



IMPLEMENTATION OF RESPONSIBLE LAND GOVERNANCE

A LAND INFORMATION SYSTEM FOR SUSTAINABLE DEVELOPMENT IN TURKANA COUNTY, KENYA

SECURING LAND AND PROPERTY RIGHTS FOR ALL

IMPLEMENTATION OF RESPONSIBLE LAND GOVERNANCE

A LAND INFORMATION SYSTEM FOR SUSTAINABLE DEVELOPMENT IN TURKANA COUNTY, KENYA

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EXECUTIVE SUMMARY

The development of the Land Information Management System (LIMS) for Turkana County has two main aims: 1) to pilot the use and application of the Social Tenure Domain Model in the context of a County Land Information System for managing tenure in an urban setting, and 2) to document the processes and 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 for 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. The LIMS development is under the Food and Agriculture Organization's pilot project "Support for the responsible governance of land and natural resources in communal lands of Kenya", which is funded by the European Union and implemented directly by FAO in two predominantly pastoralist counties, Turkana and Tana River. The project is an implementation of the Voluntary Guidelines on Responsible Governance of Tenure of Land, Fisheries and Forests in the context of National Food Security and the Framework and Guidelines on Land Policy in Africa. The project contributes to FAO's strategic objective 2, that is, to increase and improve the provision of goods and services from agriculture, forestry and fisheries in a sustainable manner. The Voluntary Guidelines are intended to contribute to the global and national efforts towards the eradication of hunger and poverty, based on the principles of sustainable development and with the recognition of the centrality of land for development by promoting secure tenure rights and equitable access to land, fisheries, forests and other natural resources.

In the process of developing the Turkana County LIMS, existing maps and land records were gathered and analysed to examine their viability for use in the system. The existing billing system, managed by the Ministry of Lands, Physical Planning and Urban Area Management (MLPPUAM), and existing business processes were documented and reviewed for consideration in the design of the LIMS. Parallel to this, is the customization of the current version of STDM (version 1.1) to meet the data needs and requirements of the ministry. STDM was modified, with new features added to suit the Turkana County context. To enable them understand the underlying concepts and applications of GIS and the STDM-based LIMS, concerned staff from the county and sub-counties were trained on the use and application of the tool to support the Ministry's recordation and management of surveying and planning information. Guidelines were also developed, in consultation with key ministry technical staff, to support mapping activities and to clarify user access and roles in using and managing the LIMS. Overtime, technical backstopping has been continuously provided by FAO and GLTN to ensure that the necessary skills are sufficient for the county to manage the LIMS.

Challenges that were encountered include the following: 1) no hand-over of previously approved survey plans from the Turkana Municipal Council to the county government; 2) delayed disbursement of funds from the national government; 3) unstructured business processes; 4) lack of quality assurance procedures; insufficient staffing; 5) lack of equipment to implement mandate of the ministry; 6) absence of ICT strategy and infrastructure; 7) limited number of technical staff in the ministry; 8) limited capacity of ministry technical staff

particularly on modern technology; 9) apprehension on the use of the STDM tool; and 10) lack of aerial photographs and digital satellite imagery.

It is anticipated that the county LIMS will support the development of the Turkana County Spatial Plan. With the LIMS in place and a systematic, large-scale mapping strategy using modern technology such as satellite imagery, remote sensing, etc., a County Spatial Plan will be the basis for the formulation of land policies to allocate appropriate land use and promote the sustainable use of natural resources. It will also assist the

county government in implementing and realizing the County Integrated Development Plan and the Strategic Urban Development Plan for Lodwar sub-county. It is envisaged that the LIMS will eventually cover the whole of Turkana County and to do this, the system needs to be rolled out to its sub-counties. The prospect of adopting LIMS by other counties in Kenya is highly probable as this information system provides the most basic information to support planning, improvement of tenure security and the provision of basic services and infrastructure.



Turkana County MLPPUAM officers conducting community sensitization exercises on the Community Land ACT.
Photo © Lawrence Okello.

ACRONYMS

CAD	Computer-Aided Design
FAO	Food and Agriculture Organization
FIG	International Federation of Surveyors
GIS	Geographic Information System
GLTN	Global Land Tool Network
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ITC	Faculty of Geo-Information Science and Earth Observation of the University of Twente
LADM	Land Administration Domain Model
LIMS	Land Information Management System
MLPPUAM	Ministry of Lands, Physical Planning and Urban Area Management
NLC	National Land Commission of Kenya
NLIMS	National Land Information Management System
STDM	Social Tenure Domain Model
TCG	Turkana County Government
TCGLMS	Turkana County Government Land Management System
UN	United Nations
UN-HABITAT	United Nations Human Settlements Programme
VGGT	Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security

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INTRODUCTION



INTRODUCTION

The Food and Agriculture Organization (FAO) and the Global Land Tool Network (GLTN) both recognize the importance of prioritizing and addressing issues related, but not limited, to customary land because of its huge potential to contribute to poverty reduction and positive potential impacts at a global level. In this regard, the two agencies are supporting the Ministry of Lands, Physical Planning and Urban Areas Management (MLPPUAM) of the Turkana County Government in Kenya to develop and rollout a land information management system (LIMS) to manage urban and customary land tenure within the county. The LIMS development is based on the Social Tenure Domain Model (STDM), a pro-poor, gender sensitive and participatory land information system, with an initial pilot focusing on capturing tenure information in Lodwar town. The activity is under FAO's pilot project: "Support for the responsible governance of land and natural resources in communal lands of Kenya", funded by the European Union. The project is an implementation of the Voluntary Guidelines on Responsible Governance of Tenure of Land, Fisheries and Forests in the context of National Food Security (VGGT) and the Framework and Guidelines on Land Policy in Africa. It contributes to FAO's Strategic Objective 2; that is, to increase and improve the provision of goods and services from agriculture, forestry and fisheries in a sustainable manner. The Voluntary Guidelines are intended to contribute to global and national efforts to eradicate hunger and poverty, based on the principles of sustainable development and recognizing the centrality of land for development by promoting secure tenure rights and equitable access to land, fisheries, forests and other natural resources.

This report documents the experience of MLPPUAM in Turkana County in establishing a county LIMS based on STDM, which captures all types of land tenure

information and which is customizable to the needs and context of communities, sub-counties and counties. STDM has already had successful applications in the different counties in Kenya, such as Nairobi, Mombasa and Baringo in capturing land information in urban, peri-urban and rural settings for purposes of informal settlement upgrading, natural resources management and improvement of land tenure security. In these counties, participatory enumerations and mapping were conducted by community members themselves, who also managed and updated the database, with support from local non-government organizations involved in organizing these particular communities. The experience of the Turkana County Government (TCG) in pioneering STDM as a tool to build its land information system to support tenure security, land-use planning and local revenue collection will serve as a precedent for other counties to adopt the system as well.

BACKGROUND

The 2010 Constitution of Kenya provides for the devolution of resources and functions, and the creation of a whole new layer of county governments. There are three categories of land as provided for in the new constitution, namely: public land, private land and community land. The constitution further created new land administration and management institutions such as the National Land Commission, the environment and lands courts. It also delegated the responsibility of holding in trust unregistered community lands to the county governments.

The advent of devolution made planning a shared mandate between the national and county governments. Thus, planning at the county level is a requirement under the constitution and other subsidiary legislation such as the County Governments Act (2012). Devolving power and functions of government entails a better



Temporary huts or manyattas within Lodwar town. Photo © Rhea Lyn Dealca.

representation of citizens' opinions in decision making, equitable sharing of resources and improved service delivery. Devolution is an opportunity for counties to direct the vision and aspirations of their people. In the case of the Turkana County Government, devolution aims to make the county a prosperous, peaceful and just county with an empowered community enjoying equal opportunities to realize the social economic transformation of its people. With its devolved mandate to develop plans to manage its jurisdiction, including its natural resources and to ensure that activities promote sustainable development, the Turkana County Government must develop strategies based on available information to achieve these goals.

Accurate and current land information is a prerequisite to developing and implementing projects and programmes on sustainable land management. Reliable and up-to-date spatial data on land provides the basis for spatial planning, environment and natural resources management and land administration. The county, with

the present challenges, needs a land information system which will provide policymakers with information not just on its constituents, but also with a visual overview of the different land uses that could serve as input to planning and person-to-land tenure relationships that can be a basis for programme development on securing land tenure.

DESCRIPTION OF TURKANA COUNTY

Turkana County is situated in the north-west part of Kenya. It borders West Pokot and Baringo Counties to the south, Samburu County to the south east, and Marsabit County to the east. Internationally, it borders South Sudan to the north, Uganda to the west and Ethiopia to the northeast. The county shares Lake Turkana with Marsabit County. The total area of the county is 77,000 km² and it lies between longitudes 34° and 36° 40' east, and between latitudes 10° 30' and 5° 30' north of the Equator. The county is administratively divided into 7 sub-counties, 30 wards, 56 locations

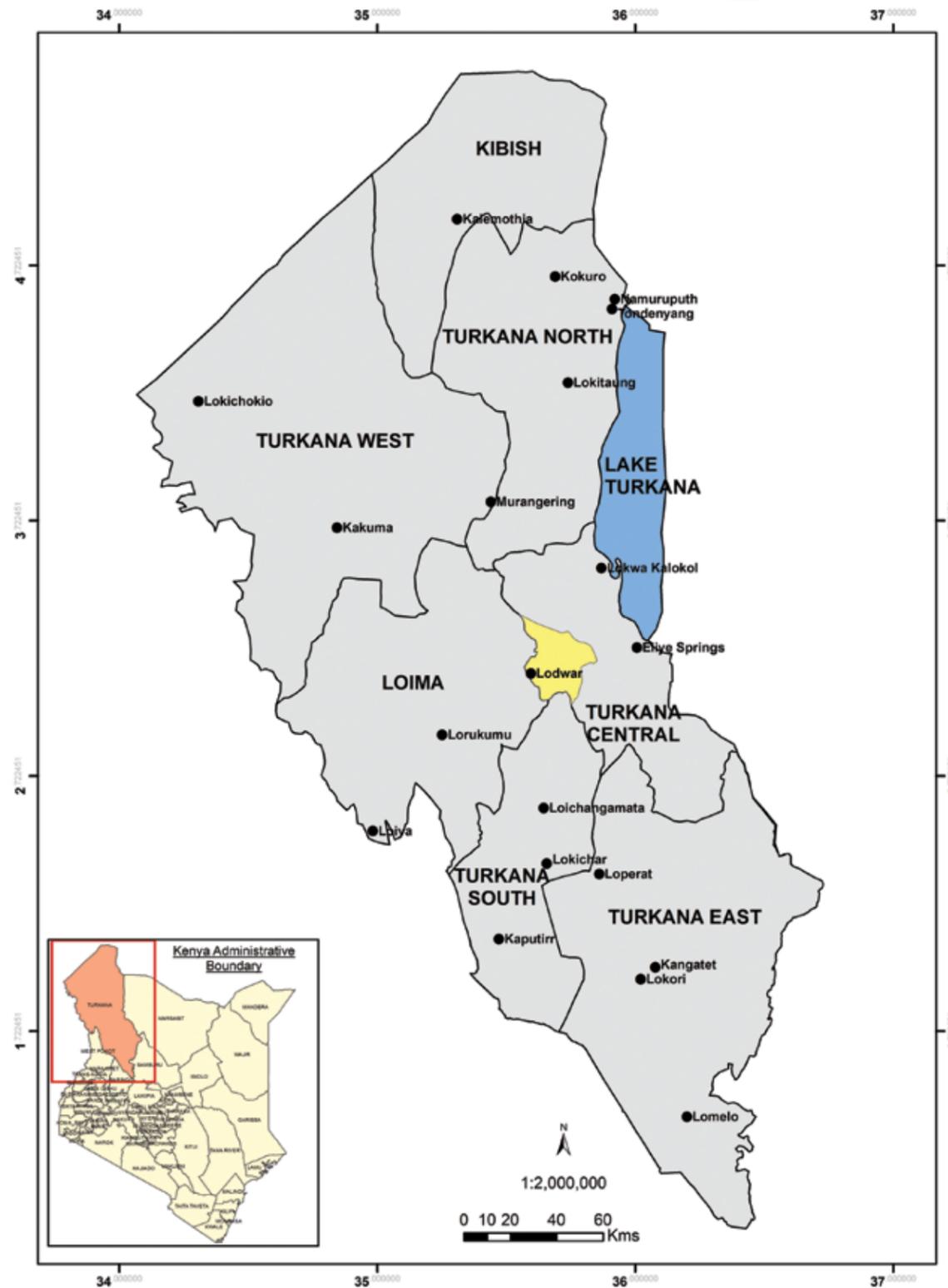


Figure 1: Map of Turkana County, Kenya.

that are further sub-divided into 156 sub-locations. The settlement patterns in the county are determined by various factors such as climate, soil fertility and infrastructure. Turkana people are traditionally pastoralists and the only notable migration pattern is rural to rural movement in the form of nomadism.

The county has three urban centres: Lodwar, Kakuma and Lokichoggio. Of the three, Lodwar is the most developed with a significant higher number of infrastructural services and social amenities. There are nine market centres in Turkana County.

Huge deposits of minerals, including gold and gem stones among others are available in Turkana County. There are also prospects of oil deposits in the county as indicated by several ongoing feasibility studies. According to Tullow Oil plc update in a Kenya exploration and appraisal report covering a series of exploration activities in Blocks 10BB, 13T and 10BA regions, Ngamia-1 appraisal well of block 10BB successfully encountered over 100 metres of net oil pay (Tullow Oil plc, 2015). According to the Turkana County Integrated Development Plan, 2013-2017, the second well, Twiga South-1, also made an oil discovery in October 2012. Gold mining, although on a small scale, occurs in various locations in the county.

The discovery of oil has opened up Turkana County to further exploration and exploitation of the oil fields. For decades, the community living in Turkana has largely been excluded, marginalized and locked out of the formal economy because of the lack of security, access to education, infrastructure and other public services, (Cordaid 2015; Makoloo and Ghai; 2005). Communities there are also among the most marginalized in Kenya and often experience drought, famine and starvation resulting in a reliance on relief food (Bush, 1995).

Recent developments in oil exploration by large investors, the regional and international communities, and upstream oil companies have led to the local community raising concerns over land and environmental rights.

