

Low-Cost Land Information System for Sustainable Urban Development: Case Examples in Kenya and Zambia

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SUMMARY

Sustainable urban development strongly depends on how well land is accessed, managed, used and transferred for the benefit of the current and projected urban population. Ensuring sustainable urban development requires proper land information. If relevant and good decisions are to be made by public authorities, private resource users or community organizations, they must be based on sound information about the land and environment in order to contribute to sustainable development. There is still a gap in implementing and operationalizing sustainable and affordable land administration systems for registering formal and informal tenure in developing countries. Aside from the social and economic implications, this also means that there is a huge gap of land information that will appropriately inform decision makers, citizens and urban stakeholders.

This paper describes the experiences of developing and deploying of innovative land information systems coupled with appropriate land tools and methodologies in Kenya and Zambia.

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1. INTRODUCTION

Urbanization has been a global phenomenon and has significantly contributed to economic development (Chen, Zhang, Liu, & Zhang, 2014). However, the rapid rate of urbanization is increasing the social, economic and environmental load of cities. On average, 1.5 million people become urban dwellers every week; it is expected that by 2050, the urban population will account for more than two-thirds of the world's population with 90% of the increase taking place in Africa and Asia (DESA, 2014). One negative consequence of urbanization has been the deterioration of the urban environment and the resulting reduction in the quality of life in urban areas. This is evident in many urban areas where infrastructure is deteriorating, provision of basic services lacking, proliferation of slums and informal settlements, cities being choked by traffic and high pollution levels (UN-HABITAT, 2005). As such, urban development is the current global priority but the biggest challenge is how to ensure that these urban areas develop in a sustainable manner.

Sustainable development strongly depends on how well land is accessed, managed, used and transferred for the benefit of the current and projected urban population (Williamson & Grant, 2002; United Nations Division for Sustainable Development, 1992). Ensuring sustainable urban development requires proper land information. If relevant and good decisions are to be made by public authorities, private resource users or community organizations, they must be based on sound information about the land and environment in order to contribute to sustainable development. For example, without spatial maps on different infrastructure and facilities on the ground, planning would be incomplete or inaccurate; similarly, it is difficult to identify bonafide beneficiaries for compensation in cases of disaster in an informal settlement if spatial data on properties and corresponding tenancy or ownership information is not available. Land information constitutes, but is not limited to, land data registers (land tenure, land value, land use), natural resources, utilities, and other information. The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) recognizes the need for open standards, fit-for-purpose innovative approaches and platforms to collect and collate, share and distribute land information needed to address the challenges and opportunities for the 2030 Agenda for sustainable development particularly in developing countries (UN-GGIM, 2015). Authoritative and up-to-date land information that is consistently available and accessible over time reinforces good land administration and management leading to good land governance and sustainable development.

Various literature recognize that there is still a gap in implementing and operationalizing sustainable and affordable land administration systems for registering formal and informal tenure in developing countries. Aside from the social and economic implications, this also means that there is a huge gap of land information that will appropriately inform decision makers, citizens and urban stakeholders. Consequently, planning and decisions are being made on ‘few’ and fragmented information. Indeed, there is a need to close this gap and current land administration and information infrastructures are not adequate nor can it be used on scale. What is needed is a cutting-edge information system that can be used by many land stakeholders, affordable and sustainable.

The rapid evolution of Information Communication Technology (ICT), geospatial technologies (Geographic Information System (GIS) and Remote Sensing), cloud computing and Big Data has created an opportunity for expediting economic development by facilitating use and access of land information (Whitehead & Marbell, 2013). Technology is no longer a bottleneck in land administration and urban development projects. However, the positive impact ICT development on the quality of, and access to, land information in developed countries is not a guarantee that technology will have a similar impact in developing and (post)conflict countries. Technology should be trialled to explore options and take advantage of new technologies at lower risk. Trials should use Commercial Off-The-Shelf (COTS) or hybrid solutions, wherever possible. In turn, this will allow innovative service design and delivery of land information.

This paper describes the experiences of developing and deploying of innovative land information systems coupled with appropriate land tools and methodologies in Kenya and Zambia. The typical implementation process involves a scoping study where a thorough understanding and analysis of the needs of the lands institution who are the primary custodians of land information within the given jurisdiction; this analysis also identifies the expected benefits of implementing a land information system, with emphasis on improving security of tenure, enhancing revenue collection, improving delivery of land administration services, and more informed decision-making in planning of the urban areas and the urbanization trends. This scoping study seeks to articulate the current specific problems being faced in the absence of this system. The objective of the needs analysis is to identify technical requirements pertaining to mapping and geographic information processing activities, inventory of the mapping resources for both spatial as well as attribute data, evaluate the quality of the data sources, examine the abilities of current staff members and institutions, and determine if additional human resources is needed. It also determines capacity development needs at both the organizational and individual levels as well as identify data accessibility and sharing requirements for both internal (other departments such as planning finance, housing, etc.) and external clients (other government agencies, general public etc.). Based on the scoping study, the process of developing and deploying the land information system basically involves: (re)designing data collection, approval, analysis and integration of business processes; developing the system using agile ICT approaches; and, providing on-the-job training to relevant staff members in the institution. The whole process also involves cost benefit analysis including efficiency gains and potential for replication and/or scaling up.

The paper highlights the changes in procedures, responsibilities and computing environment within these land institutions with a focus on good land governance and efficient land services. This has been achieved by adopting flexible user-driven ICT approaches built upon open source software technologies and transparent land information with easy access for other departments (and clients) within the institution. The paper also highlights the importance of capacity building as a key component in ensuring successful deployment of innovative land information systems. The need to develop local competencies is given prominence as the key to developing sustainable land information. The implementation and outcome of these initiatives in Kenya and Zambia have provided key lessons for consideration in future projects particularly in addressing the requirements of other government authorities including at national level. These include technical capabilities of the information system that are low-cost, related tools and methodologies, business process management, capacity development at societal, organizational and individual levels; multi-stakeholder collaboration, and, knowledge sharing and management.

2. LAND INFORMATION MANAGEMENT FOR URBAN DEVELOPMENT

2.1. Benefit of Land Information Management

Urban areas currently manage considerable amount of land-related information. However, the challenge is that this information is traditionally separated across different departments based on thematic areas. This, coupled by decoupled and disjointed information management regimes, leads to a considerable loss in the value of the information as a resource. A contextualized Land Information Management (LIM) approach for urban areas provides the means to technically and institutionally integrate data on the different thematic areas of land information and transform it into a truly valuable information resource (Laarakker et al, 2002). Consequently, this promotes sustainable development of land by providing decision makers with consistent, accurate and integrated information about land. Figure 1 below shows how LIM can add value by combining information concerning land tenure, land value, land use, natural resources, utilities etc.

