SOLUTIONS FOR OPEN LAND ADMINISTRATION (SOLA) SOFTWARE – CUSTOMIZING OPEN SOURCE SOFTWARE TO SUPPORT THE SYSTEMATIC LAND TITLING REGISTRATION PILOT PROJECT IN ONDO STATE, NIGERIA.

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ABSTRACT

The current system of land titling and registration in Nigeria is fraught with many problems such that only about 3% of the land in the country has been registered. To improve the situation, the Presidential Technical Committee on Land Reform (PTCLR) adopted a Systematic Land Titling and Registration (SLTR) approach and decided to use FAO Solution for Open Land Administration (SOLA). SOLA is an open source software developed by the FAO through a multi-donor trust fund project. It aims to make computerized land registration more affordable and more sustainable in developing countries.

The introduction of land administration automation using SOLA is aimed at improving systems’ efficiency, standardization and accessibility, which in turn, would contribute to responsible land governance. One of the objectives of using SOLA for the SLTR pilot project in Nigeria is to modernize, improve efficiency and effectiveness of land registration process in a transparent manner.

This paper expatiates on these key challenges to responsible land governance and how SOLA has been customised to meet some of these challenges in the SLTR pilot in Ondo State. It also looks at the technical aspects of the software architecture and its workflow driven process as well as its database structure.

KEY WORDS:
Land administration domain model, land tenure, open source software, responsible land governance, software architecture
INTRODUCTION

Land is a central issue in the developmental process of a nation and to secure land rights in support of sustainable development, there is a need to make it possible and attractive to undertake long term investment. The more accessible land and real estate assets become, the greater the possibility of their use as collateral for mortgage purposes and the more likely they are to contribute to the economic growth process and alleviation of poverty. However, since formal land registration began in Nigeria over 100 years ago, not more than 3% per cent of the land in the whole country has been registered.

Most states in the country operates autonomous registries that are not consistently connected with each other. These registries operate on paper. The current system of land titling, ownership, possession and administration in Nigeria is fraught with so much uncertainty, insecurity and bureaucracy that leave it operating at below optimal level for the sustenance of man and the nation’s economy. A system that is laden with much human interface and operated manually cannot but be corrupt and inefficient in this ICT age. Land use charges and other property based levies are still being assessed manually and arbitrarily mostly by the rule of the thumb and at the discretion of the officer in-charge. Citizens’ apathy to payment of taxes and other levies could be attributed to this syndrome (World Bank, 2015). Duplication of Certificate of Occupancy over the same land, improper mapping and charting of surveys and orchestrated false reports in order to exhort citizen is still prevalent. All these have resulted in weak land governance in the country. Some of the problems that have resulted as a result of weak governance include tenure insecurity, inequitable access, a lack of accountability and transparency, expensive and difficult land administration procedures.

The solution for open land administration (SOLA) is an Open Source Software developed by the United Nations Food and Agriculture Organization through a multi-donor trust fund project that ran from June 2010 to December 2013. It aims to make computerized land registration more affordable and more sustainable in developing countries. SOLA presently supports land registration and administration in five countries; Ghana, Nepal, Samoa, Lesotho and Tonga (Pullar, 2012).

As part of its land reform activities, the Presidential Technical Committee on Land Reform (PTCLR) in 2012 adopted a Systematic Land Titling and Registration (SLTR) approach which is being tried in a number of pilots including Ondo State. In doing so, PTCLR decided, with the support of GEMS3, a DFID funded program, to use the FAO SOLA open source software in support of the SLTR pilots. The introduction of
land administration automation using SOLA is aimed at improving systems’ efficiency, standardization and accessibility, which in turn, would contribute to responsible land governance. One of the objectives through which these aims are being achieved in SLTR using SOLA is the digitization of property records in order to streamline land registration processes. Once achieved, the various departments responsible for land administration in a state (survey, town planning, land records etc.) can electronically link systems to improve information sharing and coordination. Unlike what is presently obtainable in the various land departments, these digital records take up less space and offer more security to title-holders since they are more difficult to alter.

This paper begins with an overview of SLTR as deployed in Nigeria. This is followed by:

- An outline of the minimum generic capabilities of SOLA as customized;
- SOLA software architecture
- Systematic registration service
- Generation of reports and
- Database backup

The last section of the paper contains the challenges and concluding remarks.

AN OVERVIEW OF SYSTEMATIC LAND TITLING AND REGISTRATION (SLTR)

According to the manual of Standard Operating Procedures on SLTR for Nigeria, prepared by the PTCLR with the support of GEMS3, SLTR is defined as a process by which most rights to land in a particular area are ascertained and then documented in an official register of land titles. The process seeks to ascertain all legal rights and interests including encumbrances and restrictions. The document issued as a result of SLTR is a Certificate of Occupancy (C of O) and the register is the current land title deeds registry operating according to the land, (instrument) registration laws of every state. The C of O is issued by a State Governor or Commissioner in accordance with the Land Use Act of 1978. The C of O is a documentary evidence of a Right of Occupancy.

Three things that are established about a parcel of land through the SLTR process are: (a) the person(s) or entities that own land rights, (b) the land rights that exist including any third party rights that have been or are capable of registration (e.g. mortgage, leases, easements) and (c) the location and the extent of the land
SLTR is undertaken on a systematic basis with the objective of investigating and adjudicating rights for all or as much land as possible in the area declared for SLTR. The SLTR activities are then conducted in a transparent, participatory and cost-effective manner, according to principles summarised in Table 1.

