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IMPLEMENTATION OF AN INTEGRATED LAND MANAGEMENT INFORMATION SYSTEM (ILMIS) FOR TANZANIA

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Abstract

The Government of Tanzania is committed to land-related reforms and to economic and public sector change as a firm basis for development. In 2016, the Government of Tanzania through the Ministry of Lands, Housing and Human Settlements Development (MLHSD) and funded by the World Bank, engaged a consortium led by IGN FI to implement a two-year project to design, supply, install and commission an Integrated Land Management Information System (ILMIS). Phase 1 of the project has been completed and is currently in the final maintenance stage before operationalization and scaling up to cover the rest of the country. Phase 1 included integration of all aspects of land management comprising the procedures of land allocation and registration involving Land Administration, Survey and Mapping, and the Registration of Titles (linked with Physical Planning and Property Valuation) managed in the Dar es Salaam Zonal Office.

Key Words: Administration, Management, Mapping, Registration, Survey



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INTRODUCTION

A pilot initiative to design, supply, install and commission an Integrated Land Management Information System (ILMIS) was successfully implemented by the Ministry of Lands, Housing and Human Settlements Development (MLHHSD). The Government vision is “to strengthen the business environment in Tanzania, including land administration reform, and improve access to financial services”. With funding from the World Bank, a consortium led by IGN FI was engaged through a competitive process to implement the project which commenced in July 2016 and completed in July 2018 followed by a one-year maintenance period.

Generally, the Government aims at improving the delivery of services and addressing the challenges associated with the land sector through the provision of improved land management services to the public. The ILMIS was developed and piloted in the MLHHSD National Land Information Centre (NLIC), Dar es Salaam Zonal Office, and two districts; Kinondoni and Ubungu Municipal Councils. The system, ILMIS, fully integrated land administration, registration and surveying, and supported the transformation of land records and maps into digital formats for the pilot area. The business processes for the Property Valuation Unit and Physical Planning Division are under development and will be implemented by July 2019. Plans are now under way to up-scale ILMIS nationally in the next phase of the project.

BACKGROUND

Tanzania has been unable to tap into many opportunities presented by its land resources with the estimated less than 10 percent of her land planned, surveyed and registered. Mostly land administration processes were managed semi-manually leading to complications, high costs, vulnerability to deliberate errors and corruption. The Government of Tanzania recognized the need for further land-related reforms as a firm basis to realizing her potential strategic development objectives.

The design, supply, installation, and commissioning of the Integrated Land Management Information System (ILMIS) project fully integrates all aspects of land management in two phases: 1) the Design, Installation and Pilot and 2) the national roll-out now being planned. This paper presents Phase 1 insights and shares experiences associated with its implementation as lessons learnt for the following Phase 2 and more generally to the interested stakeholders.



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The land sector reform stands to provide a considerable potential to support a transformational and inclusive shift in all sectors of the Tanzanian economy. In the agricultural sector, smallholder farmers cultivate between 0.2 and 3.0 hectares, with little use of irrigation and other improved agricultural inputs. However, the potential to increase agricultural productivity is extremely high. Improved productivity can be facilitated through documented land rights leading to increased investment incentives that include the provision of access to collateral-based financing. Similarly, in urban areas where 70 percent of the land is comprised of unplanned settlements, regularization of land tenure of the mostly informal settlements would promote investment in occupied land, improve the living conditions of occupants through better housing, upgraded infrastructure and other services. The increased economic activities on registered land rights would also expand the tax base through transparency on paid land rent and other land management services.

Demand for market-oriented land use and resources has been growing rapidly in both rural and urban areas leading to unguided urbanization and the commoditization of rural land. However, more than 70 percent remains unplanned. The pattern of urban development has resulted in the proliferation of unplanned settlements and the growth of informal neighborhoods lacking basic social services and infrastructure. The limited number of villages with village land use plans and clear village boundaries are among the main sources of land use conflicts, some of which have resulted in loss of property and life. These challenges facing the land sector in Tanzania typify problems in other African countries, most of which revolve around limited property rights. The pace of land surveying, mapping, and registration is not keeping pace with the fast-growing human and livestock populations and their respective socioeconomic activities; resulting in economic growth stagnation due to land conflicts and restraint to government efforts to bolster revenue collection for socioeconomic development.

