyzed by the tourist attraction as well as existence of abandoned historical buildings, Galataport urban regeneration project has been suggested in the area. Covering the massive land within the historical fabric of Karaköy, the project is considered as a cruise port initiative aimed at boosting public space through mixed used development.

Started in 2015, construction of the Galataport urban regeneration project has been driven by multifaceted set of objectives. These include the transformation of the area into a cruise port meeting with global standards, the opening access to the long-closed coastal strip, the enhancement of visitor experience, and the preservation of the historical port's significance (Galataport Istanbul, n.d.). However, during and after the construction, the project has been subject of many criticisms, mainly focusing on the social spatial segregation that the project causes in the area. According to Korkut and Nalbantoğlu (2023), the luxurious commercial businesses and profit-oriented functions suggested in the project only serve to attract tourists' fancy, rather than integrating with the needs of city dwellers. Consequently, the attraction of a

new socio-economical profile has let the disruption of social integrity with the other areas nearby, particularly social flow with Kabataş area is stressed. Furthermore, several scholars criticize the massive scale of the project as it destroys the historical characteristics of the city, creating a barrier between sea and the urban area (Karslı, 2015; Köksal, 2012; Durmuş, 2009).

3. Methodology

Using the location-based Google Maps data, a case study approach is adopted to inquire subtle dynamics of urban regeneration within the Karaköy Salıpazarı district, and provide a comprehensive understanding about public sentiment patterns (Figure 2).

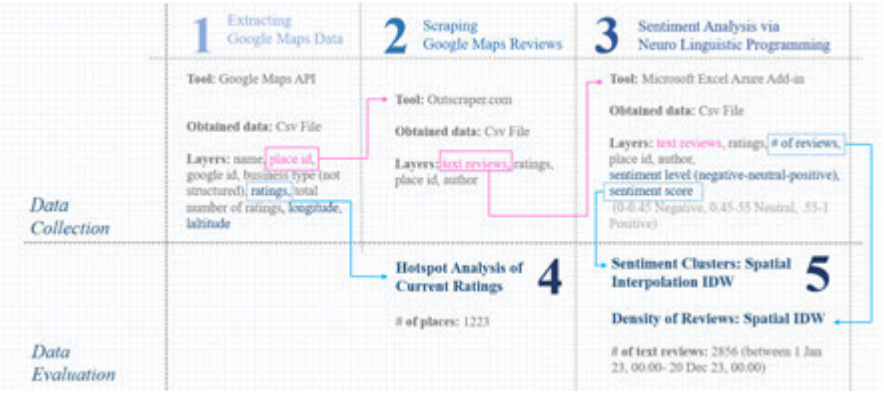

Figure 2. Research Flowchart

3.1. Data Collection

The main evaluation of the study relies on location-based data derived from Google Maps. Google Maps data is considered as a highly convenient source for the research since it enables users to rate places and share associative reviews. The places in obtained data covers wide range of functions (i.e., administrative, commercial, cultural, financial, service activities, food sector, health and sport facilities, religious buildings and so on) as well as point of interests (open spaces, parks, viewpoints, nodes and so on).

Data is obtained through Google Maps' Application Programming Interface (API). However, in this step, the research faced with a limitation imposed by data sharing policy of Google maps, which restricted retrieving data to maximum of 60 venues per one search. Therefore, the study area which occupies land area of approximately 31 hectares, was subdivided into 32 circles with varying radius ranging from 30 to 100 units (Figure 3). For an inclusive outcome, places that are not covered in specified circles are detected manually and added to the dataset. The result is acquired as a csv file, which includes attributes of place ID, google ID, business type (with 5 keywords), ratings, total number of ratings, longitude and latitude of total 1223 venue points.

In the second step, Google Maps reviews of each venue between the time interval from January 1, 2023, 00.01, to December 23, 2023, 00.01, is acquired by utilizing a data scraping platform, specifically outscraper.com. Obtained csv file consists of 2856 text reviews, and their corresponding ratings, place ID attributes.

Figure 3. Exact Locations of Circles for API Search (created by author using mapdevelopers.com platform)

Lastly, sentiment analysis is performed on the text reviews associated with places through Microsoft Excel Azure Machine Learning add-in due to its recognized effectiveness in Neuro Linguistic Programming (NLP) tasks (Peslak, 2018). As a result, processed data along with sentiment level (negative, neutral, positive) and sentiment score (0-0.45: negative, 0.45-0.55: neutral, 0.55-1: positive) attributes is exported as csv file.

3.2. Data Evaluation

Collected data has undergone through two primary analyses and was mapped using ArcGIS Pro. Firstly, Hotspot Analysis was applied to aggregated ratings of venue points, to identify clusters with both high and low popularity. Secondly, in order to identify sentiment clusters, Spatial Interpolation with Inverse Distance Weighting (IDW) was implemented on the sentiment scores corresponding to respective venues. For a comparative analysis, the count of reviews was visually represented using a heat map technique within ArcGIS Pro environment.

4. Results and Discussion

4.1. Spatial Distribution of Venues

The LBSN data obtained from Google Maps comprises 1223 venues within the borders of the Karaköy Salıpazarı district. The predominant concentration of venues is observed in the southwestern region, near the port side, while the northeastern part, where the Galataport Complex is located, displays a sparse distribution of venues (Figure 4).