**Table 1 here**

The process produces a set of records that show all land plots and all land claimed in the SLTR area including: Public land, land with existing Rights of Occupancy (SROs). Land held or occupied under customary, traditional or informal tenures that can be recognized as rights deemed to have been created under the LUA.

The objectives of SLTR are to provide all land occupiers and users in a declared area with a C of O and to protect the rights of occupancy by having the C of O registered in the land or deeds registry; and to create an index map of all occupied lands within a SLTR area.

The staff required for implementing SLTR includes, but is not limited to, one or more of the following positions as defined in the LUA Regulations:

- SLTR officer
- Deputy SLTR officer
- Registration officer
- Recording officer
- Demarcation officer
- GIS officer
- Public outreach (sensitisation) officer
- Mediation officer
- Ancillary staff (drivers, assistants, etc.)

The steps involved in achieving the above objectives are summarized in figure 1.

**Figure 1 here**

As illustrated in figure 1, a decision is taken first by a state government to carry out SLTR. The next immediate steps include publication of a legal notice, consultation with key government stakeholders, identifying the funding and preparing budgets and procurement plans, and initial contact and discussions with local government (LG) and community leaders. Other planning and preparatory tasks that follow include recruitment of SLTR staff and training.

Fieldwork starts in the first ward or section of a ward after public outreach has been conducted in that ward and more widely in the state and nationally. The fieldwork is done systematically, ward by ward, section by section, across a LGA, substantially completing a section before moving to the next. Details of
persons who claim land and details of the evidence to support their claim and the identification of the land boundary features (demarcation) is recorded on standard forms.

Information is entered and kept securely in a computer database and then assessed and decisions taken (adjudication) based on the available evidence of who is entitled to the land, after which it is printed on lists and maps and displayed to the public for objection to the decision and any corrections necessary to the data.

At the end of the public display period and all corrections have been made and disputes resolved that can be resolved, and the adjudication record finalised, the certificates of occupancy are printed and sent for the necessary authorising signatures. A processing fee is paid after which the beneficiary receives a copy of the C of O and another copy is registered and retained in the State Land Title Deeds Registry.

The SLTR process as briefly summarized above is being piloted by PTCLR, with the support of GEMS3 in 3 local government areas of Ondo State – Akure North, Akure South and Ifedore - and 2 LGAs in Kano State – Fagge and Ungongo. This paper is illustrated with the Ondo state SLTR pilot. An SLTR office is established in each of the pilot LGAs.

The remaining parts of this paper summarises how SOLA is being deployed to support the SLTR process.

**GENERIC CAPABILITIES OF SOLA**

SOLA is the software tool being used for SLTR in Nigeria. SOLA is being used to support both the SLTR activities and the on-going operations of the land registration system. The implementation of SOLA is being supported by FAO and GEMS3. The development, implementation and use of SOLA, particularly the new Systematic registration module that has been developed for SOLA went hand in hand with the ongoing refinement of SLTR processes in Nigeria.

SOLA has been customized to have the following minimum generic capabilities specifically for SLTR:

- Workflow management (process definition, rules, validation)
- Custom interface (input, management, output)
- Access control, security, audit trails and backup
- Spatial data input and editing (raster and vector)
- ISO 19152:2012 compliance (land administration domain model).
The workflow process in SOLA has been specifically customised to include the various roles of each SLTR officer. These roles include registration functions, (Geographic Information System) GIS and cadastre functions and administrative functions. The registration officer has access only to the data entry module of the software while the GIS officer has access only to the parcel digitization and editing part of the software. The SLTR officers have access to administrative functions giving approvals to work being done by both the GIS and registration officers and have exclusive access to sensitive functions such as title printing. This customised access control helps to provide some level of security. Also, the application of customised automated business rules in the processing of applications for registration or cadastre change (now feasible through computerised systems), not only allows application processing to be streamlined, but reduces the need for the land office staff to apply discretion; and hence reduces the possibility of coercion or persuasion for land office staff to behave inappropriately. For example, the business rules make it impossible to print the title for an application that have neither gone through a 30 day period of public display nor received the approval of the SLTR officer. All these and more help to achieve systems’ efficiency which is a requirement for good land governance.

Accessibility to land records, which is one of the challenges to good land governance in Nigeria has been customised and implemented in SOLA. Applications and documents can be searched using various parameters including parcel numbers, application numbers, location, claimants name, claimant address etc. This search functions are also be extensible to the web using SOLA web services. This alone represents a huge paradigm shift in title search which is presently being done manually in land ministries across the nation.

**SOLA SOFTWARE ARCHITECTURE**

At a summary level, the SOLA software architecture (McDowell, 2011) focuses on delivering a set of loosely coupled interoperable and extensible services consistent with the principles of Service Oriented Architecture (SOA).