Turkana County has held its land communally for a long time. Despite this, there has been little effort to register and title the land. Currently, all the community-held land in Turkana County is held in trust by the county until the nation assembly passes a law providing for the adjudication of community land in Kenya. There is a need for land tenure security to protect people from displacement, to enable them to have access to loans, to promote their livelihoods and to build investor confidence and assurance in their investments.

LAND ADMINISTRATION IN TURKANA COUNTY

The MLPPUAM's vision is to have an efficient and effective land administration system that promotes security of tenure, equitable access and control of land for sustainable socio-economic development of the Turkana County. To reach its vision and mission, strategic objectives were formulated which include: 1) the development of spatial plans to provide the spatial framework to guide, coordinate development activities and management of all urban/towns within the county; 2) planning and management of urban infrastructure and services; 3) provision for planning and survey services; 4) facilitation of ownership rights; 5) establishment of a modern land registry; 6) formulation of the county's land policies and regulations for effective land governance; and 7) promotion of public participation and inclusiveness on land management and governance. Figure 2 shows the structure of MLPPUAM.

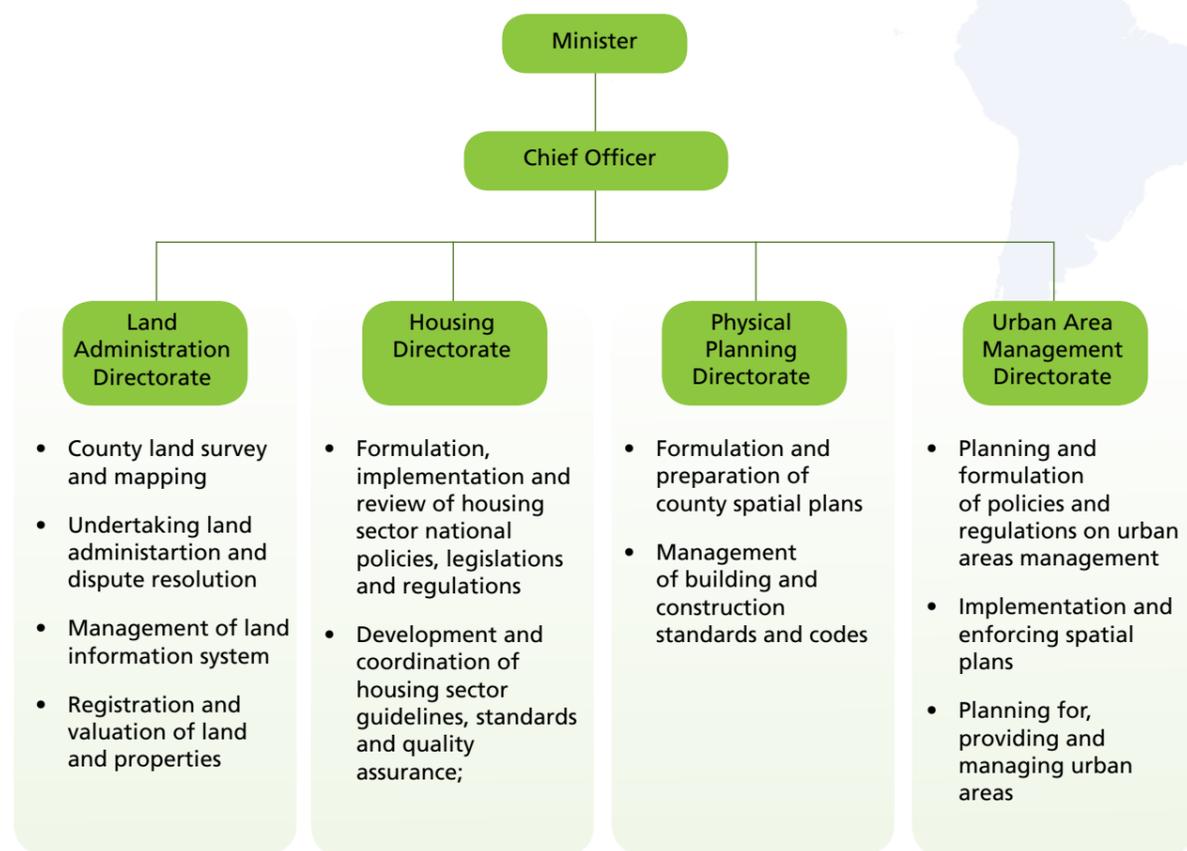


Figure 2: Organizational Structure of MLPPUAM.

The ministry is composed of four directorates, namely: 1) Land Administration; 2) Physical Planning; 3) Urban Areas Management; and; 4) Administration and Finance.

Most of the land records, spatial and non-spatial, are found at the Survey and Physical Planning Office, which supports the directorates by providing the following technical support:

1. Carrying out general land adjudication processes, including land demarcation;
2. Conducting inspections to ascertain development controls;

3. Giving technical advice to the public on land matters;
4. Mapping of country resources, which includes premises and structures;
5. Providing technical support for the approval of building plans; and
6. Performing other tasks related to surveying and planning.

In one of the interactive sessions during the project, the Chief Officer of MLPPUAM, Mark Ewesit Ewoi, emphasized the need for a land information system so

as to realize the ministry’s vision. According to him, this will make information easily accessible not just for the local government but also for the public. He views the LIMS as important for increasing the county’s revenues from rents and permits, reducing disputes on land, managing and allocating land use appropriately and improving land tenure security for the county residents.

LAND TENURE IN TURKANA COUNTY

Land in Kenya is classified into three categories: 1) public land; 2) community land; and 3) private land, as provided for in Article 61(2) of the new Constitution of Kenya, 2010 (CoK, 2010).

Public land is that which, at the effective date, was unalienated government land as defined by an Act of Parliament in force at the effective date; land lawfully held, used or occupied by any state organ, except any such land that is occupied by the state organ as lessee under a private lease; land transferred to the state by way of sale, reversion or surrender; land in respect of which no individual or community ownership can be established by any legal process; land in respect of which no heir can be identified by any legal process; all minerals and mineral oils as defined by law; government forests other than forests to which Article 63 (2) (d) (i) applies, government game reserves, water catchment areas, national parks, government animal sanctuaries, and specially protected areas; all roads and thoroughfares provided for by an Act of Parliament; all rivers, lakes and other water bodies as defined by an Act of Parliament; the territorial sea, the exclusive economic zone and the sea bed; the continental shelf; all land between the high and low water marks; any land not classified as private or community land under this constitution; and any other land declared to be public land by an Act of

Parliament—in force at the effective date; or enacted after the effective date (Kenya Const. art. 62.1)

Community land consists of land lawfully registered in the name of group representatives under the provisions of any law; land lawfully transferred to a specific community by any process of law; any other land declared to be community land by an Act of Parliament; land that is lawfully held, managed or used by specific communities as community forests, grazing areas or shrines; ancestral lands and lands traditionally occupied by hunter-gatherer communities; and land that is lawfully held as trust land by the county governments. The constitution also provides against disposition or use of community land, except in terms of legislation specifying the nature and extent of the rights of members of each community individually and collectively (Kenya Const. art. 63.1)

Private land is registered land held by any person under any freehold tenure or leasehold tenure; and any other land declared private under a relevant Act of Parliament (Kenya Const. art. 64)

Most of the land in Turkana County is unregistered community land held in trust by the county government. A small portion of land is public land held on behalf of the county and national government by the National Land Commission. Land leases are regulated by the county government. It is estimated that a household has access to two hectares of land. With much of Turkana land being unregistered and lacking any form of documented ownership, Turkana communities lack proof/ evidence of holding land and as such find it very difficult and almost impossible negotiate for fair compensation when their land is acquired by the government through expropriation.



A pictorial showing Turkana's landscape. Photos © Rhea Lyn Dealca.

DEVELOPMENT OF THE TURKANA COUNTY GOVERNMENT LAND INFORMATION MANAGEMENT SYSTEM

DEVELOPMENT OF THE TURKANA COUNTY GOVERNMENT LAND INFORMATION MANAGEMENT SYSTEM

FAO's pilot project, "Support for the responsible governance of land and natural resources in communal lands of Kenya", is funded by the European Union and implemented directly by FAO in two predominantly pastoralist counties, Turkana and Tana River. The project is an implementation of the VGGT and the Framework and Guidelines on Land Policy in Africa. The project contributes to FAO's strategic objective 2, i.e. to increase and improve the provision of goods and services from agriculture, forestry and fisheries in a sustainable manner. The Voluntary Guidelines are intended to contribute to the global and national efforts to eradicate hunger and poverty, based on the principles of sustainable development and with the recognition of the centrality of land for development by promoting secure tenure rights and equitable access to land, fisheries, forests other natural resources.

Turkana County, one of the counties of support under FAO's representation in Kenya programme, is at least 90 per cent under customary tenure, though with increasing large scale investments in oil and other minerals. FAO agreed to support the county within the framework of the pilot project in three areas: strengthening community land rights, county land-use planning, and establishing a land information management system (LIMS), which would include the registry. The obvious relationship between all three areas of support requires a central management system that could make the technological links and capture the information through a centralized information system.

From May to August 2015, FAO and UN-Habitat/ GLTN discussed how to jointly support the County

Government of Turkana in securing land tenure for local communities and the recordation of urban land in major towns in the county through technical support, capacity building and institutional reforms. In October 2015, they signed a Joint Agreement to design, develop, deploy and build capacity on a land information system for the Ministry of Lands, Physical Planning and Urban Areas Management, with an initial pilot focusing on capturing tenure information in Lodwar town.

OBJECTIVES

A county LIMS is essential to efficiently administer and manage county land. 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 urban land, to document the processes, and to build capacity for its use and capabilities, with the opportunity of scaling it up to manage communal land 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 over grazing and water resources between communities; improve tenure security; form a basis for inclusive planning and enhanced access to basic services and infrastructure, consequently promoting food security through secure land tenure.

IMPLEMENTATION PARTNERS

The "Facilitator"

The Food and Agriculture Organization of the United Nations (FAO): Aside from being the main implementer for the project, FAO strategically placed the project as a pilot case study for implementing the Voluntary Guidelines on Responsible Governance of Tenure



Preliminary discussions between MLPPUAM, FAO and GLTN. Photo © Lawrence Okello.

(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.

The "Supporter"

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

The "Beneficiary"

Ministry of Lands, Physical Planning and Urban Areas Management (MLPPUAM), Lodwar, Turkana County: The ministry, through its leadership, particularly the

Chief Officer, has provided enormous support to ensure that the project deliverables are achieved. Aside from hosting staff from the UN-Habitat/GLTN Secretariat during the project, it has allowed its limited staff to fully participate and provide input throughout the process, including the system design and modelling, and the review of survey plans and ground verification.

EXPECTED OUTPUT

An operational LIMS which features the following capabilities:

- Managing land parcels in a GIS environment, including the land-use types;
- 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 on information captured from the land-use planning process.

THE SOCIAL TENURE DOMAIN MODEL

THE SOCIAL TENURE DOMAIN MODEL

As a concept, STDM implements the continuum of land rights principle, an inclusive, pro-poor and gender-responsive approach, which encompasses and recognizes a wide range of land rights, including formal, informal and customary land rights. As a model, STDM is based on a global standard, the Land Administration Domain Model (LADM), which enables data integration. The STDM is a flexible land information system that can manage various types of land rights and claims. It is built on top of QGIS, thereby enabling users to benefit from all the capabilities of QGIS. PostgreSQL with PostGIS are used in the backend for storing and managing both spatial and textual data.

STDM is about all people and all types of “people-land” relationships (see Figure 3). “People-land” relationships can be expressed in terms of persons (or parties) having social tenure relationships to spatial units.

Parties are people, or groups of people, or non-natural people, that compose an identifiable single entity. A non-natural person may be a tribe, a family, a village, a company, a municipality, the state, a farmers’ cooperation or a church community. This list may be extended and it can be adapted to local situations, based on community needs.

Land rights may be formal ownership, apartment right, usufruct, free hold, lease hold, or state land. It can also be social tenure relationships such as occupation,

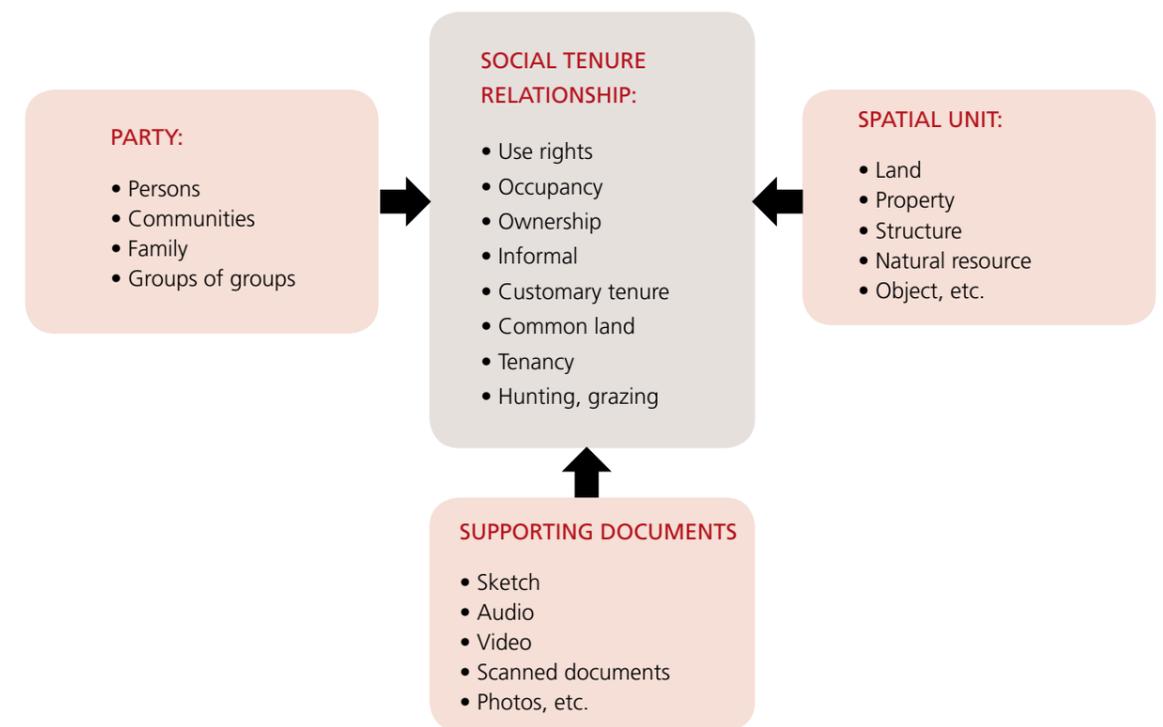


Figure 3: The STDM Conceptual Model (UN-Habitat/GLTN, 2014).