The study area encompasses a diverse range of urban functions. Since Location-based Google Maps data classifies function of each venue with five keywords, the determination of utilities are determined based on the first keyword representing the dominant use of respective venue. The functional composition of the area comprises administrative, commercial, cultural, educational, financial, food-related, health, religious, and sports facilities as well as interaction/attraction points (Figure 5).

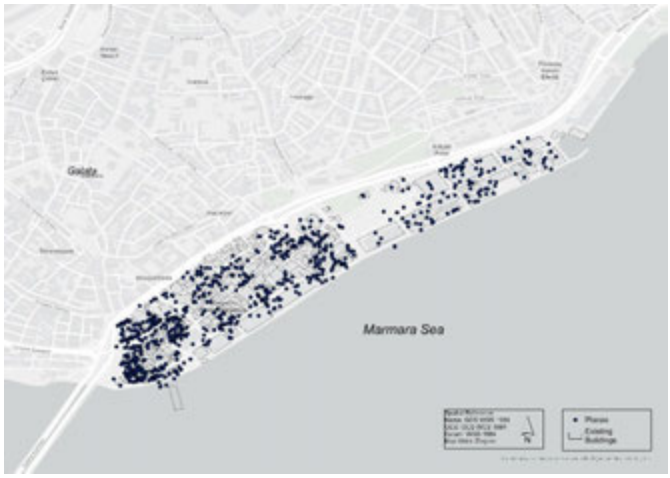

Figure 4. Distribution of Venues (created by author using ArcGIS Pro)

Figure 5. Building Functions (created by author using ArcGIS Pro)

4.2. Public Attachment Patterns

Cluster and hotspot characteristics of footprints and trends were analyzed as an initial step in the investigation of community attachment in the area. To achieve this, Getis-Ord Gİ* analyses were performed based on the attribute value of overall ratings of the venues. The results of the hot spots analyses revealed two notable clusters within the case area. A significant cold spot emerged near the portside, around Rıhtım Avenue, where food-based, financial and administrative functions are evidently concentrated. Adjacent to this cold spot, around Necatibey Avenue on the northern side, a distinct hot spot cluster was observed. This hot spot district is predominantly characterized by commercial and food-based venues, as well as nodes and interaction/attraction points such as viewpoints. In addition to these two clusters, the western part of the area displays several small hot spot clusters distributed across diverse districts (Figure 6).

Hot spot analyses provided a significant outcome, revealing the small cold spot clusters within the eastern part of the area, coinciding with the focus on the inquiry, Galataport Complex. This finding leads to the inference that Galataport area reflects a clustered pattern characterized by lower overall ratings, indicating a concentration of venues with lower satisfaction levels.

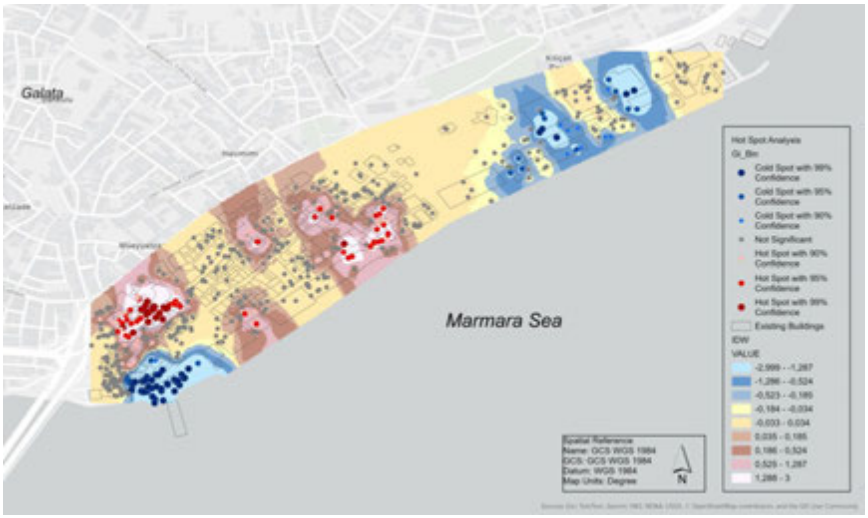

Figure 6. HotSpot Analysis and Spatial Interpolation of Venue Ratings (created by author using ArcGIS Pro)

Secondly, sentiment scores of venues were calculated in Microsoft Excel Azure Add-in, based on Google Maps reviews published in time interval of 1st January 1 am and 20th December 1 am., 2023. To see the distribution of positive and negative sentiments, Spatial Interpolation with Inverse Distance Weighting (IDW) was implemented on the sentiment scores corresponding to respective venues.

The analysis showed an interesting result, indicating a presence of positive sentiment cluster near the portside. This location intersects with the significant cold spot cluster regarding venue ratings, observed in the previous analyses. Although it is not possible to make a definitive inference, this result suggests a potential shift in public attachment patterns to this area in recent years (Figure 7).

Concerning the area where Galataport Complex is located, public sentiments showed a negative-neutral tendency, in parallel with the formations of small cold spot clusters in the area. For further investigation, the study is elaborated to comprehensive comparison of public sentiment distribution and density of the reviews, utilizing spatial interpolation techniques based on number of reviews in respective venues (Figure 8).