2.2. Reality of Land Information Management

There are still challenges in implementing LIM for urban areas in developing countries. This is primarily caused by local authority's lack of knowledge and understanding of how LIM can more effectively support planning, revenue generation and delivery of key services. Consequently:

- High-end technology is seen as a solution rather than as an enabler within an ecosystem of other components that support ease of access and use of land information;
- LIM-based projects are fragmented with minimal coordination from the key stakeholders such as thematic departments and aid agencies;
- There is little or no data upgrading and quality maintenance of records;
- The legal framework is not aligned to support ICT and e-government services;

- There is a high dependence to bring on board external consultants to keep the projects operational since the skills and experiences of local authority's staff is limited. This makes the projects unsustainable to the high consultancy costs;
- There is minimal or no technical support for the corresponding ICT infrastructure for the LIM;
- Data management, especially its collection, is seen as a one-off process that is only carried out during the duration of the project. As such, the data becomes outdated as it is not maintained or shared to the benefit of other departments or external users;
- Only specialist, technical staff have access to land information. As a consequence, land information is not accessible by the city officials or citizens, leading to many decisions being made in a spatial vacuum.

Consequently, the value of land information as a corporate resource diminishes with time and ultimately fails to support decision making for sustainable development.

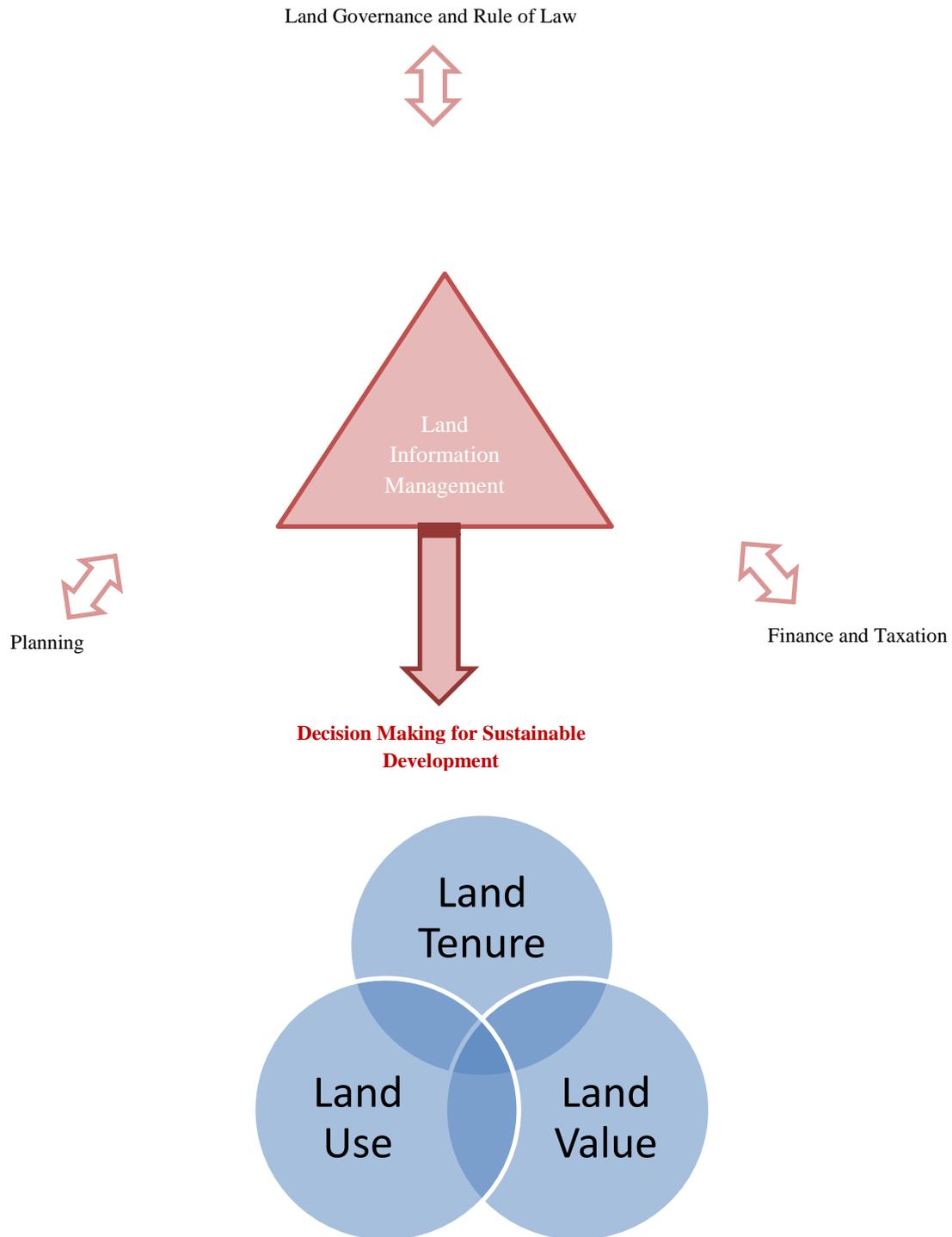


Figure 1: LIM to support decision making for sustainable development (Dale & McLaughlin, 2000)

2.3. Land Information System as an Essential Element of LIM

A Land Information System (LIS) is a critical component that supports the creation and management of urban land information. Land information systems are not only a geo-database but are a combination of technology, data, people, organization and funding mechanisms for sustaining the system (UN-Habitat, 2012). The fascination with and initial emphasis of LIS on technology (hardware and software) has gradually been replaced with a focus on data. But information systems also need qualified and motivated people to develop and operate them, institutional arrangements and management that have a vision, and technical skills to orientate and support the development of a LIS.

Data are not a means, but should be processed through data models to support land administration and urban development. Lack of accurate and up-to-date data is a critical bottleneck. Also, data collected that is not used or cannot be used is a waste of resources. The content, quality, accuracy, scale, compatibility, data processing models and use of the data can be reviewed by visiting key land institutions and municipalities. Such a review should determine the quality of spatial and aspatial data, whether the data is well structured and up-to-date and how it is used.

Technology consists of hardware, software, networks, cloud computing services and support technology (UPS, air conditioning, back-up storage facilities). Over-investment in hardware and software is common; many software functions and equipment are not used due to, for example, a lack of skilled staff and/or lack of data.

