ROUTLEDGE STUDIES IN SUSTAINABILITY TRANSITIONS

Urban Sustainability Transitions

Edited by
Niki Frantzeskaki, Vanesa Castán Broto,
Lars Coenen and
Derk Loorbach

ROUTLEDGE

Urban Sustainability Transitions

The world's population is currently undergoing a significant transition towards urbanisation, with the UN expecting that 70% of people globally will live in cities by 2050. Urbanisation has multiple political, cultural, environmental and economic dimensions that profoundly influence social development and innovation. This fundamental long-term transformation will involve the realignment of urban society's technologies and infrastructures, culture and lifestyles, as well as governance and institutional frameworks. Such structural systemic realignments can be referred to as urban sustainability transitions: fundamental and structural changes in urban systems through which persistent societal challenges are addressed, such as shifts towards urban farming, renewable decentralised energy systems, and social economies.

This book provides new insights into how sustainability transitions unfold in different types of cities across the world and explores possible strategies for governing urban transitions, emphasising the co-evolution of material and institutional transformations in socio-technical and socio-ecological systems. With case studies of mega-cities such as Seoul, Tokyo, New York and Adelaide, medium-sized cities such as Copenhagen, Cape Town and Portland, and nonmetropolitan cities such as Freiburg, Ghent and Brighton, the book provides an opportunity to reflect upon the comparability and transferability of theoretical/conceptual constructs and governance approaches across geographical contexts.

Urban Sustainability Transitions is key reading for students and scholars working in Environmental Sciences, Geography, Urban Studies, Urban Policy and Planning.

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Andrés Felipe Valderrama Pineda has been studying and working with sustainable urban development and the role of mobility. His work is based on a curiosity to understand the challenges of sustainable transition as more than a matter of the right intentions. There is no causal relation between people's intentions and actions – and thus no causal relation between visions and reality. Sustainable transition is a matter of practices.

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1 Urban Sustainability Transitions

The Dynamics and Opportunities of Sustainability Transitions in Cities

Niki Frantzeskaki, Vanesa Castán Broto, Lars Coenen and Derk Loorbach

Introduction

The agreement of a New Urban Agenda to put urban areas at the centre of achieving sustainable development for future generations was a key objective for Habitat III, the United Nations Conference on Housing and Sustainable Urban Development, which took place in Quito, in October 2016. Habitat III follows on from the inclusion of an urban goal among the Sustainable Development Goals adopted in New York in September 2015. The role of cities has been also recognised in other international frameworks such as the SENDAI Framework for Disaster Risk Reduction and the Paris Agreement on Climate Change. The New Urban Agenda emerges as a tool to harness 'the transformative power of urbanisation'. A massive demographic transformation is taking place, with the UN expecting that 70% of world population will be urban by 2050. However, the transformative power of urbanisation is not merely a demographic change. Urbanisation has multiple social, political, cultural, environmental and economic dimensions that will profoundly influence social development and innovation. This fundamental long-term transformation will involve the realignment of urban society, its technologies and infrastructures, urban cultures and lifestyles as well as governance and institutional frameworks. Such realignments are shockwise, nonlinear and complex processes of change, driven by deeper transformations but also by innovation and experimentation on the ground. Such structural systemic realignments within urban contexts can be referred to as urban sustainability transitions: fundamental and structural changes in urban systems through which persistent societal challenges are addressed. Examples range from shifts towards urban farming to renewable decentralised energy systems to sustainable urban mobility or social economies.

The need and drive for urban sustainability transitions is apparent (Tollefson, 2012). City governments are increasingly demonstrating what can be done in cities. Copenhagen in Denmark has pledged to be carbon neutral by 2025. Rio de Janeiro in Brazil has defended a model of environmental management that incorporates its poorest residents living in favelas. Cities like Singapore and Barcelona are experimenting with ICT to improve their service delivery. Increasingly, innovations are being developed and tested in cities

all over the world. But city governments are only one actor in the context of urban sustainability transitions. The process of urbanisation that accompany land transformation and their manifestation in countries with different political systems questions the city and the city government as the central actor. The perspective of Urban sustainability transitions are processes of societal change and innovation with multiple causes, drivers and dynamics. A myriad of other actors have come to intervene in cities and urban areas with both punctual projects and initiatives to deliver impact at scale. Overall, the urban sustainability transition is a multi-actor process occurring simultaneously at different levels.

This volume seeks to contribute to this debate by interrogating two interrelated questions: what constraints and opportunities for sustainability transitions emerge within an urban context? To what extent can sustainability transitions be governed at the urban level and how? By exploring these two questions from different angles, this volume seeks to respond to a noticeable gap in the sustainability transitions literature. In a recent paper surveying the field of sustainability transitions, Markard et al. (2012) found that only 6% of transition studies have taken an urban perspective, compared to 38% adopting an explicitly national focus. Similarly, most theory in sustainability transitions has paid until very recently relatively little attention to the role of space and place in transitions which leaves it ill-prepared to understand and explain its geographically uneven development (Coenen et al., 2012). In spite of some exceptions (Bulkeley et al., 2011; Loorbach et al., 2016), there is a lack of insight on the possibilities and limitations in governing sustainability transitions at the level of the city. While important contributions have been made in the areas of mobility, food and energy (Geels et al., 2012; Spaargaren et al., 2012; Verbong and Loorbach, 2012), these studies have left unaddressed the specific questions about the dynamics of transitions that emerge in an urban context, and the active role that urban actors can play in instigating, starting or accelerating transitions.