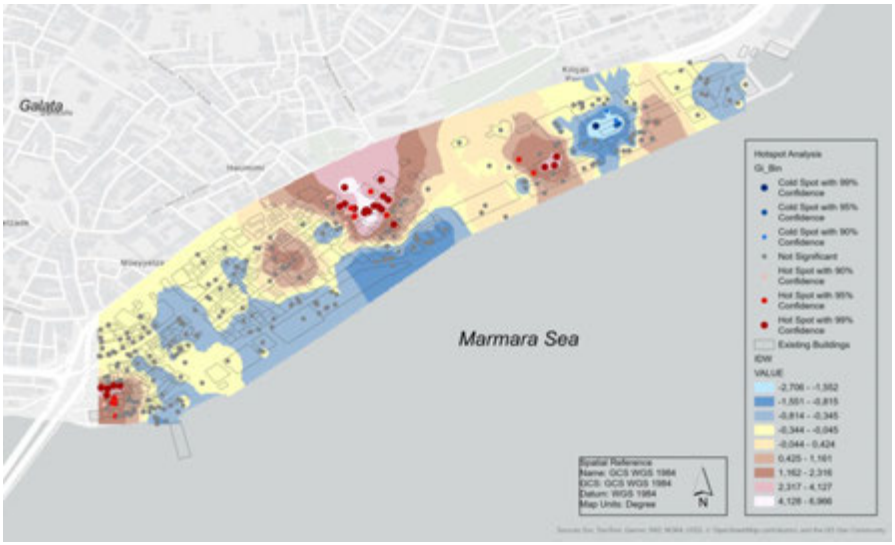

Figure 7. Hotspot Analysis and Spatial Interpolation of Public Sentiments with (created by author using ArcGIS Pro)

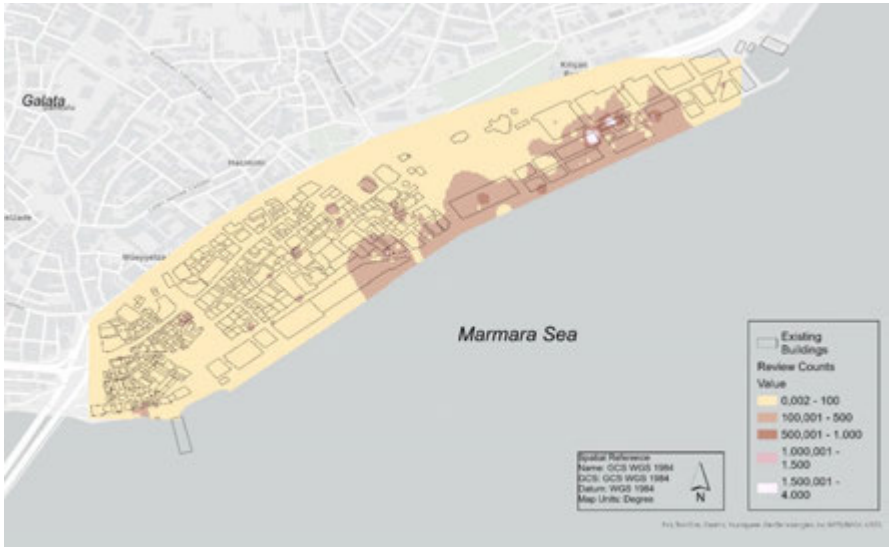

Figure 8**.** Review Density Spatial Interpolation Map (created by author using ArcGIS Pro)

The results highlighted that, in Galataport Area, where negative sentiment clustering is evident, density of reviews published in recent year tends to be in the highest degree. Therefore, the study revealed that the Galataport area not only reflects the negative public attachment patterns, but also indicates a strong prevalence of negative sentiments within the community, suggesting a sense of detachment from this area.

5. Conclusion

The study utilized spatial sentiment analysis to observe the public attachment patterns related to the Karaköy Salıpzarı area, which has undergone the Galataport urban regeneration initiative in recent years. The primary focus of the study revolves around substantial criticism directed at the project within the context of social integrity. The source of the analyses was Location-based Social Media (LBSN) data derived from Google Maps platform, as it enables users to rate places and share associative reviews.

During the data collection phase, the study faced with several limitations. While retrieving Google Maps data, the study was restricted by new data sharing policy of Google Maps, allowing to scrape only limited number of reviews linked to the venues. Consequently, the study utilized data scraping platforms, namely outscraper.com. Additionally, during sentiment analysis of obtained reviews, another limitation arose by Natural Language Processing (NLP) tool within Microsoft Excel's Azure Add-in. This tool only computes sentiments for text reviews written in Latin alphabet, resulting in the exclusion of numerous reviews in languages using different alphabets.

The study has contributed urban literature by evaluating sentiments of post urban regeneration in Karaköy Salıpazarı area. The primary claim of the research indicates that, even Galataport Complex has a popularity with a substantial number of reviews over the past year, public sentiments tend to be in low-moderate level. This result aligns with the criticism about the project, suggesting that the regeneration efforts in area do not fully integrate with the needs of city dwellers (Korkut&Nalbantoğlu, 2023; Karslı, 2015; Köksal, 2012; Durmuş, 2009). Highlighted with this outcome, the study underscores the significance of the social dimension in the urban regeneration process, revealing the negative reflections on public settlements patterns in instances where its realization proves elusive. In navigating complex landscape of urban regeneration, and for fostering inclusive and resilient urban environments, the study recommends the adoption of a comprehensive approach in future planning endeavors.

