# Analysis of Studies on the Land Administration Domain Model in Turkey

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**Key words**: ISO 1952 LADM, Cadastre, Cadastre 2034 Vision

## SUMMARY

When the past or present cadastral systems are examined, it is seen that the cadastral systems have different purpose, content, scope and administrative structure in different countries. However, all of these systems are generally based on the same logical basis. This basis is the relationship arrangement between people and land through the rights of the cadastre on real property. 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. An effort to standardize cadastral systems started in 2002 by Lemmen and van Oosterom, who had the vision of the Core Cadastral Domain Model. Since then, the model has evolved to the international standard Land Administration Domain Model (ISO 19152). The LADM provides an abstract, conceptual model and is organized into three packages and one sub-package. The packages in LADM relate to:

- parties (people and organizations);
- basic administrative units, rights, responsibilities and restrictions (ownership rights);
- spatial units (parcels, and the legal space of buildings and utility networks) with the subpackage: spatial sources (surveying), and spatial representations (geometry and topology).

The main class of the party package of LADM is class LA_Party with its specialisation LA_GroupParty. There is an optional association class LA_Party-Member. A Party is a person or organisation that plays a role in a rights transaction. The administrative package concerns the abstract class LA_RRR (with its three concrete subclasses LA_Right, LA_Restriction and LA_Responsibility), and class LA_BAUnit (Basic Administrative Unit). A 'right' is an action, activity or class of actions that a system participant may perform on or using an associated resource. The spatial unit package concerns the classes LA_SpatialUnit, LA_SpatialUnitGroup, LA_Level, LA_LegalSpaceNetwork, LA_LegalSpace-BuildingUnit and LA_RequiredRelationshipSpatialUnit.

One of the fundamental objectives of LADM is to provide an extensible basis for the development and refinement of efficient and effective land administration systems, based on a Model Driven Architecture (MDA). To enable involved parties, both within one country and between different countries, to communicate, based on the shared vocabulary (that is, an ontology). The standard provides the basis for national and regional profiles and enables the combination of land management information from different sources in a coherent manner. With the adoption of the model as a standard, many countries have started to carry out various studies at the academic and institutional level in order to be applied in the countries of the model. Many countries such as Poland, Republic of Korea, Croatia, Cyprus and Republic of

Cape Verde have proposed country profile based on LADM as reported by Bydlosz (2013), Kim et al (2013), Vucic et al (2013), Elia et al (2013) and Andrade et al (2013). Some of these studies have focused on the physical database design using MDA, while others examine the The practice of a LADM- compliant 3D Cadastre. The practice of country profiles based on LADM makes it is possible to compare cadastral information systems.

In parallel with the developments in the world, various studies have been started at the academic and institutional level so that the model can be implemented in Turkey. In terms of academic level, Inan (2010) developed a spatial data model consistent with the LADM by addressing the agricultural construction in the country in terms of land administration in his doctoral dissertation. Özçelik (2013) has developed a spatial data model compatible with the LADM for private agricultural products in our country. Döner (2010) examines the support of 3D cadastre by the LADM in his doctoral thesis titled "Three Dimensional Approach for Turkish Cadastral System". İnan and Yomralıoğlu (2011) examined the LADM in their work and proposed spatial modeling for the land administration in our country. Çete and İnan (2013) touched on the importance of the cadastre of Turkey by taking the LADM in their work. Aydınoğlu and İnan (2014) have developed a land registry and cadastral-based data model and have associated them with the Land Registry Cadastre Information System (TAKBIS *in Turkish*) and the Turkish National Geographic Information System (TUCBS *in Turkish*) projects. Çağdaş et al, . (2016) developed a valuation and taxation data model based on the LADM in their work. Alkan and Polat (2017) proposed a LADM model related to the basic classes for Turkey in their work. In terms of institutional level, initiatives projects are developed for providing integration to LADM and on the future of cadastres. These are namely, Turkey National GIS (TUCBS *in Turkish*) the Land Registry and Cadastre Information System (TAKBIS *in Turkish*), Spatial Property System (MEGSIS *in Turkish*), Land Registry Archive System (TARBIS *in Turkish*), Land Registry and Cadastre Modernisation Project (TKMP *in Turkish*) and The Map Data Bank (HBB *in Turkish*).

In this study, it is aimed to see what the model is applied in our country by analyzing the contents of the studies done in our country. The results of study indicate that effective functioning of the information infrastructure LADM-based requires proper integration of data, proceeded by analysing the contents of existing data sets, indicating key registers and defining a linkage system between them.