In this context, the book makes two novel contributions. First, it shows how urban sustainability transitions are empirically and conceptually distinct from sector-specific transitions. Previous contributions on sustainability transitions have largely taken a domain-oriented approach (energy, water, food, etc.). By looking explicitly at urban transitions, this book foregrounds how multiple domain transitions intersect and are inter-related. Urban transitions are thus not distinct because they are observed at a different scale, but because they involve the alignment of resources and actor constellations across domains within a given geographical setting. Cities are thus 'natural' sites where the multiplicity of different dimensions concerning sustainability transitions comes together. To make sense of and govern this multiplicity requires city-specific analytical tools.

Secondly, the book shows that studying urban sustainability transitions identifies shortcomings in existing conceptual frameworks in transitions research, thus contributing to their further development. Moreover, urban

sustainability transitions also invite us to engage with and reflect upon novel conceptual and methodological approaches beyond the usual models. The urban is not just a laboratory for policy and technological innovations: it is also a means for academics to develop new understandings of transitions to sustainability and why they matter. This volume aims to consolidate and extend the convergence points between transition studies and urban studies. Sustainable urban development and transformation, as an empirical field, has been studied by other approaches besides transitions theory such as urban studies, development planning and human geography (McKormick et al., 2013). Studying urban sustainability transitions thus invites for a potentially stimulating dialogue across different schools of thought in which the transitions perspective still needs to 'carve out' its specific value added. Cities have been and are likely to remain the seedbeds where major social and economic transformations in our societies are initiated and developed (Hall, 1998). Similarly, we know that urban agglomerations are highly conducive environments for novelty creation and disruptive innovation, not just in technological terms but also to foster policy, social and ethical innovations (Glaeser, 2000; Mieg and Topfer, 2013).

Overall, and following the research questions proposed above, this introduction provides an overview of the thinking that underpins the formulation of the book's objectives: (a) to provide new insights of how sustainability transitions unfold in different types of cities across the world and (b) to explore possible strategies for governing urban sustainability transitions. Following this, Section 2 outlines our contributions to studies of sustainability transitions and emphasises the implications of the book theme to their governance. Section 3 provides an overview of the structure of the book, and Section 4 outlines the five recommendations drawn from the book for developing and advancing research on urban sustainability transitions as a new pathway for sustainability transition studies.

Contributions of the Book

Contributing to Sustainability Transition Studies

The book taps into an emerging research current on urban sustainability transitions, as well as the geographies of sustainability transitions more generally, aiming to bring *new insights for transitions' theory and practice*. Following the Routledge Studies in Sustainability Transitions series, this book focuses on the co-evolution of material and institutional transformations, in socio-technical and socio-ecological systems. The book builds from empirical cases focusing on contemporary sustainability transitions in cities as grounds to examine distinct dimensions and patterns of transitions. These cases draw conclusions about theoretical concepts or frames that are required to better examine the complexity, distinct dynamics and politics of sustainability transitions in cities. As such the book engages with 'the here and now' of sustainability transitions, with cases distributed across

very different geographical settings, with a pocketful of cases presenting historical analyses. The variety of urban sustainability transitions, brought together in this volume, provides a rich empirical basis to study and compare commonalities and differences in dimensions and patterns of transitions that hopefully allow the reader to see beyond the idiosyncrasies of the individual cases.

The book showcases, particularly, research that emphasises the multi-scale dynamics of transitions beyond the multilevel frame of niches, regimes and landscapes. Hence, this book will contribute to the existing books in the series an explicit consideration of the scalar dimensions of sustainability transitions. This is akin to asking at what levels of social, economic and political exchange do sustainability transitions occur, including local to global interactions and interdependencies. In this way, the book also addresses the 'scale' and 'scaling' debate in sustainability transition studies building from contemporary cases.

Next to these, the book aims to create new conceptualisation(s) about urban sustainability transition processes building on evidence (empirical cases) from international cases on urban sustainability transitions beyond Europe. This book will extend the geographical scope of sustainability transitions by explicitly considering empirical evidence that goes beyond the areas that have traditionally received most of the attention in sustainability transitions debates (i.e., cities in North Western Europe). The book contains studies on sustainability transitions in mega-cities (e.g., Seoul, Shangai, New York, Adelaide), medium-sized metropolitan cities (e.g., Cape Town, Portland, Berlin, Copenhagen), and non-metropolitan cities (e.g., Freiburg). Opening up the geographical scope of the book provides an opportunity to reflect upon the comparability and transferability of theoretical/conceptual constructs and governance approaches of transitions theory across geographical contexts.

