LAND ADMINISTRATION

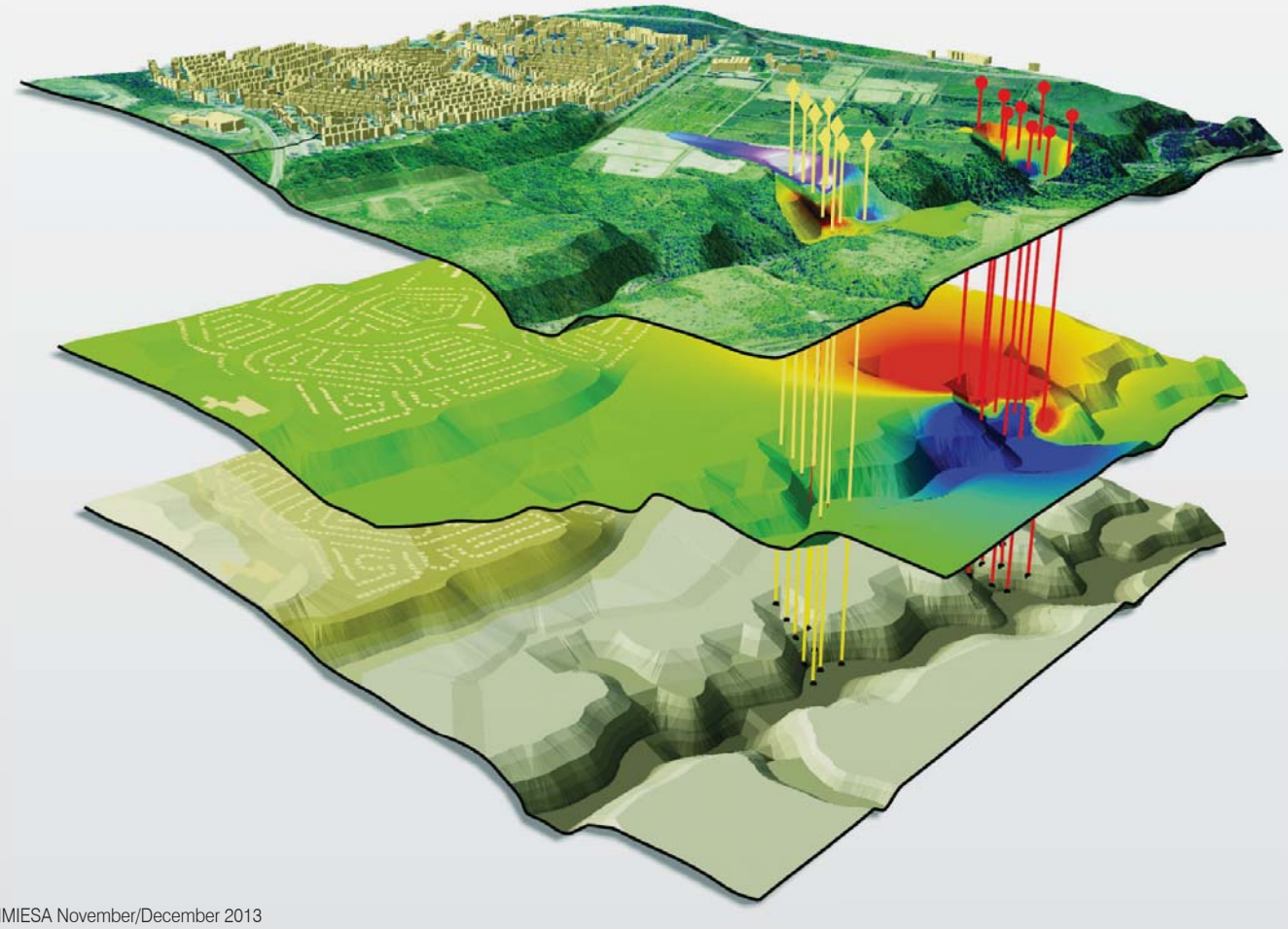
A new model for the City of

PART ONE

The application of the Land Administration Domain Model (LADM) to the City of Johannesburg Land Information System is based on the fact that different organisations have different responsibilities in data maintenance. Part 1 of this paper is published here, with Part 2 to be published in January 2014. **by Serena Coetzee, Centre for Geoinformation Science, University of Pretoria, and Dinao Tjia, City of Johannesburg**

THE LADM IS A conceptual schema that facilitates the exchange and maintenance of different data sets by different organisations, especially in distributed systems, and was published by the International Organization for Standardization (ISO) as an International Standard on 19 November 2012 (ISO 19152:2012).