Informal urban settlements continue to shape the emerging urban forms characterized by land use conflicts, limited accessibility, inadequate infrastructure and poor sanitation. It is noteworthy that only urban landholders with surveyed land currently pay land rent. As more village and general land is transparently managed in a computerized environment; a proportionate revenue increase will be realized. Digitization of the existing legacy data and of provision of land management services through the new system can contain revenue pilferage and increase collection tremendously. From July 1, 2018 to February 28, 2019, the pilot districts have contributed about US\$ 1 million directly from the services offered through ILMIS. Further realization of the potential revenue requires an increased pace in terms of registering, planning and



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surveying more land parcels coupled with the simplification of the process of land registration and adjudication across the country. This can only be achieved by harnessing the increasingly cheaper, efficient and effective Information Communication Technology (ICT).

Based on the foregoing, the Government should continue to build a sound institutional and legal framework for modernized land administration. Government has been making necessary interventions, contingent on the availability of resources. TAREF11, a nation-wide geodetic network infrastructure based on the International Terrestrial Reference Frame and the Universal Transverse Mercator projection system, provides an efficient framework in which to use modern digital surveying and mapping technologies to increase the volume of planned, surveyed, mapped and titled land in both urban and rural areas in a timely and affordable way.

These interventions aim to address some of the challenges that will contribute to a guaranteed security of tenure to all landholders in the country. Regular land policy and legal reviews are pertinent initiatives to be undertaken concurrently to address property rights dynamics in the land sector. Capacity building in terms of staff training and procurement of equipment, decentralizing land service delivery, and adopting new technologies in land management are some of the examples of specific initiatives being taken by the government. These initiatives are cognizant of the fact that enhanced land tenure security will attract land based investments, guarantee food security, minimize land related conflicts, increase government revenue, promote land markets, promote orderly development of urban and rural areas, create employment and protect the environment. Enhanced security of tenure is a prerequisite component for socioeconomic development.

For the sake of a smooth social-political environment necessary to support land sector modernizations, enhanced and inclusive debates covering land technical and social issues are equally important. Debates will reduce the political risk around implementation by increasing public participation at all levels of governance.

INTEGRATED LAND MANAGEMENT INFORMATION SYSTEM (ILMIS)

The ILMIS (conventionally Land Information System) Project contributes to the creation of a reliable land administration service for clients and improves public confidence in land administration services.



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ILMIS sought to: 1) Increase land tenure security; 2) Provide affordable, secure and reliable land administration services to the customers; 3) Reduce the time required to check, update and transfer land; 4) prevent encroachment on wetlands, forests, road reserves and other public land; 5) Improve stewardship of land and natural resources; 6) Help to reduce corruption associated with checks, registration and transfer of titles; and 7) Improve public confidence in the land administration system.

The six specific objectives of the ILMIS were as follows:

Objective 1:

- Prepare the ILMIS detailed design,
- Develop/customize the ILMIS solution/software,
- ILMIS solution Phase 1 implementation preparation,
- Establish the National Land Information Centre (NLIC).

Objective 2:

- Rehabilitate and convert existing data and land records including cadastral maps,
- Upload of digital data to the ILMIS database.

Objective 3:

- Integration of all land records into a single data set,
- Linking land registration data (certificates of occupancy, land administration records) and cadastral parcels data,
- ILMIS full data set (Phase 1) prepared for use in the LIS,
- Upload to the appropriate domains of the ILMIS database.

Objective 4:

- Establish and implement the ILMIS,
- Purchase and installation of hardware, equipment and consumables according to the system design and architecture for offices,
- Improve security and reliability of the registration and cadastral services delivered to customers.

Objective 5:

- Increase public awareness regarding the advantages of the formalisation of property rights,
- Inform the public about the advantages of a new system for land acquisition and registration,
- Promote new registration and cadastral services and encourage the customers to formalise their property rights.



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Objective 6:

- Train MLHHS D personnel to operate and maintain the ILMIS.

Project Governance

A Project Steering Committee comprising members from the MLHHS D and other key stakeholders was formed and was intended to be the overall strategic decision-making body to advise the consortium on the overall direction of the ILMIS project but in practice, the OPM Deputy Permanent Secretary provided the guidance and decisions. The tasks and responsibilities of the ILMIS Project Steering Committee are outlined below.

- a. Take responsibility for the project's feasibility and achievement of outcomes resulting from technical deliverables;
- b. Ensure the project's scope aligns with the requirements of the stakeholder groups;
- c. Provide those directly involved in the project with guidance on project business issues;
- d. Ensure effort and expenditure are appropriate to stakeholder expectations;
- e. Address any issues that had major implications for the project outcomes;
- f. Keep the project scope under control;
- g. Reconcile differences in opinion and approach, and resolve disputes arising from them;
- h. Report on project progress to the project sponsor;
- i. Check adherence of project activities to standards of best practice, both within the Ministry and in a wider context; and
- j. Take responsibility for any government-wide and cross-sectional issues associated with the project.