For further investigations, it is highly suggested to inquire about the reasons of negative sentiments and cold spot clustering within the Galataport Complex. This investigation might require detailed content analysis of text reviews retrieved from Location-based Social Media (LBSN) platforms.

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TIRANA'S HOUSING UNITS AND PARKING IN 2024

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Abstract
Open parking spaces in residential areas of Tirana today are more concerned with finding suitable locations than merely accommodating a specific number of vehicles. This study aims to analyse the challenges associated with open parking within residential units and internal streets of the city. The construction of new residential complexes over the past 35 years has introduced changes in their design elements compared to the housing stock from the single-party system, prior to the 1990s.The objective is to identify and evaluate the issues arising from the unplanned allocation of parking spaces within the residual areas of residential units designed 40-50 years ago. Finally, it underscores the impact of these improvised parking solutions on urban living conditions and residential environments. Challenges posed by the lack of planned parking spaces, and their distribution within streets and squares of residential units are identifies by employing exploratory, comparative, quantitative, and qualitative methods of analysis. Questionnaires were conducted in the premises of the case study area, in order to get the insight of residents and users.

Keywords: Residential housing units, underground parking, open parking, street parking.

Introduction
Every vehicle user in Tirana experiences in a typical workday significant traffic congestion at nearly every hour, particularly in the city centre or other populated spots throughout the city. Throughout continuous economic and political changes, mobility has undergone substantial changes. This shift is more accurately described as a transformation rather than a simple change. Thirty-four years ago, residents of Tirana predominantly relied on public transportation such as local buses, bicycles, and walking, with taxis used only in exceptional circumstances. The number of taxis in Tirana at that time was almost symbolic.
Following the transition to a different political system, owning a private vehicle become more and more common. Today, Tirana's streets are predominantly occupied by personal vehicles, taxis, public transportation, school vans, and, to a lesser extent, bicycles and motorcycles. The convenience of private cars, together with the lack of more possibilities of transport, has driven their increased usage. However, a more pressing issue than traffic itself is the parking of vehicles: open parking spaces, both free or paid, as well as parking within inner streets. In some parts of the city, particularly in newly developed units, the parking issue has been effectively addressed and no longer causes significant stress for its residents. The adequate conditions and location of parking spaces is as crucial to residents as their living space. Thus, for vehicle owners residing in units constructed before the 2000s, parking is often problematic.
Previously, the major part of residents did not possess personal vehicles, and mobility was primarily facilitated through public transportation. In contemporary Tirana, spaces that were once designated for recreation, greenery, and other communal purposes have been repurposed. During the initial years of the political transition period, in the 2000s, a considerable number of residential buildings were constructed, in addition to several formal and informal extensions to existing constructions, without following appropriate urban planning standards. Additionally, the majority of these residences did not include any internal parking facilities, neither closed or open leading to significant changes in the quality of life for residents and service users.
Since the 2000s, the number of owners of personal vehicles has increased significantly. A considerable portion of green spaces has been replaced by commercial and service areas on ground floors. Consequently, parking spaces are used mostly by their users, in addition to

residents. Considering parking as a crucial factor affecting the daily lives of residents, the following research conducts a morphological analysis of areas designated for parking from 1990 to the present.

The population of Tirana, which was approximately 250,000 thirty-four years ago, is now estimated to be around 1,000,000, accounting for more than one-third of the national population. This dramatic increase has significantly escalated the demand for parking, transforming it into a general source of stress, particularly problematic for residential units constructed before 1990.

Over these thirty-four years, numerous elements have been transformed, including the concept of mobility. Previously, public transport, bicycles, and walking were the primary modes of movement. Today, although these modes still exist, there is a marked preference for personal vehicles, taxis, and lately also scooters. Moreover, the ground floors of buildings, which were predominantly used for residential purposes in the past, have been repurposed for business activities. These businesses not only require parking spaces for their vehicles, clients, and services but also include establishments such as bars, restaurants, and other venues that occupy surrounding spaces with parking. The areas once designated for greenery and residential use, are now public spaces congested with vehicle parking. Consequently, green spaces have been significantly reduced.

Residential units constructed over the past two decades, however, present a better situation. Building blocks have been designed with underground parking facilities, contrasting with the older housing stock. Consequently, contemporary residential units, with their internal streets and available open spaces, face significant challenges due to the proximity and considerable number of vehicle parking, including noise, pollution, safety concerns, and a shortage of parking spaces. Historically, the internal streets of residential complexes built before 1990 were primarily traversed by service vehicles. Occasional use was made by fire trucks, ambulances, fuel supply vehicles in winter, taxis during weddings or similar events, and bicycles, as private car ownership was not allowed for the large population.

