TU Delft

Delft University of Technology

Further standardisation in Land Administration

Lemmen, Christiaan; van Oosterom, P.J.M.; Kalantari, Mohsen; Unger, Eva-Maria; Teo, Chee Hai; Zeeuw, Kees de

Publication date
2017

Document Version
Final published version

Published in
Proceedings of the Annual World Bank Conference on Land and Poverty

Citation (APA)
Lemmen, C., van Oosterom, P. J. M., Kalantari, M., Unger, E.-M., Teo, C. H., & Zeeuw, K. D. (2017). Further standardisation in Land Administration. In *Proceedings of the Annual World Bank Conference on Land and Poverty* World Bank.

Important note
To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Copyright
Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy
Please contact us and provide details if you believe this document breaches copyrights.
We will remove access to the work immediately and investigate your claim.

This work is downloaded from Delft University of Technology.
For technical reasons the number of authors shown on this cover page is limited to a maximum of 10.

Responsible Land Governance:
Towards an Evidence Based Approach

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

FURTHER STANDARDISATION IN LAND ADMINISTRATION

CHRISTIAAN LEMMEN
Cadastre, Land Registry and Mapping Agency, The Netherlands
Chrit.Lemmen@Kadaster.NL

PETER VAN OOSTEROM
Delft University of Technology, The Netherlands
P.J.M.vanOosterom@TUDelft.NL

MOHSEN KALANTARI
The University of Melbourne, Australia
Mohsen.Kalantari@Unimelb.edu.AU

EVA-MARIA UNGER
Cadastre, Land Registry and Mapping Agency, The Netherlands
Eva.Unger@Kadaster.NL

CHEE HAI TEO
United Nations Statistics Division, Department of Economic and Social Affairs
Teo@UN.Org

KEES DE ZEEUW
Cadastre, Land Registry and Mapping Agency, The Netherlands
Kees.deZeeuw@Kadaster.NL

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

The paper describes the ongoing developments and standardisation in land administration. Standards are relevant in relation to build as well as maintain and develop a land administration.

Standards like the ISO 19152 Land Administration Domain Model (LADM) are helping to jump-start new initiatives and are connecting top-down and bottom-up projects together. The LADM facilitates the efficient set-up of land administration and can function as the core of any land administration system. LADM is flexible, widely applicable and functions as a central source of state-of-the-art international knowledge on this topic. Some future trends in the domain and the maintenance of the standard are presented and being discussed in the paper. These trends may be relevant for the development of a second edition of the LADM over the coming years.

These models do not include land administration processes for initial data acquisition, data maintenance and data publication. This is because these processes were considered to be country-specific when the first edition of LADM was prepared; a generic and global approach was likely to be difficult to model. This view may now need reconsideration.

Key Words:

Land Administration, Cadastre, Land Registry, Standardisation, ISO 19152, LADM, STDM

1. INTRODUCTION

The United Nations 2030 Agenda for Sustainable Development includes consideration of the land issue across a number of targets and its indicators. UN FAO has initiated and developed the 'Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security'. UN-Habitat's Continuum of Land Rights is now a widely accepted paradigm .

The International Federation of Surveyors argues for the need to move beyond mere advocacy of the accepted continuum concept and to focus on embedding it into real land administration solutions. In practice this translates and expands into developing a continuum of adjudication and demarcation methods, a continuum of appropriate surveying technologies and techniques, and so on. The World Bank and FIG jointly promote the fit-for-purpose land administration approach that enables appropriate land administration systems to be built within a relatively short time, at affordable costs, and with the opportunity to upgrade when required. The fit-for-purpose approach is promoted by the Global Land Tool Network (GLTN/UN Habitat/Kadaster, 2015 and FIG/WB, 2014) and is integrated in the UN-GGIM Addis Ababa Declaration – Geospatial Information Management Towards Good Land Governance for the 2030 Agenda and in the New Urban Agenda (UN, 2016).

Satellite imagery, GPS and a world connected by the internet open up new opportunities that were unimaginable just a few decades ago. Standards like the Land Administration Domain Model (LADM) (ISO, 2012) are helping to jump-start new initiatives and are connecting top-down and bottom-up projects together. The LADM facilitates the efficient set-up of land administration and can function as the core of any land administration system. LADM is flexible, widely applicable and functions as a central source of state-of-the-art international knowledge on this topic. LADM is of one of the first spatial domain standards. Some future trends in the domain and the maintenance of the standard are presented and being discussed in the paper. These trends may be relevant for the development of a second edition of the LADM over the coming years. This development is under preparation by the Technical Committee 211 (TC211) on Geographic Information of the International Standardisation Organisation (ISO).

