Design and Determine Cadastral and Land Management Performance of Turkey with Cadastre 2034 Vision

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Key words: Cadastre, Land Management, Cadastre 2034, GDLRC

SUMMARY

The first step of the general cadastral vision started with The International Federation of Surveyors (FIG)'s 7th Commission which deals with the subjects of Cadastre and Land Management decided that a vision should be developed for cadastre in the following 20 years period in XXth ordinary congress in 1994. Within in this scope, FIG was decided and published which is the work group completed its long-term studies and published a report named "Cadastre 2014 - A Vision for A Cadastral System in the Future" in 1998. Over time, many countries in the world have worked on the vision of cadastre 2014. One of the countries that make these studies is Turkey. Later, in 2014, the congress held in Malaysia was determined that the 2014 vision principles could not be realized on a world basis and the cadastre 2034 vision was revealed. In this context, based on the two declarations, it is expected that each country will carry out evaluations in the context of cadastral and land management according to 2034 vision.

In Turkey, there are a lot of cadastral works have been made under the leadership of the General Directorate of Land Registry and Cadastre (GDLRC). Also, a lot of academic studies should be found for Turkish cadastral and land management system. According to this, in this study, the technical, scientific and other studies that have been done so far in Turkey will be presented by a needs analysis. Based on the needs analysis and the 2034 vision, a description design for Turkey will be proposed in the context of both cadastre and land management.

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1. INTRODUCTION

LTC data has two components in Turkey; land title data and cadastral data. Land title data includes such information as the owner and ownership rights (Comert & Alkan 2004; Alkan and Comert, 2010). Whereas, cadastral data defines the location, shape and size. In Turkey these two components are handled by land title and cadastre offices which are separate state departments.
The International Federation of Surveyors (FIG)'s 7th Commission which deals with the subjects of Cadastre and Land Management decided that a vision should be developed for cadastre in the following 20 years period in XXth ordinary congress in 1994. Within the scope of this decision, the working group completed its long-term studies and published a report named "Cadastre 2014 - A Vision for A Cadastral System in the Future" in 1998. This study called as "The Vision of Cadastre 2014" has underlined the view on how cadastre will be developed and how it will look like in the following twenty years. Within the scope of determined targets, the working group reviewed the current cadastral systems for developing the vision and researching the trends on the cadastre as a first step. For this purpose, a survey was decided to prepare for determining the existing developments related to the cadastre in the world in the first year interviews of commission members. The survey form was arranged for analyzing the existing cadastral trend in the world and these surveys were conducted for many countries. Many important suggestions occurred as a result of this survey and six subjects were determined. It was agreed on six principles which are created within the public rights and integration of limitations, the activation of services, the digital format and data model, the partnership of public and private sector and the economic productivity are suggested to implement across the world (Steudler, 2006). These six principles were published as "The Vision of Cadastre 2014" by FIG in 1998.

In Turkey, there are a lot of cadastral works have been made under the leadership of the General Directorate of Land Registry and Cadastre (GDLRC). Also, a lot of academic studies should be found for Turkish cadastral and land management system. According to this, in this study, the technical, scientific and other studies that have been done so far in Turkey will be presented by a needs analysis. Based on the needs analysis and the 2034 vision, a description design for Turkey will be proposed in the context of both cadastre and land management.

2. CURRENT CADASTRAL AND LAND TITLE SYTEMS FOR TURKEY

In the current land title and cadastre system of Turkey, real estate’s such as land parcels, buildings, apartments, business offices etc. are defined with two general types of information. These types are named as “land title data” and “cadastral data” in this article. Land title data

involves ownership identities such as name, last name, father name of the owner. The date and transaction via which the ownership was obtained is also involved. In addition, ownership rights and responsibilities such as mortgages on the estate, rights of third parties on the estate are components of land title data. Cadastral data, on the other hand, determines the location in a coordinate system and the shape of the estate. At the moment, cadastral data is maintained in either analog or digital medium. In Turkey, both types of data are handled by two separate state organizations; land title offices and cadastre offices which are operated under the General Directorate of Land Registry and Cadastre belongs to the Ministry of Public Works and Settlement.