A number of countries considered the adaption of the LADM to their local needs. Examples documented in ISO 19152:2012 are the country profiles for Portugal, Australia, Indonesia, Japan, Hungary, the Netherlands, the Russian Federation and the Republic of Korea. Elia et al (2013) investigated the adaptation of Core Cadastral Domain Model (LADM's earlier version) in



Johannesburg Information

the Cyprus Land Information System (CLIS) with the aim of improving its data model. In Portugal, an object-oriented conceptual model based on LADM has been developed for the Portuguese Cadastre and the Portuguese Real Estate Register (Hespanha et al, 2009). Pouliot et al (2013) used the LADM in a comparative case study between condominium/co-ownership in Quebec (Canada) and Alsace Moselle (France).

This research presents an initial exploration of the LADM application within the South African context.

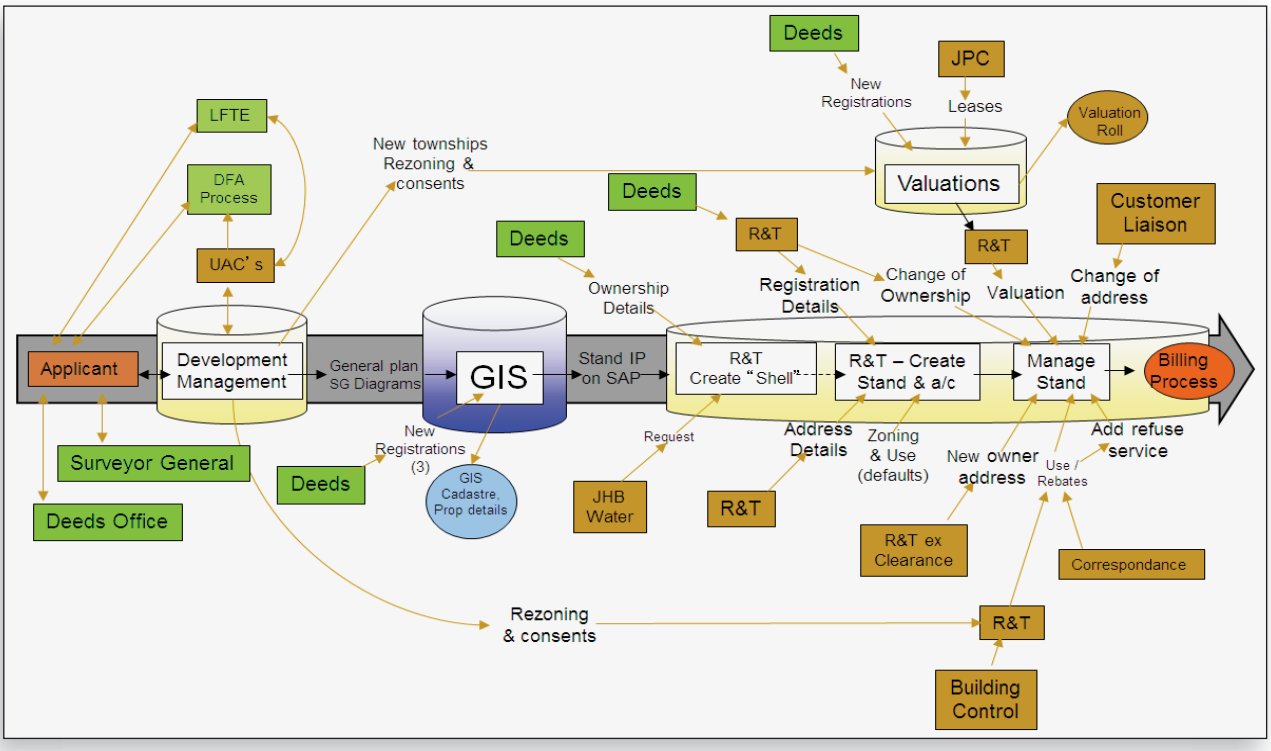
City of Johannesburg Land Information System (COJLIS)

The vision of the City of Johannesburg (COJ) is to develop a unified repository of property information within its jurisdiction. Historically, the COJ departments that dealt with property information operated separate databases and systems (Tjia & Coetzee, 2012). This mode of operation made property information maintenance and sharing across departments virtually impossible and resulted in data duplication and misinterpretation. The lack of integration of property data and systems negatively affected service delivery turnaround times for development applications (i.e. township development, subdivision, consolidation, etc.). This in turn affected the economic growth of the city. Because various departments used independent databases, customers often had to be referred from one department to the other in order to obtain a complete set of property data. This impacted negatively on the customer experience. Figure 1 shows the old COJ Property Value Chain Model on which the city's Land Information System (LIS) is based.

