Re-engineering of Turkish land administration

M. Cete^{*1} and T. Yomralioglu²

The role assigned to cadastral systems has evolved over time from supporting taxation to assisting the land market, land management and sustainable development. This change has forced countries to re-engineer their traditional cadastral systems into land administration systems. Governments need to develop their own solutions in the re-engineering process for their own circumstances. In this context, this paper examines the findings of academic research carried out to analyse the efficiency of the current Land Administration System (LAS) in Turkey and then to develop a new vision for the future of the Turkish LAS. The analysis shows that there is a need for re-engineering the Turkish LAS. The main characteristics of the vision, inspired by the case study research carried out in some European countries and the statements of some well known international reports, are a land law, a leading institution and a land information system.

Keywords: Land registration, Cadastre, Real estate valuation, Land administration, Re-engineering, Turkey

Introduction

Cadastral systems have played several roles in western history primarily based on changes in humankind and land relationship. During the agricultural revolution and feudal system, land was a main symbol of wealth, and the cadastre recorded land ownership in this period. Cadastres became a tool to support land transfer and land markets during the Industrial Revolution when a process of strong physical ties to the land began. The post-World War II period with population boom created awareness that land was a scarce resource. Western countries preferred to address the scarcity with better planning in this period, and cadastre supported the planning process. Finally, in the 1980s, the focus was on wider issues of environmental degradation, sustainable development and social equity. Thus, land became a 'scarce community resource'. This forced the extension of cadastres into land administration systems and infrastructures [31], [42], [6], [27], [4].

Land Administration System (LAS) is defined by the UNECE [35] as 'the processes of determining, recording and disseminating information about the tenure, value and use of land when implementing land management policies'. It includes land registration, cadastre, and land information systems, and in many systems information supporting land use planning and land taxation systems [6], [43], [14], [2]. Traditional cadastral systems need to be re-engineered to include these components, and must be evolved from their market focus to an additional facilitative role for multipurpose spatial information infrastructures in order to support the implementation

of sustainable development objectives [34], [14], [42], [6], [40], [24], [5]. In this context, the evaluation of national land administration systems has become more and more of an issue of concern over the last few decades worldwide, with no indication of a slowing down of the evaluation process [43], [27], [25], [40], [24], [22].

With experience of more than 160 years in cadastre, Turkey is one of the countries carrying out some reform projects, especially since the 1980s, to ensure improvement in the system, and to address the current and future needs of cadastre. However, an overall evaluation of the national LAS has not been performed yet in the country. Therefore, a doctoral study was carried out to analyse the overall efficiency of the current land administration system, and to develop a new vision for the future Turkish LAS. This paper aims at summarising the results of this study.

Methodology

Currently, there are no internationally accepted methodologies to evaluate the performance of LASs and to develop an efficient national LAS vision [28], [1]. Therefore, a research design using a number of standard methods together was structured at the beginning of the study (Fig. 1). Ali et al. [1] states that success of a LAS depends on technical, legal and organisational aspects. In this context, an analysis of current Turkish land administration regulations and institutions as well as the works carried out by these institutions was performed as an appropriate LAS can be built with a clear understanding of existing land administration issues and directions [42], [19]. Then, semistructured interviews which are one of the most common data collection methods [1], [26] were conducted with 63 land administration experts to research the efficiency level of the current LAS in Turkey, the issues experienced in land related works and the proposals of the experts regarding solutions to the issues. The experts interviewed were

¹Department of Geomatics, Faculty of Engineering and Architecture, Izmir Katip Celebi University, Izmir, Turkey ²Department of Geomatics, Faculty of Civil Engineering, Istanbul Technical University, Istanbul, Turkey

^{*}Corresponding author, email mehmet.cete@ikc.edu.tr





senior managers or those with the most experience in the land administration domain.

Analysis of the current situation of the Turkish LAS clearly showed the need for re-engineering the system. Therefore, the second step of the study was aimed at researching good practices in LASs to provide comparisons with good working systems elsewhere as well as to get inspiration to use in the development process of the Turkish LAS vision. Similar to the case in many other research studies carried out in land administration domain [1], [26], case study approach was used during this research. German, Dutch, Danish and Swiss LASs were examined as case studies of good practice through literature research and 26 semistructured interviews carried out with LAS experts in these countries. In addition, some reports published by such international organisations as the United Nations (UN), the European Union (EU) and the Federation of International Surveyors (FIG) on LASs were examined to find out proven and internationally accepted principles in the domain.