The reason for selecting a web services based architecture is to provide the best alignment with the constraints, customization and integration needs that the SOLA software will likely be subjected to in the diverse operating environments. Figure 2, the Component Model diagram, illustrates the layered architecture of the SOLA software along with the main components and their key dependencies. A two dimensional layering approach has been used for the SOLA software to structure the software firstly by responsibility and secondly for reuse. As shown in Figure 2, the SOLA software architecture can be broadly divided into 3 layers; Presentation Layer, Services Layer and Data Layer. These three layers are briefly described below.
1. PRESENTATION LAYER OF SOLA SOFTWARE

The presentation Layer of the SOLA software includes two JAVA SWING desktop applications; SOLA Desktop and SOLA Admin. The SOLA Desktop is the primary client application of SOLA and provides case management and support for the front and back office tasks that would normally be associated with cadastre and registration processes. It also includes the SOLA GIS map viewer which has been built around the Geotools open source GIS toolkit. Other open source tools that are also used by the SOLA Desktop include Jasper reports, Java Help and Hibernate Validator which is a bean validation framework.

SOLA Admin is the second client application and it provides user management and general system administration capability. As shown in Figures 3 and 4, most of the packages from the SOLA Desktop are shared with SOLA Admin.

Both client applications are deployed to end users with Java Web Start technology. Java Web Start is bundled with the Java Runtime Environment (JRE) and supports the deployment and one click installation of java applications via the web. It also includes automatic update capability minimising the overall deployment and configuration overhead needed to support future releases of the software.

2. THE SERVICE LAYER OF SOLA

SOLA runs an architecture that applies an innovative architectural system which breaks down all the processes involved in land administration into individual software based components. Each component involved in the land administration process is represented by a single access point in this service layer.

For example, every person, institution or organization is represented in this services layer as a “Party”. And so all transactions that concern any person or institution is handled by the Party component. The same applies to administrative transactions, address related transactions, searches and documents.

The SOLA Services layer consists of two major grouping of elements namely the SOLA Web services layer and the SOLA Enterprise Java Beans.
The SOLA Web services layer is the entry point for all communication with the SOLA database. This database access and business related transactions are handled by the second layer called the SOLA Enterprise Java Beans. Hence, when an edit is made on the desktop software, it communicates with the services layer that handled the authentication of the request before forwarding this request to the SOLA Enterprise Java Beans layer. The Enterprise Java Beans communicates directly with the database and also performs any business related transformation to the data before it is returned to the desktop software through the Web services.

The reason for this split into layers is such that the mode of interaction can be changed from a desktop software to a mobile application or a web page. Hence, one can easily take out the presentation layer and still have access to the SOLA Web service.

3. DATA LAYER

The data layer persists SOLA data into a PostgreSQL database. The structure of the SOLA database is based on the data storage requirements implied by the Land Administration Domain Model (LADM – draft ISO standard 19152) although extensions and adjustments have been included to support the functional requirements of SOLA. The decision to use LADM as a basis for the SOLA database design was in order to profit from the considerable international domain knowledge in land administration that has resulted from the prolonged discussion and consultation associated with its formulation and consideration by ISO. It has also been useful through creating a common vocabulary for the discussion of land administration concepts in the context of computerised land administration system.

The database contains multiple schemas with the data in each schema managed and maintained by a primary SOLA EJB. The PostGIS Database provides support for storage and manipulation of spatial data.

SYSTEMATIC REGISTRATION SERVICE

Services are a key component of SOLA as they control the changes that can be made to the land register and cadastre information maintained by SOLA. Every application lodged in SOLA must include at least one service. In cases where several changes to the land registry or cadastre information are required as part of a single application, you can choose to add multiple services to the application. SOLA includes a default set of services which are divided into three broad categories;

- Registration Services
- Survey Services
- Supporting Services

**Registration Services:** For the purpose of the Systematic Land Titling and Registration Pilot in Nigeria, the registration service was customised to collate necessary information on all SLTR Forms as well as SLTR supporting documents. The SLTR service can be used to add, modify or remove the rights and restrictions recorded for a property.

**Survey Services:** Survey services can be used to capture details from new plans and update the cadastral network information recorded in SOLA. The two (2) survey services used in SOLA to support SLTR is shown in Table 2 below.

*Table 2 here*

Significant amount of customization went into the numbering convention used for parcel numbers. The adopted convention is called a Unique Parcel Identification Number (UPIN). The Unique Parcel Identification Number (UPIN) is based on the State, Local Government Area and ward. The UPIN is therefore comprised of the State code, LGA code, Ward code and section number plus a parcel number. An example is shown in the table 3 below:

*Table 3 here*

Ensuring a unique C of O number is achieved by assigning a unique state code, a unique LGA code in each state, a unique ward code in each LGA and a unique parcel number in each ward in the range 1 – n where n is the total number of parcels in that ward. However, section numbers are not used in the allocation of the final CofO number. SOLA has been customised to ensure that the parcel numbers in each ward are unique and sequential. This helps to ensure a level of standardization across all states in Nigeria. A snapshot showing this Unique numbering system is shown in Figure 5 below:

*Figure 5 here*

**Supporting Services:** Supporting services do not necessarily result in changes to the land registry or cadastre information, but can be used to address requests for information by agents. They can also be used to register or de-register official documentation such as Power of Attorney and Standard Documents.

