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General Evaluation of Cadastre of Turkey in the Framework of Cadastre 2034 Vision: Sarioglan District/Konya

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1.INTRODUCTION

Land has been the basis of ownership since the beginning of the existence of mankind. No piece of land has lost its importance in any period in history and it has always been so significant that it caused wars. For this reason, the concept of cadastre which arises from the need of ownership over time has passed through various stages up to day.

Figure 1/a. Egyptian Surveyors

1.INTRODUCTION

FIG PUBLICATION NO. 11

FIG Statement on the Cadastre

In the Cadastre Report published by the FIG in 1995, the definition of cadastre is as follows: **"A Cadastre is normally a parcel based, and up-to-date land information system containing a record of interests in land (e.g. rights, restrictions and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of the interests, the ownership or control of those interests, and often the value of the parcel and its improvements."**

1.INTRODUCTION

According to Enemark (2012), the concept of cadastre is difficult to identify. **It may be designed in many different ways, depending on the origin, history and cultural development of the region or country. Basically, a cadastre as such is just a record that identifies the individual land parcels/properties. The purpose of this identification may be taxation or it may be security of land rights.** Today, most cadastral registers around the world are linked to both the land value/taxation area and the area of securing legal rights in land.

1.INTRODUCTION

In Turkey and all over the world, the view and the conception on land and cadastre has changed dramatically over the last few centuries. As it can be seen in figure 1, **the land, which was a means of wealth first, then gained the properties of being a commodity, then a scarce resource, and now a social scarce resource; has turned into financial instruments from simple property registers and has become the cornerstone of planning with immovable property markets (Cagdas and Gur, 2003).**

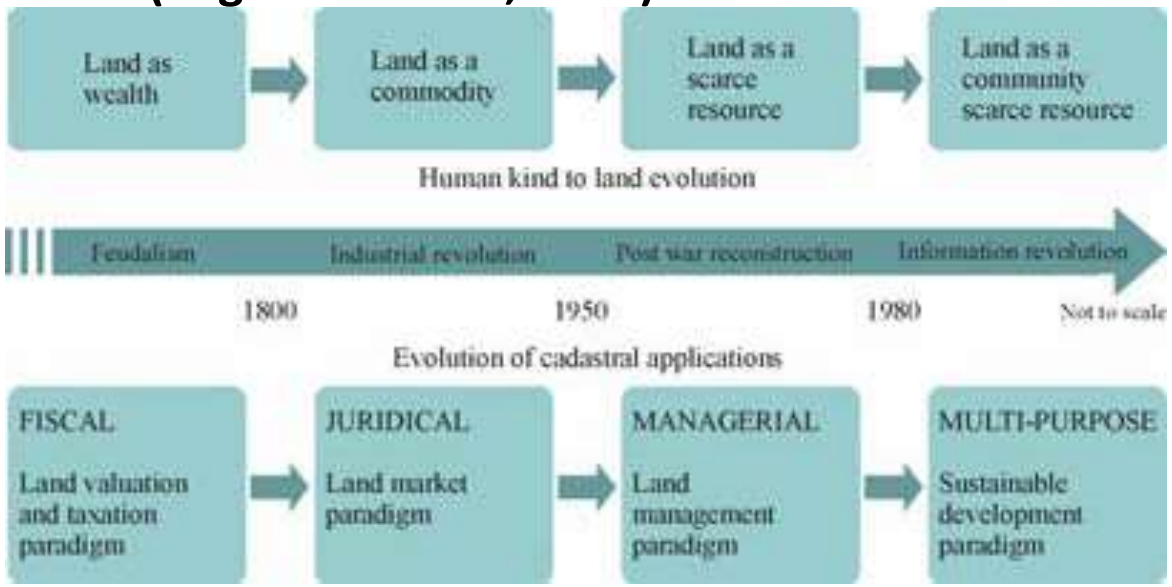

Figure 1. Development of cadastre in the world and Turkey (Enemark, 2001)

1.INTRODUCTION

After the 1990's, since modern cadastral theories such as multipurpose cadastre have begun to be discussed due to the increase of cadastral anticipations and a lot of work has been done in this respect. Some of these;