Lodwar urban centre. Photo © Rhea Lyn Dealca.

tenancy, non-formal and informal rights, grazing rights, livestock corridors, customary rights (which can be of many different types with specific names), indigenous rights, and possession. There may be overlapping claims, disagreement and conflict situations and there may also be uncontrolled privatization. Again, this is an extendable list to be filled in with local tenancies. A restriction is a formal or informal entitlement to refrain from doing something; for example, ownership in indigenous areas is not allowed. A servitude or mortgage may be a restriction to the ownership right. There may be a temporal dimension, for example, in the case of nomadic behaviour when pastoralists cross the land according to the seasons.

Spatial units are the areas of land (or water) where the rights and social tenure relationships apply. According to the LADM/STDM ISO-standard, those areas can be represented as a text (“from this tree to that river”), as a single point, as a set of unstructured lines, as a surface, or even as a 3D volume. This range of spatial unit representation can cover community-based land administration systems, or rural, or urban, or other types of land administrations, such as marine cadastres and 3D cadastres. Surveys may include the identification of spatial units on a photograph, an image or a topographic map. There may be sketch maps drawn up locally. A sketch map may be drawn on a wall and a photograph taken of it.

STDM AS A LAND GOVERNANCE TOOL

The development of STDM aimed to implement the concept behind the continuum/range of land rights. This technical gap was identified as early as 1998 when experts realised that there were various types and ranges of tenure arrangements that could fit with the conventional land registration systems and parcel-based spatial description of the rights (United Nations Economic Commission for Africa, 1998). This thinking progressed until the beginning of 2000, when a number of key people in the land administration field became convinced that the conventional land registration and administration systems were not sufficient and not always appropriate for the range of tenure types that existed, such as for the pastoralists, customary and slums. Fourie (2001) further advanced the idea of the need for new forms of spatial information - not a cadastre - to provide tenure security in informal settlements and customary land.

Over time, it became clearer that this technical gap, aside from impacting on the security of tenure of the poor, contributed directly to chaotic and unsustainable cities, the mismanagement of the scarce natural resources (e.g. forest), environmental degradation, delays in conflict management and proliferation of slums and informal settlements (Augustinus, 2009). Christiaan Lemmen, of the Faculty of Geo-Information Science and Earth Observation (ITC) of the University of Twente, took the lead in developing the solutions to fill this technical gap from 2002 onwards by starting to develop the Social Tenure Domain Model (STDM) at the conceptual level along with the development of the FIG-led Land Administration Domain Model (LADM) (Augustinus, Lemmen, & Van Oosterom, 2006). The University of Twente (ITC) was then financially supported by GLTN to develop the design of the model

further, including the technical aspects. FIG, through the leadership of then President Stig Enemark, has supported its development, including the peer-reviews of STDM designs (conceptual, technical and functional) by known land professionals. In 2009, the initial version of the STDM prototype was tested by UN-Habitat and ITC in the context of the rural land administration in Ethiopia, particularly in Amhara region, in collaboration with the World Bank (Zevenbergen & Haile, 2010). The STDM prototype was launched during the FIG Congress in Sydney, Australia, April 2010. This featured the new joint publication with FIG and ITC: *The Social Tenure Domain Model - A Pro-Poor Land Tool*. STDM was also highlighted in the Sydney Declaration (www.fig.net). Finally, the tested STDM prototype, including the designs, was handed over by ITC to the UN-Habitat/GLTN Secretariat in August 2010.

Since then, the UN-Habitat/GLTN Secretariat has been working on enhancing STDM and its further development in three areas: adding more functionality, improving the user-friendliness of the software and reshaping STDM system to cater for the information needs and requirements across different application contexts. In addition, GLTN has put in place an outreach strategy that seeks to create awareness and build capacity in the use and application of STDM across a wide range of global stakeholders.

FAO and GLTN both recognize the importance of prioritizing and addressing issues related, but not limited, to customary land because of its huge potential to contribute to poverty reduction and its positive potential impacts at a global level. In this regard, the two agencies supported the MLPPUAM and the Turkana County Government, Kenya, to develop and rollout a land information system for managing tenure with regard to urban and customary land within the county.

METHODOLOGY

METHODOLOGY

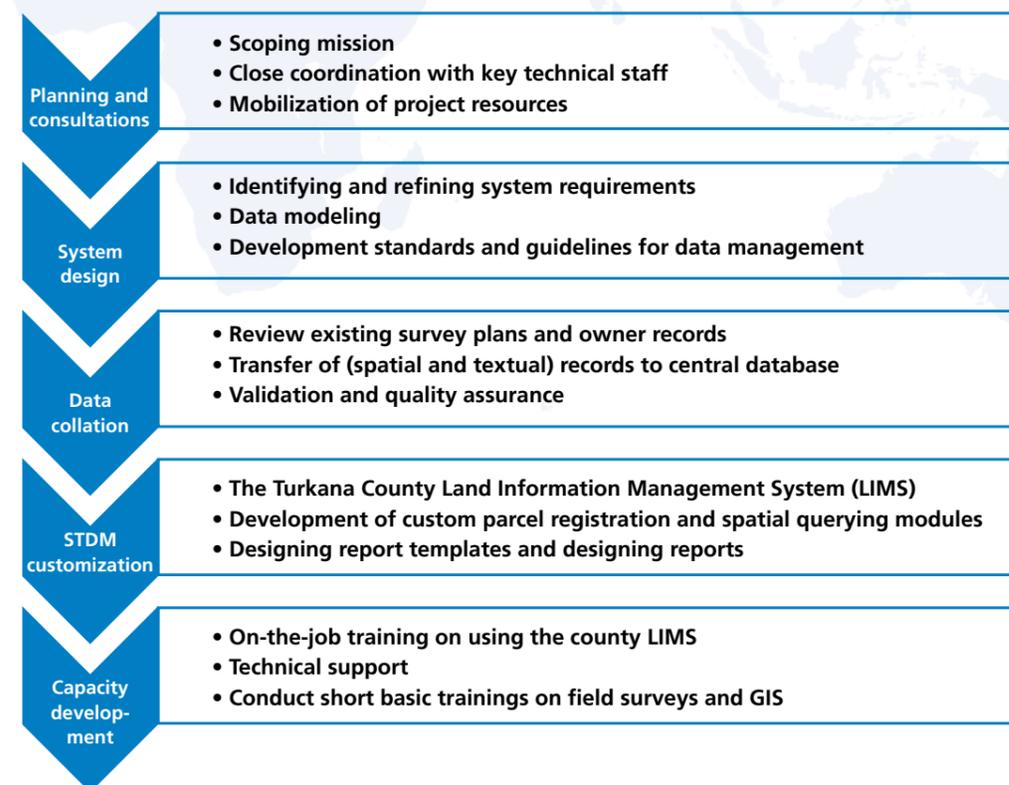


Figure 4: The processes involved in establishing the Turkana County LIMS.

PLANNING AND CONSULTATIONS

Scoping Missions

In April 2015, a joint mission was conducted by FAO and GLTN to Turkana County to assess the land information needs, current status of land records and equipment available in order to develop a County LIMS with the application of STDM. The mission included interviews with key staff in the ministry; agreements on roles and responsibilities; the review of existing datasets, both spatial and tabular; a survey of the existing billing system for capturing land rates payments and reviewing the business processes within the ministry. See Annex 1 for a list of the key technical staff interviewed.

After the signing of the Agreement between UN-Habitat/GLTN and FAO in October 2015, subsequent missions to Turkana were conducted and these yielded an understanding of STDM and its application in the context of the County LIMS and the development of an implementation plan.

Close coordination with key technical staff

Working closely with the technical staff made it easier for existing data to be collected and to understand clearly the existing business processes in the ministry. Through this, gaps were identified and guidelines were developed to bridge them.

Mobilization of Resources

To provide project implementation support, onsite consultants were recruited and stationed at the ministry. The necessary equipment, such as computers, printers and a large-format printer, were also provided to the ministry. These resources were needed for smooth project implementation.

SYSTEM DESIGN

Identifying and refining system requirements

Interviews with key staff from the ministry, which included the Chief Officer, System Administrator, Chief Planner, Land Records Officer, and County Surveyor/Cartographer, assisted in identifying and refining the system requirements for the Land Information System. A Software Requirements Specifications document (see Annex 2) was developed which formed the framework of developing, testing and evaluating the system's functionality.

An initial LIMS data model, to address the data requirements of the ministry, was developed through various discussions with key personnel from the ministry.

In order to share the central database among different users in the ministry, an appropriate ICT infrastructure was needed. Currently, different pieces of land information are held by different offices and people within the ministry, which limits access to said databases. The proposed architecture model of the system, as shown on Figure 6, would ensure access to the central database but with access control from the designated system administrator. The central repository is composed of: 1) parcel information, including boundaries (coordinates) and the land use type; 2) parcel owner information; 3) parcel tenure information; and 4) rates payment history. However, since the ministry already had an existing billing system, the system was maintained with a few enhancements, which were to be under the accountant's office.

The following are the roles of key officers within the ministry:

- System Administrator – configures both systems; troubleshoots; does performance tunes and monitors status of both client systems and central database.
- County Surveyor – registers new parcels (assigns unique parcel identifier, land-use type and geometry); updates parcel information; defines tenure relationship by linking an owner to corresponding parcel.
- Accountant – registers a new landowner in the system; updates parcel land rate payments; issues receipts and reports on payments made.

The chief officer can view the parcel and owner information, along with the payment status and land use type. Other officers (e.g. county planner, cartographer, etc.) within the ministry can access the system with controlled privileges.

Data modelling

To start the customization of STDM, a review was conducted on the initial database diagram which represented the data requirements of the ministry. In addition, the existing billing system needed to be reviewed and factored into the customization process. With this data, a detailed database diagram was developed into which new features of the database structure were integrated. The process of customization involved adding new features into STDM and modifying the existing code to accommodate the new database structure.

The process involved customizing the system's data fields to match those for entities specified in the data model which had been agreed on with ministry representatives. Additional modules were also developed to enable the seamless management of survey data from the field. Customized modules for performing spatial queries and generating map reports were also tested and integrated into the tool.

Table 1: Core Table of the LIMS Data Model.

Table	Description
Parcel	Captures all the major information related to the parcel such as administrative unit of the parcel, parcel code, area/size of the parcel, monetary value of the land service, date of allocation, land-use type, disputes, and the polygon geometry.
Person	Stores data on the individual owner of the parcel. The table has fields such as full names, date of birth, address, national ID, and so on.
Institution	Stores data on party* type other than individual owners. Institutions include non-governmental organizations, churches, businesses, and other organizations. The table captures the registration number, name of the institution, address and telephone number.
Social Tenure Relationship	Indicates a relationship table that links the parcel table with the party tables, namely the person and institution tables.
Survey	Keeps track of all the surveys done for each parcel. It captures the parcel, date of survey, and the planner and surveyor involved. The surveyor and planner data is stored in a separate table but the survey table links the two.
Service Payment	Stores all payments made by party for a service related to a parcel. This could also include new client payment that entails payment without a parcel. If a parcel is assigned to a party, the table can be updated. The table has fields such as the reference number, date of payment, and the party who has paid for the service.
Rate Payment	The service and the amount are stored in another table called rates payment. This table was needed because one party can pay for multiple services with different amounts.
Lookup tables	Lookup tables are used by STDM to simplify the process of data entry as the user can use a drop down menu on the forms to enter them. These tables are differentiated with a prefix of 'check'. The tables also simplify the process of updating names or adding new names. For instance, the service type lookup table named 'check service type' lists all the service types. If a new land service is introduced, it can be added. Also, when there is a need to modify existing lookup values, for instance, modifying one or more service types, it can be done from the STDM interface and this change will automatically reflect in the data automatically.

*Party refers to a person or an institution.

Table 1 above shows the core table on the LIMS data model. Figure 6 on page 21 shows the LIMS data model covering parcel-based data requirements of the Ministry.

Proposed Architecture of Land Information Management System for the Ministry of Lands, Physical Planning and Urban Areas Management (MLPPUAM), Turkana County