In the book, contributions bring different theoretical standpoints as analytical lenses to investigate transition dynamics: economic geography (Binz and Truffer), policy studies (Bettini et al.), governance theories (especially multilevel governance in Burch; Haase et al.; Pineda et al.), urban ecology (McPhearson and Wijsman; Kronenberg et al.) and sustainability science (Wiek et al.). Sometimes theoretical perspectives have been applied in conjunction with the usual suspects from transition research, including technological innovations systems (Binz and Truffer), the multilevel perspective (Caprotti and Hammer; Swilling et al.), transition management (Bettini et al.; Burch; Wiek et al.) and strategic niche management (Wolfram). This further justifies the need of theoretical plurality and integration for examining and consequently understanding contemporary urban sustainability transitions. The contributions that make up this book represent a large step forward in research for sustainability transitions in general and sustainability transitions in the urban context in particular. They advance new evidence on conceptual 'adaptations', 'alterations' and pointers on conceptual/theoretical extensions

needed for examining urban transition dynamics. Overall, the contributions in this book emphasise urban sustainability transitions as consisting of multiple sub-transitions, deployed in multiple transition-scapes in cities and urban areas. They describe the urban sustainability transition as a political process in the making, permeated by conflicts and contradictions as well as alignment and cooperation.

Explaining the Governance of Urban Sustainability Transitions

Governance is the key question at the centre of this book. The governance of transitions refers to the multifaceted processes whereby persistent societal challenges are recognized, the potential for desirable transitions identified, and the dynamics that might guide and accelerate such a transition are stimulated. Governance is an often ill-described term that may be adopted with either an analytic or normative focus, often referring to multi-actor interaction processes. We did not prescribe a definition or approach to understanding the governance of sustainability transitions, but each contribution makes an effort to connect a case-specific understanding of urban transition dynamics with insights about how to bring about a sustainability transition in urban areas. For some authors such insights may have to do with specific processes of planning and managing the city. For others, however, governance processes are a means to overcome the challenges posed by a set of constraints.

Inspired by the contributions in this book and responding to the governance question, we hereby propose five governance insights that suggest what policy makers, civil society actors, and other practitioners need to consider for participating and being involved as active members, connectors, and change agents in urban sustainability transitions. Box 1.1 summarises the five governance implications that emerge from the comparative analysis of the cases presented in this book.

Indeed, more specific recommendations can be given in relation to each implication. Governance Implication #1 (Reflexively examine and invigorate stagnant transition dynamics and decelerated transition processes in spaces that persistent unsustainability prevails to exploit new types of lessons for reigniting transformations towards social, ecological and economic sustainabilities) directs attention to a need to reflect upon the social justice implications of sustainability initiatives and policies, as they can improve or worsen the vulnerabilities of social groups, such as energy poverty among young adults (Petrova). This governance implication is about opening up the problem frame to include considerations of external drivers, historicity and path dependencies in order to question the status quo. Depending on the standard of living within a city, sustainability transitions require different approaches: The core challenge of transitions in developing cities is how to create a *higher* standard of living – including new infrastructures, buildings, roads – that does not lock the city into resource dependency and negative climate impacts. On the contrary, the challenge for highly developed cities is how

Box 1.1 Governance implications from the combined analysis of the book chapters

Governance implication #1: Reflexively examine and invigorate stagnant transition dynamics and decelerated transition processes in spaces that persistent unsustainability prevails to exploit new types of lessons for reigniting transformations towards social, ecological and economic sustainabilities.

Governance implication #2: Provoke sustainability transitions' politics to instigate new relations, new understandings, new urban realities and ways of organising with and via urban transformative agency creation

Governance implication #3: Engage in politics and transformations of space for tipping urban transitions towards resilience, liveability and social, ecological and economic sustainabilities.

Governance implication #4: Nurture and foster experimental approaches from policy (top-down) and from communities (bottom-up) that connect processes of scaling with processes of local anchoring

Governance implication #5: The city is a droplet in a global pool of sustainability transition waves; meaning that cities can act as change agents and testing grounds that are shaped and shape global sustainability transitions and their dynamics.

to transform *existing* standards of living towards environmental sustainability without compromising the socioeconomic benefits that they provide (Peter et al.). These differences are not only manifest between different cities. Some examples in this book also emphasise how sustainability transitions unfold in the 'hotspots' within the city. These are places where transitions do not go 'according to a predetermined plan', but where understandings of sustainability conflict and are renegotiated. This conflict can disrupt existing plans and give a new direction to the urban sustainability transition (Rohracher and Späth).

In relation to the Governance Implication #2 (Provoke sustainability transitions' politics to instigate new relations, new understandings, new urban realities and ways of organising with and via urban transformative agency creation), the cases emphasise design policies and initiatives that can flexibly navigate the complexities of urban sustainability transitions. These complexities emerge as a multiplicity of actors with different visions advance transitions at different speeds in different parts of the city (Elle et al.). Rather than establishing add-on sustainability agendas, urban actors often find ways to creatively integrate sustainability agendas with other urban priorities such as climate change, livability and resilience. This can help to leverage synergies and show the multiple benefits that a sustainability agenda brings about connecting seemingly unrelated issues (Burch). Urban sustainability transitions follow processes that build and strengthen relationships between city administrators, civil society and business in times of tranquillity, to better withstand and recover from environmental crises, like droughts and flooding

(Bettini et al.; Wolfram). Measures such as attending conferences, workshops and events at the national and international level may be a practical way to learn from and connect with actors in other cities. These links can be mobilized to support, inform and resource urban sustainability transitions (Binz and Truffer). Equally, key to bring about an urban sustainability transition is to identify resourceful actors to be the intermediaries for anchoring new technological systems in cities is a key starting condition for urban transitions. Local networks of knowledge and expertise as well as political commitment play an important role (Binz and Truffer; Bettini; Burch; Wolfram). Governance Implication #2 is about acknowledging the inherent political nature of urban sustainability transitions and how they effect place and place identifies by actively (re)configuring new social relations.

