APPLICATION OF THE SLAAC DATA CAPTURE AND PROCESSING TOOL FOR SYSTEMATIC LAND TITLING IN UGANDA

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Key words: Systematic Land Adjudication and Certification (SLAAC), Data Capture, Tools, Customary, UgNLIS, Spatial.

SUMMARY

The SLAAC Data Capture and Processing Tool will considerably increase the coverage of land titling or certification in the country, secure land rights and ownership for vulnerable groups in the communities and increase productivity of the Ministry's technical team to deliver services to the citizens. The documented land rights and ownership records will significantly improve land customary tenure security, contribute to the social-economic welfare of the citizens, and systematically transform the economy of the Country.

1.0 Introduction

The Ministry of Lands, Housing and Urban Development (MLHUD) in carrying out its mandate and as part of its activities, implemented the issuance of Certificates of Customary Ownership (CCOs), constituted Communal Land Associations and issued Freehold land titles under the Systematic Land Adjudication and Certification program. In order to improve the efficiency, effectiveness and transparency of the SLAAC program, a SLAAC **Data Capture and Processing** Tool was developed and customised to register records of land rights and ownership, including vital spatial components of the rights registered. The tool is a collection of customised tools, procedures, and infrastructure, which supports the Ministry's technical team in the data capture, gathering, mapping of customary rights, processing and structured output of the information into the National Land Information System (UgNLIS) platform.

During the time of setting the supportive policy, legal and the corresponding strategic planning framework, especially regarding the development of the National Land Policy and the Land Sector Strategic Plan, some of the major stakeholders consulted included Cultural or Traditional Leaders as Special Interest Groups. The main aim of this was to ensure their full participation and obtain their input in the development of the National Land Policy and the Land Sector Strategic Plan thus ensuring issues of cultural heritage were provided for. The SLAAC activity for which the major data collection and processing is carried out using the SLAAC Data Capture and Processing Tool is well provided for by both the National Land Policy and the Land Sector Strategic Plan.

In that regard, a Customary Data Repository is under development. This will enable the Land Administration and Management data collected using the SLAAC Tool to be stored, managed, retrieved and queried by authorized parties including Ministries, Departments, Agencies and the Civil Society Organizations (CSOs) to support Interoperability in the Land Sector.

2.0 ADOPTION OF LAND ADMINISTRATION DOMAIN MODEL FOR SLAAC

All the data that shall be entered into the Customary Data Repository has to comply with the **Land Administration Domain Model** used in the design of the UgNLIS, thus guaranteeing a

Geospatial Interoperability between the different tools which include: the SLAAC application itself, STDM, CRIPS and Open Tenure among others.

Since the land adjudication process involves field activities, the SLAAC application was developed with a field component known as the SLAAC Land Administration data capture and collection tool. It can be installed on mobile tablets with Windows operating system with systematic upgrade into Android operating system. Most important is that, the application itself is based on open source software, running a Postgres/PostGIS database, alfresco, and QGIS software for mapping.

This approach allows the User to upload the Orthophoto and any other base reference data like topographic maps, rivers and swamps in digital format while conducting the demarcation of boundaries in rural, Peri-urban and urban areas. In addition to this, the data collection and mapping tool enables the Ministry to authenticate the identity of the applicant(s) whilst in the field, thanks to the integration with the National ID Database.

3.0 Snapshot of the SLAAC Data Capture and Processing Tool

The SLAAC application has two components, the Data Capture tool, which is used in the field to capture the spatial data and the textual data, and the Processing tool, which is used at the Data Processing Centre (DPC), which was set up to process the field data and preparing land titles for the different land tenure systems as required.

Figure 1 Snapshot of Captured Data

In addition to the textual data captured directly using the tool, the tool has a barcode feature to link the physical files to the corresponding spatial units. The physical files contain the attributes of the owner of the parcel, minutes of approval and other land administration

documents necessary for registering customary land rights. This helps in processing the documents without creating a mismatch between the textual and spatial data captured.