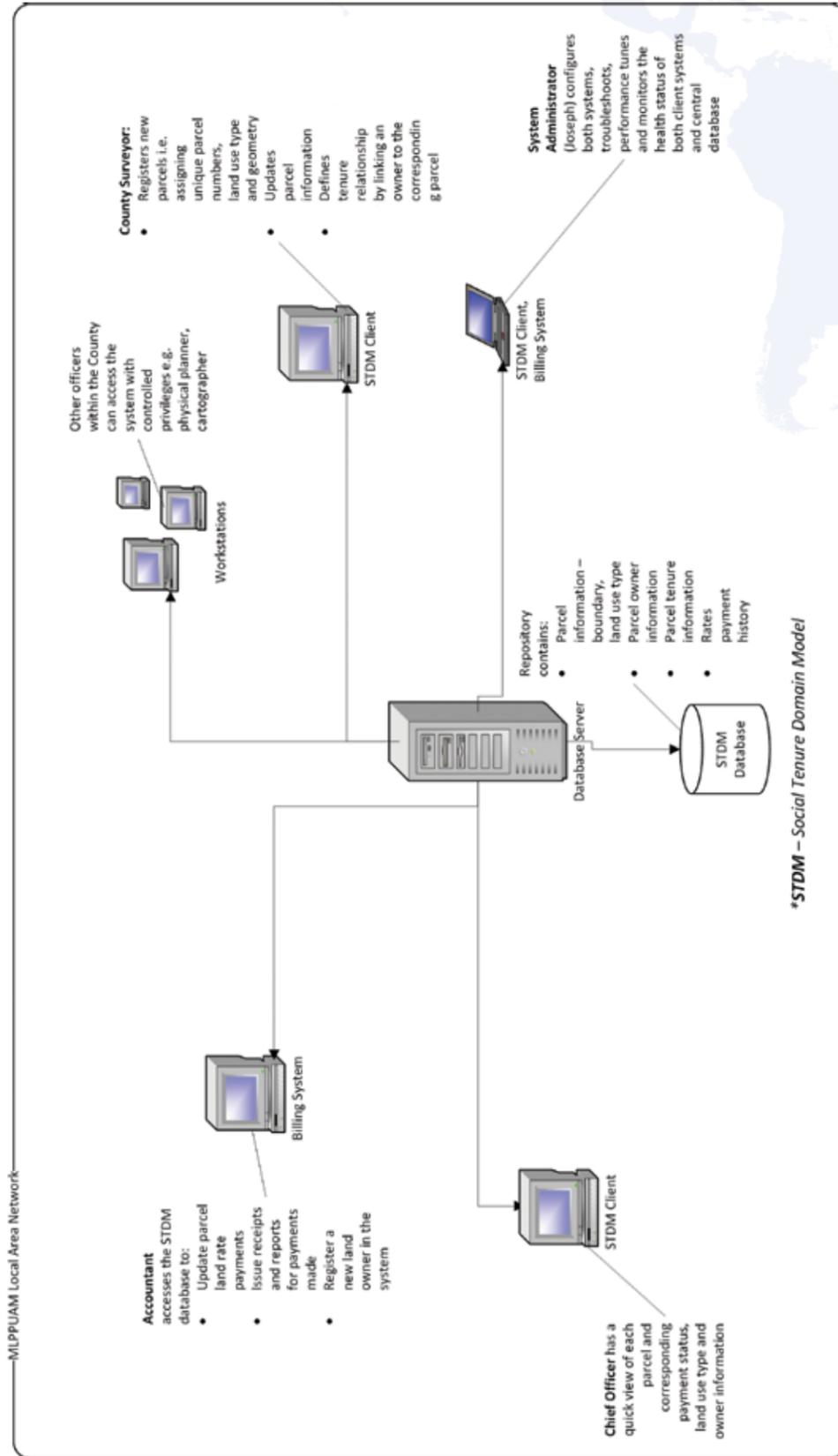
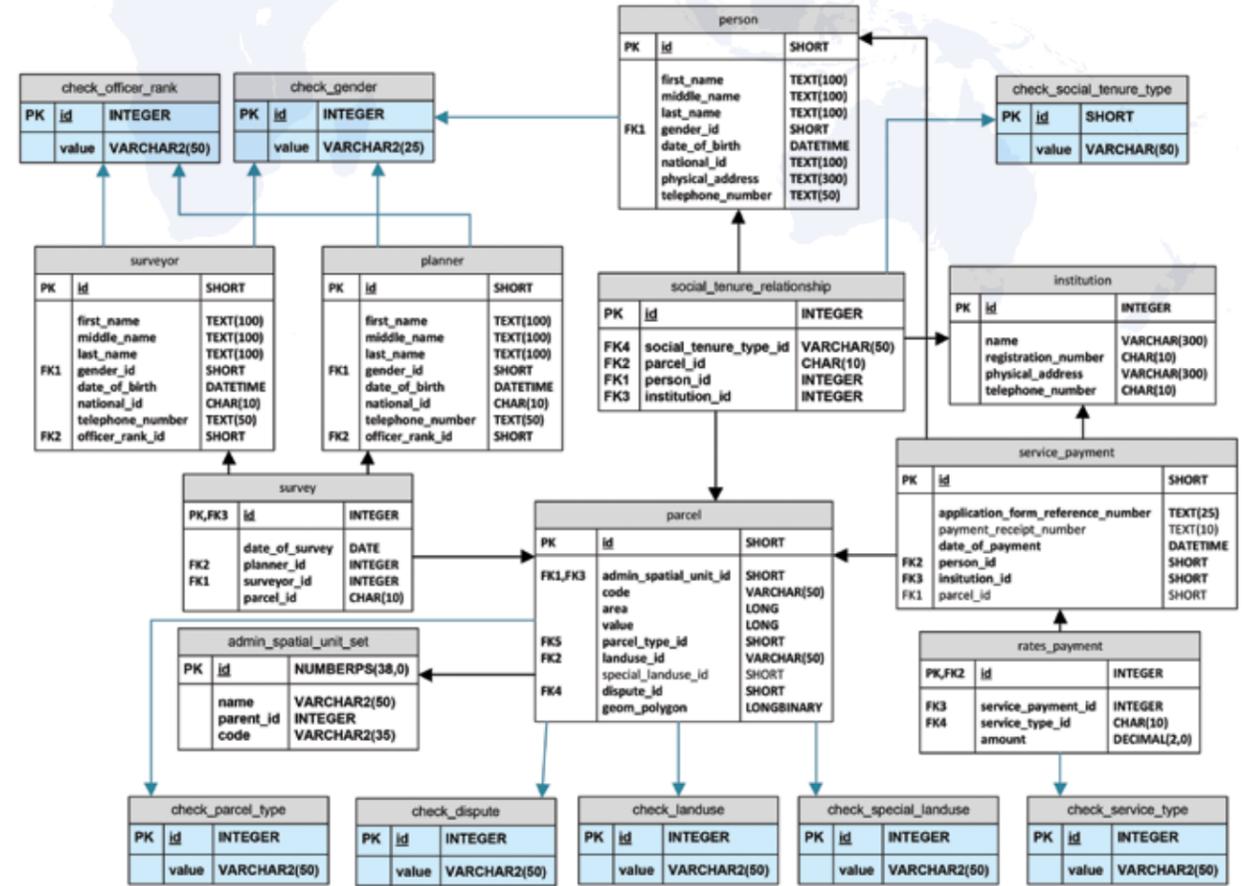


Figure 5: Architecture model of the Turkana County Land Information System.

Turkana LIMS Data Model

CORE TABLES



LOOKUP TABLES

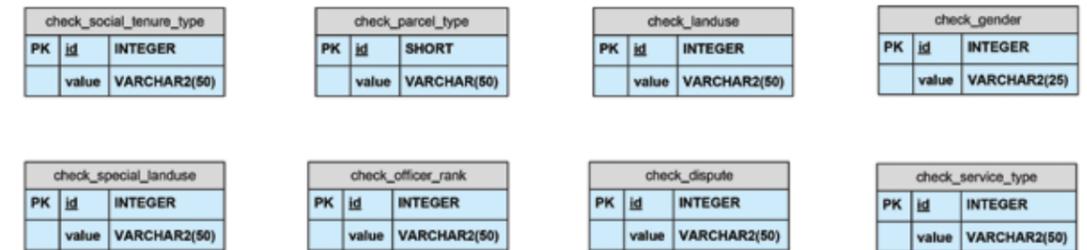


Figure 6: Land Information and Management System Data Model.

THE TURKANA COUNTY GOVERNMENT LAND MANAGEMENT SYSTEM (BILLING SYSTEM)

There was an existing in-house built billing system- the Turkana County Government Land Management System- which the county uses to record land transactions. The system is based on an MS-Access database using Visual Basic.NET programming. The database tables of the billing system are:

1. Land details – that provide information on the person or institution paying for the service, with incomplete, parcel detail in which the plot number is captured.
2. Service payment table – provides information on the services and the party paying for it and the amount.

3. Receipt detail – stores similar information with an addition of the receipt details.

To understand the existing process of registering parcel in the county, see Figure 7:

1. An incoming client goes to the Ministry of Lands to inquire about and request land services, e.g. parcel survey. Before any other land service on a particular parcel is undertaken, the parcel must first be surveyed.
2. The land records officer/desk officer will advise the client on the service charges and payment for the services demanded.
3. The client will have to go to the bank for the service payment. Once paid, the client/owner will

return to the ministry and give the bank receipt to the accounts office. The accounts officer/ accounting clerk will then enter the personal and payment data of the client/owner on the billing system, issue a receipt and application form and direct the client/owner to the surveyor/planner to carry out the request depending on the nature of service demanded. A survey date will be appointed depending on the prevailing workload and availability of a county surveyor/planner to perform the task.

4. A demarcation survey will be conducted by two personnel from the lands office comprising a surveyor and a physical planner who will record all parcel-related information on the survey form and advise the client as per their professional requirements in terms of rights to road access, etc.

5. The land records officer will ensure that the generated allocation document is approved by the county surveyor, the county physical planner and the sub-county land administrator within 14 days from the date of field survey. In the case of a dispute over a parcel, the land records officer shall notify the client of the reasons for non-approval of his/her demarcation request.
6. The survey forms are to be kept by the land records officer in indexed files according to their demarcation areas in the file cabinets. The land records officer will also check parcel size to determine if payment made is sufficient or not. If payment is sufficient, the land records officer shall issue acceptance of the application for registration, with a cover letter, survey plan and the parcel code. If not, he/she shall advise the client to make the necessary updates on payment at the accounts office.

Registration Process with the Billing System

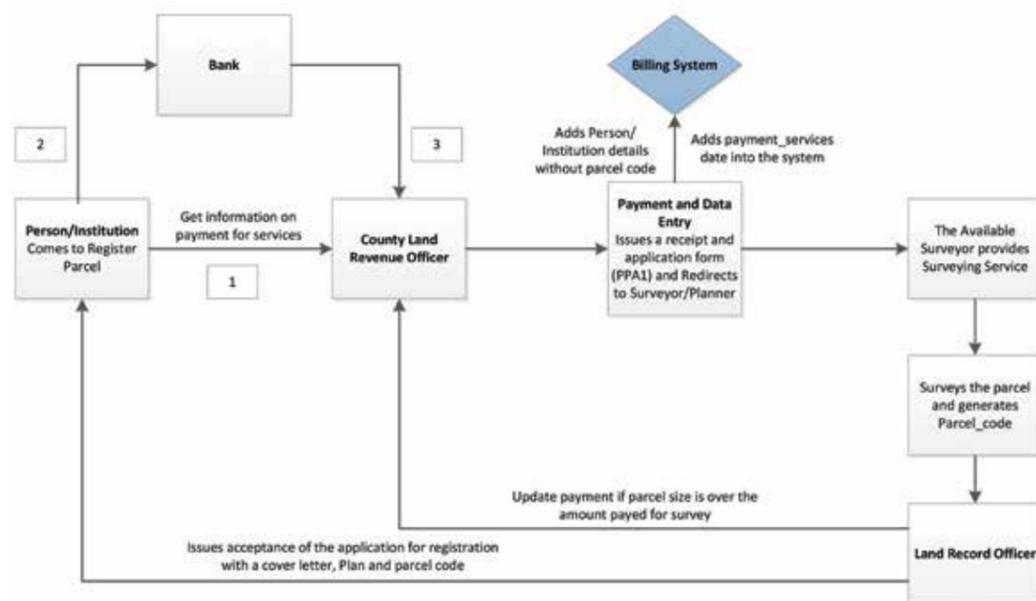


Figure 7: Existing processes in registering parcels.



Figure 8: Turkana County Government Land Management System (TCGLMS).

With the development of the county LIMS, the system was reviewed to determine how it can connect to the central database. It also needed to be integrated into the new systems under development. Figure 8 shows the payment window of the county billing system.

Some of the findings were: 1) The billing system database was based on MS-Access and needed to be converted to MS-Excel and subsequently to csv files for importation to STDM; and 2) the database structure needed to be revised to avoid duplication of data which was already captured in the land information system and which would be linked to the payment records.

The review resulted in a revision of the existing billing system database to capture required data fields for the purpose of payment for specific land services.

Developing standards and guidelines for data management

In the process of assessing, collecting and analysing available digital and hardcopy maps, guidelines for converting hardcopy maps into digital maps were prepared to establish a set of mapping standards. The guidelines included gathering spatial data in the field and importing it into open-source GIS software. See the guidelines on digitization and field mapping in Annex 3.

Guidelines on the user access and roles in operating LIMS were also prepared. The guidelines sought to provide a clear picture of the roles and responsibilities of concerned officers within MLPPUAM with regard to data entry, updating and management. They also outlined the access roles to be given to the concerned officers with regard to how data would be accessed and

viewed. Guidelines on User Access and Roles in LIMS Implementation were also prepared with consultation from key technical staff in the ministry.

DATA COLLECTION

Review existing survey plans and owner records

Data collection activities were undertaken to identify the type of land records available at the ministry. The collected land records consisted of the following:

- **Spatial Data:** There were two sets of spatial data that were collected within the ministry. Some were hard copy survey plans pre-devolution and most were digital maps stored from 2010 to present. A review of the parcel boundaries from existing survey plans that had been prepared by the survey office in the ministry was conducted. These were digital copies in DXF format, which were subsequently auto-traced to polygons and projected to the local coordinate system. Figure 9 shows a sample survey plan showing the parcels surveyed (coloured), the name of the client/owner, date of survey, GPS coordinates, measure of the lines forming the polygon and area of the polygon.
- **Textual Data:** Land records regarding applicants for various land services are documented by the land records officer. The records come from the different forms completed during an application for a specific type of land service. These forms are the following:
 1. *Paying-in Slip* – refers to the form completed before a receipt is given to the applicant by the accounts officer. This is done after an applicant presents a bank payment receipt. The slip contains the following details: name of the

applicant, types of land services requested for, amount for each land service requested, total amount paid, signatures of revenue/works officer and the ministry accountant, signature of person who received the payment, receipt number and date. See sample Paying-in Slip in Annex 4.

2. *Application for Development Permission (Form P.P.A1)* – refers to the form completed to apply for development of a particular plot. It contains 4 Sections: 1) Section A – General Information; 2) Section B – Subdivision/Consolidation; 3) Section C – Extension of Lease, Change of User, Building Plans, Burrow Pits, etc.; 4) Section D – Comments, which contains approval/disapproval of county officers with regard to the request. See sample application form in Annex 5.
3. *Cover Letter on Approved Survey* – refers to the letter provided to the applicant once the survey has already been approved. It contains details on the name of the applicant, plot number, area and address. Refer to Annex 6 for the sample document.
4. *Parcel Sketch* – Attached to the cover letter is a sketch of the parcel surveyed. A sample is attached in Annex 7.

The non-spatial data includes details of the applicant and corresponding parcel information, i.e. reference number, name of applicant, national ID number, address, coordinates of parcel, plot number, amount paid. Payment information as part of the TCGLMS, is also available at the accounting office. Figure 10 shows a data capture of the logbook and the MS Excel file which records the land transactions made.