Various technical documents were produced via property cadastre and transaction of changes LTC data in the cadastre offices. Cadastral documents were archived in cadastre offices as a result of property cadastre. Other technical documents were archived in land title offices. In this part, cadastral document were explained on the cadastral archives.

Parcel Files: Parcel files were produced case of district or villages. Information paper was produced first section number start from 1 for each village or district. Thus, determine which parcel belongs to which section. Information of section, area and after and before data of parcels was shown parcel files. Parcels geometrical changes were traced via parcel files. This means that first record between last record information was also determined by parcel files.

*Table for Cadastral Block Monitoring***:** It is a table constituted to monitoring changes in sections. District based block numbers and sheet data of sections in concerned district are hold in these tables.

Parcel Dossier of Property Cadastre: It consist of boundary and survey sketches, calculations and benchmarks of triangulation points and traversings, surveys of cadastral parcels produced in property cadastre works. Parcel dossier of property cadastre is archieved as district/village and section based.

Parcel Dossier of Change Procedures: It includes all change projects produced after cadastral work and required official registration. Change projects are archieved in parcel dossiers of change procedures as district or village based. One copy of these projects is also archieved in the district office and in the land registry office.

Cadastral maps: These are the plans in which cadastral parcels is drawn in a specified scale.

There exist a number of registers in a land title office. Land title data has to be registered in these registers to become legally valid. These registers, shown on Table 1., are named as “main” and “auxiliary” registers. These registers are currently maintained manually. The function of each register is shortly explained below.

Table 1. Land Title Registers

Main registers	**Auxiliary registers**
Land title register	Owners register
Real estate register	Representatives register
Transactions register	Corrections register
Legal documents	Public owned lands register

In Turkey, land parcels are registered in the land title register while buildings, apartments, and business offices which are commonly called “independent parts” are registered in the real estate register. There is a separate page for each real estate in these registers. If the page is full then the registration goes onto another page which is maintained by a number. Land title register includes parcel and owner information and ownership rights and responsibilities. In addition to these, real estate register includes the share of the estate on the parcel it was built, and page number of the parcel in the land title register. To track the previous and next states of the real estates, there also exist “Previous” and “next” page numbers in these registers. Land title register and real estate registers are archived by district names.
Transactions register is for keeping the track of the transactions on the basis of hour and minute of the transaction. That is, any transaction on a real estate is recorded in this register by its time. Recorded information are the transaction number, the type of transaction, the hour and minute of transaction, the name and address of the person for whom the transaction is committed, the general location of the real estate, and the number of legal documents concerning the transaction. There is only one transaction register in a land title office. And transaction numbers start from “1” for each year.
Legal documents are deeds, plans, court decisions etc. related to the land title transactions. These documents are archived by district names, land title and page numbers. Owners register shows all the real estates which belong to an owner. There is a separate page for each owner. Through this, it is possible to see the previously and currently owned estates of an owner. Owners register is archived by owner’s last name. Representatives register is for monitoring the legal validity of a representative of an owner at the time of a transaction. Corrections register is for correcting the errors which may occur during registration. Public lands register is held for the lands which are subject to common use.

3. THE VISION OF CADASTRE 2014

According to the first principle of the Cadastre 2014, *"The Cadastre 2014 will indicate all legal condition of land including the public rights and limitations"*. The world population and the consumption of land have increased. The full monitoring of personal and legal existence of land have gradually limited by the public interests. In order to ensure the security for having lands, all facts related to land should be clearly realized by future cadastral systems (Kaufmann and Steudler, 1998; Yomralıoğlu et all., 2003). According to the second principle of the Cadastre 2014, *"The separation between maps and records would be abolished"*. Many countries have a land registration system that is composed of the land registries and cadastre components. Normally, surveyors conduct the cadastral part of components while lawyers and notaries conduct the land registry part of them. Two institutions related to the similar working areas were appeared as a result of this duty distinction. Within the scope of this principle, the distinction between maps and records would be removed and a structure working integratively each other would be created (Kaufmann and Steudler, 1998; Yomralıoğlu et all., 2003; Astle et all, 2005). According to the third principle of the Cadastre 2014, *"The cadastral mapping will be dead and a model which would be used in much longer terms will be replaced instead of it"*. Maps are always models. However, the usable technology doesn't let to be used the