The creation of a property in the COJLIS begins at the stage when an applicant submits a development application (e.g. township establishment, subdivision, consolidation, etc.). Different processes can be followed: the township establishment process is conducted in accordance with the town planning ordinance, an alternative process is done in accordance with the Less Formal Township Establishment Act (LFTE), or a third alternative process is conducted in terms of the Development Facilitation Act (DFA). The LFTE and DFA processes were popular over the past decades; they were used to fast-tract development post-1994.

A number of entities within and outside COJ are involved in the development application process. The utilities, agencies and corporatised entities (UACs), such as Johannesburg Water, City Power, and Johannesburg Water comment on services in the proposed development. The Surveyor General Office approves the survey plans of developments. The Deeds Office provides the registered property ownership information. The COJ GIS division captures the Surveyor General approved plans and allocates street addresses. The Valuation division determines the

FIGURE 1 **COJ Property Value Chain (Tjia & Coetzee, 2012)**



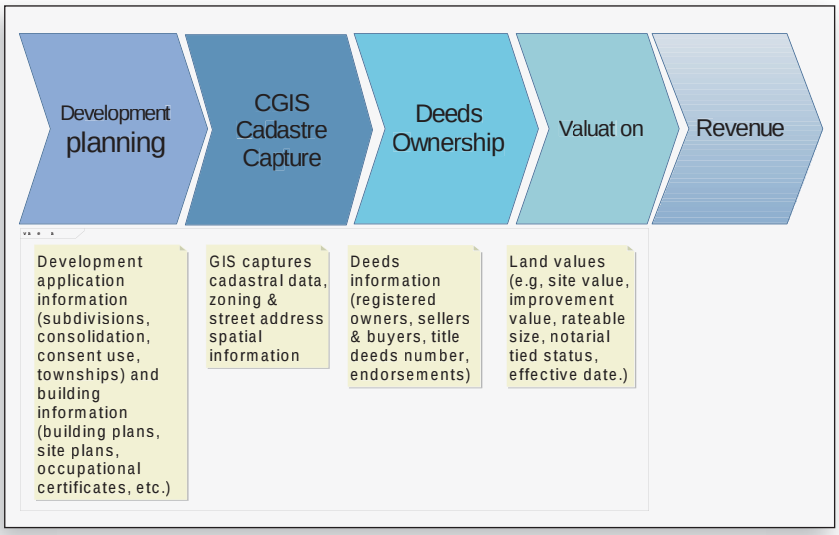


FIGURE 2 COJ property value chain of events

property value. The Johannesburg Property Company (JPC) supplies the Valuation division with the city's lease properties. The Rates and Taxes (R&T) department captures the change of ownership from the deeds ownership data. The Customer Liaison division updates the change of address and also maintains the postal address details. R&T uses the ownership data (new owner's address) to generate the tax clearance certificates. R&T creates a customer billing account. The Revenue division collects the revenue from the property assessment rates and services charges (e.g. water, sewerage, electricity, etc.). The COJ property value chain of events is presented in Figure 2.

Comparison between the LADM basic classes and the COJLIS

The LADM provides a conceptual framework and the actual implementation of the LADM is dependent on the development of an application schema. The application schema needs to be tested for conformance with the LADM in terms of package and level (ISO 19152:2012). The LADM specifies three levels of conformance. For the purpose of this paper, the first level was examined, which is limited to the basic classes o the LADM. For the first conformance level in the LADM, the following classes are relevant: VersionedObject, LA_Party, LA_RRR and its specialisation LA_Right, LA_BAUnit, LA_SpatialUnit and LA_Source and its specialisation LA_AdministrativeSource. In this section, the results of the tests for the classes, attributes and associations in the LADM are documented by showing a mapping between the LADM elements and the elements in the COJLIS data model. Subsection 4.1 shows the class mapping, subsection 4.2 the attribute mapping and subsection 4.3 the mapping of associations. The data in the COJLIS was inspected as a means to understand the model but it was not tested against the LADM requirements.