In contrast, contemporary times face private cars reaching almost the very entrances of collective residences, with very few families lacking private vehicles. Most families own at least one vehicle, and many possess multiple ones, depending on economic conditions and workplace proximity. While public transport disseminates passengers at designated stations along its route and continues onward, and taxis operate similarly, the use of private vehicles—despite their convenience in providing direct travel to destinations—necessitates the allocation of parking spaces. This convenience incurs additional costs and demands space for vehicles to remain stationary. Typically, the tendency is to park on the sides of roads, secondary streets, or within the internal spaces of residential units.

This practice exacerbates issues such as stress, pollution, dust, and noise, and it diminishes the availability of green spaces. These green spaces are essential not only as recreational areas but also as protective "green walls" for collective residences. For the first time in 2015, the Municipality of Tirana undertook initial interventions to create collective parking spaces, a part of which were offered to residents for free and the rest with payment.

Despite these measures, residential complexes in Tirana and their inhabitants face a chaotic situation regarding vehicle parking and the associated challenges.

Materials and methods

The research presents issues related to parking in residential units constructed prior to the shift to a democratic system, using data from collected questionnaires. The questionnaires have been conducted between February and April 2024, involving 245 randomly selected residents and passers-by in an approximately 2-hectare residential complex. This area is located near the center of Tirana and is bordered by two major roads, Gjergj Fishta Boulevard and Myslym Shyri Street.

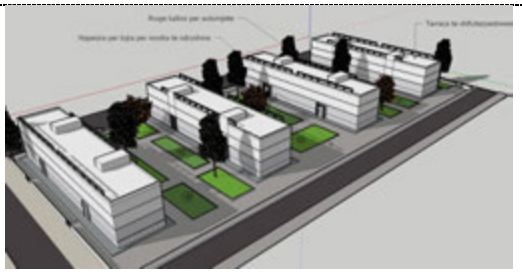
The questionnaire consists of 22 topics, with the first five addressing basic information and the remaining 17 focused on the elements that should be present in the spaces between residential buildings. The data from the questionnaires were processed using IBM SPSS Statistics Version 22 and Microsoft Excel.
By analyzing the transformation of the residential unit through different phases, the main parking issues and elements have been identified through graphical representations. Following data processing, comparative, quantitative, and qualitative methods were implemented. Additionally, a typical residential unit was analyzed as a case study and illustrated with graphical drawings, highlighting the main parking issues and elements.

Research
In the first part of the research, the residential unit is presented graphically in 3D, based on plans obtained from AQTN. The phases that the residential unit has undergone are depicted: its initial project design, its implementation, its condition after 1990 and its current state. As a case study, the multifamily residential unit known as "Godinat e Nëpunësve" (Employees' Buildings), designed in 1942 in Tirana, has been selected. The presented volumes are based on projects preserved in the AQTN archives.

Residential unit project
The residential complex includes 4 buildings, each 4-storey high and 1 underground floor. It was designed from Piero Bartolini in June 12, 1940. It belongs to the monarchical system in Albania, during the fascist Italian occupation. The urban planning scheme (October 10, 1941) did not envisage underground parking but rather open parking spaces for vehicles.

Figure 1. 3D view of the residential unit as designed in the original project. Source: author drawings based on plans from AQTN, Tirana.

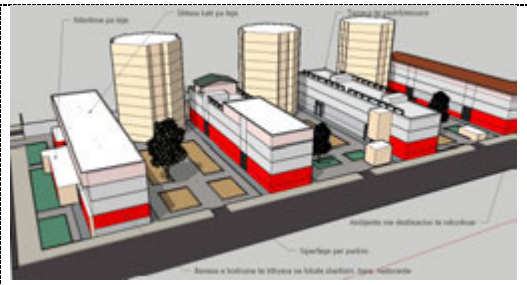
The space between the buildings was accessible by vehicle directly from the main road, with vehicles being parked in the external area. The basements of the buildings functioned as storage service areas.



Residential unit construction
In the period from 1945 to 1990, the complex was inherited within the one-party political system without any alterations to its original architectural and urban plan. The space incorporates elements such as greenery and open areas for recreational activities for residents of different age groups. The project was implemented without provision for parking spaces for residents.

Figure 2. 3D view of the residential unit after construction. Source: author drawings based on plans from AQTN, Tirana.

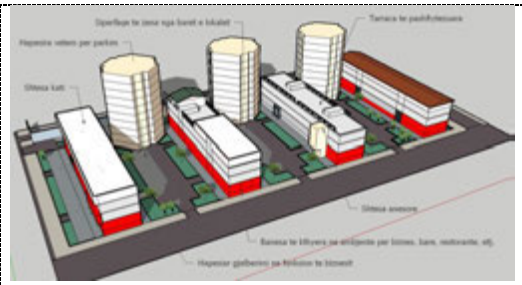
After World War II, these residences were finally utilized. At this time, after the 1960s, citizens were not permitted to own private vehicles. The internal spaces featured greenery and recreational areas, including sports corners for various age groups.



Residential unit after 1990
With the transition to the democratic political system, during the period from 1990 to 2005, there were significant urban transformations in this residential unit. New constructions, both formal and informal, as well as extensions to existing constructions altered the residences themselves and spaces between them. Green areas were demolished, and the space was occupied by unauthorized private parking.

Figure 3. 3D view of the residential unit after 1990. Source: author drawings based on plans from AQTN, Tirana.