appropriate type of models. As a result of these, there must be maps with different scales. Different scales must be shown by different data models. It will be possible with the new model developed as appropriate for the developed technology that the maps with the same data models and different scales and records in different forms would be formed. Therefore, there would not be any drawers and cartographers in the cadastral area (Kaufmann and Steudler, 1998; Yomralıoğlu et all., 2003). According to the fourth principle of the Cadastre 2014, *"The paper and pencil - cadastre will be abolished"*. With the technologic developments, computers are used in every field. Therefore, they are used in the processes of Land Registry. The modern cadastre based on technology must ensure the fundamental data model. All surveyors across the world should think in the manner of model and should obtain these models by using the modern technology (Kaufmann and Steudler, 1998; Yomralıoğlu and et all., 2003). According to the fifth principle of the Cadastre 2014, *"The Cadastre 2014 will be significantly privatized and the public and private sector would work together"*. Free economies ask flexibility in the immovable market, the land planning and land utilization. Flexibility may be ensured well by the private institutions. However, the public requirement is inevitable for necessary security as well as this. With the implementation of vision, the private sector would be important. Moreover, the public sector would focus on the monitoring and inspection. Many duties necessary for founding and maintaining a cadastral system could be realized by the private sector without threatening the registration security (Kaufmann and Steudler, 1998; Yomralıoğlu et all., 2003).

According to the sixth principle of the Cadastre 2014, *"The Cadastre 2014 will be cost-recovering"*. The cadastral system need to a great deal of investment. However, the land certificated with cadastre and guaranteed means investment. Countries are mostly carrying out the registration processes of cadastre and immovable registration and the costs necessary for founding and maintaining system are met (Kaufmann and Steudler, 1998; Yomralıoğlu et all., 2003).With the implementation of principle, the analysis cost/profit would create a important viewpoint on the cadastral reforms and implementation.

4. THE CADASTRE 2014 STUDIES AND PERFORMANCE IN TURKEY

In Turkey a lot of modernization project have been studied for cadastral and land title systems. In the following, the main work will be briefly summarized.

Turkish Land Registry and Cadastre Information System (TAKBIS): The target of TAKBIS project is to create the Turkish Land Registry and Cadastre Information System across the country and within this scope, the problems will be determined, the solutions will be found, the title deeds and cadastre services will be conducted as standard and electronic way and right, secure and updated data will be submitted to the Local Governments, the public institutions and organizations by analyzing the title deed and cadastre services within the scope of the Geographical Information System (GIS) and the Land Information System (LIS) (TKGM, 2015). As of the date 2012, all title deed directorates have started to give services. With the system working successfully, the data share is practices as online with 17 institutions. Many services such as fee interrogation, title deed interrogation are presented to the public as online with TAKBIS that is ensured its integration with E-government.

Spatial Property System (**MEGSIS)**: The Spatial Property System (MEGSIS) is an open-source application prepared by the General Directorate of Land Registry and Cadastre by conceptualizing 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 this data with shareholder institutions, organizations and municipalities and mapping services which work in the international standards and to submit the public with e-government application." Studies conducted under MEGSIS are collected as three main headings: i) Web based application software, ii) the international standards map service, iii) e-government services. Web-based application software is composed of modules consisting of the data entrance of internal and external users to the system, the data downloading, the title deeds data and the integration processes and interrogations, the control and follow-up of conducted works within the framework of the identification/authorization which ensures and directs the application to use in the different levels and needs. International standard map services, the cadastral data collected within MEGSIS is shared in standard format and its conformity to the standards specified in the Guideline of Principles of Workableness Together prepared by Open Geospatial Consortium (OGC) and DPT Information Society Department and institutions, organizations, municipalities requesting under protocols is tested with open source and commercial products. E-Government Services, collected cadastral data combined with land registry data as a map service is offered to the citizens for information purposes. These services offered by the www.turkiye.gov.tr internet address have the characteristic to be the one and only geographical service.