The MLHHS D identified a Technical Team, including a project manager and project coordinator, comprised of specialists from the various business units involved to head up the implementation of ILMIS and coordinate with the IGN FI led consortium.

Project Management

Under the Ministry of Land Housing and Human Settlement Development (MLHHS D), the ILMIS project was managed and coordinated by a consortium of companies led by IGN FI and comprising IGN, GeoFIT Expert and GeoFIT. Innola Solutions was also engaged as a subcontractor to configure and customize the Innola® software framework for ILMIS and provide technical management expertise on the implementation of the Project. Each of these companies had a specific area of expertise that contributed to



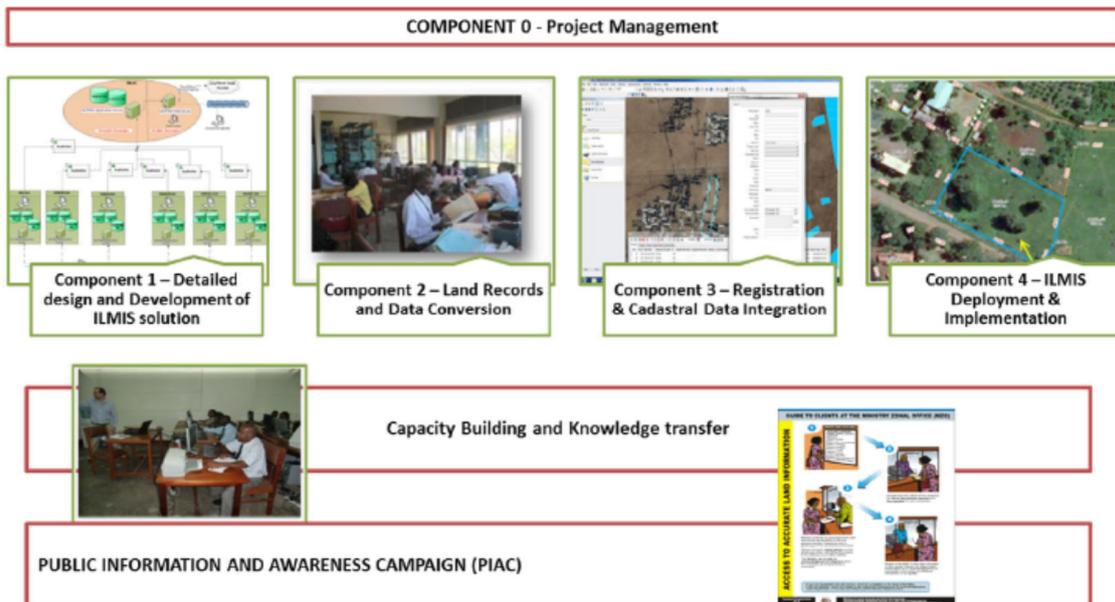
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the successful implementation of the ILMIS Project. The Project was designed with two Phases. Phase 1 was originally composed of two Stages: Pilot Stage and a future Development Stage. The Development Stage was later moved to Phase 2. This paper describes the completed Phase 1 Pilot Stage (24 months) which concentrated on the priority areas and included system maintenance and support. To manage the implementation of the project, the consortium divided the work into the following four components:

- Component 1: ILMIS Detailed Design and Development;
- Component 2: Land Data Conversion;
- Component 3: Data Integration and Validation and
- Component 4: ILMIS Deployment and Implementation.



The four components listed above and described in more detail below consisted of eight work activities:

- WA0 – Project Management
- WA1 – Detail Design of the System
- WA2 – Data Conversion
- WA3 – Registration and Cadastral Data Integration
- WA4 – Deployment and Implementation
- WA5 – Capacity building/Support/Training