In the last step of the study, first, a draft vision for the Turkish LAS was developed by taking into consideration all the findings of the studies performed in the first and second steps in order to improve the overall system. Then, the vision was discussed with some senior managers in the land administration institutions and with academicians working in the land administration realm in the country, and finally, it was revised, improved and justified by the same experts.

In brief, the study, the results of which are presented in this paper, was carried out in three main steps: (1) evaluation of the efficiency of the current Turkish LAS; (2) examination of some European countries' LASs and reports published by international organisations on LAS; and (3) development and improvement of a vision for the Turkish LAS.



² Organisational framework of Turkish Land Registry and Cadastre System [32]

The Turkish land administration system: background

This section describes the current state of and issues relating to the Turkish LAS, as a background, in three subsections: (1) land registration and cadastre; (2) mapping; and (3) real estate valuation, and then stresses the need for re-engineering the Turkish LAS.

Land registration and cadastre

In Turkey, cadastral works are performed mainly based on the Land Registration Law, and the Cadastre Law. In addition to these, there are more than 30 laws and regulations including some decrees relating to this area [9]. The responsible organisation for both land registration and cadastre is the General Directorate of Land Registry and Cadastre (GDLRC) in the country. The GDLRC carries out its work via the District and Local Directorates of Land Registry and Cadastre (Fig. 2). Except for the technical part, all cadastre works are carried out by local cadastral directorates. The technical part of the cadastre can be contracted to private surveyors. Recently, a new system of licensed surveyors and licensed surveying offices is under construction in the country. By this way, the GDLRC is transferring almost all cadastre work to licensed surveying offices. From now on, licensed surveyors will have authorisation both to carry out and control the cadastre works that are not registered into the registry. Works requiring registration will also be performed by licensed surveyors, but the control of such works will be carried out by directorates of cadastre. The GDLRC established an examination for the licensing of surveyors in the late 2009, and nowadays licensed surveyors are allocated to about 550 cadastral districts throughout the country [11].

In Turkey, work to build a land registry and cadastre system throughout the country was initiated in the mid-1920s, and almost completed by the beginning of 2010 in an approximate area of 560 000 km² through about 35 million land parcels [44]. The active involvement of the private sector in the cadastre that took place after 2004 speeded up the work and helped in its completion. The cadastre maps produced between 1925 and 2010 do not have a standard structure as they were produced with different coordinate systems, scales, surveying methods, position accuracies and sheet types over the years. Moreover, about half of the maps do not have a coordinate system because they were produced using graphical method in which parcel corner coordinates are

surveyed with chain surveys based on the polygons that exist on the ground but have no coordinate values [12]. Therefore, they do not meet today's needs, and more than half of current cadastral maps need to be renewed.

The GDLRC is presently carrying out several projects both to make cadastral services more effective and to transform cadastral maps into a digital environment in a legally binding form. One of them is the Land Registry and Cadastre Information System (in Turkish, Tapu Kadastro Bilgi Sistemi or TAKBIS) Project. The project, initiated in 2000, aims mainly to transfer paper based land registry and cadastre data into a digital environment using a standard framework throughout the country. It is planned to be implemented in three phases: TAKBİS-I, -II and -III. Consisting of the analysis, design and test stages, TAKBIS-I was initiated in 2001 and completed in 2005. Then, the implementation stage, called as TAKBIS-II, was initiated in 2005. TAKBIS-II aims to expand the implementation of the project in predefined directorates of land registry and cadastre. The last stage, TAKBIS-III, aims to finalise the extension of TAKBIS to all GDLRC units and enable cadastral data sharing with other organisations [10].

The TAKBIS-II phase, which is still in progress, has shown that digitising land registry records is easy to implement. It is not easy to say the same thing for the existing analogue cadastral maps of the poor quality. Therefore, the GDLRC initiated a new project in 2008 called the Modernisation Project of the Land Registry and Cadastre. The main aim of the project is the renovation and updating of current analog cadastral maps as a base to TAKBIS and the National Land Information System.