In relation to the Governance Implication #3 (Engage in politics and transformations of space for tipping urban transitions towards resilience, liveability and social, ecological and economic sustainabilities) the cases emphasise the need to become aware and reflect upon power struggles and conflicts. These are inherent in urban sustainability transitions, as different actor groups struggle to define problems differently and promote their own solutions (Moss). Sustainability innovators often adopt an understanding of sustainability that takes account of the space-specific problems, histories and identities of a city. This helps to ground sustainability agendas and policies in the local realities of actors, as well as empowering them to creatively engage with these agendas. (Fratini and Jensen; Wolfram). For example, a key measure in urban areas is to creatively engage with vacant lots, such as brown fields, abandoned buildings and bare soil. These areas have found to be a source of biodiversity and ecosystem services in a city (McPhearson and Wijsman). Urbanisation is not always about growth. Cities that shrink in population and economic activity can employ, for example, the principles of land use perforation, that is, establishing loose patterns of build and open, green spaces in inner cities (Haase). Overall, transitions are not only processes of socio-technical change: changes are also socio-ecological because they bring about changes in the relationships between human and ecological systems in a city. Therefore, sustainability transitions require different planning considerations, such as a greater protection of green areas towards urban sprawl, consideration of a diversity of ecosystems other than forests and parks, or the importance to conduct modern ecosystem assessments to better understand the ecological diversity in the city (Kronenberg, Krauze and Wagner). Governance Implication #3 is about facilitating and engaging in and across new arenas for urban transitions in the making of politics and movements for livability, inclusion and resilience in cities.

In relation to Governance Implication #4 (Nurture and foster experimental approaches from policy (top-down) and from communities (bottom-up) that connect processes of scaling with processes of local anchoring), a key objective is to create spaces for initiatives to experiment with sustainability solutions, as this can help to raise awareness, demonstrate the feasibility

and attractiveness of specific solutions as well as changing existing policies, cultures and discourses (Späth and Ornetzeder). Urban sustainability transition labs can be spaces for experiments to develop, test and implement sustainability interventions in cities or neighbourhoods. However, several factors need to be taken into account to successfully realise these labs, such as partnerships, capacity building, as well as monitoring and evaluation (Wiek et al.). Bottom-up and top-down transition processes require leadership by cities and local initiatives, shared visions of change, targeted empowerment, as well as governance intermediaries that create trust and translate perspectives between actors (Wolfram). Stemming from these, governance implication #4 is about creating physical, institutional and financial spaces for radical alternatives and experiments, resonating from the sustainability deficit.

Finally, Governance Implication #5 (The city is a droplet in a global pool of sustainability transition waves; meaning that cities can act as change agents and testing grounds that are shaped and shape global sustainability transitions and their dynamics) points towards the key role that urban sustainability transitions can play in global sustainability transitions, particularly when they are constituted as 'agents of change'. Messages and solutions proven in cities can be transferred and picked up globally (Fuenfschilling). For urban areas to lead action, however, there needs to be consideration of the actual capacity for intervention and the availability of resources. The emphasis on international organisations on national-led interventions as well as the difficulties to finance action in cities may limit the possibilities for local governments and other urban actors to lead transitions sustainability. Thus, it is important to also examine and track the impact imprint across spatial scales on the ways sustainability transitions shape and are shaped by ecological, geophysical, economic, political and cultural dynamics in the region and nation scales that they are embedded in (Caprotti and Harmer). Governance Implication #5 is about fostering and facilitating connections translocally: across urban places, communities and networks to mobilise and accelerate urban sustainability transitions.

Book Architecture and Chapter Contributions

The book contributes to transition studies by proposing a focus on urban context to empirically and theoretically understand sustainability transitions. Based on three distinguishing characteristics of the urban context as grounds to understand and explore (contemporary) sustainability transitions, we have structured the book as follows:

- Part I includes chapters that centre on characteristics that make urban sustainability transitions distinct from domain-based transitions.
- Part II includes chapters that centre on experimentation and its role in urban sustainability transitions.
- Part III includes chapters that centre on the politics of urban space, conflict and urban sustainability transitions.

Each part of the book includes an interlude chapter that summarises and distils lessons and governance implications from the collected chapters. Interlude chapters (Fuenfschilling, Miller and Levanda, Avelino and Wittmayer) are our 'lighthouse' chapters that take a reflective and meta-analytical perspective to address the objectives of the book and synthesise new messages and exiting findings.