The Open Geospatial Consortium (OGC) has set up a domain working group on land administration (OGC, 2016). This OGC initiative was prepared and discussed during the World Bank Conference on Land and

Poverty in 2016. OGC has a close cooperation with World Bank in this domain. OGC has standing liaisons with major players in the land administration domain, including Technical Committee 211 of the ISO TC211, the Royal Institute of Chartered Surveyors, the World Wide Web Consortium, OASIS, the International Federation of Surveyors, and the Global Land Tool Network. OGC always strives to use, build on and complement existing standards. However, while there are some standards describing elements of an administrative system, such as in LADM, there might be gaps in the way that they incorporate geospatial descriptions of land records, and/ or inadequate rules for defining and describing the quality of the records. The Land Administration Domain Working Group aims to assess the existing standards and address any gaps it finds.

The OGC members drafted a charter for a working group for the land administration domain. In this draft there is particular emphasis on the low- to middle-income countries, which is where most challenges exist today. The charter describes how to improve the interoperability, effectiveness and efficiency of land administration systems by optimising the use of OGC and complementary open standards. Land administration activities in all countries can benefit from improved interoperability. Improved interoperability contributes to for example reduced deployment time, lower system lifecycle costs, improved flexibility and scalability, improved choice from the IT marketplace, and improved ability to share, exchange and integrate information related to land administration. See (OGC, 2016).

This paper describes the ongoing developments in relation to standardisation in land administration. Standards are relevant in relation to build as well as maintain and develop a land administration. Main developments are a second edition of LADM and operational standards within the OGC. Some future trends in the domain and the maintenance of the standard are presented and being discussed in the paper. These trends may be relevant for the development of a second edition of the LADM over the coming years. As said: this development is under preparation by the Technical Committee 211 (TC211) on Geographic Information of the International Standardisation Organisation (ISO). The identified trends may also be of importance in relation to another (coordinated) development: the Open Geospatial Consortium is preparing an initiative to develop operational standards in Land Administration.

Processes such as initial data acquisition may concern millions of spatial units (parcels) where people to land relationships have to be determined, documented and reviewed. The organisation of this process requires geospatial support in logistics and case management based on geospatial information. During field

work a check on the completeness of the data acquisition needs to be performed – in an easy way. Tools, transport, paper, imagery, awareness, local support from local authorities (in co-management with traditional authorities), grass root data collectors combined with professional expertise has to be organised at the right place and time.

With geospatial technologies and sensors coupled with a new professional mindset, the provision of effective and efficient land administration that supports good land governance and secure land and property rights for all appears to be a feasible objective within the current generation.

2. PUSH FOR DEVELOPMENT OF LAND ADMINISTRATION SYSTEMS

Land information provides an overview of people-to-land relationships. It shows us how people relate to the space around them. The information can be used to realise responses to major societal and developmental challenges including attaining the United Nations 2030 Agenda for Sustainable Development.

Land information tells us about the ownership, use, value and development of land – whether statutory, informal or customary. Many of those relations are neither recognised nor documented. There is no inclusiveness for all. Meanwhile, populations and cities are growing and the pressure on land and natural resources is continuing to increase and in some instances, significantly. This leads to disputes and also conflicts.

Land administration develops and improves over time, the pace at times dictated by rate of change in technology as much as societal demands. In many places, land administration is either weak or not in place yet and the reasons for such a situation is multifaceted, and can be institutional setup, complex regulations and procedures, lack of capacity and political support.

However, recent advances in geospatial science and technologies meant that land administration systems can be incrementally progressed or modernised to provide for and to secure land and property rights for all. As an example, for the first time in history it is now possible to record the geometry of people's relationship to land. This information is vital to record, document and recognise the billions of interest in land. These spatial units of interest in land informs the people-to land relationship, information that will not lead to

more effective and efficient land administration and management, but also evidence-based policy and decisions making to support sustainable development.

From the geospatial perspective, many tools are already available to support and enhance this progress, *but further steps are needed to operationalise them at scale. This development requires a push from policy level based awareness, needs and requirements, resources and capacity and ease to implement.*

The global importance of geospatial information was recognised by the United Nations in July 2011 the Economic and Social Council (ECOSOC), recognizing the urgent need to take concrete action to strengthen international cooperation in the area of global geospatial information management by establishing the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM). As the peak inter-governmental mechanism to make joint decisions and set directions on the production and use of geospatial information within national and global policy frameworks UN-GGIM also provides the forum for Member States to strengthen the geospatial information management capacities of developing countries for better policy making at national, regional and global levels.