- In the congress organized by FIG in 2010 in Sydney (Australia), **Bennett and his colleagues presented Cadastral Futures: Building a New Vision for the Nature and Role of the Cadastres** (Bennett et al., 2010),
- **An article by Mathias Lemmens**, compiled by international experts on this subject and consisting of two parts **named Toward Cadastre 2034**, was published in the GIM International magazine (Lemmens, 2010; Lemmens, 2010a),
- Don Grant and his colleagues presented A New Zealand Strategy for Cadastre 2034 Report at the FIG Congress in 2014 in Kuala Lumpur (Malaysia),
- Cadastre 2034 A 10-20 Year Strategy for Developing the Cadastral System: Knowing the Where of Land-Related Rights (LINZ, 2014) Report published by Land Information New Zealand,
- Cadastral Reform and Innovation for Australia - A National Strategy (A Vision for Cadastre 2034) Report (ICSM, 2015) published by Australia Intergovernmental Committee on Surveying and Mapping,

As a result of these studies, Cadastre 2034 Vision and principles have begun to be clarified.

In this paper a general evaluation of the Cadastre of Turkey in the framework of Cadastre 2034 Vision and principles is made and the current situation is emphasized. The cadastral structure of Sarioglan District is selected as case study and examined from past to present problems, detections and suggestions are explained.

2.CADASTRE 2034 VISION

2.1. Principles of Cadastre 2034 Vision

After 1980's the requirements for land management, on the axis of sustainable development, and technological, social and economic changes emerged in the world, necessitated the restructuring of the traditional cadastre towards the land administration and the discussion of the modern cadastre concepts (Cagdas and Gur, 2003). **Many studies have been done by scientists in the framework of Cadastre 2034 Vision. As a result, principles called Principles of Cadastre 2034 Vision have emerged. These:**

1.Survey-Accurate Cadastre
2.Object-Oriented Cadastre
3.3D/4D Cadastre
4.Real-Time Cadastre
5.Global Cadastre
6.Organic Cadastre

2.CADASTRE 2034 VISION

2.1. Principles of Cadastre 2034 Vision

2.1.1.Survey-Accurate Cadastre

It means that land boundaries are measured at high accuracy (sub-centimeter accuracy) to ensure compatibility of land and cadastral maps. Many applications of the cadastre will require survey accuracy: building management, utility administration, infrastructure organization, precision farming, some navigation applications and sea-level rise response all require such accuracy (Figure 2) (Bennett et al., 2010).

Figure 2. Accurate measurement and display of the cadastre.

2.CADASTRE 2034 VISION

2.1. Principles of Cadastre 2034 Vision

2.1.2.Object-Oriented Cadastre

The development of an object-oriented cadastral understanding should be adopted instead of a parcel-based cadastre in order to re-define and legally define all rights, restrictions and responsibilities of land use to meet today's needs (Figure 3) (Polat and Alkan, 2015; Bennet et al., 2010).

Figure 3. Not all property interests fit in the parcel framework: object-oriented design is required.

2.CADASTRE 2034 VISION

2.1. Principles of Cadastre 2034 Vision

2.1.3.3D/4D Cadastre

Incorporating height and time into cadastral frameworks will be essential: proliferation of property interests and sustainability analysis require modelling and visualisation of the third and fourth dimensions (Figure 4). Technological advancements will enable traditional 2D cadastres to be extended to the new dimensions. Administrative friction caused by misinformation and poor understandings of property interests will be dramatically reduced. Consequently, planning and development times will be greatly reduced (Bennet et al., 2010).

Figure 4. 2D approaches do not enable the complete legal situation on land to be easily understood, for this, need 3D/4D cadastre.

2.CADASTRE 2034 VISION

2.1. Principles of Cadastre 2034 Vision

2.1.4.Real-Time Cadastre

Future cadastres will be updated and accessed in real-time. Emergency management, property market management and navigation tools require cadastral information to exhibit this quality. Currently, cadastral and owner information update processes may take weeks or months (Bennet et al., 2010).

Figure 4/a. Providing real-time access to the cadastral data

2.CADASTRE 2034 VISION

2.1. Principles of Cadastre 2034 Vision

2.1.5.Global Cadastre

Future cadastres will have the capacity to link into regional and global cadastral networks. Interoperable cadastral systems appear to offer a method for integrating and better understanding the relationship between land markets (Figure 5). Environmental management also requires integration of cadastral systems at regional and global levels: environmental problems and concerns are often spread over multiple jurisdictions (Bennet et al., 2010; McDougall et al., 2013).