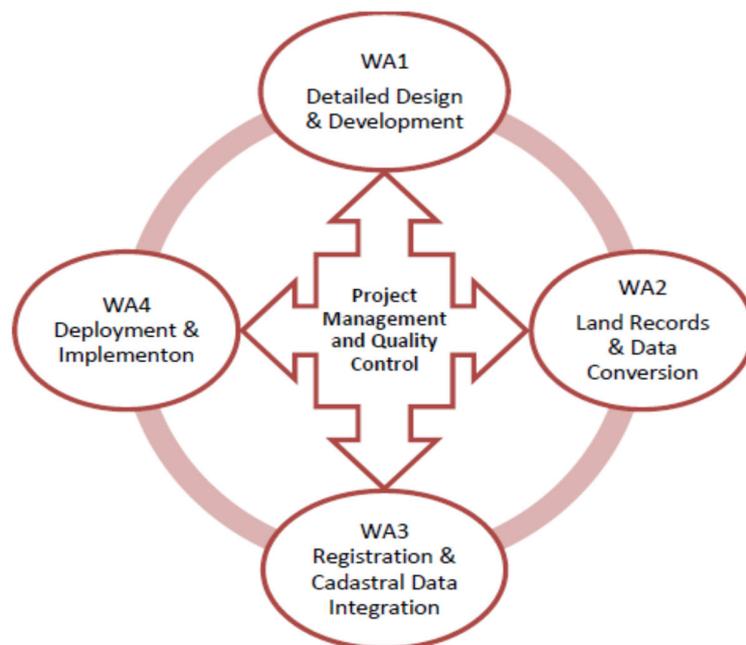
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- WA6 – Public Information and Awareness Campaign (PIAC)
- WA7 – Maintenance

Each work activity (WA) interacted with the others within the overall scope of the work and all were controlled by WA0. Capacity building, support and training (WA5) were integrated into the scope of work activities of each component throughout the implementation of the initiative while the PIAC activities were implemented as appropriate to maximise impact. The linkages among the principal work activities is illustrated in the following chart:



ILMIS Phase 1 included the business processes of three business units (LAD, SMD and RTU) implemented in four physical offices comprising the National Land Information Centre (NLIC), the Dar es Salaam Zonal Office, the Kinondoni Municipal Council, and Ubungu Municipal Council. The roles and functions of these business units and offices is outlined below:

Land Administration Division (LAD)

The Land Administration Division (LAD) is a key part of land administration and works closely with other divisions at MLHSD. The functions of the LAD extend to supporting villages by defining the boundaries



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of village land; but a primary function applies to the allocation of general land and signed Certificates of Occupancy. ILMIS has taken into consideration the functions of LAD as part of an integrated land administration system that includes the provision of information and data to the Survey and Mapping Division (SMD), roles in the Registration of Titles Unit workflows for COs, working with the planning authorities regarding land use plans prior to granting a CO and working with the Property Valuation Unit. The LAD is responsible for land administration regulation and the establishment of the methodological framework for authorised land officers employed by local governments. The business processes include a front office and back office with the former interacting with customers providing advice, applications for land allocation and transfers and accepting fees. The Land Office Registry handles all documents accepted at the Front Office and is responsible for all information, searches, new property file creation and allocating parcel numbers.

Survey and Mapping Division (SMD)

The Survey and Mapping Division (SMD) provides the spatial foundation for land administration. It conducts, oversees and implements topographic, geodetic, hydrographic, and cadastral surveys among other tasks. ILMIS is working to support Cadastral Surveying and establish a data base to manage existing digital topographic base maps and cadastral maps required for ILMIS. The SMD currently uses commercial software including ArcGIS and AutoCAD. The ILMIS has standardized survey plan submittals from private and government surveyors, streamlined the approval process, and established the cadastral parcel map serving the land administration and registration activities.

Registration of Title Unit (RTU)

The Registration of Title Unit (RTU) is responsible for the registration of property rights and management of the registry. It also handles the registration of chattels and documents, issuance of search reports and the creation and maintenance title records. First registration begins in the office of the Commissioner of Lands which allocates the land and approves the Certificate of Occupancy (CO). The CO is then reviewed and approved by the Assistant Registrars as authorized by the Registrar. Subsequent transactions are initiated by an application submitted to the RTU and are like first registration but with different documentation to start the process. Searches are also conducted for a fee and a search report on a specific property is produced. Activities, which included the registration of other legal documents, attract fees tracked by ILMIS. ILMIS has streamlined processes and workflows for registration to improve service delivery, strengthen land governance, and enhance the security of tenure and land related records.