We also need to be reminded that the 2030 Agenda for Sustainable Development is a universal and transformative agenda that aims to improve the wellbeing of people and planet in our lifetime. The 2030 Agenda specifically recognizes the need for new data acquisition and integration approaches to improve the availability, quality, timeliness and disaggregation of data to support the implementation of the new development agenda at all levels, including to exploit the opportunities availed by a wide range of data, including geospatial information. Maximizing the value of fundamental geospatial information including land information at the national and sub-national levels to capture elements of the 2030 Agenda, for informed policy-making, decisions and actions is going to be critical. Such national bottom up approach can only be achieved within the time frame of the 2030 Agenda when standards are readily available and embraced. Hence there is the urgent need and requirement for the development and agreement of standardised, which are flexible, easy to use, affordable and transparent approaches in land administration and management.

Standardisation is a strategic issue in national information systems where information management is a primary process. This is also valid in federal states.

3. LAND AND TENURE DATA FOR THE 2030 AGENDA AND ITS GLOBAL INDICATOR FRAMEWORK

3.1 Identifying fit-for-purpose land data and providing timely and reliable land and geospatial information

A Fit-For-Purpose approach for Land Administration has been developed by global stakeholders. It is a gender sensitive, transparent and highly participatory approach. With the support of geospatial technologies this approach can be implemented quickly. This approach is recognised and affirmed in the Addis-Ababa Declaration 'Geospatial Information Management towards Good land Governance for the 2030 Agenda'. In this declaration, the need for standardisation within land administration is underlined.

The Fit-For-Purpose approach argues for cost-effective, time-efficient, transparent, scalable and participatory systems. The philosophy is driven by the idea that, in many situations, it is sufficient, for example, to identify visual boundaries based on imagery. This means making use of photographs, images or topographic maps in boundary adjudication and surveying activities. Alternatively, apps on mobile devices can be combined with imagery to identify one's occupancy or use of land, thus avoiding misinterpretation of visual boundaries on the image. Images can be collected from satellites, traditional aircraft or unmanned aerial systems (UAS). In cases where values of land is high or of intensive land use, conventional field surveys using high-precision instrumentations may be deployed. Imagery can be used for many purposes, for example interaction between government and citizens and business, and not merely for the adjudication of boundaries or limits.

All those types of surveys require support in adjustments of those new (calculated) coordinates to existing maps and the keeping original observations.

Alongside the push for the increased use of imagery, global standards such as the Land Administration Domain Model (LADM) (ISO, 2012) and its specialisation the Social Tenure Domain Model (STDM), see also (FIG/GLTN, 2010) focus on standardised modelling of information at the conceptual level. These models do not include land administration processes for initial data acquisition, data maintenance and data publication. This is because these processes were considered to be country-specific when the first edition

of LADM was prepared; a generic and global approach was likely to be difficult to model. This view may now need reconsideration.

The fit-for-purpose land administration approach arguably allows for identification of more generic process-related modules in data acquisition and data handling and also maintenance and publication. Standardisation can also make it easier to monitor the progress of global indicators relating to land tenure security.

Standardisation does not mean loss of flexibility. It supports structuring data in standalone and distributed land administration environment. A set of so called 'code tables' allow the inclusion of, for example, a broad range of (local) types of recognised land rights, types of restrictions, types of responsibilities, types of holders, types of spatial units.

Computerising large sets of legacy data (maps and archives) requires analogue-to-digital conversion processes, geo-referencing and linking to digital data from other sources. Such data, for example, may be used for taxation, tenure security purposes, slum upgrading, city management, to highlight a few. This also includes land use and zoning plans implemented by land consolidation and land readjustment processes. Statistical information such as fragmentation index and price index may need to be derived from the land administration system.

3.2 Further modelling of LADMs RRRs

A more detailed classification of the legal part of the LADM is proposed for inclusion in LADM Edition II - i.e. interests in land. More detailed than described in the LADM Edition I from 2012 (ISO, 2012). The proposal from Jesper Paasch from Sweden is to further developing the LADM's 'right', 'restriction' and 'responsibility' (RRR) classes and associated code lists. Besides the more obvious formal right descriptions, this proposal also deals with informal rights' descriptions as introduced in the Social Tenure Domain Model (STDM) as a foundation for further LADM development. The proposal is based on the Legal Cadastral Domain Model, as developed by and described in the PhD thesis of Paasch, which is used as a conceptual basis for adding an additional level to the LADM. Interests in land can be classified in this model as limiting or beneficial to real property ownership. The extended classification is further based on the paradigm that there are two major types of interest in land, privately agreed interests and regulations

imposed by a public agency. The incorporation of a specialized classification of RRRs in the LADM is of value for more inclusion of social tenure in (inter-)national land administration registers. The LADM allows national profiles to be added to the standard, however, such profiles are relevant within a country. These profiles are needed in cases where detailed data of interests in land have to be exchanged internationally. International data exchange requires maintenance of code tables representing the different RRRs in use within countries. See also the section 5.2 of this paper on National Tenure Atlas.

