

# **Investigating the Conformity of the Zimbabwe Land Administration System to the Land Administration Domain Model Standard (ISO 19152)**

**Charles PARADZAYI, Robert MAPAMULA and Tinashe MTARISWA, Zimbabwe**

**Key words:** Land administration, Zimbabwe, LADM, conformity.

## **SUMMARY**

Zimbabwe is emerging from both a political and economic slumber and authorities have since realised the role that Information communication technologies (ICT) can play in resuscitating the economy. The government recently introduced the e governance initiative which aims to provide citizens timely and accurate information. As a result there is renewed interest, within various government institutions in the existing or previously abandoned information management systems. In Zimbabwe, land administration functions are distributed amongst various government and private sector organisations. The Department Surveyor General (DSG) is responsible for supervising the survey and charting of land for purposes of registration in the Deeds registry. The Deeds registries office is responsible for the registration of all transactions affecting land while land use control and valuation is the responsibility of Planning Authorities. Land value information is also captured through registration processes when land is transferred from one party to another. The Ministry of Lands and Rural Resettlement (MLRR) is responsible for managing and administering all state land under the resettlement schemes.

Over the years, different departments have developed separate electronic systems for storing and managing land information falling under their respective jurisdictions.

However, data exchange between different organisations is mainly based on manual transfer of files. Linking up of the different systems poses big challenges due to the isolated conceptualisation, different operating systems and application softwares. This challenge has effectively limited the benefits that ICT can bring to the overall land administration system. A common data model should provide a holistic solution by harmonising different datasets and functionalities of the different players. The LADM provides such a reference model for the development of efficient land administration systems.

The introduction of the LADM standard has coincided with the movement for an integrated and more efficient land administration system in Zimbabwe. In this paper LADM packages and classes are compared with elements in the current land administration system in Zimbabwe. Conformity of the current land administration system with the LADM standard (ISO 19152) is investigated. With a few exceptions, most classes in the LADM were found to correspond directly with elements in the current land administration system. This paper should form the basis for designing a LADM country profile for Zimbabwe.

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## **1. INTRODUCTION**

Zimbabwe inherited a dual land tenure system that gave one group freehold and leasehold tenure, and another communal or customary tenure. Under the Roman Dutch law that operates in the country only freeholds and leaseholds are capable of being registered. The formal land administration system was therefore designed with focus on the administration of freeholds and leaseholds.

In Zimbabwe land administration functions are distributed amongst various government and private sector organisations. The Department Surveyor General (DSG) is the custodian of all Geo-information pertaining to Zimbabwe and is also responsible for supervising the survey and charting of land for purposes of registration in the Deeds registry. The Deeds registries office is responsible for the registration of all transactions affecting land whilst land use control and valuation is the responsibility of Local Planning Authorities (LPA). Land value information is also captured through the land registration processes when land is transferred from one party to another in the Deed Registry office. The Ministry of Lands and Rural Resettlement (MLRR) has emerged as another important player in the administration of land in Zimbabwe with the mandate to administer and manage state land and all land that falls under the resettlement schemes.

Since the advent of the information technologies these organisations have made efforts to harness the new possibilities to enhance their operations and provide reliable and efficient services to their customers. In 1997 the Department of the Surveyor General in conjunction with the Swedish government developed a land information system called Land Transaction system (LTS). The system contained all properties surveyed including permits, approval dates, scanned diagrams, working plans and map compilations. The system servers crashed in 2002 thus the DSG had to revert back to the manual system. For the past few years the DSG has been putting considerable efforts in resuscitating the Land Transaction system. In the Deeds Registry office efforts were made to digitise all land registration documents. Planning authorities also developed separate systems for storing and managing land information for their own operations. The Ministry of Lands and Rural Resettlement is in the process of developing a Land Information Management System. The System is designed to maintain a complete register of all land that falls under its jurisdiction in a database that is accessible throughout the country. In spite of all these developments, data exchange between different organisations is still manual. Linking up of the different databases poses big challenges due to the isolated conceptualisation, different operating systems and different software (Chimhamhiwa, 2008). This challenge has effectively limited the benefits that ICT can bring to the overall land administration system.

The solution to this isolation is to develop effective communication among the different subsystems by harmonising data and functionalities so they are capable of being used by all subsystems. The key to such harmonisation is data modelling which both recognises and reengineers existing land administration processes. Modelling allows every single process in land administration to influence the cadastral data model and vice versa (Kalantari, 2008).