People are a central pre-requisite for a successful deployment, maintenance and troubleshooting of LIS. The main concern is whether there are enough, capable and dedicated staff with adequate skills such as ICT support, database design experts, GIS operators, programmers, GIS analysts and a help desk of technical staff for troubleshooting the LIS. Salary, career development, training opportunities should also be attractive to avoid rapid staff turnover and loss of public sector staff to the private sector. Information can be obtained to request a list of all staff with qualifications, experience and job descriptions.

Organization is the internal management and inter-institutional cooperation supportive, stable and capable of developing and exchanging land information? Land information institutions need to be free from direct and indirect political interventions, for example the appointment of staff or manipulation of land information. Weak land institutions or the absence of functional institutions such as mapping agencies, cadastre and land registries means that in many developing countries spatial data users have to produce much of the land information themselves on an-ad-hoc project basis and with access limited to a few people.

Funding: The development, maintenance and use of land information requires funding for staff, equipment and supplies. The funding should preferably be secured beyond the life span of a (donor-sponsored) project. Land information can generate income by charging directly or indirectly for services or products provided or derived. Limited funding will influence the scope

of a LIS. In some instances, a land information project can be tailored or scaled to fit the level of funding. In others, it might be better to postpone the development of a LIS if funds are too low to obtain results.

3. EMERGING INNOVATIVE TOOLS AND APPROACHES

While there are various key strategies and interventions in addressing poverty reduction, and sustainable development in general, land governance initiatives are increasingly becoming critically important. Good governance in land tenure and administration is recognized as essential for promoting economic development and ensuring good management through all levels of society. In this context, the development of reliable land information systems has become strategic and useful to bridge the information divide.

Various literatures have pointed out that the benefits of land administration systems are enormous which include contribution towards poverty alleviation, security of tenure, management of land disputes, inclusive planning, management of natural resources and protection of the environment, amongst others (Antonio 2006, Burns 2007, Williamson et al 2009, Zakout et al 2006). However, in developing countries, cadastres and parcel-based land administration systems only covers about 30% of the country and 70% are not covered by any formal land registration and information systems (Lemmen et al, 2009). Most of the poor are part of the 70% who have no legal, documented and registered land rights. What they have are informal, customary, unwritten and over-lapping land rights and claims.

The Global Land Tool Network (GLTN), and its more than 75 international partners, has been exploring solutions to address the above challenges through the development of pro-poor and gender appropriate land policies and tools. GLTN, as facilitated by UN-Habitat, is a global partnership of key international actors who are working together to specifically address land tenure and land governance issues. GLTN partners have come together to come up with new thinking, innovations and tools to improve security of tenure thereby improving the lives of the poor and ensuring country's national development within a shorter timeframe. Scaling up land governance interventions are needed to ensure that the 70% of the world's population are not left behind. These tools will ensure that there are quick, appropriate and affordable solutions for managing land information and promoting sustainable development.

The following tools and approaches are being implemented to support local authorities, with support from GLTN partners, in the collection and management of land information, and thereby promoting responsible land governance:

Continuum of Land Rights

GLTN partners are promoting the concept of continuum of land rights (Figure 2) rather than a focus only on issuing individual freehold titles (UN-Habitat/GLTN 2012, UN-Habitat 2008b, UN-Habitat 2009a). Across this continuum (see Figure 2), different tenure systems may operate either by individual and/or group claims, and plots or dwellings within a settlement and may

change over time. As GLTN partners puts it, conventional land titling approaches have largely failed to deliver their expected results because the existing technical solutions are expensive, inappropriate for the range of tenure found in developing countries, unsustainable financially or in terms of available capacity, and instead a range of land tenure options is more appropriate. This in practical terms means responding to the needs and requirements of the 70% of the citizenry in a developing country that are mostly comprised of the poor people and providing them equal socio-economic opportunities. Du Plessis et al (2016) further argue that ‘the main value added by the continuum concept is that it offers a shift away from a preoccupation with titling and individually held private property, is a simple call for change in complex contexts, a way of describing and representing new forms of practice, and a foundation for inclusion and building on existing practice. In addition, and perhaps most important of all, the continuum is an aid to both identifying and advocating for where more fundamental reforms are needed to the land policy, law and administration systems.

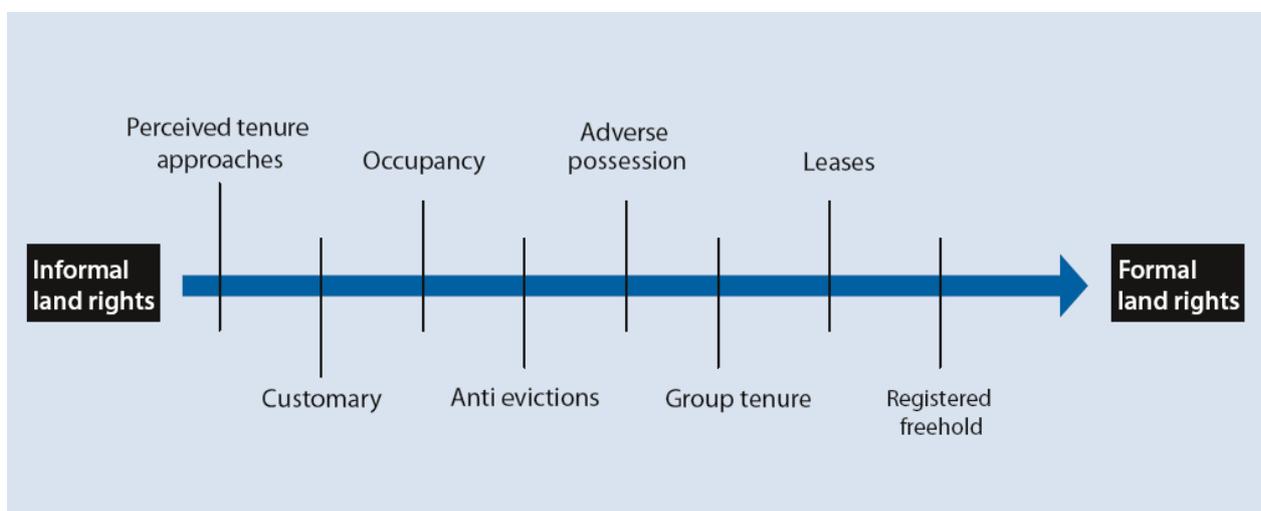


Figure 2: The Continuum of Land Rights. (UN-Habitat/GLTN 2012, UN-Habitat 2008b, UN-Habitat 2009a)

Fit-For-Purpose Land Administration

Conventional land administration systems are often based on colonial influence, expensive; require a lot of professional and technical inputs and long time horizon for implementation. Fit-for-purpose land administration offers an alternative. It is primarily designed to allow a range of stakeholders in developing countries to understand the overall Fit-For-Purpose approach and to recognize the benefits of adopting this approach. The Fit-for-Purpose solutions provide opportunities for land administration systems to deliver benefits, including secure tenure rights, to a wide range of stakeholders within a relatively short time and for a relatively affordable costs in a flexible manner. It provides structured guidance on building the spatial, legal and institutional frameworks in support of designing country-specific strategies for implementing

FFP land administration. It contains the analysis and operational advisory guidelines to implement the approach (Enemark et al 2016).