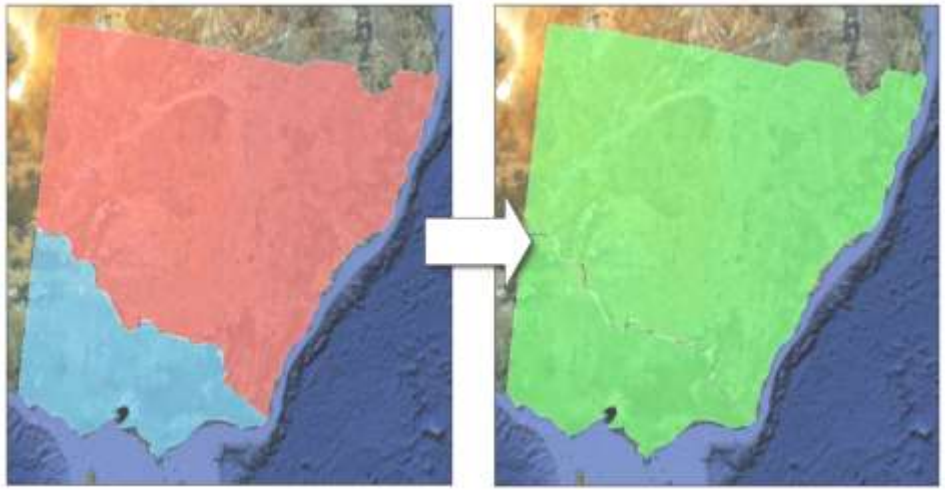

Figure 5. Cadastral systems will become interoperable allowing management of economic and environmental concerns at regional and international level.

2.CADASTRE 2034 VISION

2.1. Principles of Cadastre 2034 Vision

2.1.6.Organic Cadastre

Cadastres will better model the organic natural environment (Figure 6). Many new property interests are designed around natural phenomena, rather than the strict bearings and distances or Cartesian coordinates found in traditional land parcels. For example, many interests in the marine environments exhibit fuzzy and changeable boundaries (Bennett et al., 2010; Grant et al., 2014).

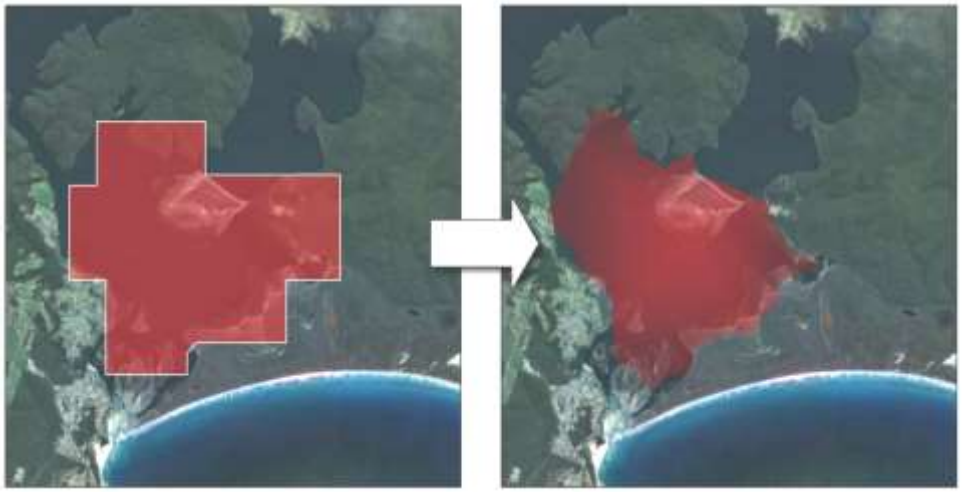

Figure 6. Future cadastres will better model the organic natural environment.

3.TURKEY CADASTRE

In Turkey, the first cadastral survey of the Ottoman Empire period in 1912 had begun with Law on Land Registry and Cadastre but was suspended because of war. After the proclamation of the Republic, Land in Artvin, Ardahan, Kars Provinces with Kulp, Iğdır, Hopa and Kemalpaşa Districts about (Law No. 474 dated 1924) **cadastral works had begun again. Today, cadastral surveys are carried out according to Cadastre Law** (No. 3402) (Yurdakul, 2017). **Turkey's first/basic cadastral works is seen in table 1.**

Figure 7. Piri Reis's World Map (1513)

3.TURKEY CADASTRE

Table 1. Turkey's district and village current cadastral situation (GDLRC, 2017)

	District		Village		Total (District + Village)	
Total Number of Units	18784	Rate	33265	Rate	52049	Rate
Total Number of Finished Units	18721	99,66 %	32857	98,77 %	51578	99,10 %
Number of Ongoing Units	30	0,16 %	76	0,23 %	106	0,20 %
Number of Problematic Units	33	0,18 %	332	1,00 %	365	0,70 %

