Generic land registry and cadastre data model supporting interoperability based on international standards for Turkey

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ABSTRACT

Managing land information effectively is a key factor in achieving successful land administration and sustainable land development. To manage land, each government has a land policy and administration system. A land administration system (LAS) enables identification, registration and sharing of information about land in compliance with land policies by using information technologies effectively. In this context, land information systems (LISs) are designed to fulfill the requirements related to land, to provide tenure assurance and to manage natural resources sustainably. In Turkey, the necessity of information technologies and geographic information systems (GIS) was recognised by public institutions in the early 1990s. The Land Registry and Cadastre Information System Project (TAKBIS in Turkish) started to manage land registry and cadastral data and processes throughout Turkey. By using a standard framework, the project aimed to digitise land registry and cadastral data and to perform all activities and queries in a digital environment. However, the project did not reach the expected level of success because the data infrastructure was not standardised and did not meet the data requirements of other stakeholders at the national and international level.

On the other hand, studies of a new e-government project called Turkish National GIS (TUCBS in Turkish) was initiated to establish a national geographic data infrastructure (GDI) which allows efficient management of geographic data and corresponds to national-level user requirements and Infrastructure for Spatial Information in Europe (INSPIRE) specifications. In this study, to provide data interoperability among different institutions and meet stakeholder needs, the data model of the Land Registry and Cadastre Data Theme is examined and improved. Within the design process, the ISO 19152 Land Administration Domain Model (LADM) and INSPIRE Cadastral Parcels are examined and applied as the baseline international standards. In addition, main land and land group parcel types in the Turkish cadastral system, the main rights, restrictions and responsibilities related to land in the Turkish registration system, mortgages established over rights, cadastral maps, standard subdivision of two-dimensional (2D) space with special names, surveyed point and monumentation types were explained briefly within the revised land registry and cadastre data model. As a case study, data sets from different sources were transformed to open data sets compatible with the model. This model enables data interoperability in land-related applications. However, models should be kept as simple as possible for effective data transformation and management.

1. Introduction

Access to land and proper management of land have significant outcomes, including rightful housing, security of natural resources and food, peace and safety and ultimately sustainable development. Land as a basic source has been the main place for human activities since the early times of human settlement; it is one of the most important issue for all societies (Larsson, 1996; Grant, 1997; Williamson and Ting, 2001; Yomralioglu, 2011). As stated in the 2030 Agenda for Sustainable Development (UN, 2015), which is a plan for people, planet and prosperity aiming to end poverty and degradation and provide prosperity with sustainable development goals, land should be protected and sustainably managed for social cooperation, security and order. Within sustainable development goals, land administration with the use of information and communication technologies (ICTs) is highly important for better and sustainable housing, urbanisation and production.

How governments address land-related issues like access, administration and use is often defined as land policy (UN/ECE, 1996; Lemmen et al., 2015). Therefore, land policy affects environmental
sustainability, social justice and equity, economic progress and growth, poverty reduction and housing. To achieve efficient land policies, governments need legislation and regulations regarding the security of land tenure, land use planning, land market and taxation and natural resource management. Sustainable and appropriate land policies can be developed, implemented and improved with qualified and standardised land information. Having a proper land policy is meaningless without the instruments to carry out such policy. According to the definition of UN/ECE, LAS involves the processes to identify, register and share information about land in compliance with land policies (UN/ECE, 1996). Considering this content, the main function of LAS as an assistive tool is to enable proper land management and policy implementation in the broadest sense (Van Der Molen, 2006).

LASs are fundamental for the conceptualisation of rights, restrictions and responsibilities related to land, people and policies. Most countries have developed their own LAS according to their own administration approaches. Most of the Western European countries and their former colonies, the United States and Latin America countries use deed registration under the Spanish/Portuguese law, while others such as the United Kingdom and many Commonwealth countries use title registration. Some of these systems are based on a general boundaries approach and others are based on a fixed boundaries approach. Similarly, some are centralised whereas others are decentralised (UN/ECE, 1996; Bogaerts and Zevenbergen, 2001). However, LASs generally are not completed in terms of serving for all purposes around the world. Available data are not thoroughly updated and not expedient in the majority of systems. Therefore, there is a global demand for a standard or domain data model which is accepted and flexible enough to function as the basic model of all kinds of LASs. In this context, after a comprehensive design and development procedure, an international standard called the ISO 19152 Land Administration Domain Model (LADM) was published in 2012 (ISO, 2012; Lemmen et al., 2013, 2015).