Land Registry Archive System (**TARBIS):** With the realization of the project, its aims such as scanning archival documents stored at Department of Land Registry Archive and Istanbul TKBM (except for foreign records) and ensuring easy access to scanned documents linked by index system of people authorized to access to archive information and documentation within the security framework of persons authorized and developing reporting functions of the information entered into digital media by the user by reviewing the original document in the archives within the scope of Title Deed Archive Automation were carried out.

Land Registry and Cadastre Modernization Project (TKMP): The aim of this 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. In 2008, the budget of the Project of Title Deeds and Cadastre Modernization signed by the World Bank and the Republic of Turkey was determined as 35 million Euro (Approximately 203 Million $).

The Map Data Bank (HBB): It is a Spatial Information System 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, updating them, submitting on the internet and therefore preventing the resource waste with the repeated map production.

Turkey's National Geographic Information System Project (TUCBS): TUCBS is an e-government project aiming at establishing the infrastructure for Geographical Information System in accordance with the technological developments at the national level (Turkish

National Geographic Information System-TUCBS) and being created a web portal by public institutions and organizations to provide the geographic information they are responsible for on a common infrastructure, creating the content standards in the manner that geographic data can meet the needs of all user institutions and determining the standards of geographic data interchange. It was conducted under the responsibility of the General Directorate of Land Registry and Cadastre.

The Licensed Topographical and Cadastral Offices (LIHKAB): In accordance with the Law No. 5368 on the Licensed Topographical and Cadastral Engineers and Offices, the practice and control of processes which are not subject to the registration and the practice responsibility of those which are subject to the registration are conducted by licensed topographical and cadastral offices. As a result of license exam which was practiced, there are 551 licensed cadastral engineers who have gained the right to open the licensed topographical and cadastral office. In our country, important projects have been developed and implemented to 2014 from 1994 in order to practice it in the direction of principles specified in "The Vision of Cadastre 2014". The relationship between each project and these 6 principles are presented with their realization percentages on the Table 2.

Table 2: The relationship between each project and these 6 principles are presented with their realization percentages

Name of Activity/Project	Start/End date	The Six Statements on Cadastre 2014					
		1- Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions	2- The separation between 'maps' and 'registers' will be abolished!	3- The Cadastral mapping will be dead! Long live modelling!	4- 'Paper and pencil - cadastre' will have gone!	5- Cadastre 2014 will be highly privatized! Public and private sector are working closely together!	6- Cadastre 2014 will be cost recovering!
Land Registry and Cadastre Information System (TAKBIS)	2005-2013	✓	✓		✓		
Spatial Property System (MEGSİS)	2011-continues		✓		✓		
Land Registry Archive Information System (TARBİS)	2005-2009		✓	✓			
Land Registry and Cadastre Modernization Project (TKMP)	2008- continues	✓				✓	
Map Data Bank (HBB)	2004-2008			✓	✓		✓
Turkey's National Geographic Information System (TUCBS) Project	2006-2011	✓		✓			
licenced mapping and cadastre offices	2005-continues					✓	
Tax and fees							✓
Applied percentages of Statements on Cadastre 2014 (in Turkey)		60-80	100	60-80	80-100	100	100

On the other hand, these studies done in Turkey and described and some advantages and disadvantages of the current state of cadastral systems analyzed. Studies with turkey cadastral respectively as assessed by swot analysis strengths, weaknesses, opportunities and threats direction was determined. Detailed information can be obtained from Polat and Alkan, 2015.

