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Between Monitoring and Modeling

Spatial Hierarchy and Context of Land Rights

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Published in:
Integrating Generations

Publication date:
2008

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Haldrup, K. (2008). Between Monitoring and Modeling: Spatial Hierarchy and Context of Land Rights. In *Integrating Generations: Improving Slum Conditions through Innovative Financing* International Federation of Surveyors.

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Between Monitoring and Modeling Spatial Hierarchy and Context of Land Rights

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Key words: Land tenure reform, concepts of secure tenure, gradual upgrading, land information, neighborhoods, enumeration areas.

SUMMARY

The paper analyses spatial dimensions of land tenure security in situations, where land tenure is predominantly informal, as is the case in major parts of the world. It takes its point of departure in a dilemma constituted by:

- on one side, the complexity of land tenure issues, and
- on the other side, the simplicity of practices of registration and scarcity of data on land tenure in many parts of the world.

The concepts of land tenure security are spatially analysed in view of the need for filling the land information gap between monitoring data at national level and specific land data, prior to availability of cadastral or other property data.

The land tenure situation outside the formal systems escapes quantification through data sources currently available at land institutions in many countries.

In accordance with the current understanding of lands rights as complex social, legal and institutional constructs this paper analyses the implications of the conceptual understanding of land rights for clarification of land rights. It is proposed that each of the social, legal and institutional aspects of land tenure is to be understood in an associated spatial context.

The paper introduces the concept of a spatial hierarchy of land tenure security defined as

- Factors determining for tenure security at levels above the individual property level (e.g., planning, land authority), and their equivalent spatial-organisational level; and
- Spatial clusters of attributes of tenure security, which happen to be similar or common for neighbouring properties of the cluster, pertaining to spatial units above the level of individual holdings (e.g., type and date of settlement).

Based on an analysis of the hierarchical nature of land rights, this paper suggests a strategy of strengthening land rights through introduction of an intermediate step of land tenure clarification at the spatial resolution of the neighbourhood level, before formalisation of specific rights. The strategy offers a potential way to more appropriate and affordable tenure upgrading, while at the same time working with a spatial frame, which may serve as a valuable contribution to the future land information system.

Between Monitoring and Modeling Spatial Hierarchy and Context of Land Rights

Karin HALDRUP, Denmark

1. COMPLEXITY OF LAND TENURE VS. SPECIFICITY OF LAND RIGHTS

The present paper analyses spatial dimensions of land tenure security in situations, where land tenure is predominantly informal, as is the case in major parts of the world. It takes its point of departure in a dilemma constituted by:

- on one side, recognizing the complexity of land tenure issues, and
- on the other side, the simplicity of practices and scarcity of availability of data on land in many parts of the world.

The land tenure situation of all those areas outside the formal system escapes quantification through data sources currently available at land institutions. The lack of information on the status of land tenure and land administration is currently being addressed at a high level internationally through development of appropriate national monitoring systems for capturing of the status of land administration and property rights. Standards are being developed by professional networks, the World Bank, UN-Organisations, and donors as described by e.g., Worldbank (2007), and USAID (2007). These monitoring data specifications are non-spatial.

At the other range of the scale much effort is devoted to developing appropriate multipurpose cadastral data models, designed to include multiple types of property data, including various forms of common property, see the FIG Core Cadastral Domain Model (CCDM), Lemmen and Oosterom, 2006. The FIG CCDM is conceptually based on the vision of FIG Cadastre 2014 (Kaufmann and Steudler, 1998) through a comprehensive study of cadastral reform in developed countries. Whereas the FIG CCDM is open for integration of data on complex tenure situations as found in situations of e.g., group tenure, the CCDM is inherently connected to situations of specificity of land rights and formalized land registration.

The magnitude of areas held informally in a development context makes the establishment of land information systems built on cadastral data a long term goal pending the establishment of appropriate institutional capacity.

Thus the paper analyses spatial concepts of land tenure security in the transition before full implementation of cadastres, but at a more detailed level than targeted by monitoring systems at national level.

