



**IMPLEMENTATION OF NATIONAL LAND ADMINISTRATION SYSTEM –
FIT-FOR-PURPOSE IT-LEAP APPROACH**

IGOR POPIV, CAROL ROFFER, SERGIY LIZENKO, MAKSYM KALYTA
Innola Solutions, Inc., USA
carol.roffer@innola-solutions.com

**Paper prepared for presentation at the
“2017 WORLD BANK CONFERENCE ON LAND AND POVERTY”
The World Bank - Washington DC, March 20-24, 2017**

Copyright 2017 by author(s). All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.



Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 20-24, 2017



Abstract

Several decades of land administration (LA) projects worldwide have led to the development of a series of guidelines for the implementation of LA systems. Facing the complexity of the domain a more practical *fit-for-purpose* (FFP) concept evolved. Unfortunately, even with that breadth of information and guidelines, it still leaves many land administration practitioners with scopes of work that are too broad and lack a clear roadmap of key activities. The time is ripe for accepting the digital era reality and modernize FFP LA with a more specific modality – the *IT-Leap* concept. ICT has become not just an important or even critical component of the LA system but has been proven as a business driver and processes integrator. The paper presents the implementation planning aspects of an ICT solution, including details of a “how to make it work” approach. It extends the guiding principles with the FFP IT-Leap implementation roadmap, and provides a detailed set of value chain activities. It is time to use ICT as the mean to unify regulations, re-engineer processes, manage changes and drive capacity building. The FFP IT-Leap approach results in an ICT solution that fits the short-term needs and will scale up for the future ones.

Key Words: fit-for-purpose, implementation roadmap, IT-Leap approach, land administration, scalable solutions

Introduction and Overview

Several decades of land administration (LA) projects worldwide have led to the development of a series of guidelines for the implementation of LA systems. Facing the complexity of the domain and learning from the multiple lessons, a more practical *fit-for-purpose* (FFP) LA concept evolved. FFP concept guidelines provide a rational and well-justified set of principles, recommendations and approaches related to the three core components of the FFP concept - spatial, legal, and institutional frameworks (Enemark et al. (2016)). FFP guidelines are furthermore detailed with implementation aspects regarding change management, capacity development and project delivery (McLaren et al. (2016)).

Unfortunately, even with that breadth of information and guidelines (and partly because of it), it's a major challenge for many land administration executives and practitioners to set a clear roadmap of key activities and decision triggers for each stage of the implementation. Most importantly, what is still missing, is how to initiate and drive home the full set of activities while delivering the higher business value, on time and within the budget. Enemark (2015) emphasized the evidence of the divide between the state of land administration in developed nations and the rest of the world. He made a point that difficulties to close the gap “relate to a range of legal, institutional and political issues – but also to the fact that implementation of traditional Western-style cadastral systems is simply too costly, too time-consuming and too capacity-demanding.”

The paper authors believe the time is ripe for accepting the digital era reality and modernize Fit-For-Purpose LA with a more specific modality – namely with the *IT-Leap* concept. As the term suggests the core element of the proposed concept revolves around Information and Communication Technologies (ICT or IT) and the paper presents aspects of planning and implementation of an IT solution, including details of “how to make it work”. IT has become not just an important or even critical component of the LA system but has been proven as a mature business driver and business processes integrator in the developed and some developing countries. However, in the less developed countries, IT solutions should be strongly positioned in the same leading role for the nationwide LA modernization projects. It is time that we use ICT as the mean to unify regulations, to re-engineer and streamline processes, manage changes, drive capacity building and set objective sustainability parameters. This approach is especially important for planning national scale LA projects which consider the full scope of future business needs, i.e. beyond just registration of rights and cadastral management, include land valuation, taxation and physical planning, and define, sequence and place responsibilities for all of the required activities. It's based on some key elements that have been proven by the ICT industry development and LA best practices:

- Solid platform: LA industry achieved high level of maturity with data model standardization and adoption of the related industry standards
- Flexible delivery of services: Cloud computing delivery of services over Internet and/or private network;
- Continuous extension of up-to-date services: LA organizations are actively developing cloud solutions which extend the spectrum of public and commercial cloud services, including the potential adoption of cutting edge technologies, such as blockchain;
- Cost efficiency: Open and free-license enterprise stack of software made it affordable at the very beginning of the projects with no or low up-front costs.

The paper clarifies some IT related concepts of the referred FFP guidelines which in author's opinion may lead to misinterpretation: the most significant one is that the "initial ICT solutions will have to be rather simple". An initial "simple" solution, interpreted literally, does not ensure that a system is sustainable and extensible. It does however make it easier to abandon such a system and often leaves a set of produced data of questionable integrity and quality. This paper explains an approach which, if managed properly, can result in a strategically scalable ICT solution that fits the short-term needs, and should serve as the foundation for further adoption and expansion according to the future requirements. Specifically, the approach extends the guiding FFP principles with the FFP *IT-Leap* implementation roadmap, and provides a detailed set of value chain activities for each of the land administration packages.

Furthermore, the paper discuss specific LA task scenarios based on the FFP *IT-Leap* approach in order to illustrate how legal and regulatory aspects are driven by ICT activities and how the vendor performance might be evaluated at early stages focusing on defined ICT tasks. Examples of specific implementation scenario include knowledge transfer activities with a specific focus on building human capacity within the land administration institutions as one of the principal factors of sustainability and solution continuous support and development.

Budgets, time and other resources are limited, it is essential to set the right ICT solution and drive it in the right direction from the beginning.

LA guidelines and some IT misconceptions

Enemark (2015) stressed the evidence of the divide between the state of land administration in developed countries and the rest of the world, and made a major point that the constraints to close the gap "relate to a range of legal, institutional and political issues – but also to the fact that implementation of traditional Western-style cadastral systems is simply too costly, too time-consuming and too capacity-demanding."

Laarakker et al. (2014) took into account characteristics of the developing and poor countries, proposed to extend the traditional model of the land registration with state and non-state actors participating in the registration processes with their own sets of tenure classifiers and procedures. All of this again emphasizes the complexity of the land administration domain to which the experts and donor organizations responded with a new paradigm, Fit-for-Purpose (FFP), followed with a series of general and focused thematic guidelines (FAO (2012), FAO (2015)). The guidelines provide a rational and well-justified set of principles and structured approaches which identify the three core components of the FFP concept: spatial, legal, and institutional frameworks (Enemark et al.(2016)). The concept further extended with specifics of implementation including change management, capacity development and project delivery (McLaren et al. (2016)).

The ICT role in land administration, despite being recognized as very important, even critical, have rarely satisfied the implementation expectations, especially for the big international tenders (see Tonchovska et. al. (2013)). It often presented a serious managerial challenge with budget overruns and significant delays. No wonder one sees “warnings” throughout all the guidelines and various experts’ papers proposing to control the ICT scope and to adopt an approach with simple preferably locally developed solutions based on manageable incremental steps.