Gender Evaluation Criteria

Gender issues related to land are complex. They involve sensitive social and cultural territories and challenge deeply-rooted power structures. At the same time, for land activities to be effective, they need to go beyond the technical issues and consider and address socio-cultural dimensions such as gender. It cannot be assumed that women and men benefit in the same way from initiatives in the land sector. Land tools and interventions should not just benefit the poor – it must also work towards gender equality. This is critical as women continue to face large barriers in accessing land under formal, informal and customary systems of land tenure. Gender dimensions are frequently not captured by routine assessments and data collection regarding land issues. The reason for this is the absence of specific gender criteria in the process, either because gender analysis is not prioritised, or those involved lack a tool to do so. Hence, the need for the Gender Evaluation Criteria tool to address this challenge and to mainstream gender in the land governance process. The tool is a set of 22 questions under 5 themes on a range of relevant factors reflecting the gender responsiveness of policies and practices within the land sector. This tool is aimed at improving access to land and tenure security for both men and women. The Gender Evaluation Criteria is a flexible tool that can be adapted to local contexts and used by all stakeholders to shed light on gender inequalities in the land sector and to promote action. By using a range of different criteria, it becomes clearer to see where change needs to take place in order to ensure that both women and men will benefit from such processes.

Participatory Enumerations

The trends and development in the land information management as a key response to the challenges brought about by the urbanisation of poverty and the challenges on slums hinted us to go back to the ‘basics’. To go back to the basics means engagement to the lowest level of land management foundations by working with the poor communities and investigate what are their issues and how they are addressing or trying to address such challenges. After all, most of us, particularly land professionals, have a common intention – to help the poor. In the same spirit that GLTN and various partners spend a week together on September-October 2009 to write a book called ‘Count me in – surveying for tenure security and urban land management’. The book is about ‘participatory enumerations’, its purpose, applications and experiences from different countries and its potential for addressing issues related to land management and administration particularly in the urban areas. ‘Participatory enumeration’ is a data-gathering process which is to a significant extent jointly designed and conducted by the people who are being surveyed (UN-Habitat, 2010). It is an innovative approach where the people who are being enumerated are involved in the inception, design, management and implementation, data analysis and use of the data. These new ways of data gathering in settlements which was first developed by NGOs and community organisations have been called by other names, including community mapping, people’s census and self-surveys, to name a few. Participatory

enumerations that participation can provide transparency and build trust in the exercise, once accepted, the local residents can easily cooperate and will provide the information required thus resulting to improved data gathering and better data and participation also means self-empowerment. Residents can initiate, retain control of the process and ‘owned’ the process. The data on informal settlements (or other unregistered lands) are needed for a wide range of purposes: to enable the residents to demand their rights as citizens, to improve land tenure, to plan for the provision of infrastructure and services, to redevelop/upgrade the slums, to guide housing improvement, land allocation and adjudication and to use in land administration and information systems.

Social Tenure Domain Model

Information is power. Existing Land Administration Systems require extensions to include all existing types of tenures. This is the advocacy behind the continuum of land rights approach but the need for this is not always recognised and institutional changes are not so easy to implement. The Social Tenure Domain Model (STDM) could close this gap: STDM tool allows for the recordation of all possible types of tenures; STDM enables to show what can be observed on the ground in terms of tenure as agreed within local communities. Conventional land administration systems cannot easily handle customary and informal tenure systems. The concept of the Social Tenure Domain Model is to bridge this gap by providing a standard for representing ‘people – land’ relationships independent of the level of formality, legality and technical accuracy. The STDM is also a ‘specialization’ of the ISO-approved Land Administration Domain Model (LADM). In this context, specialization means that there are some differences, which are mostly in the terminology and in the application area. LADM development took place in parallel of STDM development as a concept and a model, and that the core developers of both models are the same or supportive of each other. For example, any form of right, responsibility or restriction in a formal system is considered as a social tenure relationship in STDM. The STDM information tool provides the front-end interface for testing and applying the STDM concept and model. It is built on top of free and open source geospatial software products. The client has been developed as a QGIS plugin, whereas the backend is based on a PostgreSQL/PostGIS stack for managing both spatial and aspatial data. The tool also provides basic document management capabilities for attaching supporting documents.

STDM tool was implemented (and currently being implemented) in many countries and in various contexts and purposes (more information at www.stdm.gltn.net). While STDM is frequently used in improving security of tenure in informal settlements and customary areas, the tool is flexible enough and can be customized for use and application in the formal land administration (Lemmen, 2010).

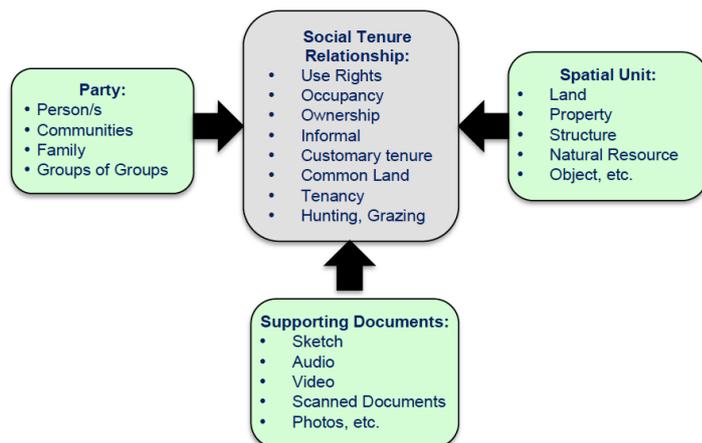


Figure 3: The STDM Conceptual Model explains the interrelationship between parties, social tenure, and the spatial units supported by relevant documents. (Source: UN-HABITAT/ GLTN, 2014)

4. CASE STUDIES

The case studies presented below showcase the process, outcomes and lessons learnt from the application of GLTN tools and approaches for supporting local government authorities in strengthening their land administration services in Kenya and Zambia respectively.