A new feature is being developed for the SLAAC Data Capture and Processing tool, using Artificial Intelligence for determining land owned by gender, which will play a key role in statistical analysis, protecting land rights, promoting gender equality in land ownership and land use and it is essential for social-economic development in Uganda.

3.1 SLAAC Data Capture and Processing Tool for Physical Planning

The Physical Planning data and other updated thematic data such as hydrography, road network, and gazetted areas are displayed as well and made available by the mobile component of the SLAAC application. This feature ensures that the demarcation activities comply with the environmental and related physical planning regulations.

Figure 2 Portion of Planning Area

The different participants involved in the titling /certification process use the SLAAC application in the process of demarcation. This enables monitoring of the demarcation activities at a higher level as well indeed; all stakeholders such as the District Land Boards, Area Land Committees, Physical Planning Committees, Sub county Chiefs, and the Ministry Zonal Offices (MZOs) are considered in the use of the SLAAC Data Capture and Processing Tool and its application.

4.0 Technical Procedures for SLAAC Data Capture and Processing

4.1 Preparation for Field Work

When preparing for any Field Work, prior organization and arrangement are carried out just like for any other conventional land surveying procedure. These preparations include:

a) Checking Tablet/Instrument

The tablet is checked for suitability of the battery level, dirt on the screen/interface, the level of brightness, connectivity of the USB, complete installation of the software, the processor speed and storage memory. At this stage, when all checks are completed successfully, the tablet/instrument is cleared for fieldwork.

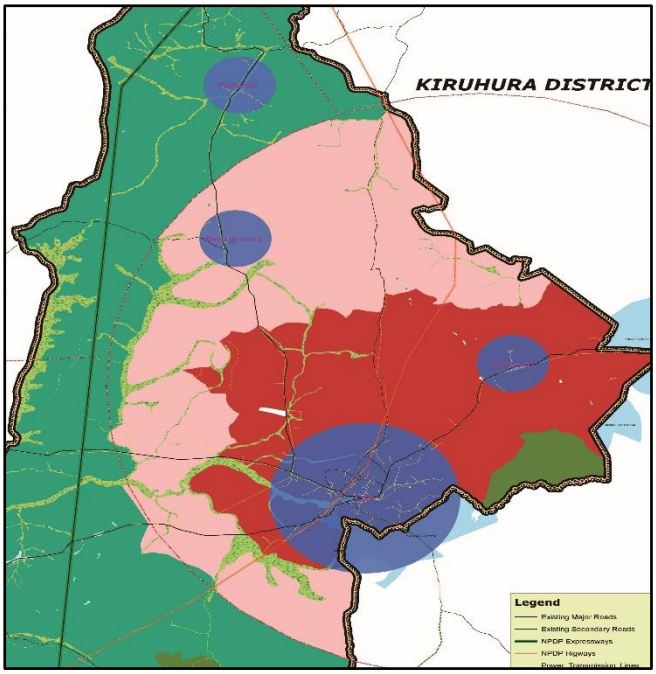
b) Setting up the software and associated connections

The SLAAC Data Capture Software is set up for usability tests. The ability of the software to open and close with ease and at the same time avoiding loss of data captured during operations of opening and closing is essential to check.

Figure 3 Preparing the Tool

c) Preparation of Reference Information

The reference information (spatial and non-spatial) needs to be prepared for ease of work in the field. The geographical names of the locality and spatial layers such as Orthophoto, local administrative unit boundaries, topographic maps, Rapid Physical Planning Appraisal (RaPPA) files, and conservation boundaries for Forest Reserves, Wetlands, and National Parks need to be uploaded into the software for self-reliance checking while capturing data in the field.



The RaPPA ensures that there is a provision as per the Physical Planning Act 2010 of the Republic of Uganda for Access Roads, Way leaves and Buffers with regard to conservation zones for each parcel surveyed and mapped as shown below in the RaPPA Plan.