Part I – Characteristics and Distinctiveness of Urban Transitions

The first collection of contributions helps explaining how urban sustainability transitions are distinct from domain-based sustainability transitions. The way actors, ideas, solutions and policy processes shape the conditions for comprehensive, domain-transcending sustainability transitions in cities are captured through the critical examination of the dynamic interconnections between those. At the same time, transitions in the urban context are products of interrelated change processes of different pace and magnitude. Cities experience fast pacing transitions in different systems of provision and stagnant processes in other ones, with governance processes bringing together otherwise unconnected actors. As Fuenfschilling (interlude chapter in this volume) argues "the particularities of urban spaces simultaneously provide opportunities and challenges for sustainability transitions".

Urban transition processes are driven by actors who are resourceful to propose and instigate local policy change and who are creative in localising ideas, institutions and solutions while enabling transformative capacities across connected networks. When examining closely the ways different actors establish conditions and enable agency creation for urban sustainability transitions, empirical results do not show a harmonious co-evolution towards 'a' common goal. Rather sustainability transitions entail processes of societal change away from perceived unsustainability. They are about contested visions, contradictions and ideas that require deliberation, a social arena for negotiating and reinvigorating all the dimensions of sustainability: social, ecological and economic. In this context, transition frameworks that centre around involving, empowering and mobilising agents of change such as transition management and strategic niche management are chosen and applied jointly with other theoretical perspectives. This theoretically promiscuous approach unravels the confluence between agency dynamics and transition processes in the making.

Binz and Truffer's case study of Chinese cities – Beijing, Shanghai and Xi'an – shows how urban actors mediate local and global resource flows by establishing urban niches. Specifically, they argue that local actors operate as intermediaries that couple local innovation processes and resource flows across scales coordinating the creation and survival of niches. They identify local actors that anchor processes in which external knowledge and practices are geographically embedded into local innovation systems and their institutions.

Bettini et al. take a closer look on how policy actors respond to change pressures and instigate transitions in urban infrastructure systems. They

interlink the four dimensional framework of policy actions from transition management with policy studies to examine the way that how networking as an action diversifies interventions for enabling urban sustainability transformations. Looking at the transformational effects of creeping and sudden crises in Queensland, they cast an eye on the ways governance actions shift focus: from police to collaborative approaches, from short term to a mixed 'short-medium term' approaches in managing the urban water infrastructure. What the chapter points at is that "transition arenas have an active role to play in advocating for attention to issues in the absence of a perceived crisis", For such participatory interventions, planners should not underestimate the critical importance of creating and fostering collaborative arrangements and networks that can set a change agenda to enact transformative capacities.

Burch presents the journey of different policy actions and inter-tangled governance processes with the local dynamics for the championing city of Vancouver. She employs transition management and multilevel governance perspectives. While pointing at the importance of task descriptions and capacities within the local policy administration as catalytic for conditioning sustainability transitions, Burch also addresses the value of engaging with the business sector and of generating synergies between different actors and different visions. The Vancouver case also shows that despite a legacy of a frontrunner city and a well-versed collaborative approach with communities and businesses, there is a "growing inertia behind a political calculus that favours environmental risk-taking and leadership". To counterbalance this inertia, an urban narrative connects climate change agendas with sustainability visions.

McPhearson and Wijsman present an analysis that zooms out from actor-specific dynamics and looks instead to broader developments in the city, approaching urban sustainability transitions in the city of New York from a systems level. They employ urban ecology as their central theoretical perspective. From this perspective, they argue for knowledge of complex urban dynamics and interdependencies between technologies, infrastructures, urban ecosystem elements and social interests and actors. The case expores changing vacant lots in New York from areas that attract negative services (e.g., crime) to urban renewal spaces. The chapter shows that "a combined approach of urban ecology and sustainability transitions can provide insights into the functionalist components of the city (…) while addressing the social and political construction and meaning" of these relations and infrastructures.

Fratini and Jensen point to the insights that can be gained by focusing on the urban context for understanding conflicts in urban sustainability transitions. They focus on regime destabilisation in the urban water domain in Copenhagen. The chapter reveals the different framings and meanings that water as an urban element receives from different interest-scapes: from a place-making versus a sectorial approach. Instead of addressing this fluid understanding of urban elements as problematic, Fratini and Jensen note that ambivalence can result and stimulate transformations by simply allowing for conflict and redefinition of meanings that can in turn foster transformations.

Wolfram addresses the civil society constellations and their role in urban sustainability transitions by casting an eye on grassroots innovations in Seoul. In this chapter the focus is on unpacking what enables grassroots in cities looking at different governance conditions such as empowerment, involvement in urban governance and in experimentation, reconfiguration of social relations and reconfiguring the meanings of urban places. Articulation of visions and shared expectations, diversity of innovation and innovative practices by grassroots as well as social learning are among the intangible benefits and conditions for enabling grassroots' operations. The case of Seoul reveals that intermediaries at different levels and of different leadership (civil society–led and public sector–led as well as hybrid forms of those) play a crucial role in maintaining the transformative capacity and impact that urban grassroots have. In the case of Seoul, over time "the intermediation capacity has been steadily expanded, diversified and brought into proximity".