Class mapping

Figure 3 shows the cross-mapping of the LADM basic classes against the corresponding COJLIS entities. The COJLIS geodatabase schema was exported into the Enterprise Architect modelling tool using its ArcGIS workspace functionality. The information represented was extracted from sample data from the COJLIS database. For readability purposes, the stereotypes are displayed to group the related attributes. The COJLIS look-up tables are shown as enumerations in Figure 3. ▶

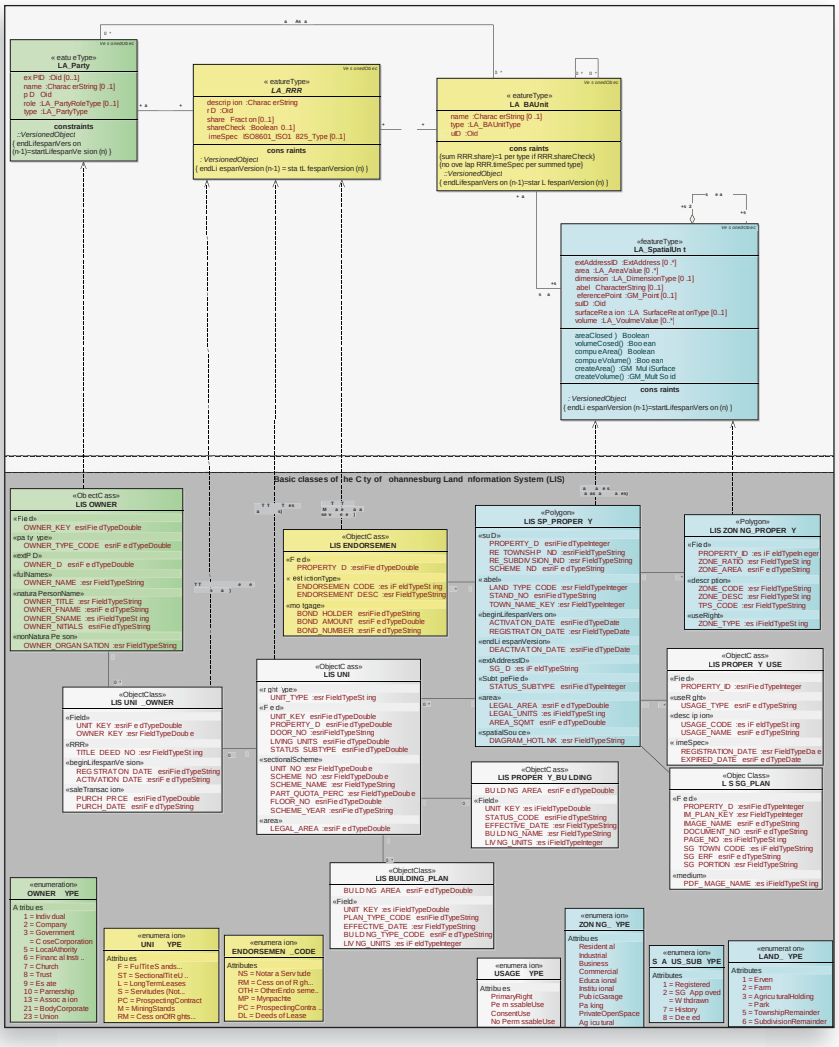


FIGURE 3 LADM and COJ LIS basic classes

The COJLIS includes information corresponding to the LA_Party, LA_RRR, LA_Right, LA_BAUnit and LA_SpatialUnit classes. VersionedObject, LA_Source and LA_AdministrativeSource are not represented in the COJLIS. Table 1 shows the mapping between the LADM classes and the COJLIS entities.

VersionedObject is the superclass of all classes in the LADM. Its attributes store historical data, i.e. inserted and superseded data are given a time-stamp. In this way, the contents of the land administration data can be reconstructed, as they were at any historical moment. The COJLIS data model contains lineage data (not included shown in Figure 3) for the spatial units only. There is a one-to-many relationship between LIS.SP_PROPERTY and the LIS.LINEAGE entity. The lineage includes descriptive information about the property development processes. COJLIS does not include timestamps for each individual entity and therefore does not conform to the LADM.

Attribute mapping

In this subsection, the attributes of the mandatory classes (see Table 1) in the LADM are mapped to corresponding attributes in the COJLIS data model.

