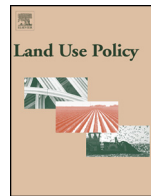




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The Land Administration Domain Model

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ABSTRACT

Societal drivers including poverty eradication, gender equality, indigenous recognition, adequate housing, sustainable agriculture, food security, climate change response, and good governance, influence contemporary land administration design. Equally, the opportunities provided by technological development also influence design approaches. The Land Administration Domain Model (LADM) attempts to align both: the data model provides a standardised global vocabulary for land administration. As an international standard it can stimulate the development of software applications and may accelerate the implementation of land administration systems that support sustainability objectives. The LADM covers basic information-related components of land administration including those over land, in water, below the surface, and above the ground. The standard is an abstract, conceptual model with three packages related to: parties (people and organisations); basic administrative units, rights, responsibilities, and restrictions (ownership rights); spatial units (parcels, and the legal space of buildings and utility networks) with a sub package for surveying, and representation (geometry and topology). This paper examines the motivation, requirements and goals for developing LADM. Further, the standard itself is described and potential future maintenance. Despite being a very young standard, 'born' on 1st December 2012, it is already possible to observe some of the impact of LADM: examples are provided.

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Introduction

The work described in this paper is the first successful attempt to create an accepted international standard in the land administration domain.

Land administration is a large field; the focus of the LADM is on that part of land administration that is interested in rights, responsibilities and restrictions affecting land (or water), and the geometrical (geospatial) components thereof. The LADM is a conceptual model, and not a data product specification. The LADM is a descriptive standard, not a prescriptive standard. Domain specific standardisation is needed to capture the semantics of the land administration domain on top of the agreed foundation of basic standards for geometry, temporal aspects, metadata and also observations and measurements from the field. The standard for the Land Administration Domain serves the following goals:

- establishment of a shared ontology implied by the model. This allows enabling communication between involved persons (information managers, professionals, and researchers) within one country and between different countries. This is relevant in the determination of required attributes and in setting responsibilities on maintenance of data sets in case of implementation of Land Administration in a distributed environment with different organisations involved. This is also in support of the development of land administration systems as core in Spatial Data Infrastructure, SDI, or: Geo Information Infrastructures (GII). One more issue is globalisation; there are already ideas for and approaches to international transactions, e.g. within the European Union. Also in relation to carbon credits registration,
- support for the development of the application software for land administration. The data model is the core here. Support in the development of land administration systems means provision of an extendable and adaptable fundament for efficient and effective development based on a Model Driven Architecture (MDA). This approach offers automatic conversions from models to implementation, where local details can be added to the conceptual model first,
- facilitation of cadastral data exchange with and from a distributed land administration. Within SDI (GII) combinations of

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land administration data with other data sources should be possible. For example legal data related to cadastral objects with data from other sources describing physical objects as roads, buildings or utilities. Exchange can be between cadastres, land registries and municipalities and between countries in a federal state or between countries; etc., and:

- support for data quality management in land administration. Use of standards contributes to the avoidance of inconsistencies between data maintained in different organisations because data duplication can be avoided as much as possible. It should be noted here that a standardised data model, which will be implemented, can be supportive in the detection of existing inconsistencies. Quality labels are important for all attributes.

A specialisation, or perhaps arguably a generalisation of LADM, is the Social Tenure Domain Model (STDM); see (Augustinus et al., 2006; Augustinus, 2010; FIG, 2010). Developed in parallel to LADM, it broadens the scope of land administration. It provides a land information management framework that integrates state based and non-state based land systems. It also integrates administrative and spatial components. Doing so, the model describes relationships between people and land in an unconventional manner: it has the power to tackle land administration needs in communities, such as people in non-state recognised settlements and customary areas. The emphasis is on social tenure relationships as embedded in the continuum of the land rights concept promoted by the Global Land Tool Network and by UN-Habitat (UN-Habitat, 2008).