With the political system transition in 1990, previous open space between buildings was used for the construction of first multi-story buildings by private entities with building permits. These buildings included one underground parking level, but only for a small number of their residents. The remaining residents parked in the external area. Simultaneously, existing buildings experienced unauthorized extensions, as notable in the 3D view. Consequently, the density increased, the available space diminished, and the number of vehicles in the area grew.



Residential unit today
Today, this space presents a less chaotic appearance. The linear gardens within the square have been redeveloped. However, the major part of the surrounding space is utilized by cafes, bars, and restaurants, as well as for parking individual and service vehicles. The surface area allocated for resident parking is considerably smaller than the demand.

Figure 4. 3D image of the residential unit in the existing situation. Source: author drawings based on plans from AQTN, Tirana.

The 3D views clearly illustrate the transformation undergone by this residential unit. This situation is similar throughout the entire city of Tirana in the residential units inherited from the previous system. Drastic changes were also observed in green areas, external parking spaces, internal roads, sidewalks, lighting, and safety measures. Furthermore, the ground floors of residences have altered their purpose, with nearly 90% of the residential stock in ground floors inherited from before the 1990s being repurposed.
The second part of the research presents the results of the questionnaires conducted in the field.

Name, Surname			
		Frequency	Percent
Valid	passer-by	34	13.9

	resident	211	86.1
	Total	245	100

Figure 5. Table of number of respondents to questionnaires

A total of 245 individuals were surveyed, of which 14% were passers-by who frequented the area for various reasons, such as meeting friends in the recreational spaces of this complex or visiting relatives. Others used the area for shopping or as a daily transit route to work or school. The remaining 86% of respondents were residents of different ages (Figure 5).
To the question, "Do you own a vehicle?" 100% of respondents provided answers (Figure 6). The question referred to whether they had a private car in their household, not necessarily an individual one. Of the respondents, 62.4% owned private vehicles, primarily employed or self-employed individuals, some of whom both work and live in this area. The remaining 37.6% did not own private cars, predominantly students and the unemployed.

Do you own a vehicle?			
		Frequency	Percent
Valid	Yes	153	62.4
	No	92	37.6
	Total	245	100

Figure 6. Results from Question nr. 6: Do you own a vehicle?

In response to Question 7, "Where do you park the vehicle?" 155 out of 245 respondents provided answers (Figure 7). Among those who answered, 26.5% park their cars in private parking spaces. Collective parking areas are used by 30.3% of respondents, indicating that they utilize above-ground and underground parking in new constructions, which are mostly paid parking spaces. The majority, 43.2%, park in public spaces such as streets and squares.
The spaces between residential buildings are filled with parked cars, making them unusable for children or the elderly, and leading to noise, pollution, chaos, and safety issues. Additionally, there is the problem of driver stress due to the time spent searching for parking, as well as the potential for fines from improper parking.

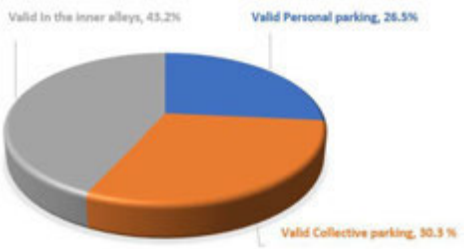


Figure 7. Results from Question nr. 7: Where do you park the vehicle?

Similar questionnaires have been conducted five years ago in in other residential areas of Tirana. When comparing the most recent results with the previous ones, it becomes evident that the percentage of parking in streets and interior spaces of residential units has increased. This indicates that the problem is worsening. Meanwhile, the number of vehicles circulating in Tirana continues to rise, as does the number of new constructions. This leads to a reduction in existing spaces, exacerbating the issue of parking in streets, squares, and public areas.
For most questions, respondents were allowed to provide 1-3 alternatives. The results present the first alternative.

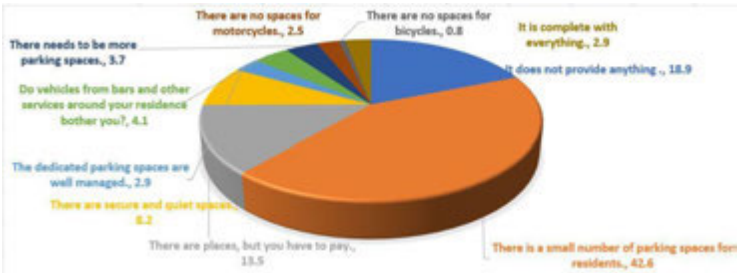


Figure 8. Results from Question nr. 11: Where do you park the vehicle?

For Question No. 11, "Does the space around the building, outside or underground, provide parking for you as a resident?" 244 out of 245 respondents answered. This question includes 10 response options, as following:

0. It does not provide anything.
1. There is a small number of parking spaces for residents.
2. There are places, but you have to pay.
3. There are secure and quiet spaces.
4. The dedicated parking spaces are well managed.
5. Do vehicles from bars and other services around your residence bother you?
6. There needs to be more parking spaces.
7. There are no spaces for motorcycles.
8. There are no spaces for bicycles.
9. There are no spaces for people with disabilities.
10. It is complete with everything.