3.3 Interoperability, data sharing and data integration

The Open Geospatial Consortium (OGC) recognises that worldwide, effective and efficient land administration is an ongoing concern, inhibiting economic growth and securing land and property rights extensively. Existing approaches are at significant risk of data loss and failure due to, for example, disasters and lack of interoperability. The charter members of an established OGC Land Administration Domain Working Group are seeking to identify enabling standards and best practices to guide countries in a programmatic way towards establishing more cost-effective, efficient and interoperable land administration capabilities. Attention will be paid to upgrade current manual processes to semi-automated ones, and to suggest new approaches for data acquisition that are more automated and flexible. These challenges are faced today in both 'developing' and 'developed' countries alike.

Interoperability, data sharing and data integration will be needed going forward and examples include:

- access to libraries with cloud free compositions of imagery,
- initial data acquisition,
- public review/inspection,
- check on complete coverage,
- reporting land disputes,
- request for information,
- publication of land data,
- provision of products and services,
- formalisation,
- map renovation, and:
- quality improvement and digital archiving.

See also section 6.2.

Providing timely and reliable land and geospatial information in areas where land administration is developed finds other requirements – development of 3D cadastre, inclusion of marine spaces, linking up with building information modelling and 3D city management for mega cities than in countries with less or non-developed land administration. Those challenges could be addressed through the specialisation or generalisation of LADM, the Social Tenure Domain Model (STDM). This model describes the relationships between people-to-land in an unconventional manner and therefore can address all of them. Nevertheless, standardisation is relevant for developed and developing countries.

Data sharing means the data are collected once and used many times through establishing linkages. Duplicative efforts in data collection and maintenance can be avoided. Data are 'kept to the source'. A considerable amount of national resources can be conserved but also requires an increasing ICT effort – but the perception is that this effort is easier when implementing with standards from scratch than from legacy automated systems.

4. STANDARDS FOR GLOBALLY COMPARABLE LAND AND TENURE DATA FOR THE SDGS GLOBAL INDICATOR FRAMEWORK

The 2030 Agenda for Sustainable Development responds to the aspirations of all people seeking a world free of want and fear. The Agenda demands the need for new data acquisition and integration approaches, including exploiting the contribution to be made by earth observations and geospatial information. Land and tenure data is an integral part of this data ecosystem needed to measure, monitor and inform on progress in sustainable development as well as evidence-based policy formulation and informed decisions. For the 2030 Agenda for Sustainable Development, monitoring and accountability will be through the agreed 17 Goals and 169 Targets. Alongside these goals and targets, a global indicator framework currently comprising 230 indicators.

The new data needs are for determining and measuring the relationship between "people and land". This will require the production, availability and easy accessibility for consistent and comparable data including land and tenure data. There is a need for considerably more integration across the various national data, information systems and platforms in order to leverage the most effective data and analysis for evidence-based policy formulation and decision making.

Geospatial information, technologies and services, a crucial component of any national data and information systems, have become critical tools to support national development, social wellbeing, environmental management, economic growth, improved evidence-based policy formulation and decision-making, and have enhanced the ability of governments to analyse, model, monitor and report social, environmental and economic development challenges and ultimately ensure sustainable development.

Internationally agreed standards will be key alongside agreed global concepts and evidence-based approaches.

4.1 Land/tenure Data and ISO 19152

Standards like the Land Administration Domain Model (LADM) are crucial to jump-start new initiatives and are connecting top-down and bottom-up projects. It is very important that there is awareness of this at policy level. Policies should support the implementation of standards particularly when such standards are globally agreed.

The LADM facilitates the efficient set-up of land administration and can function as the core of any land administration system. LADM is flexible and widely applicable. LADM is of one of the first spatial domain standards. Apart from the Continuum of Land Rights there is also a continuum of accuracy, of land recordation, of types of spatial units, of types of parties involved, and of data acquisition approaches.

All this is supported within LADM – allowing for a flexible, systematic and incremental approach in the development of a land administration and management system catering to the needs, priorities and requirements of users and society – including a focus on the needs of the poor. In this context attention should be given to issues such as: participatory maintenance of an informal land administration practice; unconventional transactions (for example formalising informal land use and legalising women's land rights or shares in land rights); conversion of land rights after review/inspection (from recordation to registration) and strategies for data protection and for IT development (with a focus on keeping systems running).

Development of a second edition of the LADM is scheduled for the coming years within ISO TC211, with input from stakeholders. This includes expansion of the RRR functionality; 3D Cadastre (mining, marine, underground utilities, complex buildings and constructions), link to topographic information (IndoorGML,

InfraGML, LandXML, CityGML, BIM/IFC, etc.) and wider application of STDM. In this development, attention to processes in land administration (data acquisition, data maintenance, data sharing) is relevant for the development of operational standards. Whereas special procedures for developing countries need to be taken into account.