The papers of Lemmen at al. (2016) and McLaren et al. (2016) provide excellent reviews of the guiding principles and recommendations for FFP LA. But even those present some statements that from the prospective of the paper’s authors may lead to misinterpretation.

First misinterpreted concept: *"initial ICT solutions will have to be rather simple."*

There are few good things about starting “simple”; which are, whatever is done might be discarded more easily as ideally not much have been financially invested, and, with the implementation of those initial steps some lessons learned and certain capacity established. We state that the simpler the solutions to be developed on the initial stages, the more chances those will be retired and completely changed as eventually more complex integrated services are required. As concluded by Törhönen (2016), for a successful LA approach “emerging real property markets require the quick implementation of efficient registration systems to allow sporadic registration as transactions happen. Otherwise, informality prevails and many potential investments are lost”. Time is becoming the most essential resource and LA projects should aim for sound results that close the gap and ensure the leap into modern solutions with a focus on services. The necessary technology leap cannot happen evolutionary via the accumulated outcome of a series of simple solutions. Simple solutions do not provide enterprise integration and automation, and it is the enterprise level which has to be considered for the national scale LA project. A more realistic approach proposed herein is to look for an “out of box” technology engine or framework providing

necessary enterprise platform components of the LA solution. With modern enterprise technology, it helps to establish an immediate footprint at the other side of “the divide”, where we want to be, using Enemark’s definition. This IT-Leap platform is not only financially affordable but offers much more flexibility and availability – those desired principles of the FFP concept. Base on the solid framework the initial stages would indeed start from simple and straightforward business processes, and incrementally add more complex rules and processes going forward.

The conclusion for this misconception is that it’s recommended to look for an adequate core technology platform that can be deployed into the cloud and serve as a sandbox for testing “simple” business applications and initiating basic work processes. This core technology must present enterprise design components compliant with the LA standard data model and implemented in a way to allow flexible on demand customization, extension, enhancements and scaling up.

Second misinterpreted concept expands on the previous one:
“There is a tendency in national land administration system programs in developing countries to invest in expensive, sophisticated ICT solutions at the start of programs. This rarely proves successful. ... A simpler, lower cost ICT solution at the start of the program will provide flexibility to accommodate changes in business processes, customer requirements and resource availability identified through assessing initial operations.”

We are aware and confirm the evaluation of limited past national scale project successes. But, as discussed earlier, the complexity of the core technologies is the reflection of the reality of the Land Administration domain and expecting that it would be possible to

Box 1: Quote of Nkurunziza, Emmanuel from “2. Implementing and sustaining land Tenure regularization in Rwanda.” – see Hilhorst et al. (2015)

“The decision to use a mix of open-source and commercial software on the LTRSS was based on breaking down data-processing activities into small component tasks and choosing the most appropriate software or combinations thereof to complete each task. However, this approach also had a downside as the lack of an overall data infrastructure created space for inconsistencies. Later on it was sometimes difficult to link the various pieces effectively, ensure interoperability, and use the LAIS data for policy analysis. It took much longer than planned to have a fully operational LAIS.”

“The interoperability of land data is an important aspect of promoting the use of land data. After completing the first registration, the RNRA migrated the IT infrastructure to a new platform, the LAIS, which combines a register with a cadaster and incorporates such functions as transfers, transactions, and mortgage registrations.”

implement a modern, efficient solution, and close the gap with small simple steps is a serious underassessment of the overall scope. If time allows and the stakeholders can afford to postpone the modern transformation of the land administration sector, the LA system could start from simpler solution. There are examples where the decision to transition to the modern integrated enterprise took many additional years after appraising the achieved results of the simple solution and building local capacity (Kyrgyz Republic, Punjab province of Pakistan, Rwanda – see Box 1). However, where political and social demand for land administrative modernization is high, **time** is the most critical factor. The technologies have matured over the last decade and have become much more available and cost-affordable. The open source license-free stack of enterprise level technologies provides an opportunity to propose modern platforms to start from at the very beginning of the program. And technologically complex cloud platforms are specifically designed to “*accommodate changes in business processes, customer requirements and resource availability*” as demanded by the FFP concept principles.

What are the technological trends which make the authors believe the time is ripe for this more technologically mature approach to implementation of LA projects?

Modern ICT in LA

IT Trends

From the perspective of the senior IT leaders in the 2016 Society of Information Management (SIM) IT Trends Study, looking at the top 10 IT management concerns of most importance to the organization (see **Table 1. IT management concerns/issues. Source: IT TRENDS STUDY, (2016)**), *Alignment of IT with the Business* ranked number one while *Business Agility* was ranked number two and three for the last four out of five straight years, clearly stating the importance of achieving and maintaining alignment while dealing with change in increasingly dynamic environments. “Although alignment has received considerable attention from both academics and practitioners, it continues to remain a challenge for many organizations. It is possible that alignment remains a persistent issue due to the changing nature of business and the difficulty that the IT organization has in responding to these changes. In other words, it is one thing to become aligned, but quite another to stay aligned” (IT TRENDS STUDY, (2016)). And the trends identified a whole set of key issues directly related to the ability of the IT to align and deliver value to the business in a most efficient and effective way – *Speed of IT Delivery, Innovation and Productivity* are all within the top five major concerns.

Table 1. IT management concerns/issues. Source: IT TRENDS STUDY, (2016)

IT Management Concerns/Issues	2015	2014	2013	2012	2011
- Alignment of IT and/with the Business	- 1	- 1	- 1	- 2	- 1
- Security/Privacy	- 2	- 2	- 7	- 9	- 8
- Speed of IT Delivery/IT Time-to-Market	- 3	- 5			
- Innovation	- 4	- 8			
- Productivity/Efficiency (Business) (a)	- 5	- 4	- 3	- 1	- 4
- IT Value Proposition to the Business	- 6	- 6			
- Agility/Flexibility (IT) (b)	- 7	- 13			
- Cost Reduction/Controls (IT) (c)	- 8	- 17	- 5	- 5	- 10
- Agility/Flexibility (Business) (b)	- 9	- 3	- 2	- 3	- 2
- Cost Reduction/Controls (Business) (c)	- 10	- 9	- 4		

ICT Generic Principles and Cloud Technologies in LA

Generic principles related to modern Land Administration ICT system open architecture (based on The Principles for Digital Development <http://digitalprinciples.org/>) might be categorized in the following aspects:

- **Scalability, Reliability & Flexibility:** The technology is scalable with the feedback and emerging requirements, and will continue to be available and reliable as the information handling needs of the enterprise increases.
- **Ease of Development & Maintenance:** The complexity of the core system is hidden under the hood and future programming and customization requirements for the system are controlled using

configured and extended rules and workflows, and data model configuration and customization tools.