Figure 6 below shows the typical life cycle of an SLTR claim in SOLA from the point it is lodged into the software to the point it is archived after a title has been printed.
REPORTS

SOLA provides several reports in order to allow the user to produce on-demand information about data of interest and to print them. The original reports implemented are: Lodgement Notice/Receipt, Lodgement Report, Application Status, Title Registration, Business Rule Reports and Map Print. SOLA system utilizes Jasper Reports and iReports as reporting tools.

During SLTR customization in Nigeria, many reports were added to the originals. This includes: Public Display Maps and Listings, Certificate of Occupancy (CofO), Parcel Plan, CofO Signing Authorization listing, Status Report, Production report, section detail report and Gender report.

PRODUCTION/STATUS/GENDER/SECTION DETAIL REPORT: The management of SLTR activities and progress requires regular, consistent and accurate reporting against the approved project management plan, reporting schedule and key indicators. The weekly production report shows the number of parcels demarcated and parcel records gathered by each demarcation and recording officer for each day of the week. The section detail report provides a template for recording production detail for each section (claims completed, data entry, public display details etc). The gender report disaggregates these outputs by gender. It indicates parcel claimed or certificates registered with women as sole owners or co-owners. All these reports are generated directly from SOLA.

See appendix A for samples of some of these reports.

PUBLIC DISPLAY MAPS AND LISTINGS: As part of the workflow of SLTR operations in Nigeria, a requirement of the land registration process is a public display of all claimed land as well as each claimant details. This helps to introduce a high level of transparency in the land registration process.

The public display is a list of all claims in a section with a map of all parcels in that section. The public display is essentially a preliminary list of the results of SLTR, which is exposed to public scrutiny for any objections or corrections to the names and information in the list or map.

A public display contains the results of at least one whole SLTR section. SOLA enforces certain business rules while generating a public display map and listing of a section. A public display cannot be a part of section and there cannot be more than one public display for each section. While generating the public display map of a section, the user has the opportunity to input an area description and a public notification.
period as shown in figure 7. SOLA supports various layout sizes for the public display map including A0, A4, A3 etc. (See Appendix B for a sample of a SOLA generated public display map and listing).

**Figure 7 here**

**C of O SIGNING AUTHORIZATION LISTING:** No longer than two weeks after the end of the public display period, the adjudication record and results of SLTR is considered as final and a list of all successful claims is prepared to be used for the preparation and printing of certificates. This list must not contain any claims with pending disputes or objections that remain un-resolved. This list will be used in obtaining the necessary authorizations for the issue of the C of O, printing of certificates, payments for the processing fee, and registration and delivery of the C of O. SOLA has been customised to generate this list.

As shown in Figure 8, appropriate business rules validations have been put in place to ensure that a signing authorization list can only be produced after a public display period has been terminated. Business rules validations also ensures that an application cannot be approved and thus the generation of C of O cannot start without such an authorization listing linked to that particular SLTR application (see figure 8 below). In the case of bulk generation, the absence of one authorization listing link would stop all C of O production in the requested sequence. (See Appendix C for a sample of signing authorization listing).

**Figure 8 here**

**PARCEL PLAN:** A title plan or plan is required for every registered C of O. Because SLTR uses the principle of general boundaries to define land, the plan also describes land using general boundaries. Therefore, there are no boundary measurements (directions and distances) or boundary corner coordinates shown on the plan. However, the plan indicates the geographic location of the land through a map grid coordinate. The plan is also orientated to and indicates grid north. The plan also shows feature detail to scale. However, where the plan is produced at a scale of 1/5000 or larger, the scale is approximate because the map is based on very high resolution (50 – 60cm) remotely-sensed satellite imagery that is orthorectified using a global DEM.

The parcel plan has a smaller location plan with a satellite imagery underlay. The ratio of the size of the area shown on the location plan to the parcel plan can be adjusted as a setting in SOLA based on individual state requirement.

As required by law, the plan must be prepared by, or under the supervision of a licensed land surveyor, and in the case of government surveyors must be counter-signed by the surveyor general. The Surveyors Council
of Nigeria (SURCON) has endorsed and authorized the use of the SLTR parcel plan after providing strict guidance on its content. (See appendix D for a sample of a parcel plan).

Finally, words of limitation on the parcel plan have been used to guide against misuse of the plan.

**CERTIFICATE OF OCCUPANCY:** A certificate of Occupancy is the final document produced from the SLTR process which is given to claimants. (See Appendix E for a sample of a certificate of occupancy).

**DATABASE BACKUP**
A robust regime of database backups and restores is essential in any major computerised system supporting a data intensive operation such as SLTR. Not only is it necessary to minimize rework (redoing of data entry) in the case of a hardware failure, database corruption or a natural disaster event but a database backup and restore regime is also needed for system support where in the case of a significant interruption to normal SOLA SLTR operations, it is likely to require assistance from SOLA specialists located elsewhere.

A multi-level backup has been designed that allows for first level restore (based on hourly backups) where there would be less than one hour of data entry lost (excluding scanned documents which are only covered in a second, third and fourth level restore). If the first level restore fails, the second level restore (based on daily backups stored on another workstation/server from the main SOLA server but on the same LAN and probably located in the same office) would minimize data loss to one working day (including scanned images loaded into the SOLA database).

A third level restore (based on weekly back-ups stored offsite along with earlier document scanned image digital archive backups) is also available which would minimize data loss to less than one week.