The marine environment (administering marine spaces and marine cadastre) may be included in LADM. A proposed approach is that the marine environment is a related domain – similar to valuation/property taxation, buildings registrations, land use/land cover, mining and extractive licence register, archaeology and heritage cadastre, spatial planning zones (restrictions), road cadastre, physical utility networks, and address registrations. The important aspect is that of 3D in many of these domains and these can only be useful and integrated when there is interoperability, standards based datasets, within all related and varied domains.

Another proposed approach is that the marine environment is an integral domain – terrestrial and marine datasets can be seamlessly integrated that allows for effective analysis and modelling of the physical realm leading to improve governance particularly for the spaces where the land meets the sea or rather where the sea washes away the land. The important aspect is that of 3D in many of these domains and these can only be useful and integrated when there is interoperability, standards based datasets, within all related domains.

4.2 OGC land administration domain working group

The linking of people, business and industry, economy and environment to a place or geographic location can result in a better understanding of social, economic and environmental realities and challenges to support policy formulation, decision making and citizen centric delivery systems. This implies availability of well-maintained links between geospatial datasets, land information and other 'basic' or 'key' or "fundamental" datasets.

The ISO 19152 Land Administration Domain Model (LADM) provides an extensible basis for efficient and effective development based on a model driven architecture (MDA), and enables involved parties to communicate based on the shared ontology implied by the model. As it is already difficult within one domain (such as land administration) to agree on the used concepts and their semantics, it will be even more difficult in case of dealing with other and linking to other domains.

However, we cannot avoid this if a meaningful interoperable information infrastructure has to be developed and implemented. It is crucial that the importance of operational standards in land administration is recognised and supported at policy level. Otherwise the standards will not be implemented. Land administration itself is based on standards – which can be sub-national, national or global. It is recognised that there should be options, perhaps a variety of options, for the inclusion of different types of rights, right-holders and spatial units. But the information infrastructure in which those data becomes available should be similar everywhere. This allows efficient communication between data sets managed by different systems. This also supports performance measurement, progress monitoring, data protection etc.

The Open Geospatial Consortium (OGC) has set up a land administration domain working group. This OGC initiative was prepared and discussed during the World Bank Conference on Land and Poverty in 2016. OGC has standing liaisons with major players in the land administration domain, including Technical Committee 211 of the ISO (this committee of the International Standardisation Organisation deals with geographic information), the Royal Institution of Chartered Surveyors, the World Wide Web Consortium, OASIS, the International Federation of Surveyors, and the Global Land Tool Network. OGC strives to use, build on and complement existing standards. However, while there are some standards describing elements of an administrative system, such as in LADM, there might be gaps in the way that they incorporate geographic descriptions of land records, and/or inadequate rules for defining and describing the quality of the records. The OGC Land Administration Domain Working Group aims to assess the existing standards and address gaps.

The OGC members drafted a charter for a land administration domain working group and in the draft there is particular emphasis on the low- to middle-income countries, which is where most challenges in land administration and management exist today. The charter describes how to improve the interoperability, effectiveness and efficiency of land administration systems by optimising the use of OGC and complementary open standards. Land administration activities in all countries can benefit from improved interoperability.

Improved interoperability contributes to efficiency and effectiveness, reduce resource consumption through, among others, reduced deployment time, lower system lifecycle costs, improved flexibility and scalability, improved choice from the IT marketplace, and improved ability to share, exchange and integrate information related to land administration.

The domain working group will examine the land administration process from the land survey organisations, up through jurisdictional levels. This will be done with partner organisations across industry, development agencies and others where necessary.

The group will further work to provide a common vocabulary for the locational aspects of land administration databases, and it will also provide a forum for connecting suitable technology for data linkage and quality assessment.

Processes such as initial data acquisition may concern millions of spatial units where people to land relationships have to be determined. The organisation of this process requires location based support in logistics and case management, utilising appropriate geospatial information.

4.3 Data for Measuring and Monitoring

The Global Land Indicator Initiative (GLII) was established under the Global Land Tool Network in 2012 with the aim to support efforts to harmonize monitoring efforts around land tenure and land governance. The GLII seeks to derive a list of globally comparable harmonized land indicators, using existing monitoring mechanisms and data collection methods as a foundation. This initiative supports ongoing global and regional initiatives such as the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (officially endorsed by the Committee on World Food Security in 2012) and Africa's Land Policy Initiative, a joint initiative of the African Union Commission, the African Development Bank and the United Nations Economic Commission for Africa, for example.