- **Total Cost of Ownership:** The core software framework ensures that the Total Cost of Ownership (TCO) is kept at optimal levels. This will take into account estimates for software acquisition mainly built on open source technologies, likely updates, initial development, training, final source code availability and maintenance costs.
- **Security:** Security is one of the prime considerations, and the various technical issues to address include data integrity, confidentiality, authorization, authentication, control, compliance, prevention from unauthorized usage and audit monitoring.
- **Open Standards:** Usage of Open standards protocols, languages and software components help protect the site and technology against redundancy, support unlimited license usage and also have the advantage of inter-operability and less TCO. Specific for Land Administration are LADM (ISO 19152:2012) standard for data modelling, OAIS/CMIS for electronic archives, OGC for geo-spatial data.
- **Ease of Integration:** The system should eventually link to other sources (websites, contents and portals). The open architecture has the provision to integrate with evolving requirements in the future using W3C recommendations.
- **Representational State Transfer (REST) and Web 2.0:** The REST software architecture for client or server communications over the web with responsive Web 2.0 and rich and multilingual client GUI within web browsers.

The most pervasive technologies penetrating all industries over last decade are cloud computing generally defined for the delivery of hosted services over the Internet. Some of the main reasons a cloud-based LA framework is the most suitable technology from which to start are:

- It leverages modern, booming technologies that have been proven in all industries, including land administration in developed countries in a form of a private cloud;
- The technology stack fully meets the Generic Principles of Land Administration ICT presented above;
- It allows immediate “doing through trying” without high up-front capital investment; deploying the selected solution on a commercial or, if available, governmental cloud platform;
- It allows for verification of the Vendor solution through a very early Proof of Concept;

- It allows all stakeholders and development team to focus on the business aspects and business values from the very beginning defining Minimal Value Product (MVP) as the next major milestone (the principle defined by the latest FFP guidelines - Lemmen et al. (2016));
- Early start with the technological focus on LA business aspects establishes and extends common terminology of the collaborative team of the Vendor and the Customer - misunderstanding is the main source of poor requirements and results in delays and poor implementation;
- Cloud based solutions, once proven via MVP, might be hosted on the in-house enterprise infrastructure – internal private or hybrid cloud, with detailed specifications defined for the hardware infrastructure (data centers) that match the platform and core data footprint of the previously tested and proven solution;
- It allows standalone implementations and off-line solutions for certain specific tasks (most suitable for remote poorly connected offices, field work and on-site data capture and migration) with the cloud solution enabling the integration of the data produced for immediate quality and integrity checks, and subsequent availability for stakeholder and public access. It should be noted, however, that the lack of data integration processes and availability of the cloud services at the very beginning may diminish the value of those standalone data production efforts;
- It provides the opportunity early in the implementation to evaluate the current human resources professional capacity and decide whether capacity building is required and what direction– either focus on building in-house enterprise governance capacity to manage, implement and maintain projects using subcontractors and outsourcers or have the whole stack of the ICT private infrastructure established including in-house development and maintenance teams;
- The cloud based solution is the most secure option for enterprises with minimal local technical capacity. It allows the agency to focus mainly on business aspects and establishing efficient work processes, and less effort on maintaining technologies and infrastructure operational security, gradually and collaboratively building it up as the solution is further customized and developed.

Vendors and different foundations, as well, have learned from past lessons and invested in building cloud based tailored solutions. Social networks, Google mapping, crowd sourcing, transformation of financial and other industries, fueled by public demand for more broad range of the e-government services, are the current eco-system elements to consider implementation of the modern land administration projects. The core enterprise technologies have reached a proven maturity level, are available as open source stack, and are compliant with industry open standards. The new approach might be to engage with the technology vendor in a partnership with less up-front costs and build the *Minimum Viable Product (MVP)* and deliver

business value earlier. In fact, cloud based technologies are perfectly suited to experimenting with several solutions and compare their performance and flexibility of the early implementations. The initial extra costs due to certain duplication of effort will be fully justified, objectively selecting the most efficient and flexible solution, thoroughly tested and investigated including the collaboration and knowledge transfer aspects. Inability or unwillingness of the vendor to engage in the MVP in fact may serve as an indicator of the vendor's platform inflexibility and limited adaptability.

There are number of initiatives specifically focused on the land administration domain exploiting cloud computing for very early efforts of the variety of rights identification and utilizing STDM land tenure model and crowd sourcing – Cadasta (<http://cadasta.org/platform/>), Open Tenure by SOLA (<http://www.flossola.org/>). The solutions specifically target pro-poor communities with underdeveloped infrastructure, which only confirms the confidence in the modern cloud technologies appropriateness for those environments.

Changing Role of ICT and Addressing Complexity

Complex domain should be addressed systematically and with adequate technology positioned as the foundation for specific applications. ICT has become a de facto driver of land administration extending the spectrum of services in the developed and some developing countries. Time to put the horse ahead of the cart and use ICT as the core platform that will require unified regulations, re-engineered and streamlined processes, managed changes, and serve to drive capacity building and objectively track and monitor sustainability parameters.

Cloud and Web-based technologies are sophisticated but it's important to differentiate the technology stack complexity from the domain model and operational model complexity. Domain and operational complexities might be addressed in a staged smooth process exactly as FFP principles define but only based on existing adequately rich, integrated and therefore intrinsically complex technological platform. It's a misconception that technically simple solutions could be easily extended and enhanced altogether with the gradually complicating business and domain requirements. It's like constructing living spaces and the foundation at once. The desired flexibility to absorb domain complexities might be done only using already complex enough technical core framework. The velocity of the changes is increasing and time-to-market is becoming a real concern for the business. Having a core technology platform, allows a start from simple and easy to operationalize processes, engaging stakeholders, and adding more specific complicated aspects over time. It would be a strategic mistake to seek a basic system and ad hoc fragmented components with no solid framework for those efforts to reliably contribute into building an enterprise integrated solution.

A key question remains, however; how to choose the core technology and prove it.

ICT as the Transformation Tool in LA Projects

Role of the ICT Strategy

It has been suggested that the way to control the long-term system implementation is to define and agree on the ICT strategy and use it as a roadmap for aligning to business needs with incremental improvements of the initial technology and processes. Lemmen et al. (2016) stated the importance of the ICT strategy for planning of the land administration projects. The necessity of the ICT strategy is mainly to guide the executive level with the major macro decisions and ensure the technology targets are business-oriented. The ICT strategy is a living document describing the enterprise architecture and is never “completed”, as the business and IT continually change. Further, it would be rather overoptimistic to expect the ICT strategy to ensure a smooth development path without fragmentation of the efforts and prevent the re-factoring and re-engineering of what was completed earlier. Like any strategic plan, ICT Strategy metrics and milestones must be re-visited frequently, and tasks or approach modified as needed. Interestingly, the demand for the integration and centralization of the services quite often arises as a result of the high cost of maintaining the distributed network of “simpler” solutions and the shortage of qualified personnel to support various distributed sites.