4.1. Turkana County, Kenya

General Information

Situated in northern Kenya, about 700km from Nairobi, Turkana County is the second largest county in Kenya covering 68,680 square kilometres (see Figure 4 below). Turkana shares its borders with four counties: Marsabit to the East, Samburu to the South-East, Baringo and West Pokot to the South-West. The county also borders with South Sudan to the North, Uganda to the West and Ethiopia to the North-East. The geo-political location and ecological variability of Turkana County has influenced resource use and political conflicts with neighboring pastoral groups, as well as neighboring countries, in the past and present. Access to land, especially in the rural areas within the County, is more widely discussed from a livelihood perspective under the right to food as opposed to as an economic right (Gottero, 2015).

However, the discovery of oil has opened up Turkana County to further explorations and exploitations of the oil fields. For decades the community living in Turkana has largely been excluded, marginalized and locked out of the formal economy through lack of security, access to education, infrastructure and other public services. They are also among the most marginalized communities in Kenya and often experience drought, famine and starvation resulting in reliance solely on relief food. However, the recent developments in oil exploration by multi-million investors, both regional and international community, and upstream oil

companies has subsequently led to the local community raising concerns over land rights as well as environmental rights.

Turkana is community land and has never been adjudicated, and therefore it is held in trust by the County Government on behalf of communities. Most of the land owners only have allotment letters. The County Government has embarked to ensure that all land users and practices under pastoral tenure conform to the principles of sustainable development; that there is equitable access to land and security of land rights.

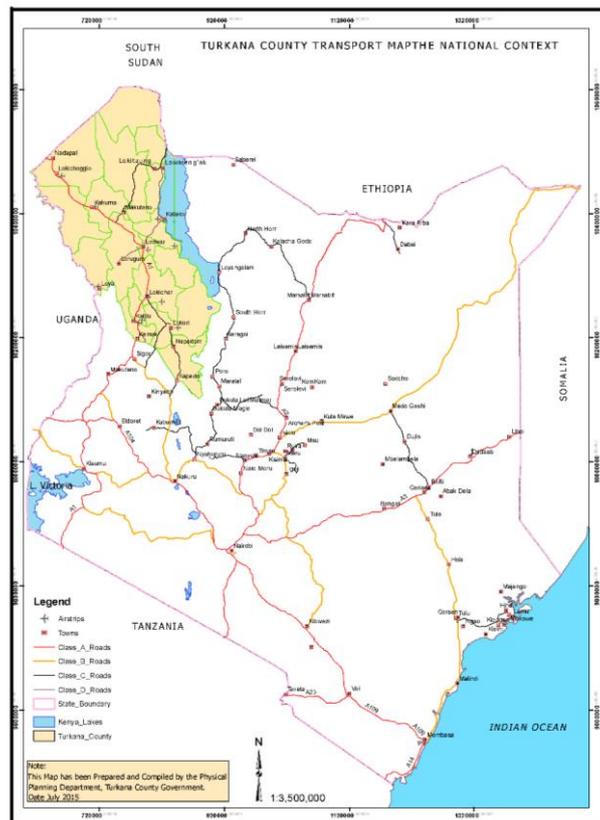


Figure 4: Map of Turkana County, Kenya. (Source: Turkana County Government, 2015)

Purpose

The specific objective of the project was to pilot the use and application of STDM in the context of a County Land Information System for managing tenure in the context of managing land rates in urban areas within the county, and to document the processes as well as build capacity on its use and capabilities, with the opportunity of scaling it up to also manage customary rights for communities within the County. The long-term objective is to address the land information requirements of women and men in pastoral communities. Consequently, this is meant to reduce

conflict for grazing and water resources between communities; improve tenure security; form a basis for inclusive planning and enhancing access to basic services and infrastructure.

Partnership

Food and Agriculture Organization (FAO) – Aside from being the funding agency for the Project, FAO strategically placed the Project as a pilot case study for implementing the Voluntary Guidelines on Responsible Governance of Tenure (VGGT) in arid and semi-arid regions of Kenya. The initial successes, challenges and lessons learnt will be carried over in the upscaling of similar initiatives in other counties in the country.

UN-Habitat/GLTN – Aside from co-financing and leading the technical implementation of the Project, UN-Habitat/GLTN provided technical support and facilitate capacity development initiatives. Specifically, it led in the customization of STDM to suit the local context and facilitated the implementation of the associated capacity development initiatives.

Ministry of Lands, Physical Planning and Urban Areas Management (MLPPUAM), Lodwar, Turkana County – The Ministry, through its leadership particularly the Chief Officer, provided enormous support to ensure that the project deliverables were met. Aside from hosting staff from UN-Habitat/GLTN Secretariat during the entirety of the project, it allowed its staff to fully participate and provide inputs during the entire process including system design and modeling, review of survey plans and ground truthing.

Process

Below were the key processes and activities adopted and implemented during the project period:

Planning and consultations – Prior to project kickoff, GLTN and FAO conducted a joint scoping mission in order to identify the scope and requirements of the project. This involved interviews with key staff in the Ministry; reviewing existing datasets, both spatial and tabular; walking through the existing billing system for capturing land rates payments and reviewing the business processes within the Ministry. Upon signing the Agreement, the technical exchanges continued and which yielded in better understanding of STDM by the county officials and its application in the context of the County Land Information System; the development of an implementation plan, the recruitment of onsite consultants to provide technical support in the project implementation; agreement on the roles and responsibilities as well as the identification and mobilization of the needed support and resources.

System design – Interviews with key staff from the Ministry – Chief Officer, System Administrator, Chief Planner, and County Surveyor – assisted in identifying and refining the system requirements for the Land Information System. A Software Requirements Specifications (SRS) document was developed and which formed the framework for developing, testing and evaluating the system functionality. The Turkana County Land

Information Management System is a desktop Windows-based client-server system which provides a centralized and integrated framework for:

- Managing land parcels in a GIS environment including the land-use types. See the parcel registration module in Figure 5 below;
- Linking the land parcels to their corresponding owners;
- Handling land rate payments made by or on-behalf of the parcel owners;
- Designing and generating map-based documents and reports;
- Feeding and receiving feedback of information captured from the land use planning process.