Caprotti and Harmer posit a space and place discussion of the governance of sustainability transitions with focusing on examples of eco-cities in China. They state that ecocities are spatial interventions of socio-technological nature that influence and 'support' socioeconomic, and socio-environmental processes and patterns. In this way, they shed light on cross-scale dynamics and effects of sustainability transition experiments. The Tianjin eco-city as a transition experiment shows that the space dimension in sustainability transitions is not another heuristic lens but a production of interactions and interrelations between spatially explicit interventions and the geopolitical, economic and technological contexts that are embedded in. Caprotti and Hammer propose approaches that can address politics, power and complexity of governance for examining and understanding urban sustainability transitions beyond the site specific and technology-bound approaches that dominate the field.

Part II – Experimentation and Urban Sustainability Transitions

Experimentation has become a key form of governance in urban environments. Bulkeley et al. (2014) describe experimentation as an open-ended process whereby different actors try to gain legitimacy for their proposals for intervention in the context of achieving a sustainable society. In this view, experimentation entails the implementation of projects with unknown impacts in concrete space, with the aim to render complex environmental problems such as climate change compelling and calculable. This form of experimentation is a key means through which urban sustainability transitions are reimagined and advanced. Thus, the second part of the book focuses on experimentation as the central governance processes in urban sustainability transitions.

The chapters in this section are not necessarily fine-cut examples of experimentation. Rather, they present a rich picture of the context of experimentation and its relevance to understand urban transitions. The focus is on the match between cities and experiments, why cities appear today to open up arenas for

experimentation while simultaneously experiments drive urban opportunities for transitions. This section also reflects upon some of the limitations of experiment-thinking.

Overall, the chapters in the section offer a perspective on the extent to which different urban contexts open up or not the appropriate context of experimentation, and in those in which it happens, how experiments can lead to demonstrable sustainability improvements (such as in Malmo, Vienna and Freiburg). The question remains about the extent to which experimentation in specific settings can lead to broader reconfigurations beyond the specific locales in which experimentation occur. While local experiments appear to have greater demonstrable impact than donor-led programs, there are still challenges in demonstrating that local experiments can indeed have an impact beyond the specific context of operation. The examples show that processes of experimentation may lead to reconfigurations in adjacent or interrelated systems to those that experimentation focused upon such as in building codes (Vienna, Malmo), dissemination of institutional learning (Freiburg), transformation of relationships between the government and business (Malmo). In the case of Berlin, the city stayed as a repository for technology rediscovery, when the landscape became appropriate.

In all these examples experimentation, in contrast to top-down programs, can only be understood as a multi-actor, somewhat chaotic process. This is elegantly captured by the interlude chapter's reflection by Avelino and Wittmayer. They present a multilevel analysis of governance processes, which reflects upon the complex interactions between actors and the extent to which they can lead to transitions. They find that the government plays a key role either as a leading actor or as an obstruction for sustainability transitions. Their interlude delineates transitions as a profoundly political process, which is the key perspective developed in the following section.

Moss's historical analysis of waste-to-energy innovation in Berlin demonstrates the importance of temporal dimensions of technological experimentation. He shows that waste-to-energy technologies had already flourished in the 1930s Berlin, with both the technological and institutional means to enable its integration in urban infrastructure systems. It was an aversion to all things that resembled the Nazi regime that led to the condemnation of waste-to-energy technologies and their posterior rediscovery in the new millennium. Waste-to-energy technologies fitted Nazi narratives of modernity so well that they were rejected in the post-WWII period. The technology has been rediscovered due to external pressures, including national regulations, global environmental discourses and changing business landscapes. This example constitutes a challenge to linear narratives of socio-technical development emphasising instead the chaotic, temporally contingent and accidental nature of socio-technical innovation – a key perspective to understand the dynamics experimentation.

Maassen's account of climate aid in Eastern Europe, the Russian Federation and Central Asia provides an insight into how global policy may influence

sustainable urbanisation at a regional level. Her regional account adopts a bird's-eye view on sustainable development in which the urban perspective seems to vanish. Maassen describes a process whereby climate aid comes to replace an ongoing investment shortfall. This climate aid supports actions which seem to advance the visions and strategies of donors, rather than of a collective assemblage of actors with a number of actions directed towards addressing political economy factors through capacity building and policy advice. There is no apparent role of urban actors – especially grassroots organizations – and little attempt to materially transform urban infrastructure. Despite the substantial resource investment, this is not a fertile broth for innovation. This is a context in which experimentation is the only alternative for any hope of action.

Späth and Ortnetzeder focus on studying initiatives that aim deliberately to break the car regime in Vienna and Freiburg explaining that, while the actors involved in these initiatives did not necessarily used the words 'regime' and 'niche', they explicitly sought to disturb the dominance of car as the main means of transport in the city by seeking to promote alternatives, in pretty much the way that is described in many transition studies. These are very positive examples that show that initiatives in a given local setting can have a positive and lasting impact, in this case, reducing local residents' dependency on cars. The authors find surprising that these experiments, which achieved their objectives, have not been replicated elsewhere in the country, even though they have become well-known examples of how the dominance of the car regime can be challenged through interventions in urban planning and architecture. In Vienna the project required changing building regulations prescribing the construction of car parking spaces. In Freiburg, a vision of a 'city of short distances' was coupled with new public transport projects and institutional development. Both cases show that success is not akin to replication, and that regime inertias are persistent, although they may be challenged in alternative ways.