LA ICT Platform Flexibility

“Trying and learning” is the recommended approach to start the implementation. We fully agree with this approach and adopt it in the proposed modern land administration implementation roadmap described below. The key element of our approach is to start from a versatile technology framework that already complies with the major principles and standards. With such a platform, it’s much easier to collaborate and focus all stakeholders on the business values that can be achieved in the shortest period, and serves as the proven base line to move forward.

So, from a practical perspective, if the business executives want to transform the organization and achieve the most valuable business goals they better start from the platform that already features major technological components and functionality. That platform should be validated through an early Proof of Concept (POC), available for review, and involvement of all stakeholders to jointly set priorities for the Minimal Value Product (MVP) implementation accompanied with the knowledge transfer. Agile methodology is the proven way of building and flexing the complex enterprise solutions for evolving business needs, and must be mandated as a blueprint for the land administration systems implementation. Business needs and requirements should be systematically reassessed and incrementally factored into the

development iterations or sprints. The ICT strategy should be detailed and expanded, accordingly, focusing on the business services portfolio based on the core technologies.

LA ICT Road Map

With the defined principles and cloud based technologies as the core platform we propose a rather specific ICT road map for the implementation of a national land administration project (**Table 2. LA ICT Road Map**). The specifics of the formulations do not rule out other options, but rather indicate the authors’ recommendations based on the experience and lessons from various projects. In fact, the proposed road map represents a well-known software system life cycle, adapted in its steps and goals for the land administration domain, utilizing agile development methodology and extending the specific principles and recommendations provided by existing LA and FFP Guidelines.

Table 2. LA ICT Road Map

Stage	Step	Goal	Clarification details
PRE-CONTRACTUAL	Baseline	Plan for an effective, flexible and scalable supporting ICT infrastructure as crucial for the implementation of the FFP approach	ICT framework to be cloud ready with integrated: <ul style="list-style-type: none"> • LADM compliant database model • BPMN workflow • Rules engine • CMIS/OASIS compliant Content Management System • GIS Server with OGC standards compliant • REST Web-based scalable N-tier architecture • Report engine • Web portal (search service and dashboards) with exemplary land admin processes • System Administration and Configuration • W3C compliant open interfaces/APIs

Stage	Step	Goal	Clarification details
	Demo – Kick-off	Stakeholders evaluate and choose the technology as the first stage of partnership	Workshop and follow-up meetings with technology demonstration and project planning and collaboration details. Identification of the Customer’s resources to engage with the Vendor in preparation of the Proof of Concept (POC) version. Establish a Customer Technical Workgroup.
INCEPTION	Proof of Concept (POC)	Prove to the stakeholders that chosen ICT platform is customizable and give a sense of progress to all involved	Develop and present in a short period (6-8 weeks) the system customization and localization of several basic processes. The Technical Workgroup and the Vendor collaborate with development of common vocabulary, notations, general boundaries and scopes of the business requirements.
	User Requirements Definition – 1 st Minimal Viable Product (MVP) iteration	Identify requirements for the MVP and continue defining the requirements for further stages	The Workgroup and the Vendor analysts define set of requirements for MVP. Should be planned in the shortest period so to allow the Vendor to start working on the MVP as early as possible.
1 st ITERATION – MVP, User Requirements Definition and	Minimal Viable Product (MVP) Implementation	Hands on testing of the MVP for the Customer base work processes	Depending on the MVP scope, the implementation of the MVP system should take from 3 to 6 months and allow Customer’s operational hands-on testing and related collaboration aspects fully evaluated.

Stage	Step	Goal	Clarification details
	Full system user requirements definition	Majority of the user requirements clearly defined	The Vendor analysts, assisted by the experts of the Workgroup, formulate most of the requirements with details of the processes, roles, forms, rules, and data migration.
	Knowledge transfer	Building local human capacity	Established collaborative environment and training for analysts and quality assurance.
2 nd ...N th ITERATIONS – Design Refinement, User Requirements Tuning, Knowledge Transfer	System Architecture Design	Define system design	Focus on design aspects of the system integration with third party solutions, support of the required standards (LADM, CMIS, Open GIS) and APIs for data exchange.
	Agile Iterative (Sprints) Development	Ensure permanent control of the development progress	Agile methodology serves to control development scope and speed of the progress and to involve Customer team into the development process and ensure knowledge transfer.
	Continuous Hands on Testing and Change Requirements	Ensure end users buying into the system and their ability to influence the development	End users evaluate the developed software and have the early hands-on experience and ability to provide operational feedbacks to factor into the development.
UAT and Commissioning	System Pre-commissioning	Data Migration and Operational Testing of the system	Incremental continuous testing performed through all previous iterations but focus on integrated and operational performance and data migration/load testing.

Stage	Step	Goal	Clarification details
	Refinement	System is tuned for roll-out and operational acceptance	All critical and major feedback addressed and system tested for the final acceptance.
	Final Delivery and UAT	System readiness for operationalization confirmed with all data load	Decision about readiness for the national scale operational roll-out
Operationalization, Maintenance and Further E-Government Integration	Commissioning into Operations and roll-out	System up and running in the enterprise. Local team in charge of front end and majority of the service levels 1 and 2 operations (level 3 might be outsourced to the Vendor).	Training of staff, loading of all validated digital data and operationalization of all workplaces. Depending on the local team build up capacity the ownership and responsibility over all components of the services delivery chain, including system support and maintenance, shared between the Vendor and local resources.
	Maintenance	Sustainable system support and further extension of the services integrated into national and communities e-government portfolio.	Performed by the local team of key stakeholders and developers with only optional and if “needed” support from the system Vendor. Ideally, the source code of the delivered system is fully available to the local team and there are no any license restrictions locking the licensee only into the licensor services to evolve the solution further for the enterprise needs.

In the following section the proposed road map is further detailed in a break down projection on the de-facto standard packages of the LA activities.

ICT and Value Chains in LA

The proposed ICT roadmap might be further considered in relation to the major enterprise architecture packages or components that, together, define the land administration landscape:

- Soft-ware
- Hard-ware
- Data-ware
- Legal-ware
- Human-ware

Each of the package’ goals should be defined in view of the other packages’ expected results as those are interdependent in every aspect. Failure to fulfill any of the expected goals will inevitably undermine, if not negate, the value of other packages’ results (for example, (i) failure to cleanse and migrate existing data into new system will render the capital investments in software and hardware almost futile; (ii) it’s impossible to design and build highly efficient software without clearly defined legal norms and regulations). Land Administration guidelines provide excellent recommendations and identify goals for all the components, including other important aspects such as environmental, social and institutional. In this paper, we try to prove that positioning ICT as a driver of the enterprise transformation from the very beginning is to accelerate the efficiency of all other components from the prospective of their activities’ practical “computerized” value (**Figure 1. IT-Leap Change of Modality in LA projects.**)