Informal rights are highly dependent on context through their reliance on social recognition and circumstance. The spatial nature of contextual aspects of land rights tend to be similar for groups of properties, such as e.g. a neighbourhood. It is discussed what are the spatial equivalent of contextual aspects of land tenure security, arising from interconnected, interdependent or common conditions. Common features of land tenure security are related

partly to the regulatory framework - whether community based or based on public land administration – and partly to the clustering of phenomenon.

2. TERRITORIAL PARTITIONING AND SPATIAL RESOLUTION OF LAND RIGHTS

2.1 Definition of Land Rights

The territorial nature of land rights is *implicit* in key definitions of property rights and secure tenure:

“**Property rights** are social conventions backed up by the power of the state or the community (at various levels) that allow individuals or groups to lay “a claim to a benefit or income stream that the state will agree to protect through the assignment of duty to others who may covet, or somehow interfere with, the benefit stream” (Deininger, 2003, citing Sjaastad and Bromley, 2000).

The objects of land tenure security are also implicit in the EU-Land Policy Guidelines (2004, p. 15):

“**Rights are secure** if they are not contested without reason and if, in case of contestation, they are confirmed by the legal or arbitration authorities (whether these be customary, government or both). Securing rights is above all a question of institutions and enforcement, rather than a function of the nature of the rights themselves”.

It can be seen that land rights are widely perceived as complex social, legal and institutional constructs, but the deeper implications of the spatial nature of such complex rights have not yet been fully explored or exploited. Moreover, it follows from the definitions that property rights are insufficiently described by parcel based data, even in cases of individualised land tenure.

It is suggested that each of the social, legal and institutional aspects of land rights can be perceived at corresponding levels of a spatial hierarchy. As an example, a classification of land between that held in private, communal and public domain defines rights at a high level in a spatial hierarchy. Land rights within each of these territories will be determined in some respects by the type of domain.

A more abstract example of a spatial hierarchy is the concept of ‘proximity’, e.g., to urban centres, which affect land tenure security in peri-urban areas, so that specific rights are exposed to threats or development opportunities related to geographical factors at a higher level of abstraction. Factors correlating with land tenure security, such as e.g. the physical consolidation of settlements, may also be a common feature of neighbourhood areas.

Unfortunately, a focus on boundaries and surveying is often diverting attention from the more sophisticated geographical nature of land rights. It is discussed below whether and how clarification of the spatial hierarchy of complex land rights in accordance with its complex nature may help unlock the challenge of clarification of land rights at a larger scale, so that

the spatial dimension of land rights can become a lever for reform, rather than remaining a technical and economical burden.

2.2 Definition of Spatial Hierarchy

The concept of spatial hierarchy is introduced here in order to achieve a better consistency between the spatial understanding of land tenure and the concepts of property rights and secure tenure. It is suggested that, clarification of a spatial hierarchy of tenure issues can help making land tenure upgrading more efficient. Common features of land rights must be captured at their respective higher level of the spatial hierarchy of land tenure.

As a result it is proposed to introduce a spatial hierarchy of tenure security factors defined as:

1. Factors determining tenure security at levels above the individual property level (e.g., planning, land authority), and their equivalent spatial-organisational level; and
2. Spatial clusters of attributes of tenure security, which happen to be similar or common for neighbouring properties of the cluster, pertaining to spatial units above the level of individual holdings.

The higher levels of the spatial hierarchy of land rights may relate to given jurisdictions of land authorities, in which case they can be associated with administrative divisions. In other cases, features of land tenure security can be described as thematic layers in geographical space, which happen to impact on tenure security within their range. At local level settlements of similar properties form a sort of spatial cluster at a resolution above the individual properties.

Tabel 1 Examples of Land Tenure Factors in Spatial Hierarchy above the Property Level	
1. Normative-Regulative Factors in Space	2. Spatial Clustering and distribution
Normative: - Domain - Jurisdiction - Community/Social grouping	Geographical factors: - Environment, degradation - Resources, land use - Proximity, infrastructure
Regulative: - Planning - Restrictions - Services - Administration and management	Socio-economic factors in space: - Tenure history and typology - Land distribution - Demographics and social order - Urban segregation and market value

In the following will be elaborated some examples illustrating the potential role of working with clarification of land tenure security in the light of a spatial hierarchy, ref to Tabel 1.