Many efforts have been made to provide standardized implementation of Land administration systems. In 1994 the cadastre 2014 was developed (Kauffman and Steudler, 1998) and in 1996 the United Nations Economic Commission for Europe (UNECE) published the land administration guidelines. The Principles of the cadastre 2014 were developed to come up with the CCDM (Core Cadastral Domain Model) (Lemmen & Van Oesterom, 2006). The specifications of the CCDM were developed to come up with the Land Administration Domain Model (LADM). The LADM have been the best effort so far, in terms of coming up with a standardized land administration systems ( Mtariswa, 2013). The introduction of the LADM standard has coincided with the movement for an integrated and more efficient land administration system in Zimbabwe. This paper analyses the conformity of the current land administration system in Zimbabwe to the LADM ( ISO 19512) standard.

## **2. THE LAND ADMINISTRATION DOMAIN MODEL.**

The LADM was developed by the Technical Committee 211(TC211) of the International Organization for Standardization (ISO, ISO/TC211, 2010) and is identified as ISO 19152. LADM provides a reference model which will serve two goals: (1) to provide an extensible basis for the development and refinement of efficient and effective land administration systems, based on a Model Driven Architecture (MDA), and (2) to enable involved parties, both within one country and between different countries, to communicate, based on the shared vocabulary implied by the model (ISO/TC211, 2012).

The LADM conceptual schema consists of three packages and one subpackage. The three packages are the Party Package, the Administrative package and Spatial Unit package. The surveying and Spatial Representation subpackages are subpackages of the Spatial unit package. Each package consists of a group of related classes. Totally the LADM consists of 48 main classes and the special class VersionedObject ( BYDLOSZ, 2013).

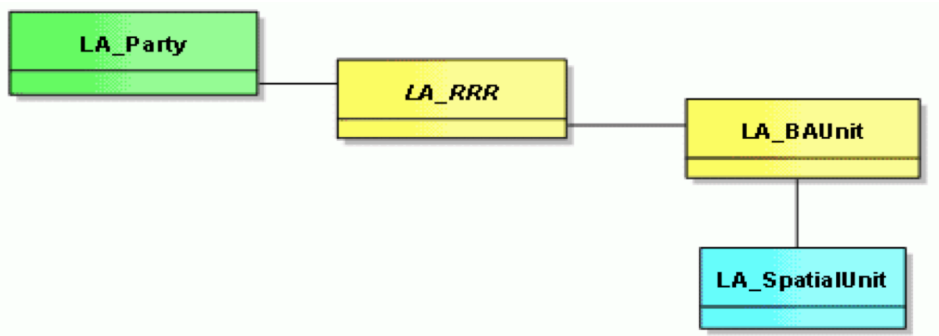


Fig. 1: Core LADM classes.

The LADM was not designed to be complete for any particular country. One consideration during the design was that the model should cover the common aspects of land administration all over the world and that it should be expandable to meet the requirements of any specific country. Therefore conformity between the LADM standard and the existing land administration system must be established before the standard can be adopted as a data model in any jurisdiction. LADM classes and their associations must be compared with the entities, relationships and processes in the existing system.

### 3. THE LADM CONFORMITY WITH LAND ADMINISTRATION IN ZIMBABWE

#### 3.1 Party Package

The LADM Party package consists of classes that represent players in the land administration system. Classes in the Party package are the LA\_Party, LA\_GroupParty and LA\_PartyMember. A party is natural or non natural person that plays a role in the functioning and updating of the land administration system. The attributes of this class give information about the identity of the party, the role of the Party in the land administration system and the type of the Party (e.g. natural or non natural).

The class LA\_GroupParty which is a specialisation of the LA\_Party class, is any number of parties which together constitute a single entity in the land administration process. Examples of group parties are communities, tribes, families, cooperatives or associations (ISO/TC211, 2012).

The association class LA\_PartyMember has the attribute 'share' which is used to manage group party members with unequal shares.

In Zimbabwe LA\_Party instance can be derived from the current holding deed (with key attributes being: name, ID number, marital status and date of birth) recorded in the deeds registry office, companies (with attributes company name and company registration number) in the company registry. The Party (right holder) can be identified in the vesting clause of a title deed which normally reads

“.....did by these presents cede and transfer, in full and free property, to and on behalf of .....( ID No., DoB, Marital status), his heirs, executors, administrators or assigns.”

Other parties that play a role in the process can also be identified in the title deed, for example every deed contains the name of the conveyancer in the preparation certificate, and the annexed diagram will give the name of the Land Surveyor.

LA\_Party attributes partyID, type, role and signature are therefore applicable in the context of existing land administration system in Zimbabwe.

In Zimbabwe, group parties are found in the form of organizations, cooperatives and individuals that hold land in undivided shares. When there is joint ownership in land, the current systems records the number of shares associated with each member of the group. Such information may be represented in the LADM association class LA\_PartyMember.