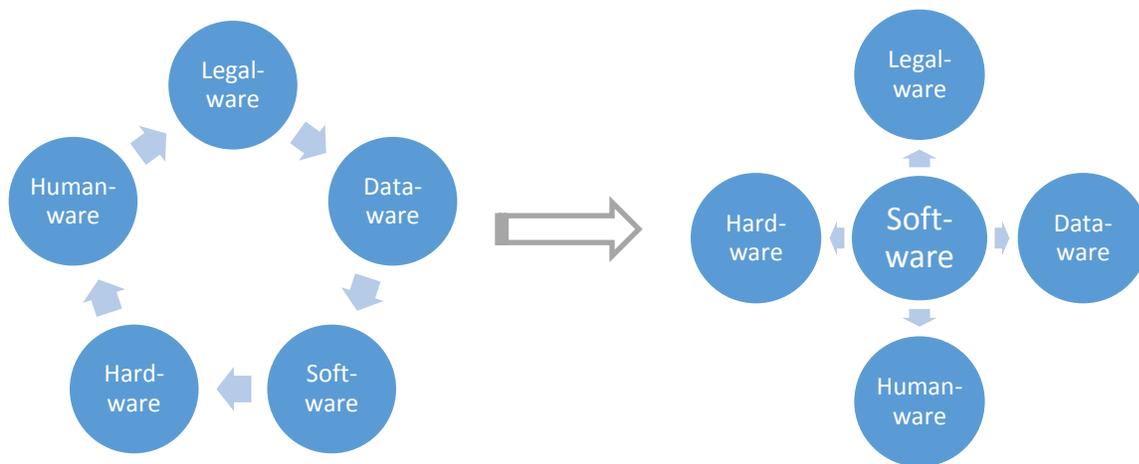


Figure 1. IT-Leap Change of Modality in LA projects

To explore the details of the ICT inter-relationship with all the packages, **Table 3. Value-chain in LA projects** presents the breakdown of activities, decision points and expected results of each ICT roadmap stage in relation to the “-ware” packages. Chain of activities are staged for each package and represent the value-chain delivering valuable product/service or capacity. In terms of the project management, the

identified activities represent the critical ICT implementation path with dependencies of parallel activities from all the packages. The activities in a specific stage ideally should be completed within that stage so not to delay the ICT implementation and the need to refactor or extend the solution at the very late stages. Lack of clarity and formal coverage in the legal and regulatory package, poor identification of the local capacities and allocation of the responsibilities, inadequate hardware infrastructure or unavailability of high quality digital data will directly detriment the ultimate system operations; leaving more room for misuse and doing business behind the system. Thus, it should be clearly recognized that the majority of current LA project problems are not with the ICT technological complexity but rather with underestimation of the direct dependency of the ICT solution with other packages, ability of the project management and the system vendor management to drive formally the necessary inputs and decisions from other activities the ICT solution depends upon. In a sense, we propose to reverse the usual way of doing an LA project – ICT should be not a passive or independent component that follows or picks up from other components and tries to build upon what has been provided in under the legal, human and data aspects. The ICT should be pro-actively demanding a formalized list of the needed inputs from all other components. Considering each ICT activity as systematically driving all others will activate the whole value chain in other packages, set the iterative clock or cycles, and force formalization into those parallel activities chains (see *Box 2: Scenario of Legal and Regulatory Aspects driven by ICT*). The authors

Box 2: Scenario of Legal and Regulatory Aspects driven by ICT.

Goal: At the *Inception stage* of the project the Customer and the Vendor should define and agree on *MVP* (Minimal Value Product) requirements.

The Customer: Should define set of the business requirements to be implemented and delivered as MVP. The most logical would be to define a set of formal transactions to be implemented within the System. The source of details for the transactions are in legal documents and regulations.

The Vendor: Start working on system definition of the requirements for MVP (**Table 3. Value-chain in LA projects:** Soft-ware – activity #3). Analyze set of the MVP transactions and come up with formalized descriptions identifying all specific details for the implementation – workflows, forms, in/out and supplementary documents, rules of processing, terminology. Any gaps and unclarified aspects of the regulations must be filled in and explained by the Customer domain experts. As a result of this request from ICT the following activities will result in:

- ✓ Business processes, business rules and forms are defined in a standardized way – BPMN notation (Legal-ware – activity #3)
- ✓ Gaps are identified and requests submitted for the Working Group review and resolution (Legal-ware – activity #4)
- ✓ Collaborative online environment established (Human-ware – activity #3)
- ✓ Certain experts of the Workgroup specialized on regulations, procedures, and technical requirements (Human-ware – activity #4).

recognize that there might be non-ICT related activities and values (such as social or institutional) and those are omitted from the ICT value-chain.

However, even for those it's not categorically irrelevant to ICT - once the ICT is firmly established, the social values are much more objectively monitored and institutional structure and high level adjustments are usually required to match the lead role of ICT within the enterprise.

The activities listed in the value-chain table might be detailed and extended with specifics (for example activities related to registration, cadastre, surveying, valuation, physical planning, properties management) and that should happen for any specific project with consideration of budget, time and other constraints. All those activities should be addressed for any land administration project that is planned for an integrated, national operational system.

Table 3. Value-chain in LA projects

Stage	Soft-ware	Hard-ware	Data-ware	Legal-ware	Human-ware
PRE-CONTRACTUAL	<p>1. ICT Strategy - 1st Version. Conceptual Design and Technical Requirements matching ICT Strategy.</p> <p><i>The Strategy will be continually refined in the ongoing stages – live “look-forward” document.</i></p>	<p>1. Specs of the critical equipment to support, primarily, Data-ware goals.</p> <p><i>No need to define specs for the system at this stage.</i></p>	<p>1. Detail inventory of all types of existing data:</p> <ul style="list-style-type: none"> - Archives - Maps - Digital <p>2. Decide about approach to data migration:</p> <ul style="list-style-type: none"> - outsource, - in-house, - mix. <p>3. Define Technical Requirements and Data Models for data conversion.</p>	<p>1. Identify all relevant legal acts and regulations.</p> <p>2. Conduct Business Analysis and Re-engineering (BA&BR) - 1st Version.</p> <p><i>Needed as part of the Conceptual Design and will be refined in the ongoing stages.</i></p>	<p>1. Mobilize local Beneficiary team of domain and IT experts into Technical Working Group.</p> <p><i>The Group will serve as the main body involved into daily collaboration with the Vendor.</i></p> <p>2. International domain experts assist or lead the Technical Working Group to conduct BA&BR and formulate Technical Requirements and define 1st Version of ICT Strategy.</p>
INCEPTION	<p>2. Cloud based Proof of Concept demonstrated</p> <p>3. Requirements clearly defined and agreed on for Minimal Viable Product.</p> <p>4. Software Requirements continually defined.</p>	<p>2. Equipment for data production procured.</p> <p>3. Evaluation of the options for outsourced hosting of the system or build the infrastructure in-house.</p>	<p>4. Outsourcing data production vendor identified or/and in-house data production capacity established.</p> <p>5. Data production independent quality control mechanism established.</p>	<p>3. Business processes, business rules and forms are defined in a standardized way.</p> <p>4. Gaps are identified and requests submitted for the Working Group review and resolution.</p>	<p>3. Collaborative online environment established.</p> <p>4. Working Group specialized on different aspects – legislation and procedures, infrastructure, software.</p> <p>5. Decide if to establish in-house development team.</p>