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Component One: Detailed Design and Development

Component 1 included the detailed design of the system architecture, business area analysis, business process re-engineering, and data modelling as well as ILMIS software development and customization. Perhaps the most significant activity was the development of the Business Process Re-Engineering (BPR) Report that involved stakeholder inputs, consensus and workshops. The BPR Report was extended to include some elements typical of a User Requirements Document. The report was produced in three volumes that included:

- As-Is Analysis
- Benefits
- Workflows
- User Roles
- Transactions

The ILMIS system was built on open-source technologies and the final source code of the commissioned ILMIS will be provided to MLHHS D for full independent control over on-going system improvements and enhancements. The core of the solution is a framework - fully web-based software solution, developed on JAVA and JavaScript. It uses PostgreSQL and GeoServer, and the specific, high-volume cadastre operations in ILMIS are performed with help of QGIS: an advanced and feature-rich open-source GIS desktop application. PostgreSQL and GeoServer have been used for ILMIS, but use of other DBMS and GIS servers is possible, if desired in the future. The framework enables 3 tier web applications and application resides on the web server or the application server, the call from the application server accesses the database server. The solution tiers are as follows:

- **1st Tier** – PostgreSQL as Database Management with PostGIS Extension to manage spatial data. PostGIS storage has been deployed on the same DBMS instance to simplify maintenance and administration of data. Alfresco CMS has been used to manage file content of the system, such as scanned documents, photos, video and other attachments.
- **2nd Tier** – The proposed solution consisted of two application servers, integrated with each other to provide seamless access of data according to the workflow. The Application Server (hosted on Apache Tomcat), as main application server, developed on Java, serves for workflow management, business logic processing, registration data management, user security and management, reporting



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and other capabilities. GeoServer is responsible for GIS/cadastre spatial data management. Servers have been deployed on a CentOS Linux operating system.

- **3rd Tier** – The system has three main web applications that run under Ubuntu Linux environment and 2 Windows desktop applications that end users interact with on daily basis:
 - **Workstation** – fully web-based application to perform document management and transaction processing tasks. It is used to start, track and manage applications and transactions and conduct all required registration data entry and verification, attach documents, print reports, monitor staff productivity etc. It has fully integrated cadastral management elements.
 - **Staff Portal** – fully web-based application on Java Script/HTML5 that provides read-only access for the office staff to the registered data (both registry and cadastre) with the ability to search and display information on property, party, transaction and documents, including their scanned copies. The Staff Portal is tightly integrated with the Workstation that allows them to browse content of the system in an integrated way. Access to review and download documents is configured by ILMIS user role.
 - **Administrator** is a common application to manage and configure all system aspects such as: user and group management; business rules; permissions; transactions configuration; perform translation to local languages; manage dictionaries; deploy new or updated reports definitions; configure integration with external systems etc.
 - **Scan Client** – is a Windows desktop application to perform scanning of documents – both from the existing archives and day-forward documents, submitted by applicants or generated by the system in scope of registration process. Scanning Client supports standard scanning protocols. It is fully integrated with Alfresco DMS Server via Alfresco DMS Server API.
 - **Dashboard** – This component is intended for managers and provides the tools to track staff productivity.
 - **Records Management** – This component of ILMIS allows the business units to manage their archived inventory of documents and maps, and track paper files.
 - **QGIS Client** – is a free, desktop GIS application to perform spatial analysis, survey data processing, spatial analysis, conversion of spatial/cadastre data, print larger custom map sheets as needed. It is not part of the ILMIS solution, as it is used to support other spatial data preparation and analysis.



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Component 2: Land Records and Data Conversion

Component 2 comprised the preparation of the methodology for data conversion; conversion of land registration legacy data (including rehabilitation, scanning and indexing of hard copies); conversion of cadastral legacy data (including scanning and indexing of records and scanning, geo-referencing and vectorization of maps and plans); conversion of land administration data; and conversion of other related data as found necessary.

Security measures were developed, including physical security, to prevent any unauthorized access to the data and documents during data conversion and to prevent loss, damage, alteration and manipulation. This also applies to when data and documents are being transported between offices etc. Data conversion software components such as the scanning module and indexing module were not deliverables under the ILMIS Project. They were designed and developed according to the needs of the data conversion and used as production tools. It was necessary to upload the converted data to the ILMIS database according to the Data Model requirements. The consortium supported MLHSD to train a quality control and assurance team to review, vet, and accept scanned land and cadastral records and documents.