The problems experienced in the Turkish cadastral system are not only related with the analogue cadastral maps but also with inaccuracy of some records in the land registry. For instance, in the registry, the owners of some real estates are dead people because there is no regulation or encouragement for the compulsory transfer of real estates to heirs when a landowner dies [7]. Also, the use types of some parcels in the registry are not up to date because landowners are not legally obliged to inform the land registry office when the use type of a parcel is changed. Cadastral maps also have similar problems. Some roads and buildings on the cadastral maps are not up to date because there is no dynamic or periodic updating process for Turkish cadastral maps. Thus, there is a need to develop an updating system for both the land registry and cadastre records to make them more accurate.

Setting up the National Geographical Information System Project of Turkey is another main task recently assigned to the GDLRC. Nowadays, the General Directorate is trying to prepare an infrastructure for the project. The main aims of the project are (1) to build a geographic information portal to provide a common platform for the geographic data produced by different institutions; (2) to form standards for map contents; and (3) to determine exchange standards for geographical data [**32**].

Mapping

In Turkey, maps in different scales are produced by different institutions in accordance with more than 10 laws and regulations (Fig. 3). While authorisation for maps scaled between 1:25 000 and 1:1 000 000 is



3 Authorised institutions for map productions in Turkey

designated to the Turkish General Commandership of Mapping (GCM), the production of maps with a scale of 1/5000 is under the responsibility of both the GCM and the GDLRC. Cadastral maps which are generally drawn in the scale of 1:1000 are also produced by the GDLRC. As for topographical and technical maps scaled 1:1000, many government institutions have the authority to produce them.

This structure results in some duplication problems in production. While there is no duplication in maps scaled between 1:5000 and 1:1 000 000, and in the cadastral maps, the same thing cannot be said for maps with a scale of 1:1000. The lack of an appropriate coordination system in the responsible institutions for this scale causes duplications in production. Therefore, the GDLRC initiated a project called the 'Information Bank of Maps (IBM)' in late 2005 in order to prevent duplications by providing online coordination. The institutions producing maps log into the system developed in the context of the project, and enter the metadata of their own maps. Thus, an institution needing a map for a specific district enters the system, and conducts a search to find if a map is already available in another institution.

Real estate valuation

There is no specific law and/or regulations outlining the rules of real estate valuations in Turkey. The principles of such works are described in more than 10 laws and regulations. The Expropriation Law and the Taxation Law, dated 1983 and 1970 respectively, are the main laws used for valuation works [45]. Beside these laws, some new regulations about licensing appraisers, building up licensed valuation offices, etc. were enacted in 2001 and 2007 for works carried out by the Capital Markets Board of Turkey (CBMT).

As for the organisational structure of real estate valuation, about 20 different institutions have the authority to make valuations in Turkey. Except for the CMBT, all the institutions work through real estate valuation commissions. A commission is made up of selected officials from the institution that needs real estate values for the purpose of taxation, expropriation, nationalisation, etc. The officials do not have to have a license to sit on these commissions. Only in valuations carried out for expropriation, a certificate is needed. This certificate is given by the chambers attached to the Union of Chambers of Turkish Engineers and Architects. As for the CMBT, it needs valuations for capital market activities, and asks for a license from the appraisers. The only institution authorised to license real estate appraisers in Turkey is the CMBT.

Evaluation of Turkish LAS

The Establishment Law of the Turkish Cadastral Organisation outlined the main duties of the GDLRC as the determination and recording of the legal and geometrical situations of real estates in 1936. The General Directorate has tried to fulfil this main duty since then but has failed to execute it in the proper sense as proved in the 'Land registration and cadastre' subsection. Moreover, a number of new duties, some of which are given in the same subsection, have been recently given to the GDLRC in addition to these main duties. In brief, constituted with appropriate legal and organisational frameworks in the 1930s, the Turkish cadastral system has not been maintained efficiently, and today, it is in need of re-engineering to fulfil all the tasks assigned to it properly.

There is no leading institution responsible for the mapping domain in Turkey. The Turkish GCM authorised to produce maps scaled between 1:25 000 and 1:1 000 000 has only a central unit in the capital city of Ankara. This means the GCM does not have district and/or local units. Therefore, it is not easy for it to produce and update all the maps throughout the country covering about 780 000 km². Many organisations produce maps in the scale of 1:1000 with no appropriate coordination. In summary, there is also a need for comprehensive re-engineering the Turkish mapping domain.

