

# Turkey National LIS Actions towards Building SDI

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## Abstract

Digital Maps started to be produced in Turkey after 1990s. Analog maps were converted to digital format and used as a base map in some specific projects. The General Command of Mapping (GCM) of Turkey pioneered digital map production especially. Standard Topographic Maps (STM), smaller than 1:5000, are produced by GCM. Large Scaled Maps, 1/5000 and larger, are produced by Land Registry & Cadastre Directorate (LRCD) and State Provincial Bank. Other public institutions and municipalities also produce maps serving their own needs, depending on their responsibilities and rights legalized by the laws. As time goes by, the needs and requirements for geographic information have increased in Turkey. E-transformation Turkey Project, following Europe+, triggered actions for building Turkey National Geographical Information Systems (GIS), almost similar to Spatial Information Infrastructure (SDI), under responsibility of LRCD with participation of public institutions. KYM-75 initiative, suggested in 2007, aims to build a portal where public institutions can present their spatial information. It is emphasized on Turkey National GIS actions that land registry and cadastre related spatial data sets should be produced and used as a part of National SDI initiatives. In this way, a variety of projects supporting Land Information Systems (LIS) were taken into effect by LRCD, such as Land Registry and Cadastre Information System (TAKBIS), Continuously Operating Reference Stations -Turkey (CORS-TR), Map Information Bank (HBB), Land Registry Archive Information System (TARBİS), and Agriculture Reform Implementation Project (ARIP). In this paper, cadastre activities and LIS related projects were examined as an integral part of National GIS actions of Turkey.

**Keywords:** LIS, Cadastre and Land Registry, Turkey

## 1. INTRODUCTION

As time goes by, the needs and requirements for geographic information have increased in Turkey. In this context, e-transformation Turkey Project, following Europe+, triggered actions for building "Turkey National GIS" under responsibility of LRCD with participation of public institutions. In these actions, current situation to build SDI was examined in 2004 and Turkey National SDI strategy as policy encouragement was determined in 2005. It was noted that INSPIRE directive should be followed as a part of e-Europe participation. KYM-75 initiative, suggested in 2007, aims to build a portal where public institutions can present their spatial information. It is emphasized on INSPIRE initiative and Turkey National GIS actions that land registry and cadastre related spatial data sets should be produced and used as a part of National SDI vision. As one aspect of SDI, LRCD collects and manages land registry and cadastre data with all sub-directorates all over Turkey, including 22 of Regional Directorates, 1018 of Land Registry Directorates, 325 of Cadastre Directorates, and 122 of Cadastre offices.

As a part of National GIS and LIS actions, a variety of projects were taken into effect by LRCD. TAKBIS project are in the development process to manage the cadastral data and all business digitally. CORS-TR project has being executed to

build GPS stations with the function of Real Time Kinematic (RTK) that enables to determine the coordinates definitely. HBB project aims to build a metadata portal to share information about produced maps. TARBIŞ project collects all land registry titles on digital format and indexes all titles since Ottoman Empire. ARIP aims to develop agriculture sector by providing some spatial data and tools for managing agricultural policy.

In this study, to support Land Information System, geographic data related issues of Turkey were examined with the role of LRCD. LIS projects with aim, target, and expectations were discussed towards building SDI.

## **2. MAPPING BACKGROUND AND NATIONAL GIS ACTIONS IN TURKEY**

In Turkey, public institutions that produce and use geographic data and maps increased investment of Information and Communication Technologies (ICT) in 1990s. The importance of GIS has been realized by a variety of public and private organizations after these years. The GCM pioneered digital map production especially. At the beginning, analog maps were converted to digital format and used as a base map in some specific projects. Standard Topographic Maps (STM), smaller than 1:5000, are produced by GCM. Large Scaled Maps, 1:5000 and larger, are produced by Land Registry & Cadastre Directorate (LRCD) and State Provincial Bank. Other public institutions and municipalities have produced maps and GIS projects serving their needs. But, according to Turkey State Planning Organization (SPO) coordination has not been provided among public institutions that produce and use geo-data. Technical, Standard, and policy deficiencies result in time and effort losses on data production, management, and sharing (SPO, 2006).

Turkey has speeded up her efforts to transform into an information society with eTurkey initiative which is almost identical to eEurope+. After 2003, these actions are combined in e- Transformation Turkey Project that aims at fostering the evolution and coordination of information society activities in a participatory manner. The actions were started for building "Turkey National GIS" under responsibility of LRCD with participation of public institutions that produce geographic data. With Action-47, current situation to build National GIS was examined in 2004. In Turkey, It has not been determined which institutions produce which data on which standard or scale. It was declared that most public institutions have GIS software, but there are no a common accepted international or de-facto standards in public institutions (LRCD; 2004). With Action-36, Turkey National GIS concept and implementation models were determined in 2005. In this way, it is pointed out that building National GIS, similar to SDI vision, is required to share geographic data on different context and scale efficiently to support better governance and environmental sustainability by reducing duplication and facilitating interoperability. Therefore, all public institutions that are data producers and users such as public institutions, companies, and universities should participate in Turkey National GIS actions (LRCD, 2006). With KYM-75, it is triggered to building SDI in 2006. The aim is to build national SDI compliant with technologic development. A portal will be established to make public institutions present the users on this common SDI. Specifications will be produced for geographic data to meet user needs and exchange standard will be determined (SPO, 2008).