2.2 Land Tenure System and Land Distribution

Land rights cannot be discussed without reference to the land tenure system, which according to (Roth and Haase, 1998) is defined by its two overarching dimensions:

- property rights definition and
- property rights distribution.

Other authors have described the relation between land tenure system and land administration (Steudler, et.al, 2004, and UN-ECE-WPLA, 2005), a topic not elaborated here.

Land (rights) distribution pertains to a higher level of spatial hierarchy than individual rights, since land distribution is an aggregated representation of the land rights classified by selected criteria of holders of land, or of holdings such as:

- specific patterns of individual holdings, which reveal e.g., the degree of fragmentation,
- distribution of ownership types and land concentration,
- distribution of type of holdings, land use, etc.

All factors of land distribution may be represented at various generalisation levels from thematic maps to statistics, and at each (spatial) level of abstraction the information may have a different meaning, depending on which information is emphasised and which is suppressed.

Information on land rights distribution is often lacking, even at a generalised level. Implementation of tenure reforms may not intend to have any redistribution effects, but due to the complex nature of land tenure, even upgrading of tenure security may over time, although not an objective of the tenure reform per se, have an impact on land distribution over time, not the least in cases of vulnerable, informal rights. Land distribution will therefore remain of interest regardless of the status of land tenure regime.

If patterns of land distribution are mapped through aggregation of detailed data, it will have to await completion of these. However, it is possible to map physical land distribution patterns at an early stage by simple, but efficient and low cost delineation of patterns visible in general image-maps combined with auxiliary information (dasymetric mapping).

2.3 Land Rights defined by Context

An understanding of land tenure as complex and contextual formed by social conventions, implies an obligation to establish context as a mandatory component of clarification of land rights, as suggested by Sjaastad and Bromley: “It is important to understand that locally evolved property institutions contain complex rules whose purpose is to meet specific social and environmental objectives.” (Sjaastad and Bromley, 2000).

Context will often be used in the meaning of ‘local context’. Local context will refer to a smaller or larger area not necessarily represented by the administrative territorial subdivision. From a spatial perspective many factors of tenure security will typically depend on communities or neighbourhoods with a degree of similarity between individual holdings within those areas.

Often, settlements are established by groups of people based on their social organisation, and land possession is regulated by internal norms and rules, which therefore constitute a common context for land tenure within their area. Such clusters may be defined as villages, neighbourhoods, localities or sub-areas of localities, - here all denominated as sub-areas (of administrative territories).

The territorial character of context is reinforced by the phenomenon of urban segregation: In practice it has proven difficult to avoid a socio-economic clustering of people and housing in urban space, even in places with a well-functioning public planning system. The clustering phenomenon - however undesirable it may be - facilitates the profiling of land tenure situation by neighbourhoods or sub-areas.

2.4 Multiple Tenures

Not all types of land rights are spatially represented by vertical partitions in space as land plots. Difficulties of territorial delineation of specific rights arise where multiple tenure arrangements occur, i.e., a situation in which more than one individual possesses rights to particular resources within a given area of land. The question may even be whether delineation is desirable, or whether such rights can be represented at other geographical abstraction levels.

Multiple tenures may spatially be dispersed, discontinuous, seasonal, impermanent, etc., so that rights of this kind may fit poorly into any spatial hierarchy. What is certain, however, is that in practice individual properties tend to be defined as exclusive, so that multiple tenures are put at risk in classical approaches to titling and parcel-based registration. As a consequence, a representation of multiple tenures may be more appropriate at another spatial resolution. For these reasons using an intermediate spatial level of land rights may not even be an interim strategy, but a better approach to representing and safeguarding these rights.