Real estate valuation is one of the most problematic domains within the Turkish LAS. Appropriate regulations defining the rules of valuation, and a leading institution responsible for managing the valuations carried out in the country are not available. Many valuations are performed by commissions the members of which do not have a license. Therefore, it is essential that the real estate valuation system of the country is re-engineered.

These needs for re-engineering each domain of land registration, cadastre, mapping and real estate valuation clearly show that comprehensive re-engineering and redesign is needed in the Turkish LAS to build up and maintain the system in a holistic and an appropriate manner.

Case study research

Experiences are valuable lessons both for the people who experience them and for others. They give hints about whether things or events made in the past are right or not; they also provide lessons about how to do things better in the future. Therefore, studying the experiences of several countries during LAS design is of vital importance to develop a new system more successfully. This section summarises the findings of the studies carried out on some European countries' LASs to learn from their experiences.

Choice of the case study countries

Similar to the case in an Australian project carried out to incorporate sustainable development objectives into Information and Communication Technologies enabled land administration systems in the country [40], Germany, The Netherlands, Denmark and Switzerland were chosen as the case study countries in this study. Some of the reasons for the choice can be summarised as follows:

- Germany: the tight interaction between Turkish and German land registration, cadastre and mapping systems, and appropriate structure of German LAS
- (ii) The Netherlands: the developments recently experienced in Dutch land registration, cadastre and mapping systems in both organisational and technical means, and the Dutch real estate valuation system being re-engineered in the near past
- (iii) Denmark: a long real estate valuation history with Scandinavian characteristics
- (iv) Switzerland: similar characteristics between Turkish and Swiss land management systems as the Turkish Civil Code is based on the Swiss Civil Code, and the recent developments experienced in the context of the 'Cadastre 2014' in Switzerland.

Main outcomes

Case study research carried out via interviews and literature search provided valuable information on the LASs of the countries studied. The main outcomes are summarised below.

Land registration, cadastre and mapping

While the rules of land registration are generally identified in the Civil Code and the Land Registration Law in the case study countries, cadastre and mapping activities are organised under the Cadastre Law and the Mapping Law. In other words, unlike the Turkish case, cadastral and mapping rules are covered by a few laws in the countries studied. Besides this general characteristic, Switzerland experienced a remarkable development in the legal mean about 5 years ago. The country enacted the Geoinformation Law to gather the scattered cadastre, mapping and geographic information related laws as well as those of the Federal Office of Topography (Swisstopo).

Land registration and cadastral works that need to be carried out in an integrated manner are performed under the responsibility of different ministries in Germany, Denmark and Switzerland (Table 1). This is not only due to insufficient relations caused by historical fragmentation but also due to a lack of common recognition of the two organisations' roles in the future land administration system [30]. This structure prevents effective coordination between the land registry and cadastre offices. Also, the cadastre is seen as a costly system in these countries because cadastral surveys incur high costs, whereas the cadastre is not seen as a burden in such countries as Turkey and The Netherlands where both systems are sustained under the same ministry and administration since land registration shares its profits with the cadastre.

Germany, Denmark, and Switzerland have a licensing system in cadastre. While licensed surveyors carry out

Table 1 Responsible ministries from land registration, cadastre and mapping in case study countries

Country	Land registration	Cadastre and mapping
Germany	The Ministry of Justice	The Ministry of Internal Affairs (in many states)
The Netherlands	The Ministry of Housing, Physical P	lanning and Environment
Denmark	The Ministry of Justice	The Ministry of Environment
Switzerland	The Justice and Police	The Ministry of Defence, Civil Protection and Sports

the technical part of cadastral work in Germany, they act as local cadastral offices in all over Denmark and in most parts of Switzerland. The main task and responsibility of the public sector is to control the development of society and not to be engaged in operational activities. The capabilities of the public sector should be used to manage and control the activities of public administration and to involve the private sector in operational activities as much as possible [**36**]. In this context, Denmark, Switzerland and, in part, Germany have appropriate cadastral licensing systems similar to the system under construction in Turkey.

Each case study country has a Cadastre Information System project. All of them try to combine separately built land registry and cadastre records, based on international standards and a common data model with other spatial information systems in those countries. The Swiss Cadastral Core Data Model with eight information layers of cadastral surveying which is compliant with the 'Cadastre 2014' vision [**29**], [**3**] and the Official Information System of the German Cadastre are the most noteworthies of these projects.