Figure 4 Portion of RaPPA Plan

4.2 Field Work and Data Capture

In preparing for fieldwork while in the field already, checks are made on the requirements above. Data is captured in the following ways:

a) Spatial Data

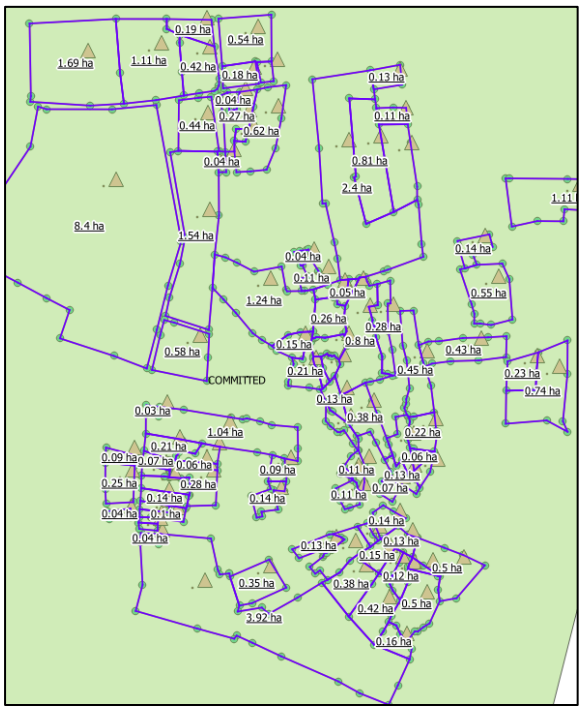


Figure 5 Portion of RaPPA Plan. The software is started and run on the tablet, all reference layers will be displayed in the software interface. To capture spatial data, the User moves, together with the adjudication/Survey/Mapping Team, to the first point on the parcel and once agreed upon by the team, marks the point in the software using the "Point Feature" as a shapefile. The User then moves along the boundary line of the parcel, once at every corner, marks a point and continues until the last corner/point on the parcel. This last point on the parcel is then closed onto the first point/corner. The points are then joined by a line to each point. The lines are automatically linked to form the parcel (polygon) to which a Parcel Identification Number (PIN) is automatically generated by the software. The parcel is now "Saved" into the Spatial Database of the Area/Locality where the adjudication is taking place. While carrying out this survey/mapping, the User will be able to check for any encroachments into the conservation areas and set out buffer areas so that the surveyed/mapped parcel is outside the boundary of the conservation features.

b) Non-spatial Data

Once a parcel is formed by the link of the "Line Feature" (Shapefile) to a polygon, non-spatial information is then attributed to the parcel. The non-spatial information includes; the Applicant's Name, Date of Birth, Sex, Locality Name, Area of the parcel, automatically generated PIN of the parcel, Picture/Photo of the applicant, etc.

Below is the summary of the parcel data captured in Mabona Parish in Western Uganda.

Table 1: Showing Mabona Parish Parcels Captured

Summary of Data Captured for Mabona Parish							
Description	**Item**	**Initial**	**Ratio**	**Total**	**Area_Hectare**	**Area_Acre**	**% of Total Area**
Parcels Captured		3338		3338	1122.497	1857.82	
Number of Applicants		5698		5698			
Number of Titles Processed		1711	1627	3338			
Gender	**Female**	**696**		**696**	**120.65**	**298.094**	**10.75**
	Male	**2036**		**2036**	**526.867**	**1300.237**	**46.94**
	Family	590	5	2950	445.052	185.839	39.65
	Institution	16		16	29.928	73.65	2.67
				5698	**1122.497**	**1857.82**	**100.00**

c) Archiving and Saving the Data

At the stage where the Surveyor needs to move to the next applicant to capture the parcel, the data which has been captured is safely saved into the Spatial Database.

In the evening after work, the data captured for the day is uploaded into a computer and edited. The editing includes; checking the correctness of the names of the applicants, photo and National Identity Cards captured, checking the correctness of the PINs to the parcels, checking partial topology of the parcel, checking partial geometry of the parcel and cleaning "flying points" captured in the field.

At this stage, the spatial and non-spatial information is completely linked to each other to achieve the recommended data quality. Once the linkage is completed, the data is submitted to the Data Processing Centre (DPC) for further processing.