The FIG Core Cadastral Domain Model is open for integration of data on territorial features described by flexible spatial and non-spatial representations, which fulfil these needs.

3. EXAMPLES OF COMMON ATTRIBUTES WITHIN NEIGHBOURHOODS

3.1 Affinity of Land Rights in Local Areas over Time

Clearly, the situation of individual property units (land, house and dwelling) and of the holders of rights are fundamental for the tenure regime, but many aspects of tenure security are common features of properties within certain areas, while at the same time being part of the definition of rights to individual properties. This is evident in areas with various forms of communal tenure, where rights and duties of holders are regulated by common rules. Hence the focus on clarification of rights at community level as recommended by several authors (e.g., Wily, 2006). Even in areas with individualized tenure forms will some conditions of land tenure be dependent on factors common to smaller or larger clusters of holdings. Other

common attributes of subareas, such as construction types, may be correlated with the land tenure status.

Informal rights are in nature forms of social rights, which are inherently interdependent. Moreover, any form of land right is dependent on its social context, as captured by the definition of land rights cited above as 'social conventions' (Deininger, Sjaastad and Bromley, EU). Fitzpatrick (2006) states that 'The enforcement of property rights depends on the nature and strength of social order.' That even well established rights are at risk, when social order brakes down, has been demonstrated in far too many cases of unrest and instability.

Demographic dynamics is one of the critical factors of land tenure security. As an example, an influx of immigrants shapes the conditions of tenure in the areas concerned. Imbalanced demographics in marginal areas (de-population and aging) or a high population pressure in urban areas influences demand and the land market. Land tenure security is at risk, where vulnerable groups are exposed to fierce market factors. The local socio-economic profiles are also indicators of the tenure situation. For these reasons, a population profile disaggregated by sub-area provides important contextual information on land tenure.

3.2 Specific Land Rights Shaped by the Past, the Present and the Future of The Local Area

The parameter of time is also needed for capturing the common denominators of land rights at a higher level of the spatial hierarchy. This is because the tenure history is determining for the recognition of claims to land, and tenure history tends to be similar within a neighbourhood. The de-facto status of land rights depend on de-facto recognition of rights by communities and authorities, which will mostly relate to a locality, rather than to individual holdings.

It is striking that in practice land rights in neighbourhoods tend to share fate in terms of recognition, and exposure to external threats and opportunities, which may interfere with or contribute to the benefit stream of their rights.

The past: A shared history of settlement shapes current land rights

The origin of land rights goes back to when and how land was first settled or acquired. Was the land area in principle under public domain, private, or community domain? Was it settled with passive accept, with permission, by invasion, by acquisition?

The history of the land determines the legitimacy of the land rights in general, and the level of conflict in an area is often linked to historical events. The settlement history may also be decisive for tenure security at a very specific level: Recognition of land rights within the settlement through adverse possession depends on length of occupation.

The present: De-facto recognition of informal land tenure is typically related to an area

Factors of importance for obtaining a degree of de-facto recognition of rights will typically be associated with the actual degree of consolidation and the physical nature of settlement. Questions of relevance for de-facto recognition include for example: Is the locality serviced

with urban utilities and infrastructure? What is the status of planning? What is the level of order or disorder in land governance related to the specific area? What is the perception of land rights and how are rights respected in the local area?

The future: Perceptions and expectations

Of importance for land tenure security are the expectations to the future development in the area. It is therefore important to define general parameters of expected threats and opportunities, e.g., associated with urban growth and economic development. Other aspects of land tenure security include risk factors, such as external threats affecting livelihoods and land tenure security, market factors, environmental hazards or degradation of the land.

Expectations to the future will in practice be reflected by the market value of the land in the neighbourhood, and increasing values of land may in turn impact on land rights in the area.

Key to land tenure security is the question of (expected) protection of rights against possible challenges. One such parameter is the protection against eviction - one of the basic rights underlined by the UN-HABITAT Secure-Tenure-for-All campaign. Usually, protection against eviction concerns an entire area and plots within, and is therefore a tenure security factor at a spatial level above the individual holding. It has been observed, that the larger the slum area, the less exposed to eviction it seems to be.