Register a New Parcel

Basic Information

Administrative Unit: Select administrative unit...

Parcel code: TS/Lok/B-A/001

Date of allocation: 2016-01-01

Area: 1200

Value: 100000

Parcel type: Private

Land-use type: Residential

Special land-use type:

Dispute type: Border

Geometry

Add Coordinates | Add CAD File

Enter comma separated coordinates /beacons in a form of x, y below to generate a parcel polygon.

Add point

Remove Point

P1: 22.355, 33.560

P2: 23.345, 34.517

P3: 22.305, 33.50

P4: 22.005, 33.167

P5: 22.312, 33.527

Save | Cancel

Figure 5: Parcel registration module in STDM

Data collation – This involved reviewing parcel boundaries from the existing survey plans that had been prepared by the Survey office in the Ministry. These were digital copies in DXF format which were subsequently auto-traced to polygons, projected to the local coordinate system and imported to the spatial database. Unique parcel numbers and corresponding land use types were finally assigned to each parcel. Existing person records from the billing system were imported from MS-Access, formatted in MS-Excel and finally imported into the central database. Tenure relationships were created for individual land owners as well as for institutions with lease agreements.

STDM customization – The process involved customizing the system's data fields to match those for entities specified in the Unified Modeling Language (UML) class diagram in the system design stage. Additional modules were also developed to enable seamless management of survey data from the field. Customized modules for performing spatial queries and generating map reports were tested and integrated into the tool.

Refactoring the billing system – The initial billing system for recording land rates payment was based on an MS-Access database. Part of the capacity building involved providing technical guidance in refactoring the VB.NET source code so that the system could now connect to the central repository, based on a PostgreSQL/PostGIS database.

Data validation and continuous updating – As part of quality assurance, the gathered information were validated by the key staff from the Ministry. Ground truthing was conducted for select parcels to ensure that the respective coordinates captured in the system matched the observed field coordinates. This process enhanced the acceptability of the information and all stakeholders appreciated the fact that the turnaround time between the field surveys and the production of results was relatively fast. After the validation period, the Ministry’s surveyors and accounts officers continued updating information in the system. Key personnel from the Ministry were trained to manage the system and to continue the updating process.

Capacity development – Key ministry officials were continuously trained on the usage of different areas to support usage and maintenance of the system such as field mapping using handheld GPS devices; data conversion techniques; basic concepts on relational database management; GIS using open source tool; basic cartography; monitoring and troubleshooting local area network connections; database server administration; and, electronic document management.

Initial Impacts, Challenges and Lessons Learnt

Key personnel from the Ministry including their clientele, of whom parcel owners were a part of, appreciated the added value of the LIS in addressing their information requirements. Moreover, they appreciated the system as a potential tool for much larger urban development objectives. Previously, the key challenge was manually synchronizing data updates where data on parcel owners, land rates payments and parcel location was stored in separate workstations; however, with the deployment of the LIS, data was now managed from a single central repository which ensured that data updates could be accessed in real-time across the local area network.

The key impacts/achievements of the Project:

- STDM, as a LIS, was tested and proven to be an affordable and technically sound solution for addressing the information requirements of Turkana’s County Government Ministry of Lands;
- Key staff from the Ministry are able to use and interact with the system and are confident to continuously manage and update the information;
- The LIS will greatly assist the County Government in implementing and realizing the strategic urban plan for Lodwar sub-County;

- The use of administrative area codes (built from the corresponding hierarchy) for numbering parcels provided a uniform and consistent addressing system which could be adopted in other sub-counties;
- Increasing demand to use and apply STDM in other counties in Kenya.

The key challenges encountered by the Project include the following:

- As expected, there were some apprehensions in using STDM because some staff were used to using other tools in mapping and database management and some staff were concerned about introducing a system like STDM might introduce delays or complexities;
- With the introduction of the new constitution in Kenya, the transition from a Municipal to County Government led to a situation where not all land records were handed over to the Ministry. As such, there was a situation where hard copy survey plans previously held by the Municipal Government were still not accessible by the County Government;
- The Ministry had limited technical staff and as such, it was a challenge to dedicate a business process owner to drive the project implementation from the Ministry's side. This led to delays in gathering and refining the requirements as well as coordinating system testing and compiling feedback;
- There was no ICT strategy in place and associate network infrastructure to support deployment of the system in the Ministry. As such, considerable resources had to be invested in building ICT capacity within the staff and setting up the required network and server infrastructure for the system;
- More time is required for sensitization and training. It is clear that more time should be allocated in training the technical staff in using and maintaining the system.

There are valuable lessons learned during the project design and implementation, these are:

- The project is a good model for partnerships. The partnership between the international organizations, national institutions and local authorities proved to be the 'facilitating' agents of change and innovations. The project was well received because all stakeholders were part of the implementation and existing projects/initiatives were considered in the design and implementation.
- The Social Tenure Domain Model (STDM) was proven to be technically sound and simple to use. Also, key personnel from the Ministry appreciated the capacity of STDM to customize and generate reports and as well as perform spatial analysis as soon as the data has been captured or entered into the system;
- Buy-in and ownership of the process by the Ministry was critical for success.

- Capacity development is a catalyst for sustainability. The project is clear that one of the most important elements of sustaining the development of a land information system like STDN is about capacitating the key users on its use and on data updating and management. In addition, the business processes for managing the data need to be clearly documented and incorporated in the standard operating procedures for the surveyors and accounts officers.

4.2. Lusaka City, Zambia

General Information

Lusaka is the capital of Zambia (see Figure 6 below), a country generally considered to be a Southern African country, because of its strong social and economic ties with the countries in the Southern African sub-continent rather than those in Central and Eastern Africa. The city has a population of 2.2 million inhabitants (Jones Lang LaSalle, 2015) with over 65 percent of the city's labour force earning its livelihood from economic activities, which predominantly consist of unregistered and unregulated small scale non-agricultural economic activities ranging from petty trading, metal fabrication and wood processing. However, the low proportion of the labour force working in the formal sector has had a bearing on the welfare of the residents of the city and given rise to the emergence of informal settlements.

About 70 percent of Lusaka's population lives in poor, unplanned settlements comprising 20 percent of the city's residential land. These informal settlements came about as a result of the quick unplanned growth of Zambia's cities that occurred during the copper boom that followed the country's independence. Previously, towns (including Lusaka) were not intended to be permanent homes for the majority of the workers thus, the legal tenure as well as the provision of housing and amenities for informal residents were not priorities.