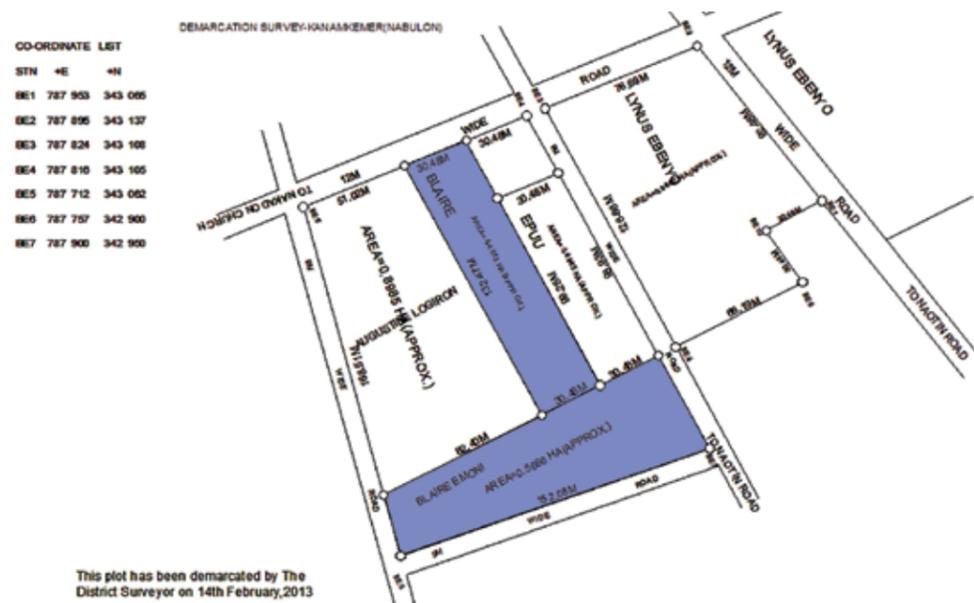


Figure 9: Sample survey plan.

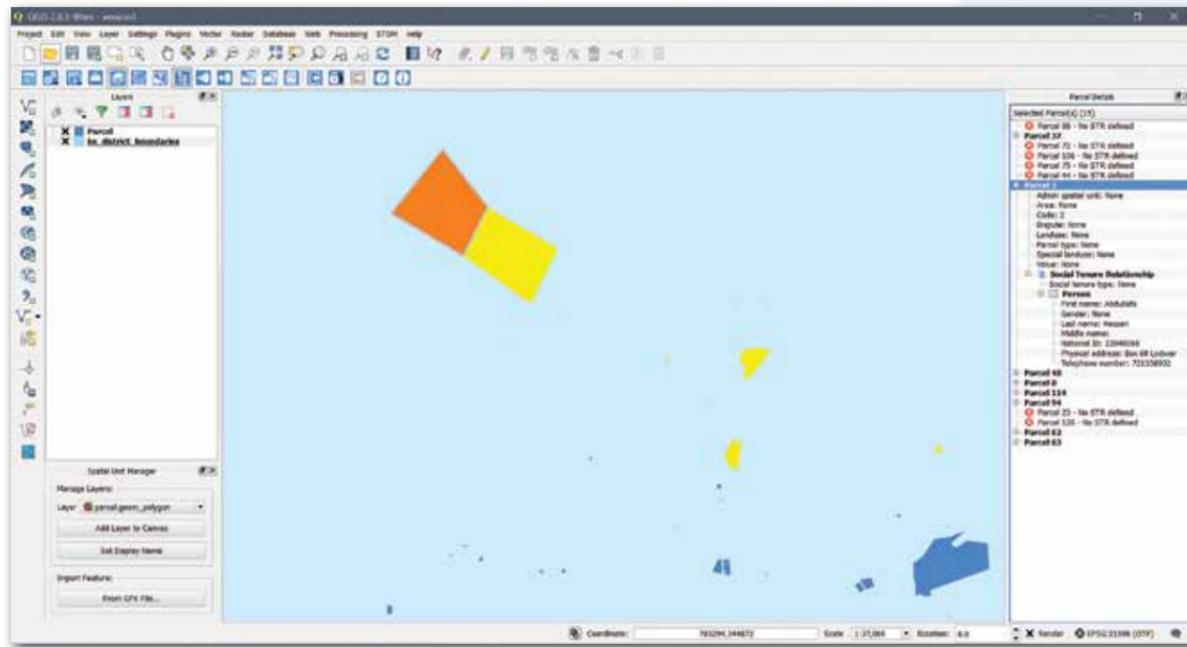


Figure 11: Parcel detail viewer.

Figure 12: Registration of a new parcel.

sub-county, ward, village, block and plot number. It is important in a land information system to be able to establish the social tenure relationship between the person/institution and corresponding parcel. In LIMS, a parcel code is automatically generated, composed of administrative unit codes which include the county, sub-county, ward, village, block and plot number auto-generated from the system. An example of a parcel code is TURTC//LOD/KNK/B-D/001 which shows that the parcel is within the county of Turkana, sub-county of Turkana Central, ward of Lodwar, village of Kanamkemer, Block D and was assigned plot number 001.

Development of custom parcel registration and spatial querying modules

New features were added as part of the customization of STDM to comply with the data requirements of the county's land information system. The Turkana County LIMS was built on top of STDM to make it more useful for the county needs taking in consideration existing processes and systems. The new features are Parcel Detail Viewer and Register New Parcel. The Parcel Detail Viewer, as seen in Figure 11, enables the user to see details of a parcel by clicking on parcel geometry on the map.

TABLE 2: CAPABILITIES OF THE NEW FEATURES.

Parcel Detail Viewer

Displays parcel detail with the heading of parcel code

Ability to select multiple parcels and find them listed. Users can expand and see each parcel's details

Lists all related tables, such as the social tenure relationship, party (person/institution), survey, payments.

Lists all related tables, such as the social tenure relationship, party (person/institution), survey, payments.

Register a Parcel

Ability to upload a Computer-Aided Design (CAD) format, specifically DXF file, which is useful, especially if the parcel map is created using engineering software, such as AutoCAD.

Ability to convert entered coordinates of the parcel into parcel polygon.

Integration with Module Settings/Records Manager, with the ability to add (with the Register a New Parcel) and Edit Parcel records.

Integration with GPS points importer in which, with a click of the save button, the selected points are added into Register a New Parcel window to preview the parcel polygon, add attribute information and register a parcel.

Automatic generation of parcel code using administrative unit manager.

Adds a temporary live preview polygon that updates in real time when users type valid coordinates, insert a DXF file, or import points from GPX file.

Form validation that guides users' type the correct coordinate format, parcel code, and form in general.

Ability to add and remove coordinate text fields.

Ability to automatically calculate the area of a parcel on entry.

Ability to detect if a parcel boundary touches another parcel boundary with no error for parcels that share boundary.

Ability to detect if the parcel being added is inside another parcel.

Ability to detect if the parcel to be added contains other parcels.

Ability to detect a duplicate entry by checking if there is exactly the same geometry in the system.

The “Register New Parcel” tool (refer to Figure 12) enables users to upload data on a single parcel and includes the geometry and other information such as the location, area, value, among other things.

Table 2 shows the capabilities of the Parcel Detail Viewer and “the register New Parcel” module:

Designing report templates and generating reports

A “Document Designer” is an STDM module that can be used to design and configure document templates where documents consist of certificates, reports etc. It brings up the QGIS Composer window with the STDM toolbar items to allow for the creation of document templates to be used when generating reports and certificate formats.

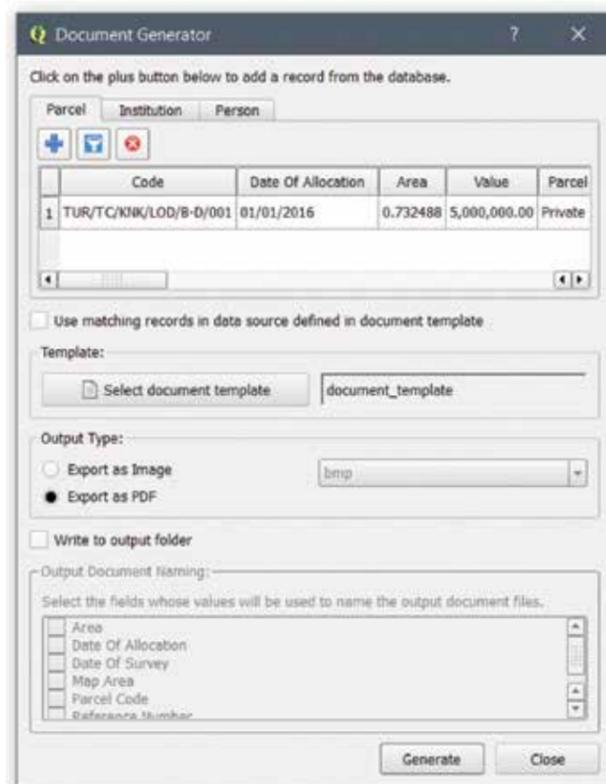


Figure 13: Documents generator.

Similarly, the “Document Generator” is a module that allows for the generation of document outputs using the designed document templates. For Turkana LIMS, a template very similar to that which the county issues to parcel occupants was pre-designed. Figure 13 shows the Document Generator:

In order to issue a parcel survey document, the following conditions had to be met.

- The occupant had to be linked to a parcel through a social tenure relationship wizard.
- The occupant had to have paid for the survey and other land services.
- The parcel survey details such as date, planner and surveyor has to be added.

Annex 9 shows the sample pre-designed documents adapted from existing MLPPUAM cover letter, while Annex 10 shows the attached demarcation survey.

CAPACITY-BUILDING ACTIVITIES

To enable key technical personnel of the ministry to perform their tasks in maintaining the county LIMS, training was given by FAO and UN-Habitat/GLTN in March 2015 at Lodwar. Topics covered included geographic information systems (GIS), the Social Tenure Domain Model tool and LIMS data management and updating. Majority of the participants were land administrators from the sub-counties who were able to identify their possible role in the LIMS. The tasks of the land administrators include resolving disputes, identification of public lands, registration of new institutions, registration of new parcels of land, approval of survey maps and approval of the physical planning maps.

The technical sessions included hands-on exercises in which the participants were able to perform different tasks on QGIS and LIMS. After training, technical backup was continued to ensure sufficient capacity within the ministry to adopt the LIMS.



Training on the use of the STDM based Land Information Management System. Photo © Lawrence Okello and Rhea Lyn Dealca.

CHALLENGES

In undertaking the processes towards building the land information system of Turkana County, there were challenges encountered.

No hand-over of previously approved survey plans from the Turkana Municipal Council to the county government

Getting the hard copy survey plans from Turkana survey records for scanning proved difficult because there was no hand-over of the previous records during the transition from Turkana Municipal Council to the county government. This in turn hindered the scanning of survey plans. However, discussions are ongoing on the methods to be employed in handing these records over to the ministry.

Delayed disbursement of funds from the national government

Another challenge is the delayed disbursement of funds allocated to the county from the national government to pay county workers and finance development projects. This causes operational problems in the ministry with efficiently providing for public services.

Unstructured business processes

Apart from the ministry's Service Delivery Charter, there were no other guidelines or flowcharts which could guide both the ministry personnel and public clientele on the various land services being offered by the ministry. The absence of structured business processes affects the efficiency of service delivery.

Lack of quality assurance procedures

Concern about field data was also raised due to the lack of quality assurance processes to check the accuracy and correctness of the gathered data.

Insufficient staffing

With regards to staffing, the procurement process

was slow and tedious. There was also a concern that vacancies not filled prevail because applicants who had previously applied had not met the required standards.

Lack of equipment to implement mandate of the ministry

The lack of equipment hinders providing a fast and efficient service to clients. For this particular project, computers, printers, including a large-scale printer, and a server were provided in order to create an appropriate working environment, particularly because the establishment of the county LIMS requires an infrastructure through which data can be shared. Equally important was appropriate space for the technical team.

Absence of ICT strategy and infrastructure

There was no ICT strategy in place or associate network infrastructure to support deployment of the system in the ministry. 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.

Limited number of technical staff in the ministry

The ministry had limited technical staff and it was a challenge to have a dedicated 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.

Limited capacity of ministry technical staff, particularly for modern technology

There is limited capacity among ministry employees for the technical and modern aspects of surveying and physical planning, including management of database systems, GIS and use of drones and satellite images for large-scale surveying and land-use planning. This meant

that considerable time was required for sensitization and training. Also, adequate time had to be allocated to training the technical staff in using and maintaining the system.

Apprehension about the use of the STDM tool

There was apprehension in using STDM (being a new tool) and as such resistance in adopting new tools for mapping and database management. Staff was also concerned of the introduction of a new system which was likely to create delays and complexities.

Lack of aerial photographs and digital satellite imagery

The lack of an aerial photograph or high resolution digital satellite imagery of Lodwar town to use in overlaying the drawn files to ascertain their correct representation on the ground and the pattern of parcel development was yet another challenge. An alternative for verification using Google Earth was used despite limited internet connectivity in the lands office.

ACCOMPLISHMENTS

The project implementation achieved the following:

- Customized LIMS was finalized according to the requirements of MLPPUAM;
- The use of administrative area codes (built from the corresponding hierarchy) for numbering parcels within LIMS provided a uniform and consistent addressing system which could be adopted in other sub-counties as well. This was finalized in consultation with key technical officers of MLPPUAM;
- With the development of the Turkana County LIMS, technical processes were documented to guide technical staff on its implementation;
- STDM, as a land information system was used to build up the county LIMS, tested and was proved to be technically sound to address the information requirements of Turkana County;

- Key staffs from MLPPUAM have been trained on how to operate and manage LIMS, are able to use and interact with the system, and are now confident about continuously managing and updating their county land information.

LESSONS

Lessons learned during the implementation of the project include the following:

Partnerships

1. The project is a good model for partnerships. The partnership between the international organizations and local authorities proved to be the "facilitating" agent 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.
2. In partnerships, the commitment of partners to the project's success is important. All parties must work together, share their resources, agree clearly on roles and responsibilities, cooperate fully on agreed activities and openly agree on the next steps. Issues and concerns need to be ironed out at the beginning to lead to smooth project implementation.

Institutional Capacity

1. Ownership by the ministry of the process is critical for the success of the project and the sustainability of the system.

Technical Feasibility and Flexibility of STDM

1. The Social Tenure Domain Model (STDM) proved to be technically sound and simple to use. Key personnel from the ministry appreciated STDM's capacity to customize and generate reports and to perform spatial analysis as soon as the data is captured or entered into the system. In addition, the existing billing system was

enhanced and integrated to the county LIMS.

2. The establishment of the county LIMS through STDM showed the flexibility of the tool in responding to different needs and purposes, by different sets of entities; communities in customary lands, rural lands, urban lands (e.g. informal settlements) or government institutions.

Capacity Development

1. 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 STDM is building the capacity of 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 key technical officers.