Unlike the Turkish situation, mapping works for scales between 1:10 000 and 1:1 000 000 are carried out by cadastre administrations in all the case study countries. This structure was formed over time by transferring mapping activities, which were previously performed by the military organisations, to cadastral administration. Therefore, the administration is not only a leading institution of the cadastre but also of surveying and mapping works in the scales stated above, and this prevents duplications significantly. In this context, the case study countries have digital databases for base maps in the scales of 1:10 000 or 1:25 000. However, it is difficult to say the same thing for large scale mapping. Several organisations are authorised to produce large scale maps in the research countries, and this has generally led to duplication in productions. Furthermore, large and small scale maps cannot be produced in a harmonised structure.

Real estate valuation

Case study countries have specific Real Estate Valuation Laws or Regulations describing the rules of valuations

Table 2 Regulations on real estate valuation in countries studied

Country	Regulations
Germany	The Development Law The Regulations on Real Estate Valuation
The Netherlands	The Law on Real Estate Valuation
Denmark	The Law on Real Estate Valuation The Law on Taxation Management
Switzerland	The Guidelines on Real Estate Valuation The Taxation Law The Guidelines on Real Estate Valuation

(Table 2). Moreover, they are supported by clearly defined guidelines. All these legal arrangements provide unique valuations in those countries.

Case study countries have different organisational structures in the real estate valuation domain (Table 3). Valuations carried out for the main purpose of taxation are performed by committees of real estate valuations whose secretariats are undertaken by the cadastre offices in Germany; by the municipalities in the Netherlands; and by the tax offices in Denmark and Switzerland. The Dutch valuation system also has a national council with the main purpose of quality control and coordination. The municipalities do not have to carry out valuations themselves in this country; instead, they can contract work to private companies of valuation.

The common characteristics of the case study countries' valuation systems include an inventory of transaction prices, a database of real estate characteristics and mass appraisal systems. A mass appraisal system is built on the databases of true transaction prices and real estate characteristics. Therefore, all research countries pay special attention to these databases to make their valuations accurate. The case study countries also use Geographical Information System technologies in the valuations. In addition, the German system publishes valuation maps yearly, and the Danish system services the valuation results through the Internet.

International reports

In the last few decades, the FIG, the UN, the EU, the WB and some other international organisations carried out several studies to develop guidelines as to what constitutes a good land administration system or to define the components of good land administration [41]. The FIG Statement on Cadastre [16], the Bogor Declaration [33], Land Administration Guidelines [35], Cadastre 2014 [21], the Bathurst Declaration on Land Administration for Sustainable Development [34], Common Principles on Cadastre in the European Union [23] and the EU Land Policy Guidelines [15] are some well known reports published by these organisations. These reports were examined in this study to determine proven and internationally accepted principles of LAS. The

Table 3 Responsible organisations from real estate valuation in case study countries

Country	Organisation
Germany	The Committees of Real Estate Valuations (of which secretariats are undertaken by the cadastre offices)
The Netherlands	Municipalities (and the National Council of Real Estate Valuation for the coordination)
Denmark Switzerland	Tax Offices Tax Offices



4 Functionality of proposed LAS vision and its main components [9]

main findings of the examination can be summarised as follows:

- (i) current land administration systems need to be re-engineered or must continually evolve both to effectively address the constantly evolving requirements of the community and to support the sustainable development objectives
- (ii) in this context, countries should study, compare and analyse different approaches to land administration and identify the best elements that are most relevant to their own unique circumstances in the re-engineering process
- (iii) re-engineering should provide a comprehensive and complete land code or a set of land laws that cover the management of land and land information
- (iv) a proper organisational framework is essential for coordination and cooperation between land administration agencies
- (v) each government should define a leading agency responsible for policy formulation and for the overall control of land administration systems, and to provide the interministerial coordination of land information
- (vi) partnership between the public and private sectors is significant for the continual improvement of land administration systems
- (vii) governments should build not only land registration systems but also real estate valuation systems to provide transparency in land markets
- (viii) good real estate records should be built and maintained to carry out valuations properly
- (ix) a unified land information system combining cadastre data with other datasets should be created.