To address some of these issues, the Lusaka City Council (LCC) was established and mandated to provide an enabling environment in the provision of housing to all segments of the population in Lusaka. Its key functions and roles, amongst others, include:

- Creation and allocation of land for housing purposes;
- Provision and maintenance of infrastructural services intended to open up land for housing development;
- Regulation of land use and controlled development.

A key feature of the upgrading in Lusaka is regularization of the land tenure in informal settlements. As such, informal settlements have to be declared an improvement area before they can be deemed legal and subsequently, have the occupiers able to secure a 30-year occupancy right.

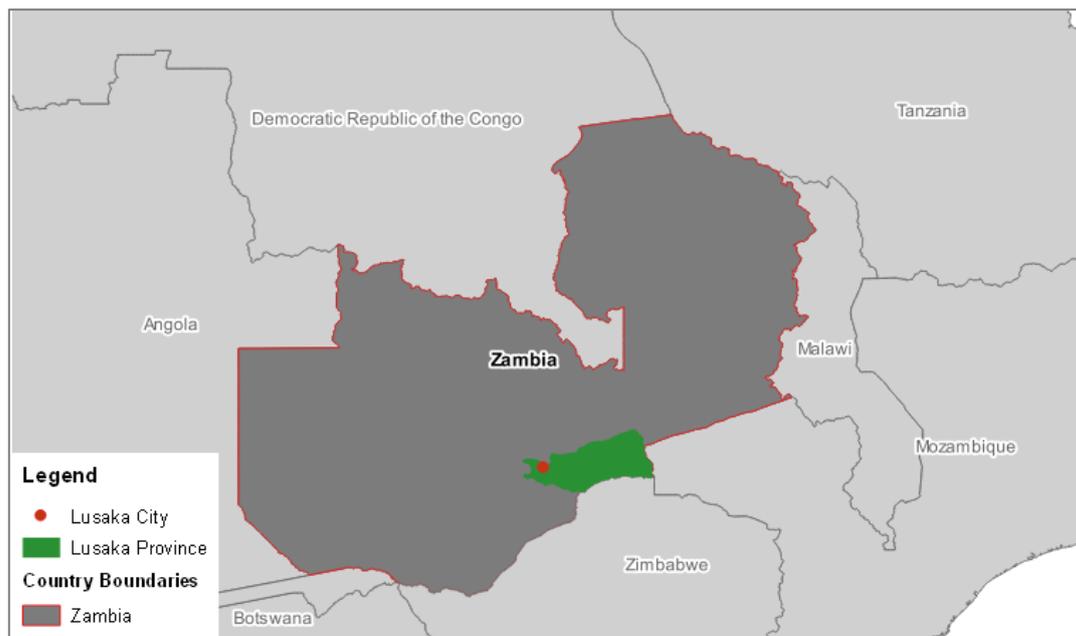


Figure 6: Location map of Lusaka City (Source: UN-Habitat/GLTN)

Purpose

GLTN responded to the request by Lusaka City Council to support processes leading to issuance of Land Record Cards in Kanyama informal settlement in Lusaka. The support was initiated at Kanyama Ward 10, which is the area where UN-Habitat is supporting the construction of a drainage through the City-wide Slum Upgrading Strategy. This process entails an inclusive enumeration process and mapping using some of GLTN tools such as Social Tenure Domain Model and Participatory Enumerations thereby ensuring quick wins towards improving tenure security for communities where they will be issued Occupancy Licenses which are valid for thirty years; the target is to issue 20,000 occupancy licenses by April 2018. In addition, LCC will use the data for other activities such as planning for service corridors and tax collection.

Partnership

Lusaka City Council – As part of their mandate in regularizing land in informal settlements in Lusaka, the Council is keen to adopt innovative fit-for-purpose land administration tools for improving tenure security by issuing formal documents in the form of occupancy licenses. The main departments involved are the Housing and Settlement, City Planning and Legal Services units. The council will also document the initial successes, challenges and lessons learnt in the upscaling of similar initiatives in other settlements in Lusaka. This experience will also be shared with other city councils, such as Chipata City Council, who have shown a keen interest in piloting this within their respective jurisdictions.

UN-Habitat/GLTN – UN-Habitat/GLTN is providing technical support and facilitating capacity development initiatives in the contextualization, implementation and institutionalization of innovative approaches for improving tenure security in informal settlements. These initiatives include on-the-job trainings that have designed to enhance sustainability and ability of the Council to identify relevant approaches and tools for specific challenges.

Process

Planning and consultations – This involved a scoping mission to, first, familiarize with ongoing activities of LCC in the different settlements and, second, to identify possible entry points for joint collaboration in improving land tenure issues in informal settlements. Subsequent discussions led to the selection of Kanyama Ward 10 as the project site for application of GLTN tools that would eventually lead to the issuance of occupancy licenses, while also building upon ongoing partnerships with other UN-Habitat units such as Participatory Slum Upgrading Programme (PSUP).

System design – This entailed mapping the business processes of issuing occupancy licenses starting right from data collection to the process of printing the certificates. This included identifying the respective roles of the key departments in the process where the:

- Housing and Settlement Unit is responsible for, inter alia, the registration of properties as well as change of ownership. It is also responsible for facilitating the upgrading of these informal settlements through the collection of relevant socio-economic data to support the decision-making of identifying settlement priorities.
- City Planning Unit is responsible for controlling land use and development as well as demarcating property boundaries through the production and updating of cadastral and topographic maps.
- The Finance Unit is responsible for managing all payments related to the property. Prior to obtaining an occupancy license, the following requirements must be met:
 - All outstanding bills (including rates and ground rent) have been cleared;
 - A processing fee for the occupancy license.
- The Legal Unit is responsible for printing and issuing the occupancy licenses which are valid for a period of not more than thirty years as stipulated in the Housing (Statutory and Improvement Areas) Act.

The documentation of the business processes was accompanied by an integrated land information model for capturing the information requirements of the different departments.

Data collation – Existing cadastral plans, satellite imagery and socio-economic data for Kanyama Settlement was reviewed to identify gaps and adapt the process to fit the specifications of the proposed land information model. The enumeration questionnaire was revised to capture ownership, socio-economic and spatial information regarding the property. By working with the Residents Development Committee, participatory enumeration and property boundary mapping was carried out by locally-trained community members. The

collected data was aggregated and reviewed daily by data officers at the Council’s offices where issues related to missing or incorrect entries were flagged for correction by the relevant enumerators.