In Turkey, the e-Transformation Turkey project as an e-government initiative very similar to eEurope*, stepped up the studies and efforts through the country after 2003 with the purpose of stimulating better governance and supporting sustainable development (SPO, 2005; Yomralioglu and Aydinoglu, 2014). This project aims to promote coordination and development of actions to become an information society. In the TAKBIS, as one of these actions, software development and applications were implemented to automate the land registry and cadastre services performed by central and local bodies of the General Directorate of Land Registry and Cadastre (TKGM in Turkish) (URL.1, 2016).

Socially reliable and functional land administration can be provided with the collection and structure of land registry and cadastre information for interoperability with other key registers such as citizenship data, addresses, buildings and infrastructure (Kokkonen, 2004; Van Der Molen, 2005; Aydinoglu, 2010). TUCBS action has initiated and developed as a part of the e-government initiative with the national GDI vision (TKGM, 2005, 2006; URL.2, 2016). GDI comprises policies and technologies with human sources to access, gather, and manage geographic data effectively by enabling data integration from different sectors at different administrative levels (McLaughlin and Nichols, 1992; Nebert, 2004; Aydinoglu, 2010). To make the data accessible and reusable in various land-related applications, the produced data sets should be interoperable and shared through open services (Buehler, 2003; Lakomaa and Kallberg, 2013). However, inadequacies in effective guidance for the geographic data management, poor data quality and non-standardised data structures hamper data interoperability.

There is a need to design a generic land registry and cadastre data model to cope with interoperability issues among different institutions and to meet stakeholder needs at the national and international levels. In this study, Section 2 explains land administration in Turkey, including organisational structure, information systems, and land registration issues, with comment on the importance of land registry data to overcome the current challenges. To obtain an international perspective, ISO 19152 LADM and INSPIRE Cadastral Parcels specifications were analysed to design a well-functioning standard data model workable among different applications in Section 3. Section 4 summarises the methodology and application schemas of the land registry and cadastre data model. The data model for the land registry cadastre data theme was examined and improved as one of the basic data themes of TUCBS. Section 5 encourages the interoperability of geographic information with a case study that transforms data sets into open and interoperable data sets based on the data model. Finally, in Section 6, findings and implications are discussed and recommendations for further research are provided.

2. Background

The land registry and cadastre was developed as a transit tool to private ownership in countries that do not have private ownership and later created private ownership by changing the economic model, as in Turkey (Yasayan et al., 2011). In the Ottoman Empire period, almost all lands and their ownership rights belonged to the government. Only use rights to the land were given to people who carried out important duties or showed success on the battlefield. After the proclamation of the Turkish Republic, the most important issue was to establish a land regime, register the immovable properties on behalf of people having use rights and re-design the old records and documents (Seylam and Yurdas, 2008). In 1924, just after the proclamation of the Turkish Republic, cadastral activities and institutionalising were started. The General Directorate of Land Registry was established and, under laws and regulations, land registry activities were initiated (URL.1, 2016).

2.1. Land administration in Turkey

In Turkey, cadastral works are conducted primarily based on the Land Registration Law (Law Number No. 2644) and the Cadastre Law (Law Number No. 3402). TKGM is the responsible organisation for both land registration and cadastre work. The Establishment Law of the Turkish Cadastre Organisation published in 1936 outlines the basic assignments of the TKGM to determine and record the legal and geometric situations of immovable properties. TKGM carries out all land administration works through its 22 regional and 1051 local directories all around the country (URL.3, 2016) (Fig. 1).

In Turkey, the process of collecting the land registry and cadastre data all around the country was initiated in the mid-1920s and...
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