The World Bank's Land Governance Assessment Framework (LGAF) can be used for identifying and monitoring sound practise in the land sector. The LGAF is motivated by the fact that land policy analyses and interventions are often fragmented.

It is understood that progress needs to be measured. Indicators are available via the Land Governance Assessment Framework and the Global Land Indicators Initiative and these efforts require data as inputs. Standardised (LADM Based) approaches are necessary and can be based on existing tools such as the Social Tenure Domain Model and also that of the National Tenure Atlases.

4.4 3D Cadastre and Marine Cadastre

The increasing complexity of infrastructures and densely built-up areas requires a proper recording and registration of the legal status (private and public), which can only be provided to a limited extent by the existing 2D cadastral systems. The registration of the legal status in (complex) 3D situations is needed in 3D-Cadastres. This includes the marine environment.

In a recent paper (Sutherland et al., 2016) it is analysed if LADM is applicable to Marine Cadastres. This analyses concerns LADMs ability to:

- accommodate information on stakeholders in marine space,
- accommodate and model complex overlapping marine boundaries,
- incorporate other relevant spatial information components,
- incorporate relevant non-spatial attributes,
- associate marine parcels with complex legal regimes, and the ability to:
- facilitate marine cadastre's data integration in SDIs.

It is concluded that "Publications dealing with the marine cadastre concept were reviewed and criteria defined therefrom so as to support an assessment of whether the LADM standard is as a whole applicable, as published, to marine cadastres. The discussions in Section 5 seem to suggest a positive response to this query. It can therefore be reasonably assumed that a purely LADM based marine cadastre can be developed and implemented. This can be good news to those jurisdictions who are seeking to develop marine cadastres – they can reasonably trust the LADM as an applicable conceptual standard." This means it should be relatively easy to include this functional requirement.

4.5 A fiscal extension module

Taxation, and specifically taxation on land and immobile property, has recently been related to the process of building effective states and markets. The political aspects of this process are critical, but the following addresses the development of the information systems needed to realize the above-mentioned government tax reforms. A fiscal registry or database is supposed to record legal, physical, geometric, economic, and

environmental characteristics of the property units, which are subject to immovable property valuation and taxation. A land administration infrastructure is required to link fiscal registries with other public registries (e.g., cadastre, land registry, building and dwelling registries). The ISO 19152:2012 Land Administration Domain Model (LADM) is a conceptual data model which provides a standardized global vocabulary for land administration. There is a proposal from Volkan Çağdaş to extend the scope of LADM with a fiscal perspective to provide a data model that could be used to construct information systems for immovable property valuation and taxation, and offer a data exchange option. The proposal (for inclusion in the second edition of LADM) provides a common basis for governments to direct the development of local and national databases, and for the private sector to develop information technology products. An option could be to include this as informative annex (similar to LPIS or INSPIRE CP annexes). Now mentioned in informative annex K (External classes: ExtValuation and ExtTaxation) of ISO (2012).

5. OVERVIEW OF SPATIAL DISTRIBUTION OF TENURES

5.1 Recognition of legitimate land rights (based on the "Voluntary Guidelines")

The Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGTs) promote secure tenure rights and equitable access to land, fisheries and forests as a means of eradicating hunger and poverty, supporting sustainable development and enhancing the environment. "States should recognize and respect all legitimate tenure right holders and their rights. They should take reasonable measures to identify, record and respect legitimate tenure right holders and their rights, whether formally recorded or not; to refrain from infringement of tenure rights of others; and to meet the duties associated with tenure rights". The 2030 Agenda for Sustainable Development has as a target the "Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure". Also the New Urban Agenda "commit to promote, at the appropriate level of government, including sub-national and local government, increased security of tenure for all, recognizing the plurality of tenure types, and to develop fit-for-purpose, and age, gender, and environment responsive solutions within the continuum of land and property rights, with particular attention to security of land tenure for women as key to their empowerment, including through effective administrative systems". The 'Environmental and Social Performance Standards and Guidance Notes' of the International Finance Cooperation from the World Bank

Group, performance standard 5 on 'Land Acquisition and Involuntary Resettlement' also called for a wide range of (recognised) land rights.

Countries need to establish a consultative and participatory process for identifying which rights are legitimate. The VGGTs provide guidance on this process: "Based on an examination of tenure rights in line with national law, states should provide legal recognition for legitimate tenure rights not currently protected by law. Policies and laws that ensure tenure rights should be non-discriminatory and gender sensitive. Consistent with the principles of consultation and participation of these guidelines, states should define, through widely publicized rules, the categories of rights that are considered legitimate. All forms of tenure should provide all persons with a degree of tenure security, which guarantees legal protection against forced evictions that are inconsistent with states' existing obligations under national and international law, and against harassment and other threats".