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## 1. INTRODUCTION

When the traditional cadastral systems are examined, it is seen that the cadastral systems have different purpose, content, scope and administrative structure in different countries. However, all of these systems are generally based on the same logical basis. This basis is the relationship arrangement between people and land through the rights of the cadastre on real property. 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 (Lemmen et al, 2015). An effort to standardize cadastral systems started in 2002 by Lemmen and van Oosterom, who had the vision of the Core Cadastral Domain Model. Since then, the model has evolved to the international standard Land Administration Domain Model (ISO 19152 LADM). The LADM provides the basic structure for national and regional profiles and enables the combination of land management information from different sources in a coherent manner. With the adoption of the model as a standard, many countries such as Poland, Republic of Korea, Croatia, Cyprus and Republic of Cape Verde have started to carry out various studies at the academic and institutional level in order to be applied in the countries of the LADM. In parallel with the LADM country profile developments in the world, different studies have been started at the academic and institutional level so that the LADM can be implemented in Turkey. In this study, it is aimed to see what the model is applied in our country by analysing the contents of the studies done in our country.

This study provides a brief overview of the current land information system in Turkey emphasizing the main issues in creating the national information infrastructure. Then, the general concept of the country profile for Turkey with the adaptation of the LADM is described. In this context, the core data model of TLIS has been reviewed against the corresponding LADM basic classes. The LADM presents an opportunity to adopt an ISO conformant model in the TLIS. The proposed LADM for TLIS can be used to describe land administration information in Turkey, although there are similarities, semantic differences, and mismatches of classes and attributes between them. The results of this study indicate that effective functioning of the information infrastructure requires proper integration of data, preceded by analysing the contents of existing data sets, indicating key registers and defining a linkage system between them. From this point of view, the results improve the understanding of land administration at country level in Turkey, but more empirical explorations are necessary to examine the applicability of the LADM within different contexts.

## 2. A BRIEF REVIEW OF LADM

LADM is identified to be the International Standard Organisation of ISO 19152 under technical committee TC/211 for Geographic Information/Geomatics (Lemmen et al, 2010; Paasch et al, 2013; Tjia and Coetzee, 2013; Van Oosterom, 2015). LADM was designed as a standard for all land registration and transactions within the country and countries or local and localities (Babalola et al, 2015). The LADM serves at least two important goals:

(1) to provide an extensible basis for efficient and effective cadastral system development based on a model-driven architecture (MDA) in order to avoid reinventing and re-implementing the same functionality over and over again, and
(2) (2) to enable involved parties, both within one country and between different countries, to communicate based on a shared ontology implied by the model (Van Oosterom et al, 2009).

The LADM provides an abstract, conceptual schema with three basic packages and two subpackages (Lemmen et al, 2010, 2011; Andrade et al, 2013; Zulkifli et al, 2013). Parties (such as, people and organisations), administrative rights, responsibilities and restrictions (such as property rights) and spatial units (such as parcels, buildings, and networks), with the latter having one subpackage that surveying and spatial representation (ISO, 2011; Elia et al, 2013). The LADM classes (Figure 1) are prefixed by LA_ to differentiate them from other classes in the ISO geographic information series of standards (ISO, 2012). The aim of LADM is to improve communication through introducing standard concepts or vocabulary in the land administration domain.

## 3. LADM APPLICATION IN COUNTRY PROFILES

Recently, several country profiles based on LADM have been proposed (Janečka and Souček, 2017**)**. These are Poland (Bydłosz, 2013), Republic of Korea (Kim et al, 2013), Croatia (Vučié et al, 2013), Cyprus (Elia et al, 2013) and Republic of Cape Verde (Andrade et al, 2013). These country profiles contain both only respective classes originating from LADM or both Land Administration Domain Model original classes and respective country classes. Some of these studies have focused on the physical database design using MDA, while others examine the practice of a LADM- compliant 3D Cadastre. The practice of country profiles based on LADM makes it is possible to compare cadastral information systems (Psomadaki et al, 2016).

## 4. STUDIES ON THE LAND ADMINISTRATION DOMAIN MODEL IN TURKEY

Our country conducted some studies and projects in order to ensure the modern cadastral system in the direction of LADM and the Vision of Cadastre 2014 and 2034 in terms of academic and institutional level. Institutional projects are under the leadership of the General Directorate of Land Registry and Cadastre (GDLRC).