A fourth level restore is much more encompassing. It is called a physical backup and it involves copying the data folder of the database to an external hard drive and restoring it to another computer after making certain registry modification. It is done on a weekly basis and has proven to be very efficient.
Daily back-up also produces a compressed backup file (excluding documents) which is copied to a folder that is part of a Dropbox setup. In the case of a situation requiring remote support, Dropbox would need to be activated on a live internet connection so as to synchronise these compressed backup files and make them available to SOLA specialists based elsewhere. Ideally this synchronisation occurs weekly thus providing another “off-site” storage of SOLA backup files.

DATABASE EXTRACTION AND CONSOLIDATION
Nigeria is divided into 36 states with a Federal Capital Territory (FCT) in Abuja. Each state is further divided into several Local Government Areas (LGAs). Each Local Government Area is further divided into Wards.

Ondo State has 18 Local Government Areas. However, the Systematic Land Titling and Registration is being piloted in only three Local Government Areas namely; Akure North, Akure South and Ifedore. Each of these Local Government Areas are further broken down into several wards. There is an SLTR pilot office in each of these LGA responsible for the day-to-day management of field and office activities. There is also a state level SLTR secretariat which coordinates the activities of SLTR LGA pilot offices and where the final C of O is printed.

The database extraction and consolidation functionality involves the transfer of SLTR digital records from LGA based project offices to a state level implementation of SOLA. Basically, as illustrated by Figure 9, it involves combining two or more databases into a single one while protecting the integrity of the data in each of source databases. This transfer can happen as SLTR is completed or needs to be centralized so as to print or sign Certificates of Occupancy. This functionality has been implemented in Kano and Ondo State where there are multiple SLTR offices.

Figure 9 here

One issue this process has highlighted is that it is vital that each implementation of SOLA must have all database changes applied. This means that each SOLA implementation database structure must be the same. If the structure of the source SOLA database is different from the target (central state level) SOLA database, these differences will be identified at the “consolidation” stage and the differences will need to be corrected before the process can proceed. This helps to enforce a level of standardization across all Local Governments in a state.
However, depending on the size of the document schema in the database, the extraction and consolidation can take several hours.

From a user perspective, the product owner (Commissioner of Ministry of Land, Director General of Land records Bureau) decides what is going to be transferred. This functionality is flexible and restrictions can be applied. It is possible to use business rules to restrict applications that can be marked for transfer. As shown in Figure 10, a database consolidation has to be preceded by a data extraction. A super-user (Administrator) can decide to extract everything that is not yet transferred in a particular database inadvertently closing down that particular office. This functionality becomes part of the user workflow. Each application has a unique ID which is generated in independent system. All extraction and consolidation functionality are logged with a progress feedback to the user. Only application can be marked for transfer. Other business information objects must be related with the application marked for transfer or should be transferred every time. For example, a cadastre object which is inserted directly in the database without an application will not be transferred because there is not any application associated with that. This provides additional check and help to protect the integrity of the data in the database.

**Figure 10 here**

From a development perspective, the complexity of extraction rule can be easily managed and debugged. Handling of logging and progress reporting within the lifetime of a long running database transaction was also considered in its implementation. Figure 10 to be here

Every database in the whole chain of extract/consolidate (i.e. each Local Government database) needs to be uniquely identified. The setting “system-id” is used to uniquely identify each database. The system-id for Akure South LGA is OD/AKR, Akure North is OD/JTA and Ifedore is OD/FGB. Implemented business rules make use of these system-id to guarantee the uniqueness of every logical identifier (application numbers, source numbers, cadastre object numbers etc) in each database. Figure 11 illustrates the step-by-step process of how database extraction is achieved while Figure 12 shows how this extracted data is restored (consolidated) into a central database.

**Figure 11 here**

**Figure 12 here**
The outcome of the implementation of the SLTR as at 13th November 2014 using SOLA as IT backbone is shown in table 4.

Table 4 here

**CONCLUDING REMARK**

The realisation that the existing mode of first time land registration deployed throughout the federation, based on sporadic registration of interests in land is incapable of meeting modern demands for the creation and registration of titles in land in a timely, participatory and transparent manners led to the adoption of Systematic Land Titling and Registration (SLTR). This adoption of SLTR is meant to empower the States, LGAs and Nigerian economically through improved land governance and especially through effectively annexing the wealth inherent in appropriately titled and registered land.

The introduction and implementation of SOLA in support of SLTR has taken care of the requirements for good land governance. However, the nationwide adoption of SLTR and SOLA is faced with several challenges including the following:

- Lack of adequately shared vision of the strategic and empowering importance of SLTR
- Inadequate mobilization and availability of requisite resources at the right time
- Limited capability, especially with regards to SOLA software developer, GIS expert etc.
- Very weak institutional arrangement which is compounded by lack of legislated body as prescribed by law for land matters at the state and LGA level e.g. Land Use Allocation Committee (LUAC) in the state and Land Allocation and Advisory Committee (LAAC) in LGAs

SLTR has the potential to revolutionize land administration in Nigeria by creating a sustainable platform for the socio-economic empowerment of Nigerians including the land sector professionals.