The conversion to digital format of land records and data comprising approximately 18,000 maps and plans began in June 2017. The work was done at the National Land Information Centre (NLIC) at MLHSD in Dar es Salaam and involved a number of stages including registration, restoration, scanning, indexing and geo-referencing. The initial maps to be digitized were town planning drawings known as TP drawings and extracts of TP drawings that were revised extracts of the original plans. Once these were digitized, the survey plans (cadastral plans) that show plot or farm boundaries and beacons were digitized and incorporated into the ILMIS. In addition to maps and plans, approximately 220,000 non-spatial land records were converted to digital format. Approximately 240 people comprising MLHSD staff and non-ministry staff were engaged to implement this. The process was complex, time consuming and dynamic requiring constant modification to manage challenges associated with the varied formats and quality of the hard copy materials, and ongoing development of the data model.

The objective of Component 2 was the rehabilitation, conversion to digital format and securing of land records, documents, survey (cadastral) plans, drawings and other legacy data needed for the land administration process and preparation of digital data to upload to the ILMIS database for the Kinondoni and Ubungu Districts of Dar es Salaam. The data conversion included all land records (certificates of right



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of occupancy, registrable instruments, land administration records and other relevant records); survey (cadastral) plans at various scales and land survey records (including Instruction to Survey (IS) records); physical planning records and drawings; as well as relevant Topographic Maps and other data required for land administration. The Base Map of digital orthoimagery for land information management was acquired from a separate Base Mapping Project, checked, and prepared for upload to the ILMIS database.

Component 3: Registration and Cadastral Data Integration

Component 3 involved the validation and scanning of existing digital data sets and integration of the land registry, cadastral and Commissioner of Lands data and data set preparation for uploading to the ILMIS. The objective of *Component 3* was to integrate the land records data into one dataset as well as to link the titles and cadastral parcels data and prepare the integrated data for use in the ILMIS from day one. Integration objectives included the following:

- a. Integration of land parcel (cadastral) data with land registration records data and integration of the data developed by Component 2 above;
- b. Ensure Data and integration quality through the conformance test and data validation;
- c. Discovering and recording of cases of registration and cadastral data inconsistency and incompatibility as well as issues with original documents and land records;
- d. Resolving the issues of data incompatibility and errors of technical nature;
- e. Recording of nontechnical errors and data inconsistency for future resolution;
- f. Registration and Cadastral Data validation and vetting.

For Phase 1, the integration activities comprised:

- a. Integration of the registration and cadastral data, discovering and recording of data inconsistency and errors;
- b. Reporting of discovered errors and data inconsistency and establishment of a system for inconsistency tracking and resolution;
- c. Review of discovered inconsistencies and errors and making the decision regarding data correction;
- d. Correction of technical errors according to the established procedure;
- e. Identification and recording in the database of the errors and inconsistencies between title registration and cadastral data.



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This included the integration of the data converted under Component 2:

- a. 90,000 vectorized parcels from 13,000 Survey (cadastral) plans conversion
- b. 60,000 Certificates of Title (Certificate of Occupancy [CO])
- c. 140,000 Land Administration Division (LAD) land records of Kinondoni and Ubungo Municipalities and Dar es Salaam Zonal Office.

The consortium developed the methodology for the land records (registration data) and cadastral data integration and implemented it to ensure the correctness and accuracy of the data integration results. The methodology comprised detailed security measures to eliminate any possible unauthorised modifications of the data, fraud or back door practices during the integration process. The cadastral digital data quality was checked and controlled according to the requirements and the correction of all discovered data errors was completed before integration. The data integration methodology and process applied ensured accurate and non-biased linkage of the Certificates of Occupancy and land administration data with respective land parcels data. The Registration and Cadastral data integration included the validation and checking for conformance of the integrated data. The data integration comprised digital land records, certificates of occupancy and registrable instruments, instructions to survey, cadastral land parcels, land administration and other data related to the land registration procedures. The data integration was implemented only by properly trained and reliable personnel with previous experience of cadastral and title registration work, knowledge of land administration legal framework and good computer and software skills. Following the conversion of existing data from component 2, the main target of component 3 was to tie the electronic parcels to any electronic land related information from the system. Linking together this information allowed the access of registry data from a given parcel and the access to a geo-referenced parcel from a given title.