EMERGING OPPORTUNITIES

With the successful implementation of the LIMS, the demand for its application and implementation has steadily increased, including for potential use/application in other counties in Kenya. It is becoming clear that STDM is a significant tool that local governments can adopt for development objectives like inclusive planning, tenure security improvement, provision of basic services and infrastructure.

Both FAO and GLTN are actively involved in the development of standards and guidelines for the National Land Information Management System (NLIMS) for the National Land Commission of Kenya (NLC). This project provides valuable case study for the NLC on how to roll out and integrate the NLIMS with county-level land information systems. The NLIMS is based on LADM and since STDM is also a specialization

of LADM, then it is anticipated that the integration of the two systems will be as seamless as possible with minimal challenges expected.

The county LIMS is also expected to support the development of the Turkana County Spatial Plan. To date, spatial plans are only being done in major urban centres of the county. Due to the vast nature of the county, (the largest in Kenya) it is a challenge to cover all areas with current methods because they are time intensive and involve undertaking transect surveys to map out the different land uses. With the LIMS in place, and a systematic, large-scale mapping strategy using modern technology such as satellite images, drones, remote sensing, etc., a County Spatial Plan will be the basis of a land policy to allocate appropriate land use and promote sustainable use of natural resources. The LIMS will also greatly assist the county government in implementing and realizing the County Integrated Development Plan and the Strategic Urban Development Plan for Lodwar Sub-County.

LIMS shall eventually cover the whole of Turkana County. To do this, the system needs to be rolled out to its sub-counties. These have land offices which are directly linked to the Ministry of Lands in the county. They hold the same land records as held in the ministry, while technical processes, such as survey and physical planning, are still undertaken by technical staff from the county. The web-based interconnection of LIMS in different sub-counties to a central repository at the county ministry is expected to provide more efficient access to land information in future.

With regard to the further development of STDM as an information system, it is envisaged that more partnerships will be forged and mobilized, including tapping the support and cooperation of other GLTN partners, universities and research organizations, developers'

community and key individuals. While STDM has proved to be technically sound as a functional land information system for cadastre and land registration systems and other conventional approaches, the objective of its development will continue to be providing alternative ways to bridge the information divide and to target the information requirements of the urban and rural poor. STDM development is expected to focus on addressing affordability issues, scalability, user-friendliness and simplicity.

The opportunities for further piloting and implementation of STDM in different contexts and countries will surely provide more lessons and experiences over time. At present, the documentation of the processes, challenges, lessons learnt and opportunities will provide a valuable overview of the project and will act as a general reference guide for improving future implementations in other counties.

RECOMMENDATIONS

Capacity needs of the Ministry and stakeholders should be addressed to allow the sustainable implementation of projects and land tools. The project identifies this as one of the most essential elements to consider so as to achieve any desired objectives. Capacity-building activities on GIS and other geospatial technology are expected to produce well-trained personnel on the actual implementation of LIMS.

To improve land administration and management, and governance, appropriate legal and institutional frameworks should be in place for the county government. This includes incorporating good civil service practices for the efficient delivery of public service to the county's constituents.

Also important is the implementation of the Community

Land Act, whereby land information systems provide the input for land tenure security.

CONCLUSION

For the last decade, land professionals have been instrumental in devising technical solutions to improve land administration and management systems in every country. With the modernization of information and communications technologies, solutions have become more powerful, faster, more efficient and relatively cheaper. Nowadays, local governments and their networks are using advanced technologies and systems and finding them to be a vital tool. Indeed, the use of information technology systems, remote sensing technologies (i.e. satellite imagery products), Global Navigation Satellite System technologies (i.e. GPS units) and GIS systems to create a land information system is no longer the "exclusive privilege of the educated elites". The Social Tenure Domain Model (STDM) offers these opportunities for land professionals, researchers, grassroots organizations and government institutions.

Governments need good information for good governance. Land information systems are rich sources of evidence-based decision-making processes. They provide an organized and systematic way of capturing data, thereby providing clear business processes along the way. It generally simplifies work, increases its efficiency and is expected to also give customer satisfaction because previous processes took a long time. With the LIMS in place, the process will take less time but with an assurance of the high quality of work undertaken. However, LIS is not a panacea to land tenure security problems. It is just one of the components in a good land administration and management system and should be supported by enabling laws, appropriate institutional arrangements, a skilled workforce and timely budget allocation.

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ANNEXES

KEY INFORMANT INTERVIEWS

NAME	POSITION/DESIGNATION	DEPARTMENT/ ORGANIZATION
1. Mark Ewesit Ewoi	Chief Officer	Office of the Chief Officer/ MLPPUAM
2. Joseph Naaka Losengei	Assistant to the Chief Officer	Office of the Chief Officer/ MLPPUAM
3. Davies Munialo	Senior County Physical Planner	Physical Planning/ MLPPUAM
4. Gideon Lotukoi Lopeyok	Land Records Officer	Survey and Physical Planning Office/ MLPPUAM
5. Jeconia Odera	Physical Planner	Survey and Physical Planning Office / MLPPUAM
6. John Mume Mutemi	Cartographer	Survey and Physical Planning Office / MLPPUAM
7. Justus Wambayi	Programme Officer	FAO

SOFTWARE REQUIREMENT SPECIFICATION DOCUMENT

Turkana County Land Information Management System Software Requirements
Specification Document Rev.11.01.2016

1. OVERVIEW

The purpose of this document is to present a detailed functional description of the GIS-based Turkana County Land Information Management System. It will explain the purpose of the system, interfaces of the system, what the system will do, the constraints under which it must operate and how the system will respond to external stimuli. This document has been prepared through close collaboration with staff from the Ministry of Lands, Physical Planning and Urban Areas Management, Turkana County – Joseph Naaka, Mark Ewesit and John Mumo.

The document is intended for both the stakeholders and technical team, and the proposal will be forwarded to the ministry's senior staff for review and approval.

Turkana County Land Information Management System will be a desktop Windows-based client-server system for recording tenure rights for land owners in Lodwar town. The system will provide a centralized and integrated framework for:

- Managing land parcels in a GIS environment, including the land-use type;
- Linking the land parcels to their corresponding owners;
- Managing land rate payments made by or on-behalf of the parcel owners;
- Designing and generating map-based documents and reports.

The system will be deployed in the ministry's local area network, thereby enabling authorized users to access and update land-tenure information in real-time. See the schematic architecture diagram of the system in appendix one.

2. PRODUCT TO BE DELIVERED TO CLIENT

Turkana County Land Information Management System

3. CLIENT REQUIREMENTS

3.1. Functional Requirements

- I. The system will enable a user to define a custom hierarchy of administrative units e.g. Lodwar/Kanam Kemer/Block 2;
- II. The system will enable a surveyor to upload the coordinate list of a parcel and attach additional attributes such as the parcel number and land use type;
- III. The system will enable a surveyor to dynamically link a parcel to the corresponding owner;
- IV. The system will enable a user to query parcel-owner information and to assess the payment status of land rates;
- V. The system will provide a fully-functional GIS visualization framework for parcel (vector) and imagery (raster) data;
- VI. The system will enable a user to click on one or more parcels on the map and load additional information associated with the parcel, such as owner information, land-use type, payment status of land rates and survey information (such as survey date and the surveyor who undertook the work);
- VII. The system will require each user to have an existing account and login in order to access authorized system modules;
- VIII. The system will enable the system administrator to create or remove user accounts, and assign appropriate access to the system modules based on a user's roles and privileges;
- IX. The system will enable a user to design map-based reports such as certificates, allotment letters, etc. using an intuitive drag-and-drop graphical user interface.
- X. The system will enable a user to generate the map-based reports by selecting records using simple or advanced query options, and by specifying the report template to use.
- XI. The system will enable a user to import textual data e.g. in tabular format such as Comma-Separated Values;
- XII. The system will enable a user to import spatial data in ESRI shapefile, AutoCAD DXF or GPS GPX;
- XIII. The system will provide the backend repository in which the billing system will connect to when updating land rates' payment records.

3.2. Non-Functional Requirements

- I. Security
 - a. The system will implement PostgreSQL's user management security framework to prevent unauthorized access;
 - b. Users will be granted access only to specific modules based on their roles and privileges. These will be assigned by the system administrator;
 - c. Only the system administrator will have full access to the system functionality.
- II. Backup
 - a. A full backup will be carried out every 7 days;
 - b. The Windows scheduling framework will be used to initiate the specific date/time when the backup script will be executed.
- III. Error Handling
 - a. Exceptions will be handled "graciously" by displaying user-friendly messages in message boxes.
- IV. Availability
 - a. The system must be available to authorized ministry's staff 24 hours per day, 7 days a week, with 99 per cent availability. This will be dependent on the network infrastructure.
- V. Database Scalability
 - b. The database structure should be as complete as possible during the design stage but it will provide room for modification without a large overhaul during later phases.

Constraints

1. The library for reading and writing spatial formats (GDAL/OGR), does not support the DWG file format hence, for any spatial file format import, the input datasets must either be in ESRI shapefile, AUTOCAD DXF and GPS GPX file format.

Risks

1. Lack of a ministry-wide local area network will limit the workstations from accessing the database. This can be mitigated by ensuring that there is a reliable network which will enable all relevant staff to access the central system database.
2. Degraded performance when accessing the system once it has gone live. This will be caused by the workstation's limited processing and memory resources. In order for the system performance to be optimized, a basic server infrastructural system needs to be procured and installed. A separate list of server equipment has already been prepared and submitted for review and consideration.

Resources

1. GIS specialist who will collate the spatial land parcel and related information;
2. GIS programmer to customize the Social Tenure Domain Model (STDM) tool and adapt it to the specifications listed in this document;
3. Computer Aided and Software Engineering (CASE) for modelling the system;
4. Access to the digital copies of the parcels' survey in CAD format as well as hard-copy survey plans where applicable;
5. A distributed source code control and versioning system hosted by BitBucket web service.

Ministry Sign-off

Signature (this indicates acceptance of the scope of the project)

Date

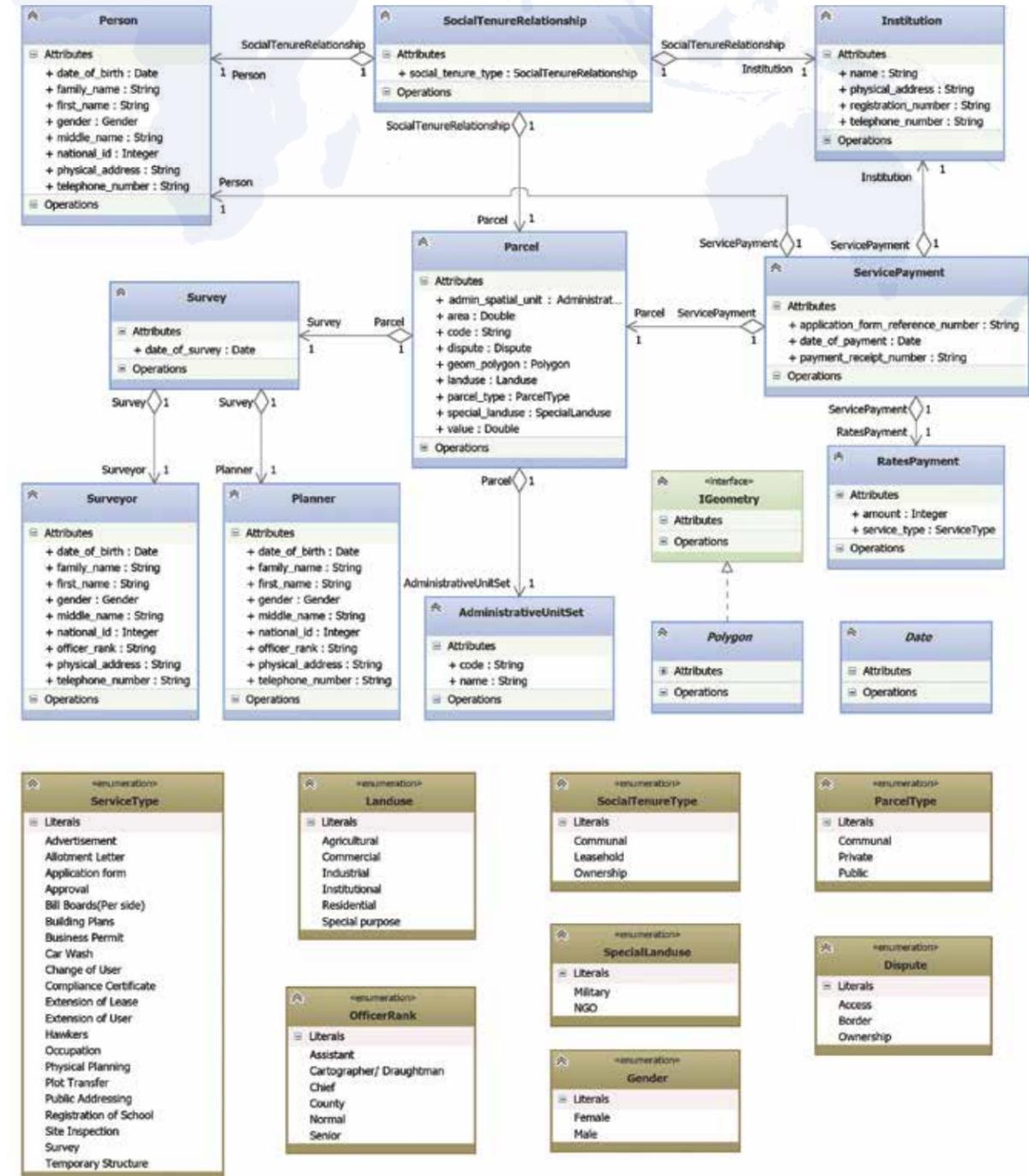


Figure A1: The UML class diagram illustrating the LIMS conceptual model.