The successful implementation of the SLTR with SOLA support across the states of the federation would, as a necessary step, lead to the development of land administration information system for the maintenance of the system in terms of the information on parcels, rights and right owners that would be regularly changing due to various types of transactions on land (e.g. Sales, subdivision and or merger of parcels, inheritance, public acquisition of land etc.). There is therefore a need for the land sector professionals to seize this moment in history to come together to shape the course of this imperative development.

This paper has highlighted some of the key challenges to land governance in Nigeria and how this is being addressed through the Systematic Land Titling and Registration and the customization of the Solution for Open Land Administration.
REFERENCES

Manoku, E. (2014). SOLA Extraction and Consolidation, NRC Land Tenure Team, FAO.


Table 1: SLTR Guiding Principles (SLTR Manual 2, December 2014)

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent</td>
<td>A public process with nothing hidden</td>
</tr>
<tr>
<td>Participatory</td>
<td>Everyone is included; no one is excluded</td>
</tr>
<tr>
<td>Conferring</td>
<td>Existing land rights are being clarified and confirmed; new rights are not being created</td>
</tr>
<tr>
<td>Fair</td>
<td>All participants are treated equally</td>
</tr>
<tr>
<td>Legal</td>
<td>Consistent with and conforming to all land laws</td>
</tr>
<tr>
<td>Replicable</td>
<td>Can be implemented in any state</td>
</tr>
<tr>
<td>Low cost</td>
<td>Affordable for states and participants</td>
</tr>
<tr>
<td>Certain</td>
<td>Results are not contestable in law</td>
</tr>
</tbody>
</table>

Table 2: SLTR Survey service types in SOLA (Pullar, 2014)

<table>
<thead>
<tr>
<th>Service Name</th>
<th>Description</th>
<th>Documents Req'd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change to Cadastre</td>
<td>Used to capture the details from new plans (i.e. Survey, Complied, Registry, etc) that require changes to the cadastral network such as the creation of new parcels by subdivision.</td>
<td>Cadastral Survey</td>
</tr>
<tr>
<td>Redefine Cadastre</td>
<td>Used to make changes to the cadastral network outside of the receipt of a survey plan such as correcting the topology of existing parcels by adding new nodes or redefining boundaries. Note that a compiled plan or sketch should be provided to describe the changes made for the service.</td>
<td>Cadastral Survey</td>
</tr>
</tbody>
</table>

Table 3: Unique Parcel Identification Number (UPIN) example

<table>
<thead>
<tr>
<th>State</th>
<th>LGA</th>
<th>Ward-section</th>
<th>Parcel</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD</td>
<td>AKR</td>
<td>01</td>
<td>45</td>
</tr>
</tbody>
</table>

OD/AKR/01/45
Table 4 Update of SLTR Activities in Ondo State

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<thead>
<tr>
<th>No.</th>
<th>SLTR Activity in LGAs in Ondo state</th>
<th>AKURE SOUTH (13 November 2014)</th>
<th>AKURE NORTH (13 November 2014)</th>
<th>IFEDORE (13 November 2014)</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parcels demarcated with GPS</td>
<td>8726</td>
<td>3030</td>
<td>2902</td>
<td>14,658</td>
</tr>
<tr>
<td>2</td>
<td>Parcel records gathered</td>
<td>4146</td>
<td>3030</td>
<td>2833</td>
<td>10,009</td>
</tr>
<tr>
<td>3</td>
<td>Parcels digitized in SOLA</td>
<td>7533</td>
<td>2884</td>
<td>2902</td>
<td>13,319</td>
</tr>
<tr>
<td>4</td>
<td>Claim forms lodged in SOLA</td>
<td>3999</td>
<td>2550</td>
<td>2410</td>
<td>8,959</td>
</tr>
<tr>
<td>5</td>
<td>Disputes lodged</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Parcels in public display</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Parcels completed public display</td>
<td>2668</td>
<td>1590</td>
<td>1325</td>
<td>5,583</td>
</tr>
<tr>
<td>8</td>
<td>Parcels ready for public display (minus control area)</td>
<td>362</td>
<td>254</td>
<td>800</td>
<td>1,416</td>
</tr>
<tr>
<td>9</td>
<td>Certificates paid for</td>
<td>97</td>
<td>7</td>
<td>9</td>
<td>113</td>
</tr>
<tr>
<td>11</td>
<td>Certificates printed</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
1. Notification of areas for SLTR
2. Preparation and sensitisation
3. Mobilisation and training
4. Recording of claims and demarcation
5. Adjudication
6. Data entry and parcel digitising
7. Public display for objections and corrections
8. Finalising objections, corrections & the record
9. Printing and signing of CoFO
10. Payment, delivery and registration of CoFO

Figure 1: Overview of SLTR process activity stages

Source: Nigeria SLTR manual, 2014
Figure 2: Component view model - SOLA Software (McDowell, 2011)
Figure 3: Packages of SOLA desktop and dependencies (McDowell, 2011)
Figure 4: Packages of SOLA Admin and dependencies (McDowell, 2011)
Figure 5: SOLA map viewer showing UPIN
Figure 6: Application Life Cycle in SOLA
Figure 7: Printing Public Display Maps in SOLA
Figure 8: Business Rule Validation for Signing Authorization Listing