The value of the mass integration linkage was to minimize the manual work of finding the related parcels of each title. This concept implies the use of tools. Strategically speaking, the mass linkage must be implemented close to the end of the data conversion activities. The current section provides details on the methodology and the activities of mass linkage that are a repetition of the following actions:

- Make a temporary copy of the data:
 - certificates and their properties
 - parcels
- Find and apply several automatic rules for linking titles to parcels



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- Check, store and analyse the quantity and quality of the results
- Detect and clean data inconsistencies
- Redo the process of mass linkage until:
 - the stagnation of the mass linkage result and
 - the end of the data conversion activities

The basic assumption is that a piece of land is identified by its District, its block and its plot number. Therefore, to link automatically a title to a parcel, the tool used must match using the previous rule. To ensure the effectiveness of the mass integration, it is mandatory to monitor it to avoid above all bad linkage and to avoid the processing of unnecessary corrections of the data converted. A series of checks are used to detect potential inconsistencies in the identity of a property record inside a digital title. The second phase occurs simultaneously with the commitment or validation of converted titles by the Ministry staff and the quality control is implemented following ISO standard 2859-1 for the definition of the sample size and of the severity of the control. After the data conversion activity, MLHSD validates the digital titles one by one and prior to any subsequent registration through the commitment procedure. As such, the linkage from title to parcel is a systematic activity contained within the validation of digital titles.

Component 4: ILMIS Deployment and Implementation

Component 4 included hardware purchase and installation, ILMIS deployment in the selected offices and data centre, on the job training and User Acceptance Testing, and a Final Report on this component. The objectives of the ILMIS deployment and implementation managed under Component 4 comprise:

- a. Deployment of the ILMIS and upgrading of the offices included in Phase 1 to enable them to carry out the title registration functions and improve land administration services provision;
- b. Upload the Integrated data and land information populating the ILMIS databases in all of the offices of the ILMIS;
- c. Testing the approach and proposed land information system detailed design and User Acceptance Test of the ILMIS;
- d. Increasing of public awareness regarding the ILMIS, promotion of the new system and its services;
- e. Establishment of the centralised land information database through the technical and methodological support of NLIC comprising of production, testing and training environments;
- f. Training of personnel for operations of the system per the scope of the project;
- g. User Acceptance Test (UAT) of the system according to the UAT Plan;



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- h. Correction of discovered errors and inconsistencies;
- i. Support of daily operations of ILMIS.

The Deployment and Implementation of the ILMIS Solution encompassed two aspects of integrating the final LIS Solution with the legacy data and other systems (especially NLIC). The data upload process ensured that data was correctly transferred into the ILMIS solution (including the combined integrated data sets to the NLIC database) so that the system was ready for use at the final implementation stage.

The system was configured following an Agile development cycle with cumulative releases. User Acceptance Testing was timed to allow time for iterative improvements and four key steps described below facilitated the final roll-out and implementation of ILMIS:

- **Test Phase:** Engineers developed the program code and adapted the database schema as required to provide the additional functionality. This approach ensured that the project stayed on target and allowed for incremental adjustments as testing progressed. A Quality Assurance team made releases available for initial viewing by MLHHSO after they were satisfied that new application code had been satisfactorily tested.
- **Training:** Training was provided during the implementation and again at the end of the Solution delivery. Experienced trainers, instructors and software specialists who brought expert knowledge of specific software modules and applications were employed as needed to assist with all aspects of system roll-out.
- **Deployment:** The Consortium worked closely with MLHHSO to conduct a series of User Acceptance Tests. This testing ensured that the ILMIS solution satisfactorily provided MLHHSO with the facilities to perform day-to-day tasks and generate the required operational and other mandatory reports.
- **Migration to Support:** After implementation, the project was transitioned to the support team.

Data Upload and Populating the ILMIS Database

After completion of Component 3, the data produced and validated was subjected to a “data check-in” control before populating ILMIS. The verification process included the use of different tools to ensure the consistency of the data at all levels; spatial data was cross-checked to verify topology, geometry, attributes, and completeness. In the same way the data from the legacy registration system and digitally stored data



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was cross-checked with the new data model to ensure compliance with the requirements. After performing all necessary verification procedures, the Consortium uploaded the consolidated data in a test environment for final verification of the integrity of the data together with the Client. At that stage the data exchange feature was verified, and the Consortium ensured that the ILMIS personnel understood the necessary protocols to be performed for the interchange of information with other data providers. The database was populated, and the necessary and planned user acceptance tests were performed on the data population and exchange activities.

Training of Personnel

The on-going training was essential for the success of the project; training activities were conducted during the life of the project from the early stages. Initially the training focussed on the prioritized offices, later some of the personnel from the MLHHS D assisted in the iterative testing activities. Upon project completion, Tanzania's Land Administration experts and trainers had the foundations to be able to maintain a robust training capacity. The Consortium LIS expert assigned to provide support provided additional training when needed coordinating with the MLHHS D training team. Gradually, MLHHS D is becoming responsible for the end-user training.