DRAFT DIGITIZATION AND MAPPING GUIDELINES FOR TURKANA COUNTY LAND INFORMATION MANAGEMENT SYSTEM

DRAFT DIGITIZATION AND MAPPING GUIDELINES: THE DIGITIZATION OF TURKANA COUNTY LAND PARCEL INFORMATION WHICH COMPRISE OF THE SURVEY PLANS AND ALL THE ASSOCIATED PARCEL INFORMATION IS ENVISIONED TO ENTAIL THE FOLLOWING ACTIVITIES:

1. DIGITIZING EXISTING SURVEY PLANS

A. Digitization in a Geographic Information System (GIS) software environment.

- I. Scanning of all existing hard copy survey plans previously done and that do not exist in digital copies as CAD drawings. These will be scanned at 300 dots per inch (dpi) and saved as a standard Jpeg file format.
- II. Each file will be named or indexed according to the drawing titles. With each scan, a quality check will be performed to ensure the plans are correctly scanned with respect to orientation and all existing information is well captured and readable.
- III. The scanned survey plans will be geo-registered according to the coordinates available on them (marking beacons on the ground) and projected to Arc 1960, UTM Zone 36 North for Turkana County.
- IV. Storage will be systematic according to county, sub-county, ward, village, sub-village, block numbers etc. folder system naming in the database server as per the administrative hierarchy where they fall.
- V. The scanned plans in Jpeg format will be digitized in a GIS system to capture the plot/parcel geometry only in polygon form.
- VI. The captured polygons will be projected to Arc1960 UTM Zone 36 North reference system – the same as the scanned survey plans.
- VII. The captured polygons should only include parcels not roads or other structures. There should be another layer for roads and other structures.
- VIII. The digitized polygons will be attributed according to parcel information available and updated where need be according to the established attribution requirements.
- IX. The created database will be imported into STDM LIM System for updating and maintenance.

B. Digitization using LIMS

LIMS already has the Register a New Parcel Window that enables entry of parcel information with its geometry. All coordinates should be projected using Arc1960 UTM Zone 36 North reference system for Turkana County region.

- I. Entry of coordinates: On the "Register a New Parcel" window, add the coordinates of a given parcel from a hard copy or a PDF-generated by AutoCAD or other software in the text field under "Add Coordinates" tab of the window, enter the other information of the parcel and click on "Save".
- II. Importing DXF file: On the "Register a New Parcel" window, go to the "Add CAD file" tab and browse the dxf file. After adding the parcel information, click on the save button to register the parcel.
- III. Entry of GPS Points: On "Spatial Units Manager", click on the button "From GPX File..." button and browse the GPX file that holds coordinates of a parcel. Then choose the coordinates and click save to add it in "Register a New Parcel from. gpx File" window and add other details of the parcel and click the save button.

2. FIELD MAPPING GUIDELINE.

The following shall entail the process of mapping a new parcel of land upon demand by a client:

1. An incoming client will be received at the Ministry of Lands Customer Care or Enquiry Desk who will ascertain the nature of service demanded by the client.
2. The customer care personnel will advise the client on the service charges and payment for the services demanded.
3. Upon paying for the service demanded and receipting by the County Land Revenue Officer, the Land Records Officer will advise on work assignment and direct the client to the relevant County Surveyors/Planner personnel to carry out the request depending on the nature of service demanded.
4. A survey form will be issued that carries information on the person's full name and national ID or institution name and registration number, service payment and amount details, parcel details and date of survey with the full name and national ID of the surveyor and physical planner. This form will be completed by all concerned parties while also keying in the same data into LIMS as the information is captured. The form should only be handled by the staff and should be kept under the client file.

DRAFT DIGITIZATION AND MAPPING GUIDELINES TURKANA COUNTY LAND INFORMATION MANAGEMENT SYSTEM

5. A survey date will be appointed depending on the prevailing workload and availability of a County Surveyor/Planner to carry the task.
6. The Records Officer will pass the survey form to the available survey team.
7. A demarcation survey will be conducted by two personnel from the lands office comprising a surveyor and a physical planner, who will record all parcel related information in the survey form and advise the client as per their professional requirements in terms of right to road access, etc.
8. The recorded data sheet/form from the field will be keyed into the LIMS by the surveyor and the registry entry approved for correctness by the physical planner involved in the demarcation exercise.
9. The survey forms are to be kept by the Lands Records Officer in indexed files according to their demarcation areas in the file cabinets as survey datasheets backups.
10. The county surveyor involved in a demarcation will add the parcel detail and drawing of the respective survey plan or parcel geometry into the LIMS that conforms to the actual representation of the parcel surveyed on the ground.
11. The physical planner validates the entered parcel into the system confirms the specific location's plan requirements.
12. When a demarcation survey is approved by the planner as specified in the survey form, the Land Records Officer will link the parcel with the assigned person/institution. In addition, he/she update the service payment table by adding the parcel for which the client has made payments for.
13. Then, the records officer has to generate and print the parcel allocation document (survey plan or map and the allocation letter) from within the system.

14. The Land Records Officer will ensure that the generated allocation document is approved by the County Surveyor, the County Physical Planner and the Sub-County Land Administrator within 14 days from the date of field survey. Any comments on approvals or rejection of a demarcation survey will be captured in the generated document by the system which can be forwarded to the relevant parties for correction or client feedback.
15. In the case of a dispute over a parcel and a demarcation survey for the parcel failing to be approved, the Land Records Officer removes the link between the parcel and the assigned institution/person and will notify the client on the reasons for non-approval of his/her demarcation request.
16. For other land services, the payment process is repeated. Payment is then recorded by the billing system, whereby LIMS is able to automatically capture the new addition on service payment. The client is then directed to approach the County Surveyor/Physical Planner for the scheduling of the land service requested. After service is executed, the usual approval or disapproval process follows.

Refer to Figure 2 and 3 for the process flow of registering a new parcel with LIMS, and for the process flow of updating parcel information with the execution of other land services on a particular parcel respectively, in the next pages.

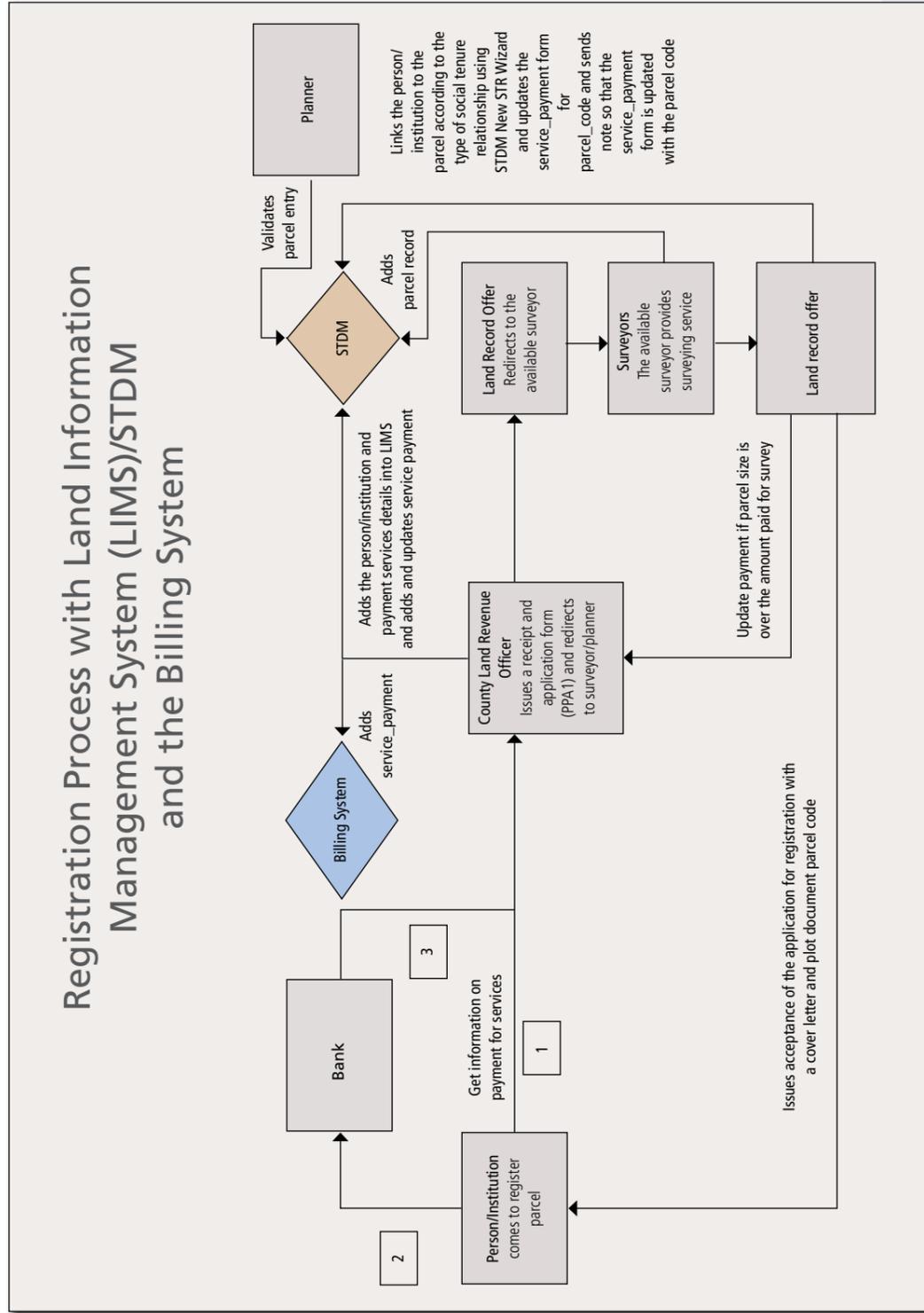


Figure A2: Registration process with LIMS/STDM and the billing system.

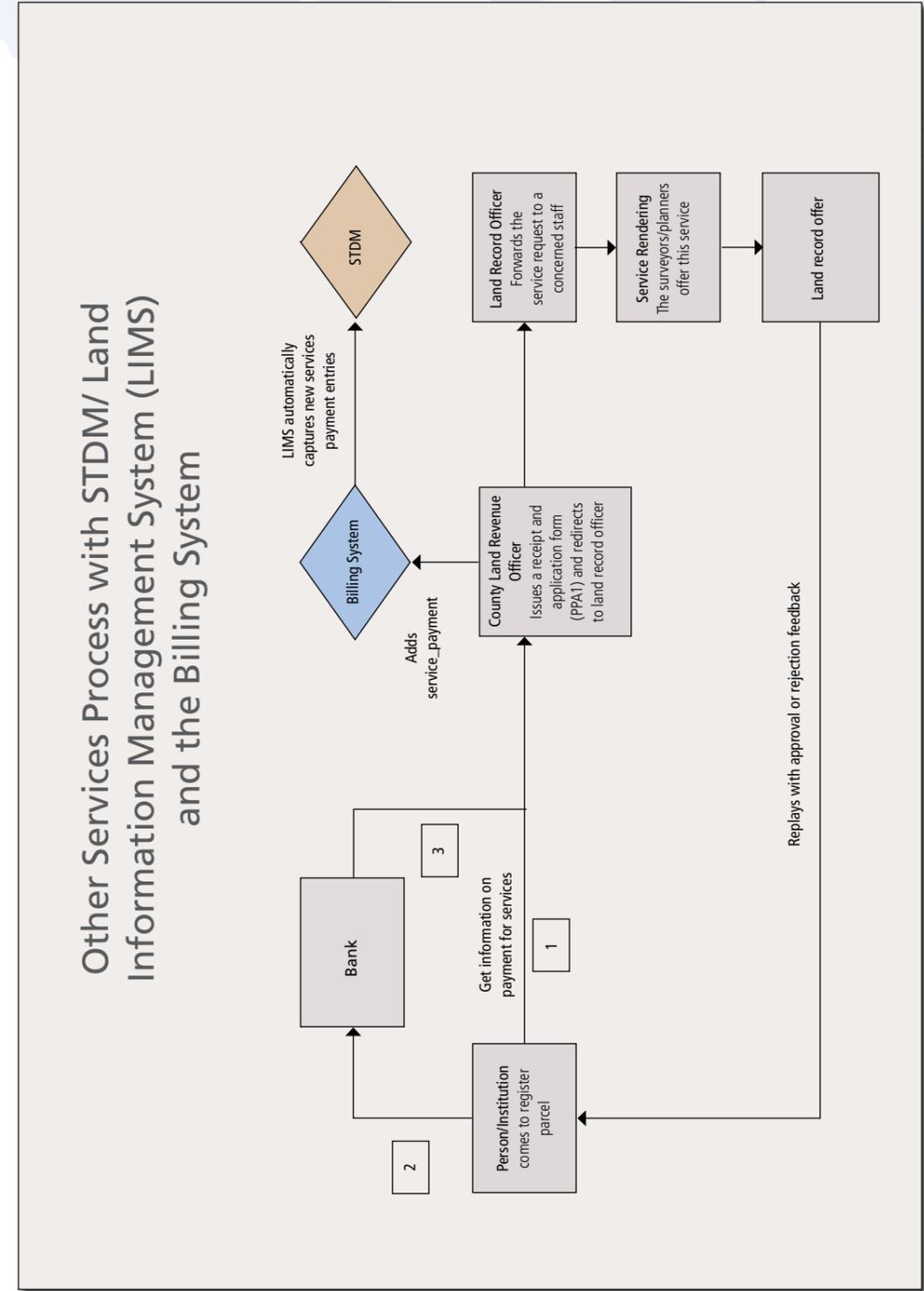


Figure A3: Other services' process with STDM/LIMS and the billing system.

SAMPLE RECEIPT

ORIGINAL

TURKANA COUNTY GOVERNMENT
MISCELLANEOUS INCOME RECEIPT

MR No. 63192
Date 27/2/2016

RECEIVED from Jako M. Witi or Solomon
Sum of Shillings Thirteen thousand only,

On account of Application and Survey

Cash/Cheque No. 13,000 -
Nairobi

[Signature]
For CFO T.C.G

SAMPLE PAYING SLIP

TURKANA COUNTY GOVERNMENT



PAYING IN SLIP

Reg. No. **TCG/LPPU/4/1/8035** DATE: 27/2/2016

Plot No.