5.2 Visualisation through a National Tenure Atlas

The end result of this recognition process is expected to be a set of categories of legitimate rights officially agreed within the country, which are legitimate under current legislation or proposed revised legislation. A Fit-For-Purpose approach can record and register all rights across a country and create a truly national land administration solution. This process could be tied to the creation of a national digital atlas of tenure types.

This national tenure atlas should provide a complete overview of the tenure systems and land rights related to the areas affected. All formal and informal tenure categories and sub-categories should be identified, and reference to the location. Also, land-use planning or other planning processes that may apply restrictions or responsibilities to certain areas can be accommodated. Different authorities have different responsibilities in the process of recording, recognising, registering and managing the various tenure types within different areas such as urban and rural.

The national tenure atlas is developed to provide an overview of the spatial distribution of legitimate tenure types across a country, e.g. areas of customary tenure, areas of informal tenure, areas of private ownership, state land, etc. This will help to identify where efforts for further documented land rights may need to be undertaken, or zoning for better natural resources management, or to enable administration and coordination between state and customary authorities through co-management. The limits of these tenure systems can be fuzzy, visible or fixed and all these can be incorporated in the national tenure atlas.

The atlas may include a layer for national and administrative boundaries, territories of land administration services, a layer for planned and ongoing projects in land administration, a layer for the various types of mapping and scales used for cadastral purposes in the different topographic areas, etc.

6. FIT-FOR-PURPOSE LAND ADMINISTRATION

6.1 Country specific strategies

The Fit-For-Purpose approach is directly aligned with country specific needs, is affordable, is flexible to accommodate different types of tenure, and can be upgraded when economic opportunities or social requirements arise. It is highly participatory, can be implemented quickly and will provide security of tenure for all. Most importantly, the FFP approach can start quickly using a low-risk entry point that requires minimal preparatory work. It can be applied to all traditions in land tenure across the globe.
The country specific FFP strategy for land administration will be based on a country context analysis and the baselines of the existing spatial, legal and institutional frameworks. The analysis will involve identifying the conditions and policies within a country that constrain and shape the way that FFP land administration can be implemented.

This will then be used as a set of guiding principles to create the country specific strategy for building the spatial, legal and institutional framework for implementing FFP Land Administration that will also require provision of capacity development measures as well as country specific manuals for capacity, instructions and implementation.

Data maintenance can be ‘programme driven’ (systematic) or ‘sporadic’. Programme driven means a complete and systematic new acquisition after some time. Sporadic means case by case in a ‘transaction driven’ way and relates to transactions in the land market (buying/selling, establishment of mortgage etc.). Quality upgrading can be part of the maintenance process. This may be required after digitisation of legacy data or in case of urbanisation or urban planning. It is crucial that data collected using survey approaches based on differing accuracies can be integrated together. Quality upgrading may also entail integration of 3D cadastral data (this includes integration with standards such as IndoorGML, InfraGML, LandXML, CityGML, BIM/IFC) and marine cadastre.

Enabling standards are also being developed with other domain working groups within OGC, such as LandInfra. Partnerships and liaisons with other associations and standards developing organisations (SDOs) will be developed to address interoperability issues that span the land administration community of practice, geographic information systems and the broader IT environment. Examples include linkages with ISO TC 211 regarding the LADM as well as those SDOs responsible for IT standards related to topics such as security, the internet and mobile services. The OGC land administration domain working group will be open to participation by any interested organisations and individuals. Participation and commitment from both the developed and developing countries are required.

6.2 Linking New Data Acquisition Methods and Maintenance – Generic Processes

So far the functionality of LADM concerns the modelling of information at conceptual (knowledge) level. Processes for initial data acquisition, maintenance and publication of the data are not included in the model (LADM I does not include UML Activity Diagrams). The reason is that those processes were considered to be country specific when LADM I was prepared. A global approach would be difficult to model. This view needs reconsideration. The Fit-For-Purpose Land Administration allows to identify modules in data acquisition and data handling. The expectation is that modules can be defined and may be implemented in a sequence that meets the requirements of the user. More generic approaches are expected to be possible for:

- Computerising legacy data (indexing and geo locating where possible)
- Determining accuracy labels for all attributes – geometric and administrative
- Adjudication of existing rights, rightholders
- Coding
- Inclusion in Tenure Atlas
- Image based acquisition:
    - Selection of cloud free imagery – access to sensors and image libraries
    - Creating cloud free compositions – may be from different sensors
    - Geo referencing (can be in post processing mode)
    - Feature extraction