User Acceptance Test

As described previously, user acceptance tests were performed at various stages during the implementation ensuring the quality of the ILMIS solution. Agile development methodology which meets both product and industry standards was used, based on an iterative release strategy. Under this approach, periodic versions of the product suite were made available MLHHS D for validation and testing. This approach assured that the project stayed on target and allowed for incremental adjustments as testing progresses. The QA team controlled when releases were made available for initial customer viewing, after they were satisfied that new application code had been satisfactorily tested.

Public Information and Awareness

The primary challenges associated with land management and administration in Tanzania are the general lack of public knowledge and awareness about land tenure, related policies and legislation; Lack of information about the importance of land titles/certificates of ownership and the offices mandated to deliver these services; Lack of relevant information concerning the requirements and information on land transaction procedures; General lack of relevant information about the role of the official land-related



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institutions; and poor capacity and quality of service provided by local land offices. As such the objectives of the Public Information Campaign and requirements of the plan and implementation procedures were as follows:

- Increase public awareness regarding the advantages of the formalisation of property rights.
- Inform the public about the advantages of the new system for land acquisition and registration.
- Promote new registration and cadastral services and encourage the citizens of Tanzania to formalise their property rights.
- Get feedback of the public acceptance and evaluation of the land administration services provided.
- Inform the project stakeholders including MLHHS staff, government agencies and business about the project progress, achievements, and benefits for the stakeholders.

The Public Information and Awareness Campaign (PIAC) was designed and implemented in close cooperation with MLHHS and was also intended to inform MLHHS staff about the project activities and involvement of the personnel in decision making to increase the project ownership by staff. The PIAC was implemented throughout the entire project cycle to keep the public, main stakeholders and MLHHS concerned staff fully informed of activities. The implementation strategy was based on the following approaches:

- Inform the clients directly by considering their level of knowledge,
- Involve the professional institutions, federations, associations, relevant NGOs, media, and local opinion leaders to that they can relay the messages and inform themselves their members and communities,
- Keep stakeholders continuously formed of the project progress so they can receive feedback from clients on acceptance and evaluation of the registration services provided.

The target groups consisted of all the stakeholders comprising individuals and groups or organizations that had a direct or indirect stake in the project. These may broadly be divided into two main groups. 1) Internal Stakeholders and 2) External Stakeholders. Not all stakeholders are equal, and they were targeted differently with different information and variations in the type and level of detail required. Maximum effort was made to identify and exploit existing synergies between internal and external stakeholders focused on the same functional areas such as the MLHHS Registrars and the Tanganyika Law Society (TLS); MLHHS Surveyors/Cartographers and Institution of Surveyors Tanzania (IST), and MLHHS Valuation Department and Tanzania Real Estate Entrepreneurs Association (TREE-A), etc... Where



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possible, such organizations were brought together and engaged as “thematic unions” for example in joint meetings and other activities. The implementation of the Public Information and Awareness Campaign (PIAC) comprised the design, development and implementation of the activities listed below to effectively reach out and engage relevant stakeholders.

- Design Workshop
- Development of the PIAC Plan
- Baseline and End of Project Survey
- Publications
- Leaflets
- Posters
- Television
- Internal Information Dissemination for the MLHSD and ZO Staff
- Workshops
- Public Briefings
- Project Webpage
- Language Translation

CONCLUSION

The ILMIS Project established a functional, integrated and unified infrastructure successfully achieving the project’s goal. The initiative made a significant contribution to the improvement of land tenure security and the reliability of land transactions through the establishment of a land information system that provides affordable, secure and reliable land administration services for customers. The ILMIS project comprised the implementation of the detailed design and development of the system software; the establishment of the National Land Information Centre (NLIC); the rehabilitation and conversion of existing data and land records including cadastral maps and drawings into digital format upload to the ILMIS database; the integration of all land records into a single data set linking land registration data comprising certificates of occupancy, land administration records and data on cadastral parcels with the appropriate domains within the ILMIS; the architecture of offices, purchase and installation of hardware, equipment and consumables according to the system design and improve the security and reliability of the registration and cadastral service delivery; informed the public and key stakeholders of the ILMIS initiative, increasing public awareness on the benefits of formalizing property rights and promote new registration and cadastral services



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to encourage clients to formalize property rights; and training MLHSD personnel to operate and maintain ILMIS.

Efficient land governance reassures both citizens and potential national and international investors of the government's commitment to the full and effective implementation of development goals to realize the full potential of Tanzania's land resources.