4.3 Data Processing Centre (DPC)

While the data is submitted to the DPC for further processing to generate the Deed Plans and Certificates of title, two compulsory and stringent stages are taken to approve data captured from the field for use. These stages include:

a) Quality Control and Quality Assurance

Figure 6 Verification of LAFs

At this stage, Surveys and Mapping Department, Physical Planning Department and Land Administration Department check the Spatial and Non-Spatial Data captured from the field and edited from the field computers again at the Quality Control Unit of the DPC to ensure completeness of the data according to the set Standards of Spatial and non-spatial Data.

While checking for Spatial Data, the shapefile of the parcels in a local unit (village/parish) is uploaded into the SLAAC Data Processing application and any other Mapping/GIS software, preferably QGis and ArcMap. Checks are made on the topological characters such as overlaps, “flying points”, the identity of parcel corner points, complete and smooth adjoining of the vertex and points, parcel shapes, buffer zones and proper alignment of the lines and setting out of the Access Roads to each parcel surveyed. The checking is done by trained Surveyors and Cartographers. The spatial data standards must conform to the standards set by the Surveys and Mapping Department and the Physical Planning Department.

While checking for non-spatial Data, the Forms (Form 4, Form 10, Form 23, Form 19, National ID of the applicant, Passport Photo and Physical Planning Form) contained in a Land Administration File (LAF) are the key requirements to be checked. The Forms and documents are checked one by one for:- completeness in their filing, dirt, tear and wear, ink validity, the correctness of name, locality, etc spelling, the correctness of filing each Form and order of the documents inside the file. This checking is done by trained Land Officers and Physical Planners. The results must conform to the standards set by the Land Administration Department and the Physical Planning Department.

Figure 7 Surveyed Parcels

At this stage, once all the required standard datasets are already checked for completeness and conformity to the standards set, the parcels are printed as "Prints" depending on the size of the parcel on A4 paper size and attached to each corresponding LAF. The LAF is delivered to the District Land Board (DLB) for Approval and registration of offers of Freehold to the Applicants. The Applicant makes payments for Registration of Freeholds at this stage and receipts are submitted to the DPC together with the Approved LAFs.

b) Production of Deed Plan and Certificate of Title

Once the DLB has approved freehold offers to the applicants, the LAFs are returned in "Shape" to the DPC for the generation of Deed Plan and Certificate of Title.

While at the DPC, the Production Unit Team carries out final thorough checking to make sure all required documents are included and in order.

At this stage, each successful LAF is then linked to the parcel once again using the UgNLIS platform with either Shapefile or Excel CSV file. The process then follows six easy steps to the level of the Deed Plan. A second process follows four steps to the Certificate of Title. The

Stages include Intake, Scanning, Review of LAF, Review of Physical Planning compliance, Review of the survey, and review and generate the deed plan. Then, in order to complete the process, the following stages are followed:- Intake, Scanning, final Review of LAF and preparation of title.

Below is a figure showing summarized processes of the SLAAC Data Capture and Processing that supports securing of Land rights in Uganda.

5.0 Projects Executed using the SLAAC Data Capture and Processing Tool

The mobile component of the SLAAC application has considerably eliminated issues and errors such as overlaps since it has inbuilt topological control and data synchronization with the Data Processing Center (DPC) while securing the topological constraints and linking directly to the National Land Information System (UgNLIS).

The SLAAC Data Capture Tool has been used in Kabale District to support the issuance of Certificates of Customary Ownership; Oyam, Mbarara, Sheema, Lira to support issuance of Freehold titles among other projects. The application and other Land Administration tools have been used to perform statistical analysis to support decision making at the County, District and National levels. For the other tools used in areas covered by Mailo land, Landlords can now determine the number of tenants, the size of the parcels and the current developments on their land. During the data collection process for customary land, the various tools focus on the specific indicators as per the project objective, however the standard attributes are followed as recommended in the UgNLIS e.g. disaggregation by Gender.