STDM customization – The process involved adapting the data model to fit STDM’s conceptual model where *a person has occupancy rights on one or more properties*, see database model in Figure 7 below. The customization was then iteratively implemented and tested in the STDM tool. Existing modules were also refactored to enable seamless importation of GPS data into STDM. Customized database views were created for producing the occupancy licenses and analytical reports for supporting the Council’s decision-making process.

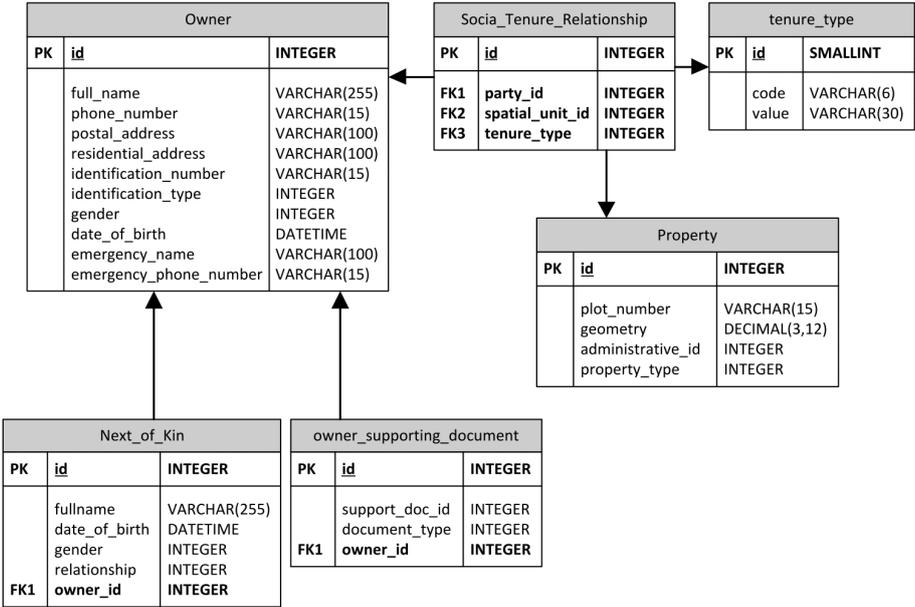


Figure 7: Core database model for property occupancy (Source: UN-Habitat/GLTN)

Integration with the property rates payment system – The Council’s property rates payment system runs on an Oracle database. LCC have expressed a strong interest in integrating it with the STDM database (which is based on PostgreSQL/PostGIS) for incorporating property payment in the occupancy-related analytical reports. GLTN is currently evaluating any potential bottlenecks or performance issues that might be related to the use of PostgreSQL Foreign Data Wrapper for Oracle, and will perform live trial runs at the Council’s ICT infrastructure.

Data validation and continuous updating – As part of quality assurance exercise, the gathered information is being validated at two levels:

- Initial verification by LCC’s data officers housed under the Housing and Settlement unit

- Community validation carried out at the zone level. This involves running week-long radio campaigns which target community members in that particular ward informing them of the upcoming data verification exercise. Maps and tabular information captured during the enumeration exercise are printed and displayed in the settlement resource center for review and correction by the community members. This process enhances the acceptability of the information by the community members, who are the target beneficiaries of the subsequent occupancy licenses. After this validation exercise, the Council's data officers update corresponding changes in the STDM database.

Capacity development – Officials from the key departments involved in the process of issuing occupancy licenses are continuously being trained on the different aspects pertaining to the usage, maintenance and troubleshooting of the system such as field mapping using handheld GPS devices; data conversion techniques; basic concepts on relational database management; GIS using open source tools; basic cartography; and, database server administration.

Challenges and Initial Impacts

Some of the initial challenges faced are:

- The transfer of key senior staff, who were part of the planning and inception of the project, from LCC. This led to delays in the implementation of some key activities as the new staff had to be oriented on the project including the partnerships, approach, processes and outcomes.
- Contextualization of the respective advantages of an integrated land information approach to the key departments involved. As such, it was important to highlight the expected benefits to each department such as up-to-date property maps for the City Planning unit, identification of housing and settlement priorities from the analysis of socio-economic data by the Housing and Settlement unit etc. This underscored the need for all departments to actively participate in the process and strengthen their internal collaboration.
- Incomplete enumeration and GPS entries with weak quality control processes which at times led to the same property data being collected multiple times thereby causing delays and overshooting the budget. To mitigate this, multiple verification processes were introduced to ensure that each officer (from enumerator, supervisor, ward leader and data officer) had a role to play in validating correctness of the information.
- High turnover of data entry officers which required new officers to be re-trained on performing quality checks and using STDM for data management including entry and importation of data from enumeration forms and GPS devices.

Some of the initial impacts of the project are:

- There is greater buy-in and trust by the community members regarding the interventions by LCC. This had led to a better understanding of the community issues and priorities by the Council.

- It has strengthened the collaboration of LCC's departments in moving towards a corporate land information management environment, where decisions are based on consistent, accurate and integrated information about land.
- Capacity development of key change agents within both the Council and Residents Development Committee has increased the awareness of the project across different stakeholders, including local leaders, and expedited the data collection process.
- The Council has appreciated STDM as an affordable and flexible all-in-one information tool for managing spatial and aspatial data as well as producing custom analytical reports to support the decision making process.

5. CONCLUSIONS

With the successful deployment of STDM as an alternative low-cost land information system, the demand for its application and implementation has steadily increased including for potential use/application in other local administrative jurisdictions in Kenya and Zambia. It is becoming clear that STDM is one significant tool that local governments can adopt for development objectives like inclusive planning, tenure security improvement and provision of basic services and infrastructure.

STDM also offers great opportunities for land professionals as they can now extend their services to all, they can now offer people-centred and affordable solutions and they can also contribute to the further enhancement of STDM framework. With STDM, land professionals can easily promote and communicate their plans, strategies and services to civil society organizations, government authorities and other stakeholder groups. With STDM, it is now possible to bridge the information divide and to serve all members of society and to undertake development interventions such as tenure security for all at scale. Government authorities and decision makers will definitely benefit from its use, recognition and implementation.

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Oumar Sylla is the Land and Global Land Tool Network (GLTN) Unit Leader within the Urban Land, Legislation and Governance (ULLG) Branch at UN-Habitat. Prior to joining Land and GLTN Unit, Oumar served as a Senior Advisor in UN-Habitat's Regional Office for Africa. Before that, He was Chief Technical Advisor for the UN-Habitat country programs in Central Africa.

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