In this paper the Land Administration Domain Model (LADM) and its design and development are presented. The paper has synthesised progressive developments outlined in earlier works (Lemmen, 2012; Lemmen et al., 2013a,b). First, the motivation, background and goals of LADM are provided in “LADM motivation, background and goals”. LADM supports land administration system development. Land administration and land administration systems support the implementation of the contemporary societal demands, embodied in land policies (cf. UN/ECE, 1996). That is, the land administration design should align with the societal requirements as described in Byamugisha (2013), CheeHai (2012), Enemark (2012), FAO (2012), FIG (2010), and UN-Habitat (2003, 2004, 2008, 2012). An efficient means for achieving this alignment is through the development and utilisation of a land administration standard. In other words: a standard can bridge the gap between land policies and information management opportunities. In this regard, LADM must be broadly accepted: it should be adaptable to local situations (Lemmen, 2012). An overview of LADM requirements is given in “LADM requirements”. The LADM as available in the International Standard ISO 19152 is presented in “The LADM (ISO 19152)”, is based on the common pattern of ‘people–land’ relationships. The model should cover the basic data related components of land administration (legal/administrative, mapping and surveying) and it should satisfy diverse user requirements. The domain model in its implementation can be distributed over different organisations with different tasks and responsibilities. A very first overview of LADM impact and future developments are discussed in “Impact of LADM and future developments” and “Conclusions and recommendations” are presented.

LADM motivation, background and goals

Contemporary political objectives including poverty eradication, gender equality, indigenous recognition, adequate housing, sustainable agriculture, food security, climate change response, and good governance, substantially relate to access to land, and to land-related opportunities. How governments commence dealing with issues relating to land access and use, is often defined as land

policy (UN/ECE, 1996). However, a robust land policy is one thing, having the tools to enforce the policy is another altogether: the well-regarded land policies of Kenya and Namibia, amongst others, provide testament. Consequently, governments need instruments like regulations and administrative procedures to support land tenure security, land markets, land use planning and controls, land taxation, and the management of natural resources. It is within this context that the function of land administration systems can be identified: a supporting tool to facilitate the implementation of a land policy in the broadest sense.

Even in contemporary times, most countries (states or provinces) develop their own unique land administration systems. Some countries operate a deed registration, while other operates a title registration. Some systems are centralised, and others decentralised. Some systems are primarily based on a general boundaries approach, others on fixed boundaries approach. Some land administration systems have a fiscal background, others a legal one (Bogaerts and Zevenbergen, 2001; UN/ECE, 1996). However, organisational structures with distributed responsibilities and ever-changing system requirements make the separate implementation and maintenance of land administration neither cheap nor efficient. Furthermore, different implementations of land administration systems complicate cross-jurisdiction system interoperability (e.g. in an international context such as within Europe or in a national context (e.g. in a less developed country) where it may happen that different partners in development co-operation on design and provide different land administration systems without co-ordination).

Standardisation is supportive and helpful in design and (further) development of land administration systems. It is relevant to keep data and process models separate, this means that (inter-organisational) processes can be changed independent from the data sets to be maintained. The data model can be designed in such a way that transparency can be supported: this implies inclusion of source documents and inclusion of the names of persons with roles and responsibilities in the maintenance processes of the data model.

Standardisation is a well-known subject in the field of land administration. Standardisation concerns a prescribed approach to the identification of parcels, documents, persons, control points and many other issues. It concerns the repeatable organisation of tables in the registration and references from those tables to other components (e.g. source documents and maps) including archives. It concerns agreed methods for coding and use of abbreviations, (e.g. for administrative areas). It also concerns set workflows. All this is valid for both paper based and for digital land administration systems.

LADM requirements

Internationally, the demand for a widely accepted standardised domain model in land administration emerged in the early 2000s, partly as a result of Cadastre 2014 (Kaufmann and Steudler, 1998) and more generally from discussions regarding technological opportunity and societal demands embedded in land policies. This wish was supported by the International Federation of Surveyors (FIG) and UN-Habitat and also by the Food and Agricultural Organisation (FAO) of the United Nations (UN).

It was required that the data model should be able to function as the core of any land administration system. The standard had to be flexible, widely applicable and function as a gathering point of a state-of-the-art international knowledge base on this theme. After an extensive design and development procedure, starting in 2002 within the FIG and from 2008 within ISO TC211, and involving many stakeholders from UN Habitat, EU/Joint Research Centre,

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