LA_Party and the corresponding COJLIS OWNER class

The attributes of LA_Party are: extPID (identifier of party in an external database), type of party (e.g. natural and non-natural persons), name of party, the role of party, and the identifier of party (ISO 19152:2012). Table 2 shows the LA_Party and LIS.OWNER comparison.

The LIS.OWNER entity class contains information about the owner(s) of a property in the role of ratepayers or developers. The OWNER_TYPE_CODE attribute stores the code that represents the type of owner: individual, company, close corporation, trust, etc. The owners in the COJLIS are identified in OWNER_ID by using the identity numbers as captured in the national population register. Passport numbers are used for foreign nationals. The OWNER_NAME attribute stores the registered legal full name of the owner. The OWNER_TITLE, OWNER_INITIALS, OWNER_FNAME and OWNER_SNAME, as well as the OWNER_ORGANISATION attributes are populated by the Revenue department through the SAP billing system. The OWNER_ORGANISATION attribute represents the organisation's name or names of non-natural parties, such as companies, close corporation, trust, etc

There is duplication of owner names in the COJLIS data model. The OWNER_NAME and OWNER_ID attributes are populated through the COJLIS interface, while the OWNER_TITLE, OWNER_INITIALS, OWNER_FNAME, OWNER_SNAME and OWNER_ORGANISATION attributes are populated through the SAP billing system. There is a one-way flow of information from the COJLIS to the SAP billing system, implying that the OWNER_TITLE, OWNER_INITIALS, OWNER_FNAME, OWNER_SNAME and OWNER_ORGANISATION attributes are available but empty in the COJLIS data. This duplication results in discrepancies in owner information, for example, when the new owner is filled into the OWNER_NAME attribute but the SAP billing system does not yet reflect the new owner in the other five attributes.

The COJLIS data model conforms to the LA_Party attribute requirements of the LADM. The OWNER_ID attribute corresponds to the extPID attribute, the OWNER_KEY attribute to the pID attribute and the OWNER_TYPE_CODE attribute to the type attribute in LA_Party. The name attribute in LA_Party is represented by more than one attribute in the COJLIS data model. There is no attribute in the COJLIS data model that corresponds to the role in LA_Party. However, this attribute is optional in the LADM.

The COJLIS is designed to store information about owners of property with the purpose of collecting revenue from property rates and service charges. However, there are a number of other parties involved in the development process at the COJ. The key parties include an applicant or developer who submits an application for development approval, the surveyor who prepares the layout plan for the land proposed to be developed, and the conveyancer who collects rates clearance from the municipality and prepares the deed of sale and deed of transfer, certificate of title, etc. Adding the role of the party to the COJLIS data model would enable representing the fact that parties may play different roles in LA. The current labelling of all parties as owners in the COJLIS data model restricts inclusion of other parties who are not necessarily the owners but are involved in the development process and property value chain. [35]

In Part 2 of this article, corresponding classes are considered, as are endorsements, zoning and a useful summary.

TABLE 1 The LADM basic classes and their corresponding COJIS entities

LADM Basic Class	COJIS Entity
La_party	Lis.owner
La_right (LA_RRR)	Lis.unit_owner
La_restriction*	Lis.endorsement Lis.property_use Lis.zoning_property Lis.building_plan
La_responsibility*	-
La_baunit	Lis.unit
La_spatialunit	Lis.sp_property
La_administrative-source (La_source)*	Lis.sp_property. Diagram_hotlink
La_spatialsource*	Lis.sg_plan
Versionedobject	-

TABLE 2 LA_Party and LIS OWNER attribute comparison

La_party	Lis.owner	Lis.owner Attribute Description
Extpid*	Owner_id	The Id Number (Or Company Registration Number) Of The Owner
Name*	Owner_name	The Full Names Of The Owner (From The Deeds Office)
	Owner_title	The Title Of The Owner
	Owner_initials	The Initials Of The Owner
	Owner_fname	The First Names Of The Owner
	Owner_sname	The Surname Of The Owner
	Owner_organisation	The Organisation Name
Pid	Owner_key	The System Generated Unique Identifier Of An Owner.
Role*	-	The Cojlis Model Contains Only The Owners Of Property. Their Role Is Not Distinguished. However, The Owner Of A Property May Be A Rates Payer, Buyer Or Seller
Type	Owner_type_code	The Type Of Party (I.e. Individual, Company, Trust, Etc.)
* Optional attribute		