Vision for Turkish LAS

'Land administration best practice evolves over time and varies from place to place and country to country in response to national and global drivers. In other words, the best practice for one country is not necessarily the best practice for another' [43]. Therefore, countries should develop their own solutions and visions in land administration [3]. Although LASs have a dynamic nature, they cannot be changed continuously. This means that LASs have to be developed on a long term basis, and their legal, organisational and operational frameworks should be adaptive to cope with changes experienced over time [37]. 'The overall principle is that land policy drives legislative reform which in turn results in institutional reform and finally the implementation with all its technical requirements' [43]. This study proposes a vision for the Turkish LAS by considering this principle based on the studies carried out on the Turkish LAS, and the lessons learned from the case study countries' LASs and the international reports. The vision, with a broader and more integrated approach than the previous fragmented one, is composed of three main components. These are (1) legal arrangements; (2) organisational structure; and (3) technical organisation (Fig. 4).

Legal arrangements

Turkey needs for a 'Land Law' in order to reorganise its existing scattered land-related laws, to eliminate the duplications and gaps in the relevant regulations, and to provide an appropriate legal basis for an efficient land administration system. This law should mainly include regulations on such domains as property, development, environment, geographical information management and real estate appraisal. The new law should be built on appropriate land policies considering sustainable development objectives. Therefore, current land policies, and gaps in policy need to be revised before preparation of the law. Paying special attention to the active participation of relevant experts in the preparation period and preparing a law for the long term, which are generally disregarded aspects in Turkey, are other important points in this process [9].

Organisational structure

Establishing an appropriate organisational structure is crucial to provide sustainability of any system [14], [17]. In this context, an appropriate Turkish LAS should have a 'leading institution' to eliminate duplications, and to provide effective coordination in the land administration. The research carried out in this study shows that, on the one hand, the General Directorate of Land Registry and Cadastre is the most suitable administration to become the leading institution. On the other hand, the General Directorate has difficulties in fulfilling the existing duties assigned to it, and has recently undertaken some new additional responsibilities. Therefore, it would not be easy to make the General Directorate the leading institution responsible for land administration in its current organisational structure

Considering that the leading institution will be responsible not only for land registry and cadastre but



5 Organisational structure of proposed Turkish LAS [9]

also for mapping and real estate valuation, the institution should be placed on a higher level than a general directorate in the Turkish administrative hierarchy. The leading institution should be established as an undersecretariat of the prime ministry. Carrying out all functions of a land administration system goes beyond the capabilities of a single organisation because 'requests in land administration are mostly delivered through business processes that run across multiple organisations' [8]. Therefore, this study proposes establishment of a leading institution of Turkish LAS named as the Undersecreteriat of the Turkish Prime Ministry for Land Administration (UPMLA) and composed of the General Directorates of (1) Mapping; (2) Cadastre; (3) Land Registry; (4) Land Information Management; and (5) Real Estate Valuation (Fig. 5). The district directorates and local offices of these General Directorates can be built based on the necessary requirements. It is considered that this structure will ensure the operation of land administration in an integrated way, and each component will be carried out by its own expert administrations [9].

Technical organisation

One of the most important goals of land administration systems is 'to effectively handle land information data in and between the organisations in the systems through efficient and effective' land information infrastructures [30], [3]. Therefore, 'LASs are increasingly evolving into a broader land information infrastructure which supports economic development, environmental management and social stability in both developed and developing countries' [43]. 'Holistic treatment of land information generated by a nation's administration and land market is no longer arguable; it is essential' [5], [3]. However, the organisational framework that many public organisations are placed in often makes difficult the development of efficient and effective land information infrastructures. 'Due to historical reasons land administration systems typically consist of various governmental organizations located in separate ministries in many countries. This fragmentized structure gives rise to issues concerning interorganizational collaboration, which are critical to the function of the systems' [30]. In contrast to these situations, the proposed Turkish Land Administration System will provide an infrastructure for building up and sustaining an efficient Land Information System (LIS). The UPMLA will make such land related data as cadastre, buildings, topography, geodetic control points, administrative boundaries and real estate values available to other

governmental organisations and private corporations through the LIS. This will minimise data duplication and provide economical efficiency. The LIS will organise and present not only the data produced by the UPMLA but also the land related data produced by other organisations. Management of the LIS is proposed to be carried out by the General Directorate of Land Information Management [9].