These examples demonstrate how common features of neighbourhoods determine the nature of specific land rights.

4. LAND RIGHTS DEFINED THROUGH DOMAIN AND JURISDICTIONS

4.1 Domain of Land

The above definition of land rights establishes the link between specific land rights and land institutions through the mechanism of enforcement and protection in case of contestation, since property rights need to be backed by the power of the state or the community, at various levels. As a consequence property rights will be defined by their dependency on institutions within various hierarchies of organisation and jurisdiction.

Naturally, at the top of the hierarchy are the national territory and institutions defining the normative framework of statutory law and institutions common of a nation, even if it sometimes in plural legal regimes is challenged by customary law and/or practices in certain areas. Uncertainty or insufficiency of the legal regime is a root cause of conflict and uncertainty.

Land tenure classified by domain (public, private, communal) belongs to the higher levels of the spatial hierarchy. Within each domain a further classification can be made according to prevailing principles. Public land in particular will need further differentiation into local government land, state land, and land under state enterprises or institutions, such as the military areas.

Despite the paramount importance of specifying the domain, the extent of e.g., state land vs. community land is often left uncertain with negative consequences for the definition of individual land rights within the concerned territories.

Of particular importance is the clarification of land tenure at community level, whether in the context of various forms of communal land (Wily, 2006) or indigenous land rights (Hvalkof, Plant, 2001). Land tenure regimes at community level are predominantly rural phenomena, whereas customary land tenure arrangements tend, for internal and external reasons, to be breaking down in peri-urban environments. Where the social organisation of communities and local power structures are undergoing change, the security of land rights will also be challenged.

4.2 Jurisdiction of Land Authority

Tenure security depends on the protection of rights, that the rights are defensible in case of contestation, and that they are confirmed by the legal or arbitration authorities, and backed by the power of the state or the community. Thus, security of rights is defined in relation to land authorities and their jurisdiction. In countries with well functioning land administration systems, this will not be a critical parameter, since services will cover all areas and all properties, and in cases of contestation, it can be presumed that all are equal before the law, and that there will be no discrepancy between law and practice.

Jurisdiction of the land authority becomes critical, where the land authority is ambiguous, weak, in-transparent or inaccessible for groups of people or areas. An overburdened court system or of other services will result in land tenure insecurity in the affected areas. Land tenure security will then become dependent on the policy, capacity and integrity of the land institutions in their jurisdictions.

4.3 Planning Authority over Administrative Territories

Land rights are ideally regulated by various types of planning and management of urban development, protection of the environmental, regulation of natural resources, etc. Planning authority and actual plans are related to administrative territories and specified areas within them. Clarification of land rights will to some degree depend on specific planning regulations. In cases of expropriation for public purposes, there is a direct connection between public planning authority and specific land rights and their need for protection.

Delineation of administrative units is sometimes rather vague, and the definition of the administrative territories and planning may be part of the problem of clarification of land tenure at a high level of the spatial and conceptual hierarchy. This is even more critical in the case of customary land tenure.

4.4 Materialisation of the Spatial Hierarchy of Domains and Institutions

So how can these spatial hierarchies be materialised? Ideally, each of the authorities would be defined by their institutional area of jurisdiction and the territory it extends over. However, in practice the most challenging task of tenure clarification will often be the determination of the upper strata of the land tenure hierarchy: the extent of the domains of the state, communities, etc. The ideal proposition would be a settlement of these territories in a systematic legal process prior to engaging in tenure clarification at the lower conceptual levels of the spatial hierarchy.

For professionals it seems meaningless to work with clarification of individual rights, if the whole system determining the conditions of tenure remains undefined. However, where weak governance has eroded the overall regime of domains and institutional authority, the local communities are often left to fend for themselves area by area. Then a classification area by area may work in a positive direction both upwards in the spatial hierarchy, and as a framework for definition of specific rights within each sub-area.