### 3.2 Administrative Package

This package contains the classes LA\_Right, LA\_Restriction, LA\_Responsibility and LA\_BAUnit (Basic Administrative Unit). The LA\_Right class is concerned with the activities that can be carried out on a parcel of land. The LA\_Restriction deals with restrictions in land use for example the Local Authority may prohibit the building of residential house too close to a river or dam. A “BAUnit” is the set of zero or more spatial units against which (one or more) unique and homogeneous rights, restrictions, and responsibilities applies, e.g. an apartment unit with three spatial units (the apartment, a garage, and a laundry room).

In Zimbabwe the basic unit for land administration purposes is a piece of land that is registered as a single entity in the Deeds registry. Therefore the LADM BAUnit corresponds to single land parcels. The Rights, Restrictions and Responsibilities attached to a land parcel are referred to as conditions of tenure. These conditions can be deduced from conditional clause of the corresponding deed. A deed is a source document in the context of the LADM. When a parcel is granted by the state for the first time, the deed of grant will be subject to conditions that will be stated in the conditional clause of the deed. These conditions may be related to the use to which the land may be put, subdivision restrictions, easements enjoyed or affecting the parcel and conditions restricting or allowing alienation. The conditions may also impose responsibilities on the holder. In subsequent transfers or conveyances, these conditions are incorporated by reference and not repeated verbatim. Every condition or servitude referred to in a title must give a reference to the deed in which it was first imposed. The LADM classes LA\_Right, LA\_Restriction, LA\_Responsibility can be deduced by looking at the conditional clause of the current holding deed and then tracing all the creative deeds back to the original Deed of Grant.

Deed of Grants, Deed of Transfers and all forms of certificates of Title are collectively referred to as Title Deeds. These together with other documents create rights in land such as notarial deeds and mortgage bonds correspond to the class LA\_AdministrativeSource in the LADM. The classes in this package are directly applicable in the current land administration system in Zimbabwe.

An additional classes ZW\_DocumentStatus is suggested to keep track of a document in the administration cycle. The ZW\_DocumentStatus may have the code list document status which can furnish information pertaining to the current status of a document, for example a

document can be accepted, rejected or borrowed.

### 3.3 Spatial Unit Package

A spatial unit is an area of land and/or water, or a single volume of space. A spatial unit can be represented as a point (the coordinates of a single point), line (spaghetti), text-based units (descriptive text), area or volume. The spatial unit package is concerned with the classes LA\_SpatialUnit, LA\_SpatialUnitGroup, LA\_Level, LA\_LegalSpaceNetwork, LA\_LegalSpaceBuildingUnit and LA\_RequiredRelationshipSpatialUnit. The spatial unit group has an aggregated relationship to itself; this facilitates the further subdivision of spatial units. A 'spatial unit group' is a group of spatial units, e.g. spatial units within an administrative zone for example a municipality or a district.

The law in Zimbabwe defines a land parcel as a piece of land that is registered in the deeds registry as a single entity. Therefore, in Zimbabwe the LADM Spatial Unit corresponds to a piece of land which is registered as a single entity in the Deeds Registry. The LA\_SpatialUnitGroup can represent a group of spatial units. In Zimbabwe the designation of a piece of land is the unique within the district. A piece of land may be designated as-

” Stand 11615 Mkoba North Township of Mkoba. Situate in the District of Gwelo”.

In the implementation of the LADM, the district(Gwelo) will represent the highest level of spatial unit groups containing all spatial units within the district of Gwelo. The next SpatialUnit group level will be Mkoba which will be constituted by all the spatial units in Mkoba ( Mkoba North and Mkoba South). The next level will contain all spatial units ( and SpatialUnit groups) in Mkoba North Township. Therefore the spatial unit group class of the LADM and its aggregations is fully compliant with the current land administration system in Zimbabwe.

In the current cadastral setup in Zimbabwe, the LA\_LegalSpaceBuildingUnit can be used to represent the legal space of a building that is subject to exclusive rights of occupation or under a sectional title. For such a building the law requires a diagram showing the position of the building in relation to the boundaries of the parcel on which it is located.

Although Local authorities supervise the construction of buildings by issuing permits based on the proposed building plans, the plans do not appear on the national cadastre. The LA\_LegalSpaceBuildingUnit can be used in future to incorporate buildings in the national cadastre. The LA\_LegalSpaceNetwork can be adopted to represent servitudes that are represented on survey plans.

Spatial units in the current cadastre in Zimbabwe are created based on different legislation with differing requirements of accuracy for example spatial units are identified as Stands, Lots or farms. This distinction can be represented using the LA\_Level class.

#### 3.3.1 The Survey Package

The surveying package is a subpackage of the spatial unit package. It contains position and source information which is used to specify spatial units. The classes of the package are LA\_Survey point and the LA\_SpatialSource. An instance of class LA\_Point is a point. A

point represent the turning point of a property boundary or a point that forms part of a curved or curvilinear boundary. The survey documents from which point information is derived is represented in the LA\_SpatialSource class. The class contains all the survey documents from which point information and attributes are derived.