The processing of the responses to Question No. 11 reveals that 18.9% of the respondents indicated that the space around the building does not provide any parking facilities for them. This implies that the area lacks essential elements necessary for accommodating parking needs. A significant 42.6% of the respondents selected the first option, indicating that residents with private vehicles encounter difficulties in finding parking spaces. This issue impacts their daily lives, reduces their quality of life, increases stress, consumes their time, and affects their psychological well-being. It suggests that local authorities need to take measures to ensure a greater number of parking spaces for residents. Resident parking typically falls under the category of free parking.

In contrast, 13.5% of the respondents chose the second option related to paid parking. Paid parking in Tirana is managed by the institution Tirana Parking and is known as "Parkim me SMS" (Parking by SMS). The city of Tirana is divided into four parking administration zones. Residents are guaranteed free parking spaces within their residential zone, except in designated main road areas subject to a fee system. These paid parking areas are marked by white lines and signs. Short-term parking spaces intended for business purposes are classified as Reserved Parking, which businesses obtain through annual payments. The number of these spaces is usually limited compared to demand, causing residents' parking spots to be occupied by business clients.

With the political system change after 1990, existing collective housing underwent functional transformations. Many of the ground-floor and first-floor apartments were converted into various types of businesses. Even today, they continuously change their purpose. Former service areas, equipped with permits from local authorities, are being turned into cafes or bars. This consequently affects the residents' lives. Apart from the noise generated by these establishments, concerns also arise from the vehicles and service cars. Regarding the fifth question, 4.1% of the respondents express their concern regarding the parking of vehicles from

the businesses on the ground floors. In addition to the problems of noise pollution, this also leads to a lack of security for the residents of units. Although the questionnaire was conducted in a specific complex, the same symptoms can be viewed in the entire city of Tirana.
Another important issue is the lack of designated parking spaces for bicycles or motorcycles. Additionally, inadequate conditions for the mobility of persons with disabilities has been mentioned through the questionnaires. 15% of the respondents have chosen as their second and third alternatives of issues to the question that elements for persons with disabilities are lacking in the spaces around their homes. This is especially true for housing units built before the 1990s, which do not provide any mobility conditions. There are sporadic interventions on the sidewalks along the main roads, while within the same housing units, there are no elevators or ramps. Question 12, "Which common space do you use the most?" was answered by 243 out of 245 respondents (Figure 9).

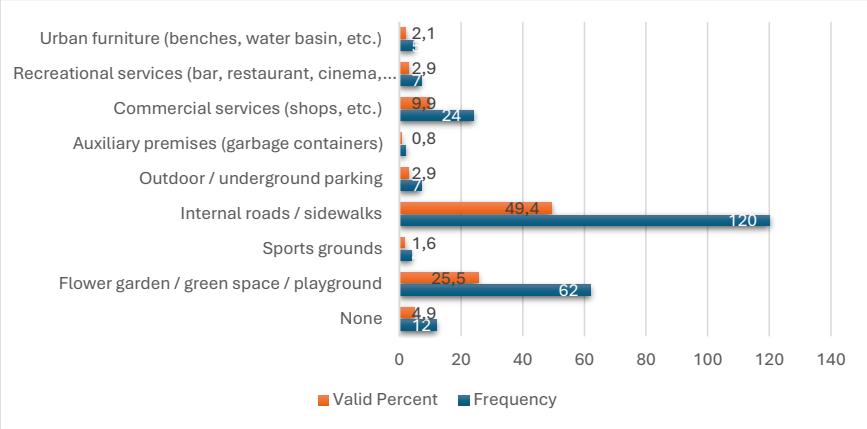


Figure 9. Results from Question nr. 12: Which common space(s) do you use the most?

Respondents could choose up to three alternatives for the question. The table (Figure 9) shows the results of their first choice. The options of question 12 were as following:
0. None
1. Flower gardens / Green space / Playground
2. Sports grounds
3. Internal roads / sidewalks
4. Outdoor / Underground parking
5. Auxiliary premises (f.e. garbage containers)
6. Commercial services (f.e. shops)
7. Recreational services (f.e. bars, restaurants, cinema etc.)
8. Urban Furniture (f.e. benches, water basins etc.)
9. Other
The analysis of the questionnaire outcomes distinctly reveals that spaces between buildings, in the majority of instances, lack essential elements, including green areas, urban furnishings, secure pathways, sidewalks, adequate open parking facilities for residents, service amenities, recreational zones catering to various age groups, lighting, security measures, among others.
Among the surveyed individuals, approximately 49.4% noted that the space surrounding their residences merely consists of access roads facilitating entry and exit. Notably, the designated parking spaces are limited, with a mere 3% utilizing the parking provisions allocated for them. Specifically for the case study illustrated graphically in Figure 4, the space between the

residential buildings predominantly consists of decorative greenery and parking spaces. Nonetheless, these spaces are predominantly used by local businesses. It's noteworthy that the design and allocation of these spaces before 1990 were primarily intended to cater to the needs of the residents. Presently, however, the parking provisions available to them fall short in adequacy. This insufficiency is further compounded by the observation that a significant number of families, particularly those with an average age surpassing 60 years, do not possess private vehicles. Consequently, the quality of life within these residences has been compromised, attributed to their proximity to the urban core and primary thoroughfares. While these circumstances may contribute to a heightened sense of safety, they do not necessarily ensure comfort. Significant concerns mentioned by residents include noise pollution, dust, vehicular emissions, and any potential encroachment by new developments within the immediate courtyard surroundings.