Name of Applicant/Developer Jako M. Witi

FEES

1. Application form fees	1000/-
2. Building Plans fees	
3. Physical Planning fees	
4. Survey fees	12,000
5. Compliance Certificate	
6. Occupation fees	
7. Plot transfer fees	
8. Site inspection fees	
9. Advertisement fees	
10. Allotment letter fees	
11. Approval fees	
12. Change of user	
13. Extension of user	
14. Extension of lease	
15. Business permit	
16. Registration of School	
17. Temporary Structure	
18. Public Addressing	
19. Hawkers	
20. Car Wash	
21. Other s (Specify) Bill boards. (Per side)	

TOTAL 13,000

REVENUE/WORKS OFFICER *[Signature]*

MINISTRY ACCOUNTANT
COUNTY RECEIPT OFFICE *[Signature]*

Payment received by Samson Lyangon
Receipt No. 63192 Date 27/2/2016

**MINISTRY OF LANDS
PHYSICAL PLANNING AND
URBAN AREAS MANAGEMENT**
2 FEB 2016
TURKANA COUNTY GOVERNMENT
P.O. Box 187 - 30500, LODWAR

ACCOUNT NO, 1140763687,
TURKANA COUNTY GOVERNMENT EXCHEQUER ACCOUNT, KCB, LODWAR BRANCH

APPLICATION FOR DEVELOPMENT PERMISSION, FORM P.P.A1
Section A and B

SECTION A – GENERAL INFORMATION

1. Owner name and Address
JATA MUMBI

2. Application name and Address Box LOUARA

3. If applicant is not the owner state interest in the land e.g. lease, purchaser etc whether the consent of the owner of this application has been obtained.

4. (a) ~~R~~ or parcel number... MUMBI ROAD BLOCK 31029.

(b) Road, Town and Sub- County ... TUAVANA CENTRAL

When replying please quote above Reference Number and Date.

SECTION B- SUBDIVISION/CONSOLIDATION

6. Describe briefly the subdivision including the purpose for which land/buildings are to be used

7. State the purpose for which land and/or building are now used. If not now used, the purpose for which and the date on which they were used

8. State whether the construction of a new or an alternative of an existing means of access (a) (b) from a road is involved

9. State method of,

a) Water Supply

b) Sewerage disposal

c) Surface water disposal

d) Refuse disposal

10. Give details of any relevant easements affecting the proposed subdivision.

APPLICATION FOR DEVELOPMENT PERMISSION, FORM P.P.A1
Section C

SECTION C- EXTENSION OF LEASE, CHANGE OF USER, BUILDING PLANS, BURROW PITS ETC

11. State whether subdivision is involved and if so whether permission has been applied for and if so give number of the application.....

12. Describe briefly the proposed development including the purpose for which land and/or buildings are used.....

13. State the purpose for which land and/or buildings are now used. If not used, the purpose for which they were used

22. If the site abuts on the road junction, give details and height of any proposed wall, fence, etc fronting thereon.....

23. State the method of:

a) Water supply.....

b) Sewerage disposal

c) Refuse disposal

d) Conservation/Restoration

24. Give details of any relevant easements affecting the proposals.

25. State the;

a) Area of land affected.....

b) Area covered by buildings

c) Percentage of site covered

(i) By existing buildings

(ii) Proposed building

APPLICATION FOR DEVELOPMENT PERMISSION, FORM P.P.A1
Section D

SECTION D-comments

26. County physical planning officer
Recommended/not recommended..... *[Signature]*

27. County surveyor
Recommended/not recommended..... *[Signature]*

28. County works officer/county roads engineer
Recommended/not recommended.....

29. County public health officer
Recommended/not recommended.....

30. Land Administrator/registrar
Recommended/not recommended..... *[Signature]*

31. County environment officer
Recommended/not recommended.....

32. Town/Ward Administrator
Recommended/not recommended.....

33. Any other officer
Recommended/not recommended.....

SECTION E-DEVELOPMENT APPROVAL

County Executive/Chief Officer.....
Recommended/not recommended

STAMPS:
 COUNTY PHYSICAL PLANNING OFFICER
 P. O. Box 435 - 30500 LODWAR
 01 FEB 2015
 MINISTRY OF LANDS
 TURKANA COUNTY
 TURKANA CENTRAL SUB-COUNTY
 MINISTRY OF LANDS, PHYSICAL PLANNING
 & URBAN AREAS MANAGEMENT
 P. O. Box 187 - 30500, LODWAR

SAMPLE APPLICATION FOR DEVELOPMENT PERMISSION

TURKANA COUNTY GOVERNMENT



MINISTRY OF LANDS, PHYSICAL PLANNING AND URBAN AREAS MANAGEMENT
 P.O. BOX 187 – 30500 LODWAR, KENYA

Our Ref. No. **TCG/LPPU/4/1/8035** Date:

You're Ref. No.

FOURTH SCHEDULE

FORM P.P. A 1 (S.31 (I))
 Registered Number
 Of Application

APPLICATION FOR DEVELOPMENT PERMISSION

(To be submitted in TRIPICATES in respect of each transaction and sent to in let an appropriate official Authority)

To the ...TURKANA COUNTY GOVERNMENT

.....

(Insert name and address of appropriate Local Office)

We hereby apply for permission to develop the land/or building as described in this application and the attached plans and drawings.

Date Signature of applicant or Agent.....
 If by agent state.
 Name: *[Signature]*
 Address: *[Signature]*

A SAMPLE ALLOCATION DOCUMENT

TURKANA COUNTY GOVERNMENT



**MINISTRY OF LANDS, PHYSICAL PLANNING, HOUSING AND
URBAN AREAS MANAGEMENT
P.O. BOX 187 – 30500 LODWAR, KENYA**

When replying please quote:
Ref. No. owner2

COUNTY LAND SURVEYOR,
SURVEY DEPARTMENT,
P.O. BOX 187-30500,
LODWAR

Date 13/04/2016

RE:DEMARCATED PLOTTUR/TC/KNK/LOD/V1/B-D/001

The plot detailed here below has been demarcated, checked and authenticated by the County Land Surveyor.

Owner Ref.	Parcel Code	Area	Address
Peter Mena Maco	TUR/TC/KNK/LOD/V1/B-D/001	0.7325	box 1 lodwar
Wycliff Mayen Akuyo	TUR/TC/KNK/LOD/V1/B-D/001	0.7325	Lodwar

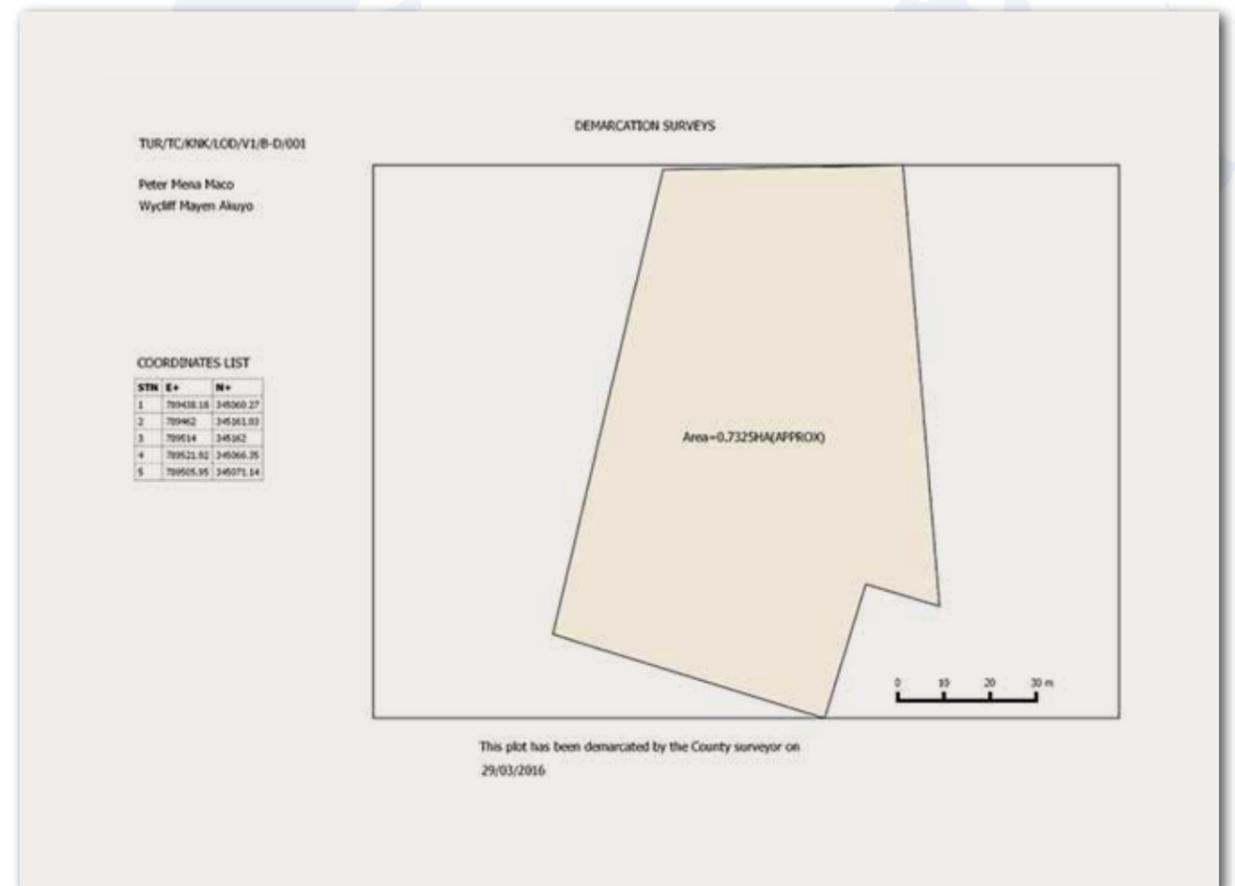
SIGNED

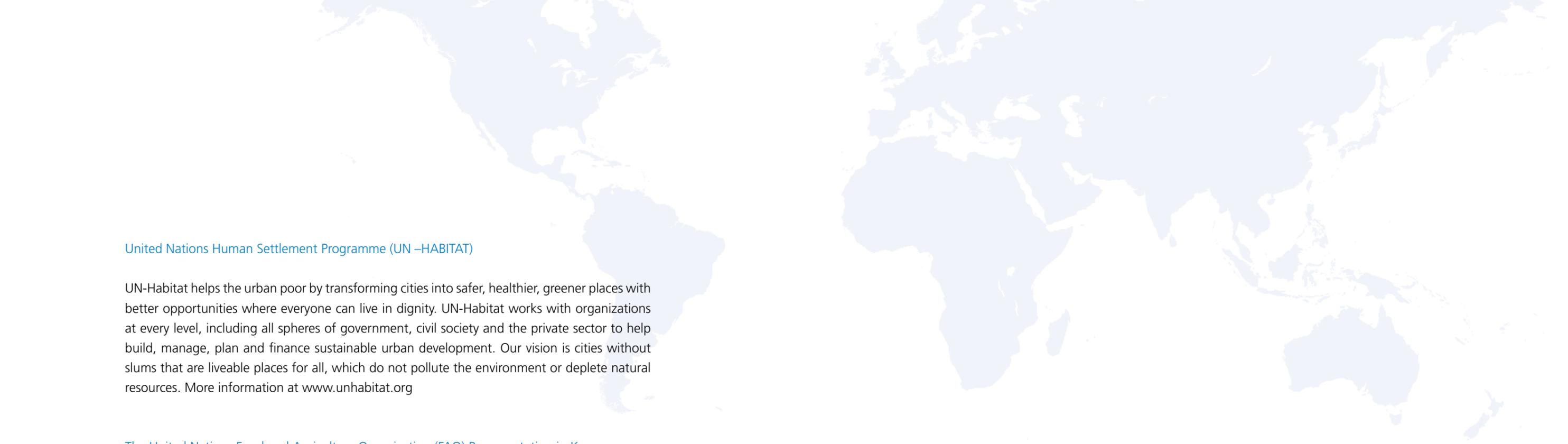
FOR

**COUNTY SURVEYOR
TURKANA**

Cc. Peter Mena Maco
Cc. Wycliff Mayen Akuyo

SAMPLE STDN-GENERATED LOT DEMARCATION SURVEY





United Nations Human Settlement Programme (UN –HABITAT)

UN-Habitat helps the urban poor by transforming cities into safer, healthier, greener places with better opportunities where everyone can live in dignity. UN-Habitat works with organizations at every level, including all spheres of government, civil society and the private sector to help build, manage, plan and finance sustainable urban development. Our vision is cities without slums that are liveable places for all, which do not pollute the environment or deplete natural resources. More information at www.unhabitat.org

The United Nations Food and Agriculture Organization (FAO) Representation in Kenya

FAO's mission is to work with the Government of Kenya towards a food-secure country, free of hunger and malnutrition, especially the poorest, in an economically, socially and environmentally sustainable manner. The organization's activities are integrated within the government's medium and long-term development strategies: the Comprehensive Africa Agriculture Development Programme (2012) and the UN Development Assistance Framework for Kenya. Focus is on five key areas: policy and institutional re-form; productivity and competitiveness; sustainable natural resource and environmental management; food security and nutrition initiatives; as well as information, knowledge management and coordination systems. For more information, visit the FAO website at www.fao.org

The Global Land Tool Network (GLTN)

The Global Land Tool Network (GLTN) is an alliance of international partners contributing to poverty alleviation and the Sustainable Development Goals through increased access to land and tenure security for all. The Network's partnership of organizations is drawn from the rural and urban civil society, international research and training institutions, bilateral and multilateral organizations, and international professional bodies. GLTN takes a more holistic approach land issues and improves on global land coordination through development, dissemination and implementation of pro-poor and gender responsive land tools. These tools and approaches contribute to land reform, good land governance, inclusive land administration, sustainable land management, and functional land sector coordination. For further information, visit the GLTN web site at www.glttn.net

ABOUT THIS PUBLICATION

This publication outlines the process undertaken by UN Habitat/GLTN and The United Nations Food and Agriculture Organization (FAO) Representation in Kenya to support the Ministry of Lands, Physical Planning and Urban Areas Management of the Turkana County Government-Kenya, in establishing a county Land Information Management System based on the Social Tenure Domain Model (STDM). The project was carried out in the context of the United Nations Food and Agriculture Organization (FAO) program entitled, *Support for Responsible Land and Natural Resource Governance of Communal Lands in Kenya*. A customized land information management system for Turkana County was developed, tested and rolled out according to the requirements of Ministry of Lands, Physical Planning and Urban Area Management and technical processes documented to guide staff in its implementation.

This publication also offers lessons learnt by the stakeholders during the course of implementation such as the role of effective partnerships, the importance of project ownership and capacity development among others as catalysts for sustaining development of land information systems like STDM. Through this project, FAO facilitated and carried out a pilot project aimed at testing Voluntary Guidelines on the Responsible Governance of Tenure.

HS Number: HS/061/16E

UNITED NATIONS HUMAN SETTLEMENTS PROGRAMME
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Website: www.unhabitat.org

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For more information please contact us:
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Fax: +254 20 762 4256
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Website: www.gltn.net