3.TURKEY CADASTRE

With the completion of the cadastre by GDLRC (General Directorate of Land Registry and Cadastre), it is carried out in various projects such as;

- **Land Registry and Cadastre Information System** (LRCIS-TAKBIS: Tapu ve Kadastro Bilgi Sistemi),
- **Spatial Property System** (SPS-MEGSIS: Mekânsal Gayrimenkul Sistemi),
- **Tusaga-Active System** (Turkey Constant GNSS Network),
- Land Registry Archive Information System (LRAIS-TARBIS: Tapu Arşiv Bilgi Sistemi),
- Registry and Cadastre Modernization Project (LRCMP-TKMP: Tapu ve Kadastro Modernizasyon Projesi),
- Map Information Bank (MIB-HBB: Harita Bilgi Bankası) and
- Turkey National Geographical Information System (TNGIS-TUCBS: Türkiye Ulusal Coğrafi Bilgi Sistemi).

3.TURKEY CADASTRE

3.1. The Problems in Turkey Cadastre

Cadastral works in Turkey was completed with approximately 97 % in 2010 (GDRLC, 2017c). However, cadastral works, which have been produced since 1912, have been produced numerically since the 1970s. Some of the cadastral maps produced some uncoordinated graphic maps (produced linearly) and some of them are produced in the local coordinate system and for these reasons, there are some problems in it.

Some of general problems experienced in Turkey Cadastre can be listed as follows:

- **There is no altitude information. Therefore, the three-dimensional data associated with the data in the map is not easy and economical.**
- **Due to differences in scale, type of pads, production technique and coordinate systems, it is difficult for the stations to be associated with themselves and with other usage areas.**

3.TURKEY CADASTRE

3.1. The Problems in Turkey Cadastre

- **The purchase and sale values of the immovable property do not reflect their real values in terms of land title. In this case, the State causes the tax loss.**

- Land registry and cadastre information constitute the basis of all investment and engineering services related to land. However, since this information cannot be integrated with other information about the land and spatial information systems cannot be created, many areas cannot be used in these areas and resources are wasted due to the repetition of data on production activities made by various institutions throughout the country (Durduran et al., 2007).

3.TURKEY CADASTRE

3.2. Eveluation of Turkey Cadastre in the Framework of Cadastre 2034 Vision

- **With the survey-accurate cadastre direction,** cadastral measurements should be made below the centimeter. Because this data is used as basic data in many professional disciplines. It can be stated that the **present cadastral works are provided with satellite and GNSS technology and this measure is provided by a few centimeter accuracy measurements.**

- With object-oriented cadastre direction, the objective is to define all rights, restrictions and responsibilities of cadastral parcels during and after cadastral construction in order to meet the needs of today and cadastral works are done in this concept light. **The registration of all rights, restrictions and responsibilities above and below the cadastral parcels to land registers. It is observed that completed in cadastral works in Turkey in 2010 the measurement and registration of these rights is partially done.**

3.TURKEY CADASTRE

3.2. Eveluation of Turkey Cadastre in the Framework of Cadastre 2034 Vision

- With 3D/4D cadastre direction, although the task of establishing the infrastructure of the spatial information system of the country is within the GDLRC in accordance with the Cadastre Law No. 3402, **the cadastral works are limited to two dimensions and the concepts of height and time in the third and fourth dimension seems to have been neglected.**

- **With real-time cadastre direction, it is necessary to update the cadastre instantly and provide access in real time. With the MEGSIS project made by GDLRC, it is possible to access instant cadastral data and as well as update studies are also carried out (GDRLC, 2017b).**

3.TURKEY CADASTRE

3.2. Eveluation of Turkey Cadastre in the Framework of Cadastre 2034 Vision

- **With the global cadastre direction, integration of cadastral systems at regional and global level is required. In this respect, the coordinate system used in Turkey Cadastre** (ITRF: International Terrestrial Reference Frame) **can be integrated into international networks and cadastral systems.**

- With the organic/natural cadastre direction, it should contribute to the modelling of natural environments such as marine environments, flora and fauna. In this respect, cadastral data should be shared with relevant institutions in order to be basic data for all projects. GDLRC shares cadastral information with all relevant institutions.