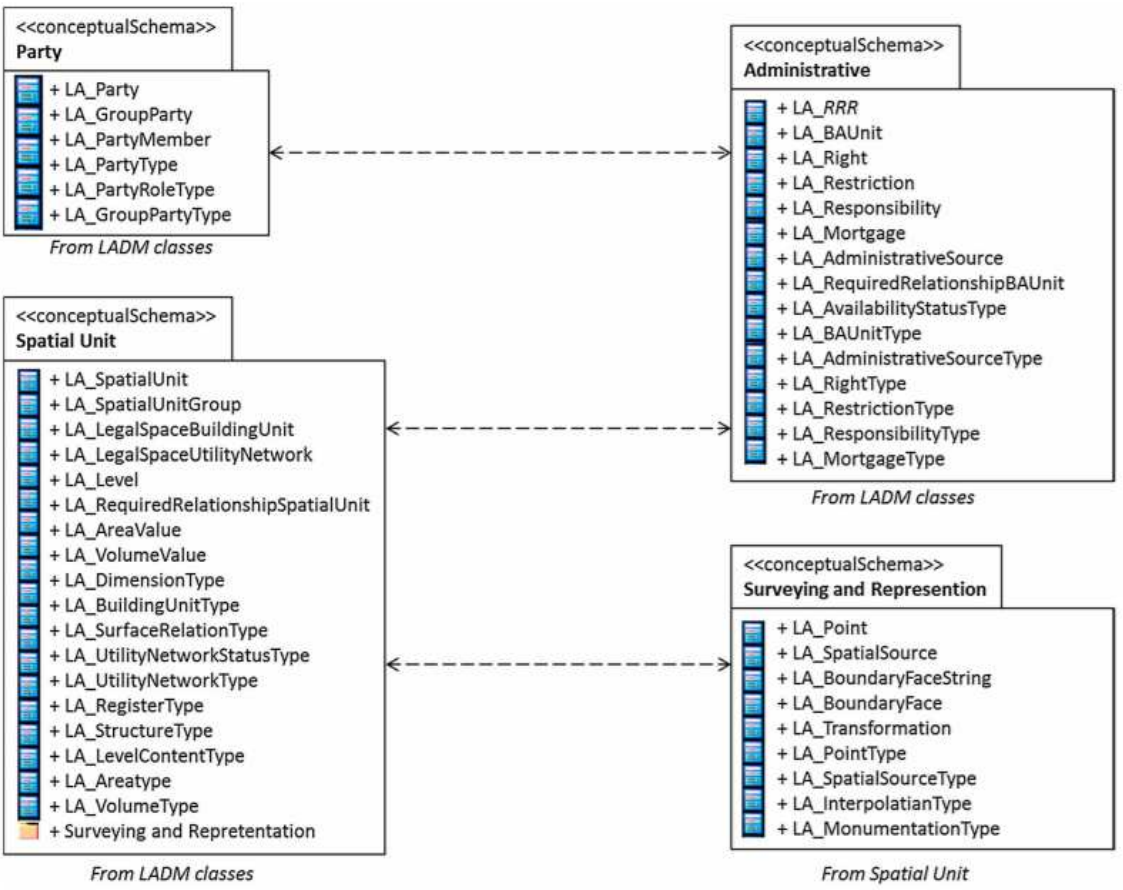


**Figure 1. The LADM overview of (sub)packages (with their respective classes) (*ISO, 2012*)**

## 4.1 Academic studies

In terms of academic level, Inan (2010) developed a spatial data model consistent with the LADM by addressing the agricultural construction in the country in terms of land administration in his doctoral dissertation. Özçelik (2013) has developed a spatial data model compatible with the LADM for private agricultural products in our country. Döner (2010) examines the support of 3D cadastre by the LADM in his doctoral thesis titled "Three Dimensional Approach for Turkish Cadastral System". İnan and Yomralıoğlu (2011) examined the LADM in their work and proposed spatial modeling for the land administration in our country. Çete and İnan (2013) touched on the importance of the cadastre of Turkey by taking the LADM in their work. Aydınoğlu and İnan (2014) have developed a land registry and cadastral-based data model and have associated them with the Land Registry Cadastre Information System (TAKBIS *in Turkish*) and the Turkish National Geographic Information System (TUCBS *in Turkish*) projects. Çağdaş et al (2016) developed a valuation and taxation data model based on the LADM in their work. Alkan and Polat (2017) proposed a LADM model related to the basic classes for Turkey in their work.

Land registry is established under the control of GDLRC for the record of immovable properties in Turkey. Land registry is a registry recorded by the state with sole liability according to real openness system in order to indicate the existing real rights on immovable properties. Title registry does not mean a single deed or record that indicates the legal status of immovable properties. Title registry is the complete file that consists of various deeds, records and documents kept indicating all rights and liabilities on the immovable properties (Figure 2).