<table>
<thead>
<tr>
<th>Feedback</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signing list attached to this application</td>
<td>critical</td>
</tr>
<tr>
<td>All documents required for the services in this application are present.</td>
<td>critical</td>
</tr>
<tr>
<td>Signing list attached to this application</td>
<td>critical</td>
</tr>
<tr>
<td>An application can be associated with a property which should have a digital title record.</td>
<td>warning</td>
</tr>
<tr>
<td>Documents should have dates formalised by source agency that are not in the future.</td>
<td>warning</td>
</tr>
<tr>
<td>Documents lodged with an application should have a scanned image file (or other source file) attached</td>
<td>warning</td>
</tr>
<tr>
<td>Title should have compatible parcel (or cadastral object) description (appellation)</td>
<td>medium</td>
</tr>
<tr>
<td>Title must have an associated parcel (or cadastral object)</td>
<td></td>
</tr>
</tbody>
</table>
Figure 9: Graphical illustration of database consolidation (Manouku, 2014)
Figure 10: Extraction and Consolidation (Manoku, 2014)
Main tables:
Information marked for transfer

Move the information to consolidation schema
Records are marked as transferred.

Consolidation Schema

Dump consolidation schema to a file.

extract_XXXXX.backup

Extraction already happen!
Not yet outside the database!
Applications are marked as “Transferred” and Unassigned!
The user cannot access these applications anymore!

Configurable!

Postgresql utility: pg_dump.

Figure 11: Extraction (Manoku, 2014)

extract_XXXXX.backup

Restore consolidation schema

Consolidation Schema

Checks through Brs.

Move the information to main tables

Main tables:
Information appears as it was in the source

Information is merged to the main tables!
Consolidation is finished.

Here can be checked if the information can be merged.
Like: Dbs must have the same structure.
All primary keys must not be violated.

Figure 12: Consolidation (Manoku, 2014)
## APPENDIX A: REPORTS

### SLTR
Ownership Gender Report
State: Ondo

Report at Saturday 06 December 2014

<table>
<thead>
<tr>
<th>LGA/Ward</th>
<th>Female</th>
<th>Male</th>
<th>Joint</th>
<th>Mixed</th>
<th>Entry</th>
<th>Not Recorded</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>AKIRITA</td>
<td>750</td>
<td>2,412</td>
<td>5</td>
<td>5</td>
<td>833</td>
<td>769</td>
<td>3,133</td>
</tr>
<tr>
<td>AKRAUG11A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>AKRAUG11B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>AKRAUG3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>AKRAUG4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>AKRAUG5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FOSYGB1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FOSYGB10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FOSYGB8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>JTAU17A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### SLTR
Weekly Production Report
State: Ondo

Report for week beginning Monday September 01, 2014
Daily target 10 parcels/lots per Field Team
Weekly target 60 parcels/lots per Field Team

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parcel/Lot Demarcated</td>
<td>Demarcation Officer: EMANUEL OLUWAJANMI</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Demarcation Officer: FEMI OLANIGAN</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Demarcation Officer: GABRIEL OYEBOLA</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>0</td>
<td>11</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>Records Gathered Parcel/Lots</td>
<td>Recording Officer: ADIBOLA OMOLOLA</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Recording Officer: AYENI MORAYO</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Recording Officer: AYODE ADEJUWON</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Recording Officer: BUKOLA JAMES</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Recording Officer: FALADE OLUWATUYOYIN</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Saturday 06 December 2014
APPENDIX B: PUBLIC DISPLAY

Systematic Registration Public Display

SECTION 138, WARD 10, AKURE SOUTH LGA, ONDO STATE, NIGERIA

1ST OF DECEMBER, 2014 TO 31ST OF DECEMBER, 2014

Parcel Listing for: Section SECTION 23, Ward FGB6, FGB Lga (OD/FGB/FGB6)

<table>
<thead>
<tr>
<th>Parcel</th>
<th>Land Use</th>
<th>Approximate area (sq.m)</th>
<th>Claimant</th>
<th>Rights/Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1066</td>
<td>Residential</td>
<td>328</td>
<td>AGBO YUSUF VICTORIA EBUN ELIZABETH</td>
<td>Ownership</td>
</tr>
<tr>
<td>1064</td>
<td>Residential</td>
<td>172</td>
<td>SAWE OLUYEDE</td>
<td>Ownership</td>
</tr>
<tr>
<td>1065</td>
<td>Residential</td>
<td>863</td>
<td>AGBO VICTORIA EBUN ELIZABETH</td>
<td>Ownership</td>
</tr>
<tr>
<td>1089</td>
<td>Residential</td>
<td>379</td>
<td>OKUNGEAMIGBE EBUN</td>
<td>Ownership</td>
</tr>
<tr>
<td>1079</td>
<td>Residential</td>
<td>4857</td>
<td>ALADETIMI FAMILY</td>
<td>Ownership</td>
</tr>
<tr>
<td>1083</td>
<td>Residential</td>
<td>153</td>
<td>SALIU OLUWAFUNKE EMILY</td>
<td>Ownership</td>
</tr>
<tr>
<td>1082</td>
<td>Residential</td>
<td>421</td>
<td>ROGBITAN RUFUS OLUFEMI</td>
<td>Ownership</td>
</tr>
<tr>
<td>1090</td>
<td>Residential</td>
<td>935</td>
<td>ERUTIMEYN ADEJUMOKUN</td>
<td>Ownership</td>
</tr>
<tr>
<td>1092</td>
<td>Residential</td>
<td>761</td>
<td>AROWOJEUIN GABRIEL</td>
<td>Ownership</td>
</tr>
</tbody>
</table>
## APPENDIX C: SIGNING AUTHORIZATION LISTING