Petrova's engagement with the energy access problems of the precariat highlights the significance of deprivation and how it becomes visible in an urban context. Here inequality is a landscape factor that shapes the extent to which an urban transition is possible. The perspective developed by Petrova, well known to urban studies scholars, is less influential in transition studies in the sense that their relevance to niche innovation and socio-technical transition is not immediately apparent. The existence of an urban precariat is agglutinated under an umbrella of landscape factors. Yet, this may be key. First, the precariat relates to a context of urban improvisation in which urban services are accessed in an uncommon manner. This requires a sort of everyday experimentation to make ends meet that may generate viable innovations. The issue is that while we understand the presence of this factor we do not really understand how innovations may emerge, mostly because, as Petrova illustrates, the presence of a precariat is largely ignored. Second, the lack of policy focus in relation to the complexity of energy access constitutes an area for potential innovation. There are possibilities for a rapid change

in the policy landscape which may constitute an opportunity for sustainable innovation by coupling socio-technical innovations which address energy poverty simultaneously with emissions and pollution reduction.

Wiek et al. take a critical and analytical turn on urban experiments or as they define them 'urban sustainability transition labs' (USTL). They start with a working hypothesis that the general guidelines of experimentation need to be accounted for the different phases of the life-cycle of the experiment itself as well. In this way they bring forward the temporal dimension in experimentation that has been underexplored in current work of sustainability transitions. Their analysis framework provides a systematic lens to map the effort, guiding principles and impact of transition experiments. The case of Phoenix in the US shows how an urban sustainability transition experiment in a public urban space took place and unfolded, explicating the way interventions can bring up sustainability in practice. Despite the fact that experiments in the Phoenix lab were not completed, the case shows the effort and operational design needed to start a process of experimentation. Overall, this provides an insightful analysis of the 'soft part' of experimentation: setting up the process and create a new narrative explanation of the desired transformative intervention. With a very critical and reflective take on the case of Phoenix, the authors draw recommendations on how to proceed in setting up and researching urban experiments for sustainability transitions. From their overall recommendations we highlight here one: "Make sure not to get stuck in the early phases and move fast into the stage of strategically designed full transition experiments and scaling-up efforts (sustainability outcomes) – to demonstrate success and motivate collaborators and partners."

Haase et al. present a historical case on the confluence of social and ecological dynamics in the city of Leipzig in Germany. They provide an account of paradigms' changing over time that shape and have been shaped by social, political and ecological events (triggers of development). A strong conceptual contribution of the chapter is the issue of persistency as a dimension of urban sustainability transitions, as a combination of process and systemic dimensions. The case analysis shows that policy shifts and paradigm changes operate and are realised across spatio-temporal scales. The message from examining persistence as a dimension of urban sustainability transitions is that it provides a more pragmatic view of the challenges that need to be faced and navigated for governing urban sustainability transitions as long-term complex processes.

Part III – Politics of Urban Space and of Urban Sustainability Transitions

In this book we characterise urban sustainability transition as inherently political, moved forward by processes of (dis)agreement, contestation, competition, negotiation, compromise and conflict. As deliberate attempts to bring about a change, actions directed towards catalysing a transition confront

first the generation of sustainability visions of the urban future that can help aligning the actors' objectives and resources which may initiate action; and to bridge the expectations created in such visions with the possibilities to act at the local level. Urban sustainability transitions are not smooth processes in which all actors find a common project and advance collectively through a well-marked, manageable path. Rather, transitions are unpredictable and unruly processes that different actors can influence in different ways. The opportunities opened in urban areas, to deliver services to newly constructed areas, to create spaces of intervention through planning and management and to give access to resources to multiple action may be central to energize the transition process.

Rohracher and Späth present two cases of urban transitions in Graz in Austria and in Freiburg in Germany that "create new zones of friction, pitch different actor worlds against each other and reframe visions of more sustainable cities". From both cases, it becomes evident that urban sustainability transitions unfold in a diverse way over different time-phases and involve multiple actors that create new meanings to spatial configuration and ideas of sustainability. The spatial projects create 'hotspots' where contestation and conflicts surface and "unexpected connections between initially separate issues are established". Amongst the theoretical contributions and highlights of this chapter, it is the conceptual proposition that for understanding the dynamics and politics of urban sustainability transitions, one has to move away from examining and explaining transitions as mere niche-regime interactions.

Pineda et al. examine the way two transition projects in Copenhagen play out with the politics of space in the city. The two lighthouse projects, the Carlsberg city district that is a redevelopment project and the Cycle Superhighway that is a low-carbon path-reinforcing project, both impact the city's spatial and social fabrics. In the Carlsberg spatial project, the actors involved in developing and shaping the way the project was envisioned and implemented created a new situation for the redeveloped area, even though in a more conforming way that enhanced unsustainable practices rather than disrupting them towards more sustainable ones. The Cycle Superhighway project case illustrates how actors, their perceptions and interests intermingle in transitions-in-the-making. As multi-actor processes where no single actor can navigate or mediate alone, urban sustainability transitions are ever evolving and changing processes.