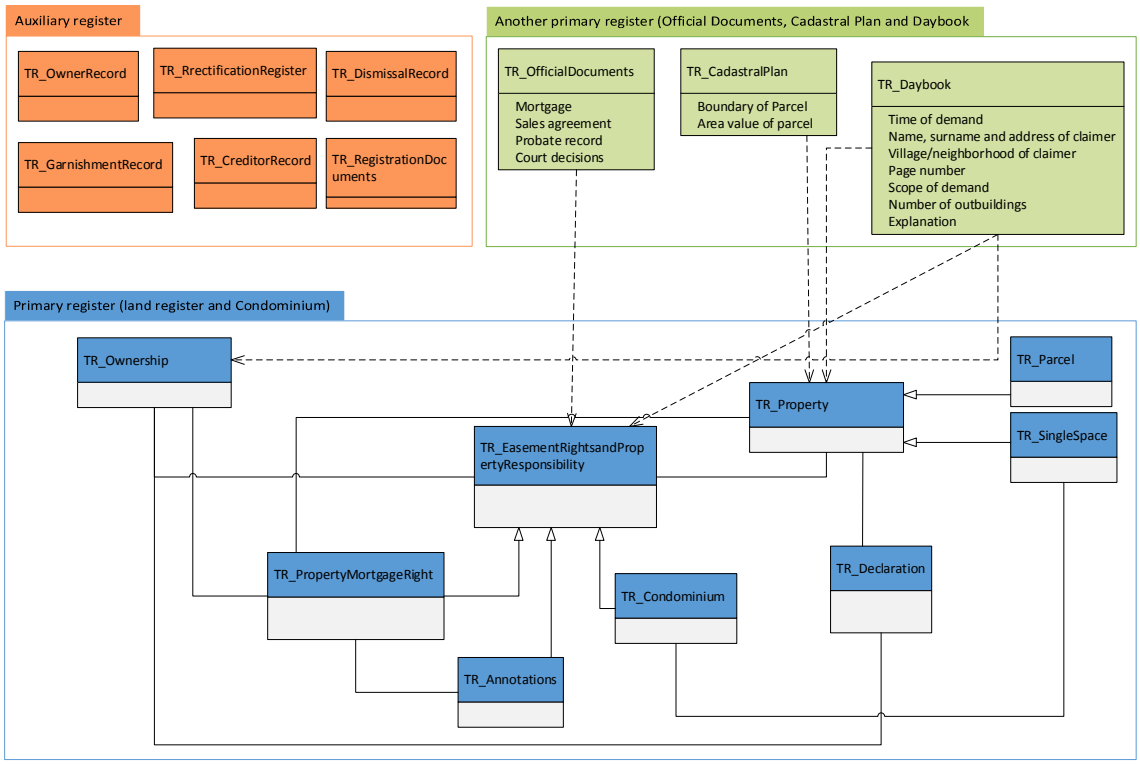


**Figure 2. Land registry procedures in Turkey (***Alkan and Polat, 2017***)**

The registers where immovable properties are recorded are the title deeds and property ownership deeds. The main groups that constitute the contents of these two deeds are Ownership class (in Turkish: TR_Ownership), Rights, Limitations, and Responsibilities Class (in Turkish: TR_HKS), and the Real Estate Class (in Turkish: TR_Real Estate). The deed registry structure in Turkey is in general similar to ISO LADM main classes. ISO LADM main classifications, which are equivalent to the elements of title registry in Turkey, are indicated in Figure 3 below.