Stage	Soft-ware	Hard-ware	Data-ware	Legal-ware	Human-ware
1 st ITERANTION – MVP, User Requirements Definition and Knowledge Transfer	<p>5. Cloud based MVP ready for hands-on testing.</p> <p>6. Evaluation of the MVP and decision if any major interventions to the development plan and setting next iterations priorities.</p>	<p>4. Design and specification of the equipment and engineering systems for the enterprise in-house infrastructure.</p> <p>5. Evaluation of the communication infrastructure and define specifications for the enterprise communication infrastructure.</p> <p>6. Evaluation of the enterprise staff equipment needs and define requirements for the equipment procurement.</p>	<p>6. Data production is underway with completed sets of data available for the Vendor to implement and test data load procedures.</p> <p>7. Ensure strict quality control of the data produced and the work processes.</p> <p>8. Consider requirements for data integration and synchronization if produced from separate original data sources.</p>	<p>5. Bring all the identified legal and normative gaps to light and identify actions to legalize all exposed aspects.</p>	<p>6. Define detailed human resource capacity development plan and establish a Competence Center.</p> <p>7. Depending on the decision about enterprise infrastructure the following specialized teams identified within the Competence Center:</p> <ul style="list-style-type: none"> a. Business analysts capable of defining detail requirements for the systems and manage in-house or outsourcing development groups. b. System and communication engineers capable to maintain future enterprise ICT infrastructure. c. System application developers capable to maintain and further evolve the system development.

Stage	Soft-ware	Hard-ware	Data-ware	Legal-ware	Human-ware
<p style="text-align: center;">2nd...Nth ITERATIONS – Design Refinement, User Requirements Tuning, Knowledge Transfer</p>	<p>7. Agile iterative implementation of the system.</p> <p>8. Continuous integration of the iterations with testing, including data migration</p> <p>9. Refinement of the system design and data model.</p> <p>10. Technical documentation in support of the knowledge transfer.</p> <p>11. User and system admin documentation.</p>	<p>7. Construction, procurement, installation and turnkey delivery of the enterprise computer and communication infrastructure into operations. 8. Integrated testing of the Software on the established running infrastructure.</p>	<p>9. Development of the migration and conversion procedures from different sources into the system unified database.</p> <p>10. Data integration and harmonization testing with validation and verification of the results.</p>	<p>6. Refinement of the regulatory documents.</p> <p>7. Development of the operational procedures.</p>	<p>8. Specialized training for the teams of the Competence Center.</p> <p>9. Collaborative development environment of the Vendor and the Competence Center and regular knowledge transfer.</p> <p>10. Working Group, Competence Center and Vendor conduct regular (quarterly) workshops reviewing the status and advising on actions.</p>
<p style="text-align: center;">UAT and Commissioning</p>	<p>12. Extensive functional, integration, performance testing to decide on the system readiness for going operational.</p>	<p>9. The infrastructure is fully operational.</p> <p>10. The new system installed on the established infrastructure and local staff conducts all of the operational acceptance tests.</p>	<p>11. Migrated data are loaded into the system and integrated with available converted data.</p> <p>12. All questionable or poor quality data are separated and flagged for separate work processing.</p> <p>13. Continue processing problematic data and those that were exposed as containing errors or missing critical fields during data load into unified system.</p>	<p>8. Operational procedures are legalized at least at the enterprise level.</p>	<p>11. All staff is trained and certified for the system use.</p> <p>12. Decide to what level the Competence Center is ready to take ownership over the delivered system.</p> <p>13. Prepare and approve Maintenance and Support Service Level Agreements with Vendors to ensure smooth operations.</p> <p>14. Continue knowledge transfer and building local capacity.</p>

Stage	Soft-ware	Hard-ware	Data-ware	Legal-ware	Human-ware
<p>Operationalization, Maintenance and E-Government Integration</p>	<p>13. Operational system is maintained and any bugs are fixed and issues resolved according to the Service Level Agreements.</p> <p>14. Change requests are planned and factored into new releases.</p> <p>15. New modules and services are planned and implemented.</p> <p>16. ICT Strategy revisited and updated to reflect new trends and expend services.</p>	<p>11. The infrastructure is maintained according to the industry standards; ensuring uninterruptable availability and fault tolerance.</p> <p>12. Regular infrastructure upgrade to meet the operational needs.</p>	<p>14. Consider plans for paper archives consolidation and removing paper documents from the daily operation.</p> <p>15. Identify and plan for migration of other data that were not included in the main project implementation.</p>	<p>9. Update operational procedures and, if needed, regulations to be in sync with the evolving and extending system operations.</p>	<p>15. Users feedback and new feature requests are prioritized by the analysts for implementation as change requests or new modules and services.</p> <p>16. Interact with the public and end users and define new lines of e-services and integration with other governmental and professional institutions.</p> <p>17. The Competence Center takes full ownership of the system and plays a role of a driver in building e-services digital enterprise and defining further ICT Strategy.</p>

ICT and the Knowledge Transfer

There are several levels for the knowledge transfer:

- Business Strategy level – Defining strategy business goals and values for the organization
- Business operational level – Setting, monitoring and administering organizational resources and processes in achieving the business strategy goals and values
- ICT level – Implementing, supporting and adapting computerized processes aligned with the changing business goals and values
- Professional level – Using and operating professional tools and applications

One of the most frequent and standard set of trainings is related to the professional level. That usually covers all kind of instruments for field work, pre- and post-processing and operating software applications – surveying, GPS, photogrammetry, GIS, mapping, specialized software for cadastre, registration, valuation, physical planning. This is, in fact, the way to build up skills and knowledge that form the base of all LA operational activities. A sign of the sustainable locally available professional capacity is the presence of active professional communities that promote knowledge sharing and stimulate continuous education. In the most developed environments many of the professional activities are conducted by licensed contractors (surveyors, registrars) and IT specialized subcontractors.

As identified earlier by the IT Trends Study (2016), the most critical issue for dozens of years, is the alignment between business and IT, which requires analytical and holistic systems thinking and knowing your organization and customers. The only way to bring the system analysts and business stakeholders into a collaborative working environment is and to ensure they speak the same *lingua franca* is to train them and ensure mutual knowledge exchange in all of its tacit and explicit forms. Workflow processes formalization supported with BPMN standard (OMG and ISO/IEC 19510) is the fundamental common language mastered by the business experts, and with no additional “interpretation” directly applied and executed in the software applications (see example of the BPMN workflow at **Figure 2. Sample of BMPN workflow – Transfer of Title**). That business knowledge might be even further enhanced with the business vocabulary and rules (SBVR from OMG) so specific aspects of the legal norms and regulations are semantically presented into the software.