Question 15. " How much do the noises of cars, unpleasant smells, dust from the premises, from the gases of vehicles or new constructions (if any) in the surrounding yard bother you in your apartment?" elicited responses from 245 respondents. (Figure 10)

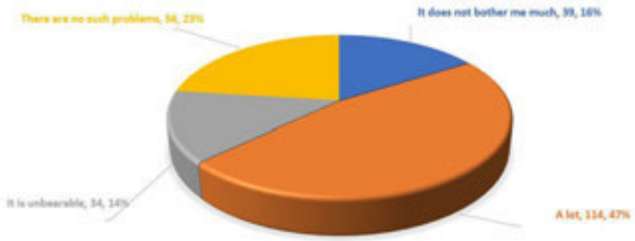


Figure 10. Results from Question nr. 15: How much do the noises of cars, unpleasant smells, dust from the premises, from the gases of vehicles or new constructions (if any) in the surrounding yard bother you in your apartment?

The graphic depicts from the collected data, and indicates that out of the total 245 respondents, 114 individuals (constituting 47% of the total) have chosen the option "A lot." When combined with the 14% who have expressed "It's unbearable", this collective represents more than half of the surveyed population. Notably, those respondents who reported being undisturbed or lacking concerns predominantly reside in upper-floor apartments or newly constructed dwellings. The utilization of new and high-quality materials for window frames and façade walls suggests a meticulous consideration of architectural elements. However, this analysis underscores potential inadequacies in the organization of housing unit forms. Internal streets are observed to be in close proximity to residential structures, and the presence of tall greenery, which could serve as a barrier against noise and dust pollution, is notably lacking. Furthermore, the placement of vehicle parking facilities appears to be inadequate. In addition to these factors, the material composition of window frames, walls, and other selected interior elements plays a crucial role in shaping residents' experiences and perceptions.

Conclusions

One of the most insightful questions of the questionnaire is the following: "What fundamental issues (in your opinion) exist in the spaces between residential buildings (courtyards)?" For this question, respondents freely expressed their views on the problems associated with the spaces surrounding their residences. The most frequently cited issues were:

"Proximity to the road and vehicular traffic"

"Air pollution from vehicles passing very close"

"Close distance between buildings and lack of adequate infrastructure for insulation"

"Lack of lighting and security"
"High-speed vehicle movement"
"Narrow streets, heavy traffic"
"Noise from frequently visited bars"
"Previously free spaces are now overcrowded"
"Common spaces have been encroached upon and transformed into gardens in front of ground-floor apartments"
"It has been transformed; spaces once filled with children playing have been converted into parking areas"
"Residences have been constructed, roads expanded, and commercial units established"
"Many free spaces have been turned into parking or construction sites"
"Our former spaces have been taken over; if organized well, the parking problem can be resolved"

Through the highlight of issues resulting from the collation of questionnaire data and the conducted qualitative analysis, it becomes evident that security within pre-1990s existing residential units has undergone a noticeable decline. Concurrently, an escalation in noise levels and pollution has been increased. Interventions in existing spaces between buildings, with the ongoing intensive construction of new tower-type residential buildings, has significantly augmented the number of vehicles circulating in the area. The predicted necessary area and number for parking spaces has been calculated in accordance to the number of residents only, not including all users of other services. Moreover, there is a conspicuous absence of varied greenery, particularly the presence of tall trees through sidewalks.

Shifting vehicular traffic at a safe distance from entrances of residential buildings is critical. Residents often perceive the large number of commercial activities, like bars and cafes, taking the place of green spaces and even small gardens, as pressing issues necessitating resolution. Local authorities grant permits for such activities.

According to respondents, in order to spend leisure time in the proximity of their residence, individuals frequent commercial venues and service areas due to a perceived lack of alternatives, as these spaces notably affect the residential environment. Residents note that elements like greenery, urban furniture, service amenities, and designated play areas positively impact psychological well-being.

Adherence to planning and design standards is crucial for ensuring adequate natural light and maintaining apartment privacy, which are currently compromised. The common spaces between buildings serve primarily as transition zones rather than recreational areas, hindering efforts to foster community engagement and enhance daily living experiences.

The construction of new multi-story residential buildings within or adjacent to existing buildings built before the 1990s has exacerbated issues of parking such as shortages, noise pollution, and environmental concerns. The increasing number of vehicles will continue to aggravate these issues, underscoring thus the urgent need for calculated parking provisions, not only to the selected case study but also similar contexts.

Throughout Tirana, the conversion of ground-floor residential spaces into commercial and service establishments has become a common trend in residential buildings dating from before the 1990s. Consequently, residents find themselves using only communal areas within the building, such as halls, stairs or others, while the surrounding spaces are managed by local authorities as public spaces.

Residents bring the issue of the absence of dedicated services surrounding their residences beyond basic infrastructure like roads and sidewalks. Consequently, they feel increasingly disconnected from the spaces surrounding their homes.

These findings underscore the urgent need for revaluation and potential requalification of the surrounding spaces, particularly to address deficiencies in greenery and recreational amenities.

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