At the operational level, during the data collection exercise, it has always been prudent to involve representatives of Cultural or Traditional institutions and their contribution has been valuable during the adjudication process and during the land dispute resolution processes. During the process of Community Mobilisation and Sensitisation, involvement of Cultural Institutions and their representatives has enabled easier implementation of the data collection programs, mainly because of the respect the local communities accord the Cultural Leaders. Moreover, during the community mobilisation and sensitization processes, application of

relevant art and cultural messages that appeal to the local communities makes it easier to deliver the required Information, Education and Communication messages.

6.0 Rollout of SLAAC Data Capture and Processing Tool to other Sectors

Figure 8 River buffering and wetlands

The Ministry focuses on the use of SLAAC Data Capture and Processing Tool not only as a Land Administration data collection tool but also as a spatial data collection tool that can be used for data collection and specialised mapping in the areas of Forestry, Valuation, Physical Planning, Housing, Informal Settlements and Agriculture. This will transform the spatial data collection component by users and improve data integrity and quality in addition to aiding the constitution of the National Spatial Data Infrastructure of Uganda.

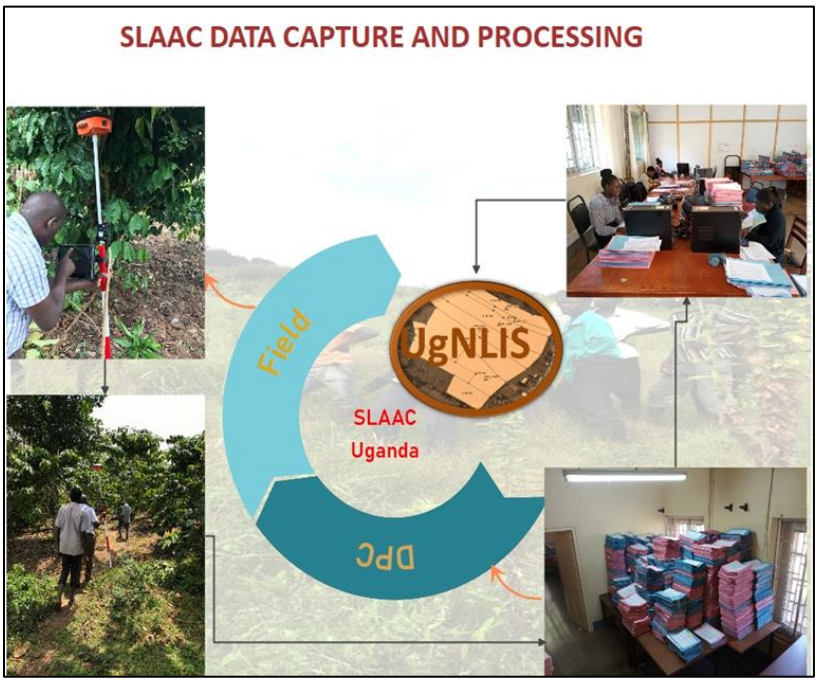
7.0 Conclusion

Securing land and resource rights in customary land tenure settings is a continuous process, for which the SLAAC application is to be improved to address the new impediments in the Land sector and in other MDAs, that will contribute to the improvement of the Land sector service delivery in Uganda.

Given the new trends of the emerging technologies like IoTs, Artificial intelligence and machine learning, cloud computing and 5G, the Land Administration and management sector should apply these new technologies. This shall improve performance of the Land Information Systems and promote securing of customary land rights in a reliable and systematic manner due to the checks and controls implemented as a result. However, the

Country should also quickly address the issue of Land Administration Data privacy to determine the level of access to the secured Land records, and ensure systems are protected from cyber-attacks that may affect the integrity of the records in the Land Registry.

Figure 9 Summary of SLAAC Processes up to the UgNLIS



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BIOGRAPHICAL NOTES

The authors' of this document have worked in the Land Sector for over 10 years with major specialties in the Land Administration and Management Sub Sector. Most of them are members of the respective Survey, ICT and Management Memberships in the Country. One of their key achievements is the transformation Land Administration in Uganda, from establishing a functional National Land Information Systems to Systematic Land Adjudication and Registration.

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