In Zimbabwe point information is captured in the field using either conventional survey techniques, GPS measurements or photogrammetric methods. Survey documents are then prepared from the field observations and lodged with the Surveyor General. The documents which are commonly referred to as survey records consist of the original fieldbook in which the field observations are recorded, the computations and the coordinate list which shows how the observations in the fieldbook were reduced to point position information including accuracy estimations. The coordinate list contains the final coordinates of the measured points after adjustments and the point descriptions as they appear in the fieldbook. The survey records also consist of a working plan, General plans and Diagrams amongst other documents. The LA\_Survey point class together with its attributes may be derived from the coordinate list. The coordinate list will then correspond with the LA\_SpatialSource class. Other survey records such the computations and the fieldbook can be considered as source documents for the coordinate list.

### **3.3.2 Spatial Representation Subpackage**

This subpackage of the Spatial Unit package is used for the representation of the spatial unit boundaries. A boundary is a set of points that represents the limit of a spatial unit. The two classes of this package are LA\_BoundaryFaceString and LA\_BoundaryFace. 2D representations of spatial units use boundary face strings while 3D representations are represented as boundary faces. Boundary face strings are used to describe the boundary of spatial units via linestrings in 2D. The classes have associations with LA\_Point and LA\_SpatialSource to document the source of the geometry. The current cadastral system in Zimbabwe does not accommodate three dimensional parcels. Therefore only the LA\_BoundaryFaceString class is applicable in Zimbabwe. Parcel boundaries are represented on survey diagrams or general plans as straight lines between two points or beacons. Where a boundary follows a durable physical feature, it is represented on survey plans by a series of points that define the physical feature. The LA\_BoundaryFaceString class can be used to represent the boundaries whilst deriving attributes from the survey diagrams or general plans.

### **3.4 Special classes**

The Versioned Object class was introduced into the LADM in order to maintain historical data in the database. Land administration data is dynamic in nature. An efficient land administration system should not only maintain up to date land records, it should also be able to give the contents of the database as they were at any time in the past. Most classes in the LADM are capable of changing their instances, attributes and methods with time. These classes will have to be versioned in order to maintain historical data and to be able to reconstruct the database as it was at any given time. Classes LA\_Party, LA\_Party Member, LA\_Mortgage LA\_RRR, LA\_Required RelationshipBAUnit, LA\_BAUnit, LA\_SpatialUnit,

LA\_SpatialUnitGroup, LA\_RequiredRelationshipSpatialUnit, LA\_Level, LA\_BoundaryFaceString, LA\_BoundaryFace, and LA\_Point are examples of classes that will have to be versioned. Zimbabwe practices the registration of deeds system. One of the basic principles of this system is the logging of time of entry of property documents. Almost all land records in Zimbabwe are date stamped. Any deed that creates real rights is officially date stamped by the registrar of deeds, any survey diagram that portrays a change in the boundaries of a piece of land is also dated. The versionedObject class can be used to maintain and manage such historical data. There is sufficient information in the current system to enable the reconstruction of records as they were at any given time in the past, however the process would be cumbersome since it would involve manual searches in many different offices.

The LADM VersionedObject class can help to organise and manage historical data in the current land administration system in a more efficient manner.

### 3.5 External Classes

External classes are outside the scope of the LADM, however the LADM indicate data sets elements that are expected from the external classes. The external classes facilitates the incorporation into the land administration system of information from other information systems or databases that are not related to land administration. In Zimbabwe the land administration system will necessarily incorporate data from the national registration database for information on Parties. The companies registration database will be required for the identification of non natural Parties. Other relevant external databases include: the property valuation database, taxation database, address database and the land use database.

## 4 CONCLUSION

This paper set out to investigate the conformity of the current land administration system in Zimbabwe with the Land Administration Domain Model (ISO 19152) standard. The major elements in the current land administration system have been described and compared with LADM classes and their associations. Most of the basic entities in the current land administration system were found to correspond directly with classes in the LADM.

LADM classes LA\_Face, MovableClass, OtherRegisterObject and NonGeoRealEstate do not correspond with any entities in the current land administration system.

The Party package was found to be fully conformal with the existing system. The Administrative package conforms with the current system if the BAUnit is defined as any piece of land that is registered as a single unit in the deeds registry office. Additional classes Document status and Ratable units need to be added to the administrative package.

The Spatial Unit package together with its subpackages are directly applicable to Zimbabwe with minor modifications regarding the possibility of a survey source document being a source document for another source document.

The management of historical data which in the current land administration system is scattered across many different departments can be improved by the use of the LADM VersionedObject class.



The motivation for this paper has been the need for a more efficient land administration system in Zimbabwe, in response to the adoption of an e-governance policy by the government. This paper should form the basis for the design of a LADM country profile for Zimbabwe.

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