  - Feature classification (optional)
  - Data cleaning and feature visualisation
  - Provision to data collectors (logistics) – this can be paper based or digital, paper based acquisition allows leaving the collected field boundary evidence to the local people. These include participatory approaches, roles, and on line/off line publication. Includes data on people id's, photos, signatures, fingerprints, video, voice recording etc. And right types and restrictions, including disputes
  - Scanning (optional)
  - Georeferencing (optional)
  - Polygon creation, topology, identification, linking
  - Conversion of rights to legal status
- Similar: UAV based acquisition, Lidar based, Radar Based, Conventional Survey Based, digital pen based
- coordinate calculations from observations,
- adjustments of new coordinates to existing coordinates (e.g. least squares adjustments),
- area management,
- Publication of parties, related rights and spatial units (incl global services as Google, Virtual Earth, Open Street Map)
- Conflict resolution
- Integration in SDI – incl.
- Linking rights, restrictions and responsibilities (RRRs) to spatial units,
- Linking (groups of) persons to (shares in) RRRs,
- Maintenance of parties and related rights and related spatial units – see book (Zevenbergen,, Frank and Stubkjaer, 2007)
- Inclusion of (legacy) Land Administration Archives and Document Information

Processes as initial data acquisition may concern millions of spatial units (parcels) where people to land relationships have to be determined. The organisation of this process requires geo-support in logistics and case management based on geo-information. During field work a check on completeness needs to be performed – in an easy way.

By using orthophotos to produce spatial frameworks the imagery is typically linked to the national geodetic reference frame through the use of GNSS systems on the space/ aircraft and on the ground.

Field surveys may be needed. Today Lidar and Radar technologies can be used. Automated feature extraction can bring support in the production of co-ordinates from identified visible boundaries drawn on top of imagery.

Processes to be supported in an integrated way could be: composition of cloud free imagery, logistic support in fieldwork (task management, logistic overviews), initial data acquisition, geo-referencing (based on elevation models), identification of boundaries, surveying (based on imagery, conventional surveys, UAVs, digital pens for imagery, feature extraction, Radar), area management, linking rights – restrictions – responsibilities to spatial units, linking (groups of) persons to (shares in) rights – restrictions – responsibilities, public review/inspection, publication of land data, formalisation, map renovation and quality improvement and digital archiving. Legacy data requires Analogue to Digital conversion and linking to digital data from other sources.

7. CONCLUDING REMARKS

To ensure the wellbeing of humanity including securing land and property rights for all, there need to be concerted efforts to improve the production of data and the generation of information needed to record all forms of people-to-land relationships that will provide for effective and efficient land administration systems that meets the aspirations of all. There will be a need considerably more integration across the various national data and information systems and platforms in order to leverage the most effective data and analysis for evidence-based policy formulation and decision making. Internationally agreed and open standards will be key to unlock the value of data and the wealth of information needed to recognise all forms of people-to-land relationships, which is vital for the wellbeing of all humanity and sustainable development.

References

- FIG/WB, 2014: Fit-For-Purpose Land Administration. FIG Publications No 60, FIG Office, Copenhagen. http://www.fig.net/pub/figpub/pub60/figpub60.htm

- FIG/GLTN, 2010: The Social Tenure Domain Model. FIG Publication No 52, FIG Office, Copenhagen. http://www.fig.net/pub/figpub/index.htm

- GLTN/UN Habitat/Kadaster, 2015: Fit-For-Purpose Land Administration – Guiding Principles. UN-HABITAT/GLTN, Nairobi, Kenya https://www.fig.net/news/news_2016/2016_07_gltnguide/fit-for-purpose-land-adm-guiding-principles-for-country-implementation.pdf

- ISO, (2012). ISO 19152:2012. Geographic information – Land Administration Domain Model (LADM). International Organization for Standardization (ISO). Geneva, Switzerland.

- OGC, 2016, Domain Working Group (DWG) Charter Land Administration. Open Geospatial Consortium. http://www.opengeospatial.org/projects/groups/landadmin

- Zevenbergen, J., Frank, A. and Stubkjaer, E. (editors), 2007: Real property transactions : procedures, transaction costs and models. Amsterdam: IOS Press, 2007. ISBN 978-1-58603-581-5

- Sutherland, Michael, Griffith-Charles, Charisse and Davis, Dexter, 2016: Toward the Development of LADM-based Marine Cadastres: Is LADM Applicable to Marine Cadastres? 5th International FIG 3D Cadastre Workshop, 18-20 October 2016, Athens, Greece http://www.gdmc.nl/3DCadastres/literature/3Dcad_2016_25.pdf

- UN, 2016: Draft outcome document of the United Nations Conference on Housing and Sustainable Urban Development (Habitat III); with Annex: New Urban Agenda – Quito Declaration on Sustainable Cities and Human Settlements for All. https://www2.habitat3.org/bitcache/99d99fbd0824de50214e99f864459d8081a9be00?vid=591155&disposition=inline&op=view

View publication stats