Some points need to be taken into consideration during the Turkish LIS design, implementation and maintainance process. For example, ensuring the compatibility of LIS data with international data standards is of great importance because local standards are not sufficient today to provide data exchange among different countries and in international projects. In addition, spatial information systems such as the topographic information system, cadastral information system and geodetic control points information system should be developed with an integrated data model to provide effective data exchange among the systems [9].

During technical development of the proposed Turkish LAS, some emerging and important issues such as 3D/4D cadastres [38], [13], standardised data models [39], [18] and the Rights, Responsibilities and Restrictions issue [20], [21] which are significantly ignored in the current system should also be taken into consideration by the UPMLA.

Final remarks

Cadastral systems initially designed to assist in land taxation, real estate conveyancing and land redistribution [16] have been extended to land administration systems and infrastructures. This forces both developed and developing countries to re-engineer their cadastral systems to meet the change, and they ask 'What is the best practice in land administration?'. It is a common view that land administration best practices vary from country to country based on the background, traditions and current needs of individual societies. This requires that each country develop its own Land Administration System being inspired by good practices, internationally accepted publications, etc.

This paper summarises the findings of research carried out to develop a vision for the Turkish LAS which can be used in the potential re-engineering process. It begins with a brief analysis of the current Turkish LAS, and stresses the need for re-engineering the system. Then, it outlines some outstanding characteristics of the German, Dutch, Danish and Swiss LASs which were researched in the study as examples of good operating LASs, before stating the main points of international reports published by some international organisations on LASs. The paper concludes with a vision for the future Turkish LAS.

The vision proposes the establishment of a Turkish 'Land Law' in a participatory way to bring together the existing scattered laws, to eliminate duplications and gaps in the regulations, and to provide an appropriate legal basis for efficient land administration. A 'leading institution' responsible for Turkish land administration should be constructed to eliminate organisational duplications, and to provide effective coordination in the domain. The existing institutions are not suitable to take on the role of leading institution because their current organisational structures are not adequate for such a duty. In this context, it is proposed that an institution named the UPMLA be established, and that all land administration works be organised and supervised by this institution. The works are carried out by the General Directorates of (1) Mapping; (2) Cadastre; (3) Land Registry; (4) Land Information Management; and (5) Real Estate Valuation affiliated to the Undersecretariat. The UPMLA makes cadastre, buildings, topography, geodetic control points, administrative boundaries and real estate values data available to all users through the LIS, and thus provides economic efficiency in productions. The vision recommends that the LIS be managed by the General Directorate of Land Information Management.

One of the most important requirements in this reengineering process is gaining the support of politicians. The strong need for re-engineering financial, service quality, efficiency, etc. means should be reported to politicians, and their support ought to be gained. Otherwise, the vision cannot go beyond the planning stage. Then, there are two choices for the transition to the new structure: implementing the vision at once or in incremental steps. It is recommended that the vision be implemented in incremental steps since it requires comprehensive re-engineering. Implementation at once could lead to some disruption and malfunctions in services during the re-engineering and subsequent processes. Thus, there is a need to clearly define the steps in the implementation of the vision. The duties and responsibilities of each general directorate proposed above, and the coordination/cooperation mechanisms to be operated among them should be made clear, and described in the regulations. Finally, all general directorates should perform their work in a contemporary manner and adapt themselves to the future directions dynamically.

Finally, it is clear that testing an unbuilt land administration vision is always difficult, but there can be some means. For example, strong support of senior administrators, Turkish land administration experts and academicians to the vision presented in this paper and the new Turkish General Directorate of Geographical Information Systems (Land Information Management) which is under construction nowadays can be some means of success of the vision. From now on, there is a need for carrying out studies to describe and detail implementation stages of the vision.

Acknowledgements

This paper is mainly derived from the PhD thesis presented by M. Cete under the supervision of Professor

T. Yomralioglu at Karadeniz Technical University, Turkey, in 2008. As the authors of this paper we wish to thank O. Univ.-Prof. Dr-Ing. H. Magel for supporting and organising case study researches carried out in Germany, The Netherlands, Denmark and Switzerland. We also would like to express our appreciation to Professor S. Enemark (Denmark), Professor Ir. P. van der Molen (The Netherlands), Dr D. Steudler (Switzerland) and their colleagues for their valuable contributions to the research carried out in their countries. Lastly, the authors offer their regards to all Turkish experts on land administration who contributed to the research and to Karadeniz Technical University for assisting the research financially.

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