5. DEFINITION OF SUB-AREAS AS A SPATIAL FRAME FOR TENURE CLARIFICATION

5.1 A Spatial Frame of Sub-areas

As a result of an understanding of the spatial hierarchy of tenure aspects, it is proposed to divide administrative territorial units into sub-areas according to their tenure situation, social organisation, and the clustering of similar tenure attributes. A true efficiency in the clarification of the tenure situation would call for a spatial grouping of holdings with most possible common attributes, i.e., delineation of territories into contingent sub-areas with due consideration of the tenure typology.

The better sub-areas are defined in accordance with social structures, the better they may serve a variety of purposes. On the other hand the size of units should be both operational and relatively uniform. The option of using census enumeration areas as the spatial frame could offer significant advantages in getting access to disaggregated statistics on population and housing.

It is not envisioned here that the sub-areas in general would serve as objects in definition of specific rights, but the sub-area division could lead to identification of blocks suited for use in future tenure regularization, as described by Augustinus and Benschop (2007):

“Among the most useful approaches for the regularization of informal settlements are blocks, super blocks containing blocks and special zones, linked to a form of group rights, leases and local land record systems, structured around the blocks.”

The strategy of initially working with block units for land registration was recommended earlier by Larsson (1991).

5.2 Sub-Area Attributes and Classification with Tenure Typology

A classification system has to be developed for each territory to reflect the type of the land tenure, planning, and socio-economic status by sub-area. Of particular importance is the establishment of tenure typology within each area. Payne (2000) has suggested methods of defining tenure typology in cases of slum areas, which can be expanded to other tenure forms.

Selected attributes are to be assigned to each of the sub-areas according to relevance. Specific data on land tenure status can be combined with other contextual data according to their present or expected availability. Examples of relevant attributes are land use, planning status, population statistics, type of settlement and housing, etc.

One attribute of importance for later adjudication of rights is the duration of occupancy of the area, or time of initial settlement (in urban areas), because this is one of the key parameters in securing tenure of informal settlements, as well as in cases of adverse possession. Many countries have defined legal criteria for recognition of occupancy rights (or title) with a proven number of years of occupancy in good faith combined with community recognition, (see World Bank, Burns et. al., 2007). Burns has found that in Indonesia the criterion for recognition is a minimum period of 20 years of peaceful occupation for recognition, in Thailand a minimum of 10 years, while some informal settlements in South Africa have been upgraded based on occupancy of a minimum of 5 years.

Having attributed the tenure situation of sub-areas the classification can be used for defining strategic priorities and geographic phasing of intervention. E.g., frontiers of urban development, “vacant land”, vulnerable areas, areas with health hazards, etc. can be located systematically for setting priorities. Of particular importance is the identification of common areas, community land, and common space, which are of paramount importance for the poor, in particular for women.

5.3 Operational Aspects of Sub-area Definition

Considering that the cost of any operation is proportional to the number of units and level of detail of the specifications, it is suggested that the introduction of an intermediate level of spatial resolution of land tenure offers a cost-efficient strategy to the first stage of land tenure clarification. In particular, efficiency can be achieved, if the spatial frame of censuses and statistics (enumeration areas) is used also for this purpose.

Untangling the status at the neighbourhood level at first is the key to an efficient, incremental upgrading of the tenure status of specific properties within the area, whenever the land authorities have capacity to do so. It may even be premature to go into land registration without prior clarification of land tenure status by area.

Many applications of land information for planning and land management need information aggregated or disaggregated to the level of sub-area units. This sub-area resolution is not only

suited as an intermediate solution, but a requirement for many future applications of information. Furthermore, it may be inefficient to collect data at the highest level of resolution for later aggregation: A reverse strategy is called for in data poor environments.

6. ENVISIONED ROLES OF SUB-AREAS IN GRADUAL TENURE UPGRADING

6.1 Use of Sub-areas

To render sub-divisions of administrative territories into sub-areas be operational, they need be applicable for multiple purposes, and the geographical frame should facilitate data collection and maintenance. The geographical frame of sub-areas is suggested to serve at least the following purposes:

- *Diagnosis of land tenure situation*
- *Monitoring of land tenure security*
- *A preliminary step of clarification of rights prior to adjudication of specific rights.*

Diagnosis of the tenure situation will help in defining priorities, and tailor and target intervention according to needs. With an overview of the typology of tenure, it will be possible to determine different areas' readiness for formalisation.