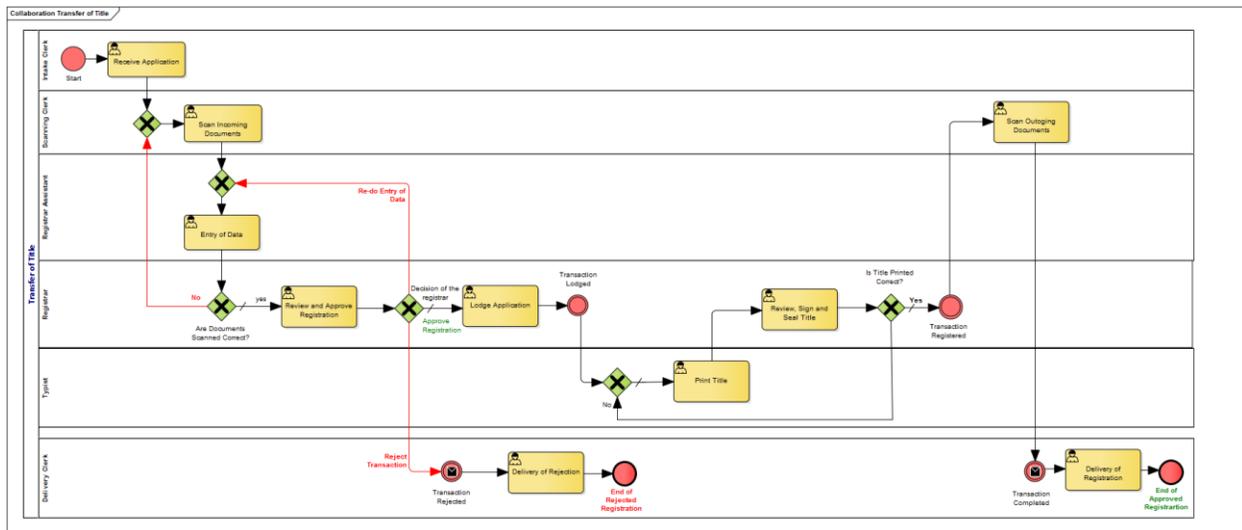


Figure 2. Sample of BPMN workflow – Transfer of Title

ICT system analysts should engage local domain business experts, and together, specify the processes and rules. That process is the personalized knowledge transfer of analysis and re-engineering of the processes, and the design of the services aligned at the operational and business strategy levels. Knowing and understanding ICT at the business operational level will ensure focus on the achievable objectives of measurable value which are fully understood from the ICT prospective. That’s the most critical knowledge transfer in contemporary organizations empowered by ICT, and quite often missed to be specifically identified in the LA projects.

The knowledge transfer at the ICT level might be considered from a prospective of establishing fully in-house, fully outsourced or hybrid model of ICT capacity. Whether done in-house or outsourced, the development and maintenance of the custom applications is often necessary since any existing packaged off-the-shelf products fail to sufficiently meet the organization’s specific requirements. In any of the models, there should be an internal ICT management and analysis group that will work with the business experts and end users groups managing ongoing changes. The primary tasks are to define requirements and set priorities for new features and specify new developments. They will also plan and manage implementation either with the internal development team, and/or outsourced subcontractors and/or dedicated strategic partner/vendor and effectively perform governance of all ICT activities within organization. ICT governance is a critical aspect of sustainability that is often undervalued in the LA projects.

Depending on the internal ICT capacity, the professional knowledge transfer is a rather standard set of required activities ranging from training for the ICT configuration, administration and use of the software, to the applications customization and extension and up to taking full control over the system source code

including internal maintenance and support. The scale of the ICT capacity should be rationalized from an economic prospective and ensuring control over the key business goals – more services to the customers and efficient and secure internal operational processes. It might be most economically justified to have ICT infrastructure hosted on a federated shared data center and an external vendor maintaining the operational system and continuing to improve and enhance upon request of the LA organization and in accordance with a clearly structured Service Level Agreement.

Some Specific Use Cases of ICT as a Driver in LA projects

To illustrate further how ICT might define the other activities to achieve specific results or decisions described herein are presented below in some typical project use cases.

Box 3: ICT as a driver – The Vendor Performance Evaluation Scenario.

Goal: To allow Customer early verification of the Vendor performance and ability to adopt the proposed platform to the local specific needs.

Customer Management and Technical Team:

Define a subset of transactions (work processes) that the Vendor must implement and deliver within certain time (it might be MVP or a Proof of Concept (POC) version).

The Vendor:

Formalize the details of the work processes, supplementary documents and business rules with support of the Customer’s domain experts.

Customize, configure and localize the framework with iterative releases tested and preliminary checked with the Customer Technical Team.

Formalized specifications of the work processes are available to the Customer Technical Team for learning/training and validation -collaboration established for analysis knowledge transfer.

Configuration and customization of the framework available to the Customer Technical Team’s developers (if such resources are available) for technical knowledge transfer.

MVP/POC version is delivered for the Customer’s formal review and evaluation.

The Customer:

MVP/POC deliverable tested and validated by Customers experts and end users. Conclusions are made about the Vendor's performance, flexibility and availability of the analysis, configuration technology and ability to deliver required product functionality in time.

Final Decision: Depending on the evaluation report the Customer has several options to decide upon:

Positive - Consider performance fully satisfactory and move on with further implementation (knowing the performance it's possible to reliably estimate the completion of a full set of the required work processes).

Conditionally positive - Consider the performance moderately satisfactory and define specific aspects for the Vendor to address and resolve in a specified time (to give another chance).

Negative - Performance is unsatisfactory and the Vendor has failed to prove its ability to build and deliver in time. The Vendor services should be terminated.

Special Aspects:

This scenario is applicable for any technology evaluation but specifically valuable for a cloud based framework review. It allows the Customer to focus on its specific business processes and business values that the MVP/POC should demonstrate. Cloud based technology should not require any specific up front capital infrastructural costs so allowing Customer focus on the requirements and evaluation. Evaluation should consider the delivered solution from operational and technical point of view but also teams' cohesion and collaboration and knowledge transfer processes. To make the impact of negative outcome less sensitive, especially for the time bound projects, the Customer may initiate MVP/POC with several vendors and chose one to work with after this assessment.

Box 4: ICT as a driver – Data Migration and Open Data.

Goal: To digitize existing paper documents, convert and harmonize existing "silos" of digital data and load into the system.

Customer Management and Technical Team:

Identify and make available all paper archives that should be digitized. Prepare an inventory of document types, quality, and quantities. Provide documentation and access to the existing digital data that should be converted.

The Vendor:

- Analyze source documents and propose detail methodology of the documents digitization.
- Define data model for the migrated digital data.
- Analyze existing digital data and develop conversion scripts for loading into new system.
- Provide data migration tools – scanning, indexing, data entry and data load.