5. THE COMPARISON OF CADASTRE 2014 ACTIVITIES IN OTHER COUNTRIES WITH THE SITUATION IN OUR COUNTRY

According to a study conducted by Lononis (2014) in Greece, the first principle of Cadastre 2014 was realized in 60 % - 80 % rate; the second principle of it was realized in 100 % rate, the third principle of it was realized in 100 % rate, the fourth principle was realized in 80 % - 100 % rate, the fifth principle was realized in 40 % - 60 % and the sixth principle was realized in 80 % - 100 % (Table 3). According to a study conducted by Horňanský et all. (2014), the first principle of Cadastre 2014 was implemented in 60 % - 80 % rate; the second principle of it was implemented in 80 % - 100 % rate, the third principle of it was implemented in 80 % - 100 % rate, the fourth principle was implemented in 80 % rate, the fifth principle was implemented in 80 % - 100 % and the sixth principle wasn't implemented (Table 3). According to a study conducted by Land (2014a), the first principle of Cadastre 2014 was implemented in 60 % - 80 % rate; the second principle of it was implemented in 100 % rate, the third principle of it was implemented in 100 % rate, the fourth principle was implemented in 80 % - % 100 rate, the fifth principle was not implemented and the sixth principle was realized in 100 % rate

Table 3: Applied percentages of Cadastre 2014 Vision in some countries.

The Six Statements on Cadastre 2014	Some countries and European average				
	Turkey	Greece (Lolonis, 2014a)	Slovakia (Horňanský at al., 2014)	Sweden (Land, 2014)	European average (Lolonis, 2014b)
1- Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions	60%-80%	60%-80%	40%-60% (fulfilled only partially)	60%-80%	40%-%60
2- The separation between 'maps' and 'registers' will be abolished!	100%	100%	100% (applied fully)	80%-100%	80%-100%
3- The Cadastral mapping will be dead! Long live modelling!	60%-80%	100%	100% (applied fully)	80%-100%	100%
4- 'Paper and pencil - cadastre' will have gone!	80%-100%	80%-100%	100% (being applied)	100%	100%
5- Cadastre 2014 will be highly privatized! Public and private sector are working closely together!	100%	40%-60%	80%-100% (implemented to a considerable extent)	not applied	40%-%60
6- Cadastre 2014 will be cost recovering!	100%	80%-100%	not applied	100%	40%-%60

When the Europe average is considered, the first principle of Cadastre 2014 was implemented in 40 % - 60 % rate; the second principle of it was implemented in 80 % - 100 % rate, the third principle of it was implemented in 100 % rate, the fourth principle was implemented in % 100 rate, the fifth principle was implemented in40 % - 60 % rate and the sixth principle was implemented 40 % - 60 % rate (Lolonis, 2014a ; Lolonis, 2014b) (Table 3). When our country's Cadastre 2014 performance is evaluated, it is successful in terms of both countries in the example and the Europe average. While our country is giving an average performance in the practice of the first and third principles, it is giving an outstanding performance in the practice of the second, fourth, fifth and sixth principles. If the existing deficiencies are removed, the practice of cadastre 2034 vision will be much easier.

6. THE WORKS FOR CADASTRE 2034

There is not much detailed information when the studies about cadastre 2034 are screened all over the world. Only detailed studies are available in Australia and New Zealand (URL-1; URL-2 ; URL-3). When these studies are examined, it is seen that they define some visions in the context of cadastre 2034. They have been identified for their intended purpose. In this context, wherein after the vision and objectives in terms of what Turkey as part of cadastre and land management will be evaluated in this study can be done. The reason, detailed study and analysis is done in the context does not already cadastre in 2034 in Turkey. The work done here will be mentioned here.

The main vision of cadastre 2034 is, " A cadastral system that enables people to readily and confidently identify the location and extent of all rights, restrictions and responsibilities related to land and real property" (URL-1; URL-2). In this context, rights, restrictions and responsibilities are very important components for cadastral and land administration systems. For the future these component covered by all of the cadastral and land title information with Geographic Information Systems which is served for all of the technologic equipment's. On the other hand, design and develop land management systems need to digital cadastral database management.