Swilling et al. present an account of the current drivers of urban transitions in African cities, elaborating on systemic drivers as well as process conditions including the introduction of new narratives for urbanisation in African cities. The authors present a very good elaboration of the binding barriers of transitions and show the diversity of persistence that it is often missed in transition studies. They propose a proto-framework on connecting the transition thinking via the multilevel perspective with metabolic flows' model to explain urban sustainability transitions in African cities.

Kronenberg et al. present the social-ecological transitions of the city of Lodz, in Poland. The chapter presents how planning practices, policies and

paradigms evolved over time and how they are imprinted in the urban spatial development of the city. Over the years, authors show how environmental modernization steered up more integrative and systemic thinking about sustainability of the city of Lodz. Prompted by researchers and NGOs, the authorities gave the environment the place that it had been missing in the documents prepared thus far. Kronenberg et al. show that this strategy opens the opportunity for Lodz to enter a delayed sustainability transition, and discuss the related drivers and challenges.

Cities as Transitionscapes: The New Pathway for Sustainability Transitions Studies

With this book we want to propose five avenues that we found relevant for future research to examine and understand sustainability transitions in cities. We hope that our reflections from the contributions of the authors in the book chapters will create a new terrain for expanding and enriching the research of urban sustainability transitions.

First, we propose that epistemological pluralism beyond the usual suspects in transition theory will benefit and enrich the academic dialogue about urban sustainability transitions. The book sets the scene for fruitful and constructive ways to engage with different theoretical frameworks to examine and understand dynamics of urban phenomena of transformations in cities. We found this epistemological plurality refreshing and opening up new debates about the multiple dimensions of urban transitions including the positioning of intermediaries, the way innovation influences ongoing transitions, the mapping of multiple actors for the transition and the way visions and conflicts confluence in the cities. We hope that in the future not only social sciences and engineering engage with the 'urban' in sustainability transitions but also that humanities and cultural studies can further the mosaic of explanations of the urban Anthropocene and its transitions (Catterall, 2014).

Second, we suggest that examining the politics of urban sustainability transitions will provide a fuller explanation of the ways solutions in cities are debated, adapted and hybridised. In this way, the meaning behind 'contested' concepts or solutions will become more evident and transparent, allowing for conflicts and contradictions to surface and provide meaning to urban choices (Fisher et al., 2012; Fratini and Jensen, this volume; Miller and Levanda, this volume) and transformations in urban social, ecological and economic fabrics. It will allow for a more in-depth examination of which solutions and which issues are contested and as such require more thorough exploration and research, steering away from universal assumptions on urban issues that may misdirect research efforts.

Third, we recommend shedding away mono-case explanations for urban sustainability transitions. As some of the contributions of the book already show, research and practice will benefit from multiple case or cross-case comparative examinations of similar phenomena also allowing (comparative or

synthesis) research to unpack context. Methodological pluralism in the case study research can also enrich the explanations, and deepen our understanding of the impact contextual conditions play in the way sustainability transitions occur and unfold. Another way that is not explored in the present book, but it is at heart of sustainability transitions' studies is knowledge coproduction between practitioners and scientists for understanding complex phenomena and employing knowledge for transformative solutions and action. We hope that in the future we will also see transdisciplinary explanations of urban sustainability transitions that co-create new knowledge to demystify context and its influence in how transitions roll out (Han et al., 2012).

Fourth, we found it refreshing to understand change from an agency perspective, rather than a system perspective only. This provides a richer explanation on the role of visions, narratives, incentives and interests in transformative changes that relate to contemporary phenomena. Agency also brings historicity in a different way into the way transitions are formed and accelerated or stalled: history of interests, visions and incentives are embedded in the current actions and motives of agency as well as in the way agency's relations to events and structures are formed and reformed. It also allows for differentiation between providing explanations from a systems' perspective that is about the heuristic framework chosen to frame the explanations and in a systematic way that refers to the methodological conciseness of the research. An agency's perspective on urban sustainability transitions will allow us to also investigate how transformative solutions play out with resolving complex sustainability problems and how with problem displacement (processes that shift the space-location of environmental problems and as such shift between vulnerable and benefiting actor groups and redistributing responsibilities, see Romero-Lankao, 2012), resulting in changes in the socio-political urban fabric.

Fifth, we found that it is both relevant and challenging to look at cases from non-European contexts such as African cities (Simon and Leck, 2015; Swilling et al., this volume). With many European cities exemplifying stories of transitions that can be inspirational to other cities and their practitioners, there is a plethora of cities that face barriers to transitions and stalemates difficult to overcome. In these challenging contexts, it is where the knowledge of governance of and for sustainability transitions will make more benefit for global socio-ecological and socio-technical transformations.

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INTERLUDE: A Multi-Actor Perspective on Urban Sustainability Transitions

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