Monitoring can occur concurrently at different levels of spatial resolution. The spatial hierarchy is useful in many cases, since some monitoring parameters lend themselves naturally to specific levels of monitoring. If no registration system exists in a large geographical area, monitoring of registration data at the individual property level is irrelevant. Therefore, efficiency in monitoring calls for clarification of the spatial hierarchical structure of the secure tenure parameters.

For specific monitoring of tenure security various forms of summary data and statistics will be required, preferably combined with data on geographical distributions. National statistics is generated at the level of enumeration areas, subdivisions of administrative territories. If the statistical spatial frame is reused for other purposes, socio-demographic and housing statistics may be readily integrated with other dis-aggregated data.

In land registration projects, field work is typically started by polygonisation of the area, i.e., subdividing the area into operational units. If data on sub-areas were defined at an earlier stage in the tenure regularisation process – and available for the parties executing land registration projects -, planning of land registration projects would be less risky, and the costs could therefore potentially be reduced.

An incremental strategy will allow for identification of multiple tenure and recognition of various forms of rights. On a longer term, sub-areas could potentially be further subdivided into blocks for a step-wise tenure regularization strategy, with recognition of blocks as objects of rights to occupancy within the blocks. One such model of flexible titling of specific blocks of urban holdings has been developed in Namibia (Christensen, 2004), where two new types

of tenure have been introduced: The Starter title, and the Land-hold title. These titles can later be upgraded to freehold title.

6.2 Land Information and Basic Land Management with Reference to Sub-areas

Subdividing the city areas into blocks and attaching some basic information to each block provides a significant improvement of the land information at a rather low cost. In a city with millions of inhabitants, such area-units could provide a practical level of detail for local governments to work with in planning and administration. When blocks are uniquely identified with a name and a code, they can be used as a geographical reference system.

The concept of sub-areas fit neatly into the requirements of micro-areas to serve as a basis for planning and valuation in future Land Information Systems.

6.3 Data Capture and Sustainability

It is recommended that the subdivision of enumeration areas for statistical purposes be investigated for use in sub-area definition. If the statistical enumeration areas form meaningful subdivisions, a co-occurrence between land-tenure sub-areas and enumeration areas would create compatibility between field activities and statistics at micro-level. Alternatively, relations between the two systems of sub-areas may need to be defined, so as to benefit from statistical micro-data.

It can be seen that if land tenure information is captured at appropriate spatial levels, the need is reduced for aggregation and dis-aggregation of data for planning and administrative purposes.

7. CONCLUSIONS

The paper has shown the significance of getting to grips with the spatial hierarchy of land tenure complexity and tenure context. Many attributes and framework conditions of land tenure security are common for clusters of properties, and features of land tenure can be delineated by sub-areas by use of low cost methods.

It is proposed to start any land tenure upgrading process by establishing a geographic frame of subareas, capturing contextual and common attributes of rights and profiling the tenure situation by sub-area prior to formalisation of rights. The territorial frame can be defined as a subdivision of administrative districts into sub-areas of manageable size, delineated in due consideration of terrain features, type of settlement and the statistical enumeration areas. When having profiled the tenure situation by sub-area, the ground is laid for better informed decisions on tenure upgrading, when resources permit.

A change of spatial resolution in diagnosing the tenure situation is an operational and affordable approach to gradual upgrading of land tenure, and the resulting spatial frame may even serve as a valuable contribution to future land information.

It is suggested to reduce uncertainty levels of land tenure iteratively through use of the spatial hierarchy of land tenure parameters. Elimination of uncertainty in an incremental manner is a key element of institutional change and economic development (North, 1990, 2005).

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BIOGRAPHICAL NOTES

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