### Signatory Authorization List

Approval is requested for the preparation and issue of a certificate of occupancy to the persons listed below:

<table>
<thead>
<tr>
<th>State</th>
<th>Ondo</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGA</td>
<td>AKR</td>
</tr>
<tr>
<td>Ward</td>
<td>10</td>
</tr>
<tr>
<td>Section</td>
<td>10</td>
</tr>
<tr>
<td>No of records</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Certificate Number</th>
<th>Name of person(s)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD/AKR/10/2304</td>
<td>FANIBUYAN JOSEPH OLUWABUNMI</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2305</td>
<td>ALEJO MATHEW ABIODUN</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2308</td>
<td>AJAYI OMOLADE</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2309</td>
<td>MRS SADIQU MORIAMO OLAGUMOKE</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2310</td>
<td>ADEGUNLEYIN ADEGOB</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2312</td>
<td>ADELUSI OLUSESAN</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2314</td>
<td>OGBUNABERU OLABISI</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2324</td>
<td>SHEU AYINDE</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2325</td>
<td>SADIQU MORIAMO OLAGUMOKE</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2326</td>
<td>OKAFOR LAMBERT</td>
<td></td>
</tr>
<tr>
<td>OD/AKR/10/2328</td>
<td>RUFUS ADODO</td>
<td></td>
</tr>
</tbody>
</table>

Authorized by:

Date: ____________________________

Signature: ____________________________

Date: ____________________________

Seal/stamp added by: ____________________________

Printing date: ____________________________

Printed by: ____________________________

Governor/Commissioner of Lands of Ondo State
APPENDIX D: PARCEL PLAN

Parcel Plan of
OD/AKR/10/231
Ward Village: 10
Local Government Area: Akure South
State: Ondo

Scale: 1:500
The area of the land in red above is approximately 171 square metres

Approved by: __________________________
Surveyor General

Date: __________ / __________ / __________

Surveyed by: Olawuyo Ahmed
SLTR Officer

Notes
1. Do not scale distances from or enlarge this plan
2. Plan has been prepared using orthorectified satellite imagery
   Date of Imagery: January 2013
   Imagery Resolution: 36 cm
   Coordinate System: MGRS Datum/UTM31N

Location Map

Plan No: __________

Sheet No: __________
APPENDIX E: CERTIFICATE OF OCCUPANCY

ONDO STATE OF NIGERIA
Certificate of Statutory Right of Occupancy
Land Use Act No. 6 of 1978

CERTIFICATE OF OCCUPANCY NO: OD/ARK/10/2822

This is to certify that:

IGBORODOWO WILLIAM OLUROPO

of
NO 6 TINUMBU LANE NEW ISOLO, AKURE
ONDO STATE OF NIGERIA

(heretofore referred to as "the holder" which shall include his lawful assignees and successors), is hereby granted a Statutory Right of Occupancy in and over land described overleaf and so delineated for a term of 50 years, commencing from 10 May 2014, according to the true intent and meaning of the Land Use Act 1978 and subject to the special terms and conditions here set out.

Terms and Conditions of Grant

1. To pay in advance a premium of N______ and yearly rent of N 1500 or as may be reviewed.
2. To pay and discharge all rates (including utilities), assessments, impositions, penalties, whatever as may be charged or imposed on the said land or any part thereof or any building thereon or upon the occupier(s) or holder thereof.
3. To pay forthwith to the Ondo State Government or its lawful agencies, if not earlier paid, survey fees, and all other charges as may be charged in respect of the preparation, registration, and issuance of this Certificate.
4. Within two years from the date of the commencement of the Right of Occupancy to erect and complete on the said land buildings and other works specified in related plans approved or to be approved by the Urban/Regional Planning Office or any other agency so empowered to do so provided that the issuing authority may extend, upon expiration of initial 2 years, the period to erect or complete the building for a further period not exceeding additional two years upon payment of appropriate fees.
5. To use the land for RESIDENTIAL purpose only.
6. Not to erect or build or permit to be erected or built on the land, buildings other than those permitted to be effected by virtue of this Certificate of Occupancy or to make or permit to be made any alteration to the said building already effected in the land except in accordance with the terms and condition approved by the Urban/Regional Planning Officer or any other Officer(s) authorized by the Governor or on his behalf.
7. To allow relevant Urban and Regional Planning Officer(s) or relevant Officer(s) authorized by the Governor at reasonable hours during the day to enter the land subject of Right of Occupancy for the purpose of inspection and compliance with the terms of the grant.
8. Not to alienate the Right of Occupancy hereby granted or any part thereof by sale, assignment, mortgage, transfer, lease or otherwise howsoever without prior consent of the Governor.
9. To comply with the provisions of Land Use Act and all rules and regulations laid down from time to time by relevant agencies of Government and to pay revised rents or charges as may be effected by the Government.
10. The holder or occupier of the land will maintain reasonable standards of accommodation, sanitary and good environmental and living conditions.

Given under my hand this ______ day of __________, 20______

__________________________
The Governor