The question of what the goals and results of the Cadastre 2034 concept should be, and many more are available from studies in Australia. The evaluations made here are called the strategic framework. On the other hand, the other studies pointed out cadastre 2014 six statements should be enlarged and detailed for cadastre 2034 vision. In the context of this and similar studies, it is of utmost importance that a vision is presented by the FIG and a declaration is published.

7. THE DESCRIPTION TURKEY CADASTRE WITH CADASTRE 2034

In Turkey, there are a lot of cadastral works have been made under the leadership of the General Directorate of Land Registry and Cadastre (GDLRC). Also, a lot of academic studies should be found for Turkish cadastral and land management system. According to this, in this study, the technical, scientific and other studies that have been done so far in Turkey will be presented by a needs analysis. Based on the needs analysis and the 2034 vision, a description design for Turkey will be proposed in the context of both cadastre and land management.
The Vision of Cadastre 2014 is presenting an effective model for a sustainable cadastral system. With this vision, the social and technologic dynamics to affect the land management is required to be regarded in the following 20 years (Alkan and Polat, 2017 ; Polat and Alkan, 2015).

Studies conducted in the context of cadastre in Turkey in 2014, was evaluated around the concept of six statements. It has been observed here that large requirements are provided. It also has important aspects in terms of land management. The International Standard for Land

Administration (LADM), an international standard, has made an important contribution to the understanding of the importance of data modeling in the field of land management. The LADM supports the implementation of Cadastre 2014 and demonstrates the full legal status of the land, including public rights and restrictions. The LADM states that today most spatial / spatial units are represented as 2D, but there is a growing demand for 3D representation in the future.

The studies and analysis requirements according to Turkey's main objectives cadastral surveying in 2034 in the context of the framework provided by the 2014 principles are described herein. These goals and outcomes are given in the Table 4.

Table 4. General Framework of Cadastre 2034 and Land Administration for Turkey

	1	2	3	4	5
Goals	Sustainably Managed for Cadastral Systems	To Make an Accurate and Object Oriented Cadastral Sytems	Definitions Rights, Restrictions and Responsibilities (RRR)	3D / 4D Cadastre Models for Real Word	Real-Time Cadastre (Accessible / Update / Interoperability)
Outcomes	Optimise general cadastral data model, standards and NSDI	Fix Parcel Boundaries, Upgraded to Survey-Accuracy, All of the Object Should be Defined Accurately	Integrated RRR	3D /4D Model for Real Cadastre Sytem, Legislation for 3D /4D Cadastre	Accessed and Updated Cadastre and Land Title Information, Interoperable Cadastre at Any Time

Matching and updating in the LADM dimension must be done and considered in the design for these purposes. This is important in the context of LADM and cadastral association and modeling of LADM.

8. CONCLUSION

Although the property rights on the immovable property is under the state guarantee in our country, all legal conditions related to the property aren't completely reflected depends on the cadastre 2014 six statements. Many projects carried out in our country are valuable and important in the context of cadastre 2014. On the other hand, the criteria for cadastre 2034 should be put forward and the studies in this context should be carried out by GDLRC. In the light of these explanations, the general goals and outcomes for cadastre 2034 have been realized by taking the studies done in this world and our country in this study.

In this study, from past to present Turkey cadastral system and studies were evaluated in general. These evaluations have been examined and examined especially in relation to the cadastre 2014 and its vision which have been put forward for years. On the other hand, outcomes were obtained from all these studies and objectives and requirements for cadastre

2034 vision were given. In the studies that will continue the findings made here should be used in a wider perspective and new and timely models should be presented. In this case, it is important not only in terms of the cadastral system and integration of the entire world is not Turkey. In this context, relevant institutions and organizations should make all the aims and all necessary detail inferences in the context of cadastre 2034 vision and a general model should be introduced.

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URL-3, https://www.linz.govt.nz/land/surveying/survey-system/cadastre-2034

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