Special Aspects:

Data migration technology is typically considered as a set of standalone tools to automate production processes of an autonomous production team (or teams) and those tools are usually of a simple architecture, especially for scanning and indexing. But the real content of the land administration records requires more elaborated tools to capture all data where not only all the data should be digitized, but the completeness, sequence and integrity of the digital data ensured.

Specialized tools are needed for migrating spatial data, and it's usually a separate process of unification of spatial and textual digitized data. Having a draft LADM compliant model of the unified database helps to define according sub-models of the migrated data and, what is the most important, helps to ensure quality of unification and harmonization of the data through the data production process. That “top-down” approach helps to define multi-staged quality control mechanisms for processing of the raw data.

Expected Results:

The most profound “quick-win” result of having the integrated approach driving the data migration might be achieved with loading unified digitized and converted data onto a kind of searchable public or corporate portal (it's primarily a political question if to make data freely available to the public or with regulated access) and make data online available for all interested stakeholders and/or public. The concept of data availability which is coined as **open data** proved to be fertile in many cases. It helps not only to involve stakeholders and public into crowd-cleansing of the possible errors in the records but also to stimulate third parties developing of specialized value adding services and integrating available open data.

Another critical impact of having ICT driving the concept of open data is in formulating professional communities and public demands for legal and regulative aspects to clearly define the data availability and accessibility policies – what data are open, what data are private, what data access services should be provided to various stakeholders (banks, financial agencies, tax authorities, etc.).

Conclusion

The paper presents reasoning to recognize contemporary cutting-edge IT as the tool to modernize, not only the technical aspects of LA, but also to use it as the foundation and the driver for all related LA components or packages of activities. The approach, to some degree, might be considered as a means to define “computerized” business value of any related activity in the way that the activity should be reflected in the technology, and provided as a function or a service by the ICT solution. For that shift in the paradigm of “how-to-do” an LA project, there should be an available, solid and proven ICT platform meeting industry principles, standards and best practices. The most advanced methodologies and best practices based on many years of LA projects implementation have been summarized into a Fit-for-Purpose approach. Cloud based scalable technologies and development of various open source and free license software have become pervasive across various industries and established in many LA organizations of developed and developing countries. It is time to accept this reality and consider it as the new modality for the land administration projects we termed as FFP IT-Leap. Putting ICT in a position of the driver of the LA activities will help to speed up all the related and contributing processes and close the dividing gap, objectively aiming for high efficiency, technologically provided flexibility, with measured and monitored performance. The primary focus in the modernization process should be on the business values created and ICT should be viewed as the most efficient driver aligned with those values using shared *lingua franca* for business and technological domains. That can only happen if there is strong political and executive support, a collaborative process established for building common *lingua franca*, and knowledge exchange between IT and domain experts. Once domain experts appreciate what IT can and is delivering, and understand how to communicate the business requirements, a totally new dynamic might be established for LA enterprise modernization toward service organization with continuous enhancements.

References:

- Enemark, S. (2015):** Closing the Cadastral Divide. GIM International, 23/04/2015.
- Enemark, S., R. McLaren and C. Lemmen, (2016):** Fit-For-Purpose Land Administration – Guiding Principles. UN-Habitat/GLTN/Kadaster, United Nations Human Settlements Programme UN-Habitat, Report 2/2016. <http://gltn.net/index.php/publications/publications/publications-list/send/2-gltn-documents/2332-fit-for-purpose-land-administration-guiding-principles-for-country-implementation>
- Hilhorst, Thea and Frederic Meunier, eds. (2015):** How Innovations in Land Administration Reform Improve on Doing Business: cases from Lithuania, the Republic of Korea, Rwanda and the United Kingdom. Washington DC.: World Bank.
- ISO, (2012a):** ISO 14721:2012 Space data and information transfer systems -- Open archival information system (OAIS) -- Reference model, September 2012
<https://www.iso.org/obp/ui/#iso:std:57284:en>
- ISO, (2012b):** ISO 19152:2012, Geographic Information - Land Administration Domain Model. Edition 1, Geneva, Switzerland. http://www.iso.org/iso/catalogue_detail.htm?csnumber=51206
- IT TRENDS STUDY, (2016):** IT Trends Study Research Team with Kappelman, L. as Primary Investigator, The 2016 SIM IT Trends Study: Issues, Investments, Concerns, and Practices of Organizations and their IT Executives. Available at:
http://c.ymcdn.com/sites/www.simnet.org/resource/collection/7A70D436-28BA-4E88-B958-C86941C704C3/SIM_IT_Trends_Study_2016_Comprehensive_Report_-_Final-v09Nov15.pdf
- Laarakker, P., Y. Georgiadou and J. Zevenbergen (2014).** Person, Parcel, Power - Towards an Extended Model for Land Registration. Proceedings of FIG Congress, Kuala Lumpur, Malaysia, 16 – 21 June 2014. Available at:
http://www.fig.net/resources/proceedings/fig_proceedings/fig2014/papers/TS05C/TS05C_laarakker_georgiadou_et_al_7394.pdf
- Lemmen, C., S. Enemark, R. McLaren, D. Antonio, J. Gitau, P. Dijkstra and K. De Zeeuw, (2016):** Guiding Principles For Building Fit-For-Purpose Land Administration Systems in Developing Countries: PROVIDING SECURE TENURE FOR ALL, 2016 World Bank Conference on Land and Poverty, The World Bank – Washington DC, March 14-18, 2016
- McLaren, R., S. Enemark and C. Lemmen, (2016):** Guiding Principles For Building Fit-For-Purpose Land Administration Systems in Developing Countries: Capacity Development, Change

Management and Project Delivery. 2016 World Bank Conference on Land and Poverty, The World Bank – Washington DC, March 14-18, 2016

The Principles for Digital Development <http://digitalprinciples.org/>

Tonchovska, R., Kelm K. (2013): Contribution of Technology for the Improvement of Governance of Tenure in ECA Region. 2013 World Bank Conference on Land and Poverty, The World Bank – Washington DC, April 8-11, 2013

Torhonen, Mika-Petteri, (2016). Keys to Successful Land Administration: Lessons Learned in 20 Years of ECA Land Projects. World Bank, Washington, DC. © World Bank.
<https://openknowledge.worldbank.org/handle/10986/24623> License: CC BY 3.0 IGO.

UN-FAO, (2015): Governance of tenure technical guide - Recording tenure rights and parcels. In Press.

UN-FAO, (2012): Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of Food Security. Rome. <http://www.fao.org/docrep/016/i2801e/i2801e.pdf>

UN-Habitat/GLTN, (2014): The Social Tenure Domain Model. Website: <http://www.stdm.gltm.net/>

Tables

Table 1. IT management concerns/issues. Source: IT TRENDS STUDY, (2016) 8
Table 2. LA ICT Road Map 13
Table 3. Value-chain in LA projects 20

Figures

Figure 1. IT-Leap Change of Modality in LA projects 17
Figure 2. Sample of BPMN workflow – Transfer of Title 25