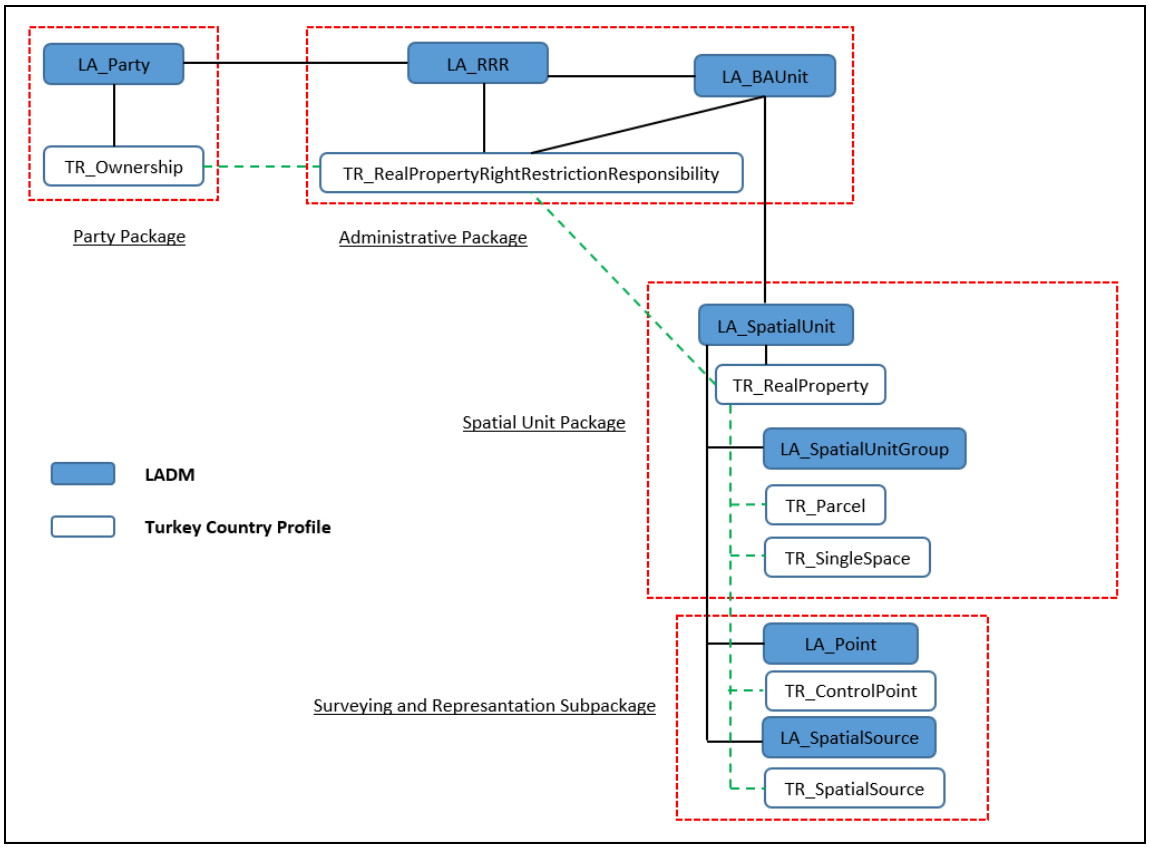


**Figure 3. Turkey's land administration profile and corresponding LADM classes ()**

## 4.2 Institutional projects

TAKBIS project was developed for automation service served by central and local bodies of General Directorate of Land Registry and Cadastre (GDLRC). TUCBS is an e-government project aiming at establishing Turkey National Spatial Data Infrastructure that enables effective geographic data management and meets national level requirements. The MEGSIS is a project prepared by the GDLRC by conceptualising the project in order to match the data with. CAD format in the local computers of cadastre directorates with the title deeds data by collecting on a central system, to share these data with shareholder institutions, organisations, and municipalities and mapping services (Alkan and Polat, 2017). TARBIS provides easy access to scanned documents linked by index system of people authorised to access to archive information and documentation. The aim of TKMP project is to update the data of title deeds and cadastre as being a base for the spatial information systems as set out by the Law on Cadastre and to bring it into use by transferring in the electronic environment in the numeric and legal form. HBB developed for entering the metadata related to information and documents of maps created by using the developed technologic opportunities by institutions which practicing maps or have maps practiced for forming large-scaled spatial information systems across the country.

## 5. CONCLUSION

LADM presents the general conceptual schemas for land administration. And also, this model provides the basis for national and regional profiles and enables the combination of land management information from different sources in a coherent manner. For this reason, there are several countries that apply LADM to establish a country profile for their land administration system.

The development of a conceptual schema could bring a common understanding within the domain of land administration for all the TLIS involved in the standardisation projects in Turkey, especially for TAKBIS and TUCBS. The study compared the basic entities in the TLIS data model concerned with land basic classes (e.g. parties, rights, restrictions and responsibilities, administrative, and spatial units) against the LADM basic classes. While there are corresponding TLIS entities for the relevant LADM basic classes, there are semantic differences between TLIS and LADM basic classes. For instance, the parties in the TLIS are modelled as owners. This limits the inclusion of other parties involved in the land administration process. Another difference is that the TLIS data model contains descriptive lineage data for the spatial units only, whereas the LADM prescribes timestamps for any change to an instance of most classes.

Finally, in this paper, the application of LADM was discussed with a focus on the academic and institutional studies in Turkey. The results of the study indicate that effective functioning of the information infrastructure LADM-based requires proper integration of data, proceeded by analysing the contents of existing data sets, indicating key registers and defining a linkage system between them.

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