3.TURKEY CADASTRE

3.2. Eveluation of Turkey Cadastre in the Framework of Cadastre 2034 Vision

Turkey Cadastre can be summarized as seen in table 2, the result of the general evaluation in the light of principles of Cadastre 2034 Vision described above details. **Turkey Cadastre is at a good level and 3 principles that are fully provided, the other three, they are in the well, middle and poor levels are evaluated.**

	Principles of Cadastre 2034 Vision	Bad	Middle	Good	Very good
1	Survey-Accurate Cadastre				*
2	Object-Oriented Cadastre		*		
3	3D/4D Cadastre	*			
4	Real-Time Cadastre			*	
5	Global Cadastre				*
6	Organic/Natural Cadastre				*

Table 2. General evaluation of Turkey Cadastre in the framework of Cadastre 2034 Vision

4.CASE STUDY: SARIOGLAN DISTRICT

Sarioglan District is a village/district depend on Bozkir County of Konya Province and has a population of about 2,200. **The first cadastral studies that began in the 1930's have importance for the analysis of the development of cadastral works in Turkey (Figure 8).**

Figure 8. Study area: Sarioglan District

4.CASE STUDY: SARIOGLAN DISTRICT

- The first cadastral works had began in the 1930's,
- **Works were finalized in 1934 and created the cadastral map in figure 9.**
- These studies were carried out in accordance with Cadastre Law No. 658 dated 02.05.1925 and **as a result of the studies 137 cadastral parcels were made measurement and registered.**

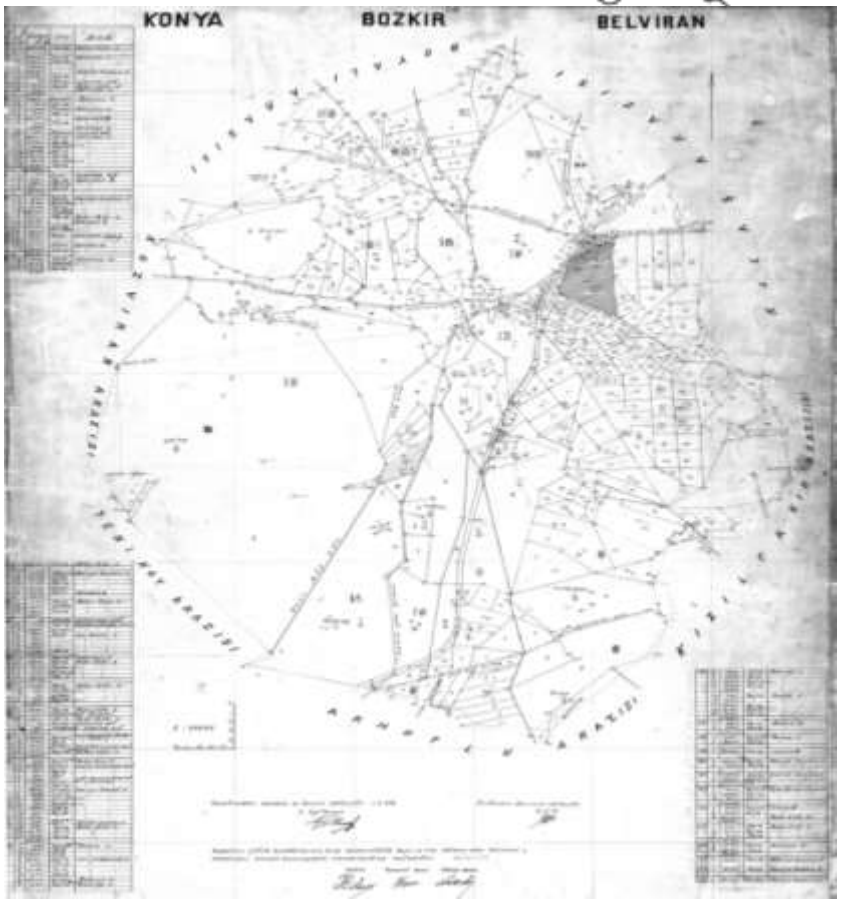

Figure 9. Cadastral map of Sarioglan District (1/10.000 scale), (1934)

4.CASE STUDY: SARIOGLAN DISTRICT

- **In 2017, a renewal project was implemented by GDLRC** within the scope of sub-article (a) of article 22 of the Cadastre Law No. 3402 **and the works were completed in January 2018.**
- **As a result, from the year 1934 to the present day, 137 parcels became 375 parcels** with parcelling, expropriation and similar applications (Figure 10).
- **However, it is seen that the number of parcels formed by the physical use of land, such as external sales, heritage and transfers between the people, reaches about 3600 and these changes cannot be reflected in the cadastral map and land registry.**

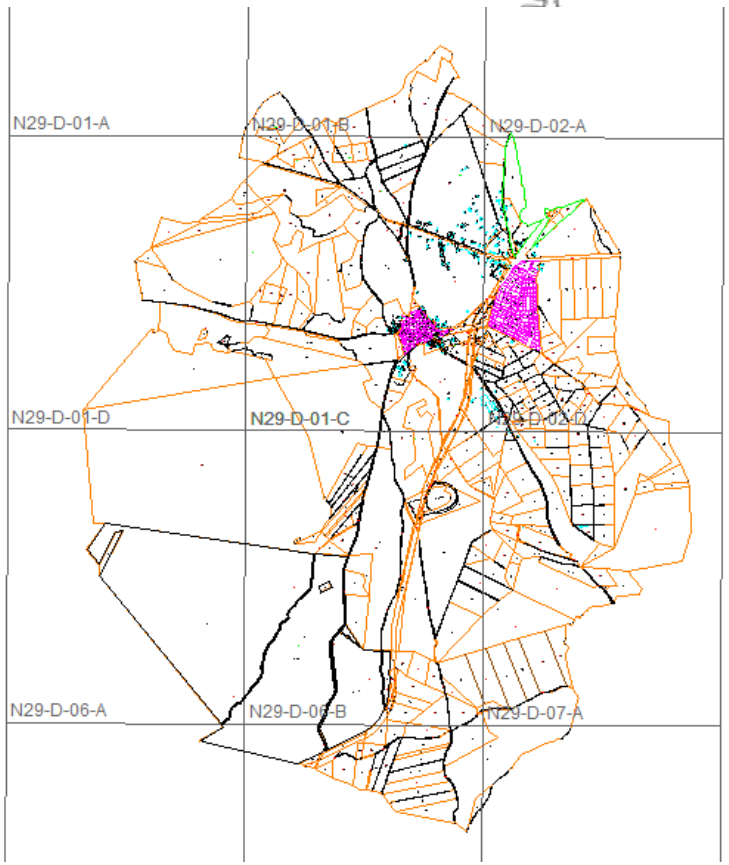

Figure 10. Cadastral Map of Sarioglan District after renewal project in scope of sub-article (a) of article 22 of the Cadastre Law No. 3402 (2018).

4.CASE STUDY: SARIOGLAN DISTRICT

Briefly evaluated in terms of principles of Cadastre 2034 Vision, the following can be said:

- **With today's GNSS technologies, land boundaries are measured in high accuracy and global coordinate systems, but these measurements are not evaluated to allow for 3D/4D modelling.** The obtained measurements should be able to evaluate the digital terrain models (3D/4D terrain models) needed/required areas.

- It can be said that all the rights, restrictions and responsibilities that parcels have during recording are partly recorded. However, **there is a special case here in Sarioglan District and the actual users of the land cannot be reflected in the land registry records. Resulting from the cadastral legislation in Turkey, in other words, because it does not allow the second cadastre of Cadastre Law (No. 3402), this problem cannot be resolved. Consideration should be given to the enactment of the cadastral renewal and updating law concerning the resolution of these problems.**

5.CONCLUSION AND RECOMMENDATIONS

In this study, by explaining the current situation of Turkey Cadastre and problems experienced, we make a general assessment in terms of principles of Cadastre 2034 Vision. We also put forward the deficiencies need to be fixed in cadastral surveys and observed in Turkey Cadastre is at a good level in terms of principles of Cadastre 2034 Vision.

GDLRC has been currently carrying out projects such as digitization projects and cadastral map and information updating projects within the scope of sub-article (a) of article 22 of the Cadastre Law No. 3402. Taking into account the changes that the cadastre concept has undergone over the last two decades, **it will be more useful to make the cadastre redefinition in the light of the principles of Cadastre 2034 Vision and to carry out future work in line with this vision.**

5.CONCLUSION AND RECOMMENDATIONS

The work to be done in order to make all the rights and restrictions on the land of cadastral works to be suitable for all information systems with a concept that uses geographic information technology and provides cost recovery should be evaluated within strategic planning (Durduran et al., 2007).

However, it should not be forgotten that cadastral systems of the future should be evaluated together with environmental, energy, environmental management, land management/administration, technology, information systems, globalization, urbanization, good governance, climate change and, most importantly, sustainable development.

Thank you

for your attention…

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