Geographic data is not interoperable because public institutions use different concepts, standards, and technologies. For example; most municipalities in especially big provinces are trying to build Urban Information System (UIS) and e-municipality applications. Interior Ministry is in the process to combine the databases of National Address Database (UAVT) and National Citizenship System (MERNIS).

And, also Building Following System is being built to work with these systems. Similar to this, many e-governments and GIS projects started on the scope of e-transformation Turkey projects (Aydinoglu and Yomralioglu, 2009).

### 3. LAND REGISTRY AND CADASTRE DIRECTORATE (LRCD) OF TURKEY

The first land registry organisation in our country was established under the name of “Defterhane-i Amire Kalemi” in 21 May 1847. It maintained its mission under a variety of names till the establishment of the Republic of Turkey. With the law no 658 (dated 22 April 1925), the organisation was represented by the General Directorate of Land Registry which was founded in 1924. The present structure and duties of the General Directorate of Land Registry and Cadastre are defined by the law no 2997 (dated 29 May 1936). It currently operates under the responsibility of The Ministry of Public Works and Settlement.

LRCD collect and manage land registry and cadastre data with all sub-directorates all over Turkey, including 22 of Regional Directorate, 1018 of Land Registry Directorate, 325 of Cadastre Directorate, and 122 of Cadastre office. Main duties of the organisation are the formation of modern land registry by carrying out initial cadastre works in the Country, performing every kind of contract and registry transactions related to real estate, regularly updating the Land Register under the responsibility of the Treasure, providing safety of property, formation of systems required for the establishment of Spatial Information Infrastructure (this is a new assignment given by the law no 5304 which was enacted in 2005).

Cadastre works and digital transformation in Turkey have long been continuing. In this process, LRCD has a crucial role because, a variety of LIS projects are carried out by LRCD. These projects are TAKBIS, CORS-TR, HBB, TARBIS- Land Registry Archive Information System and Agriculture Reform Implementation Project.

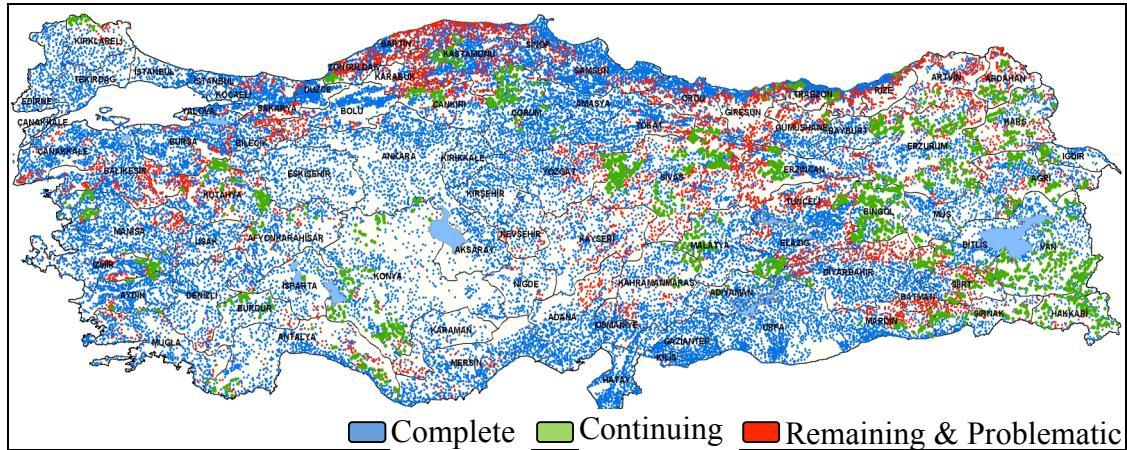
#### 3.1 Cadastral Works of Turkey

Turkey is a relatively large country and has a total area of 780.000 km<sup>2</sup>. As of the first years (1923) of the Republic of Turkey, cadastre works has been continued. Until 2000, not much more than 85% of the country land was surveyed and registered by LRCD (Demir et al., 2008). The remaining land was the most problematic areas largely situated in eastern part of the country. However, as a result of the decisive investments by LRCD, almost all of the land has been surveyed and registered. In Table 1, current situation of cadastre works are presented in number of units (districts in urban areas and villages in rural areas) and their percentages. Figure 1 shows the distribution of units where cadastre works are completed, continuing or remaining. Completed and continuing works indicate 98% of cadastre coverage (see Table 1). The remaining part has been in contracting stage and planned to be completed at the end of 2009.

**Table 1: Realization of the Turkish cadastral works (LRCD, 2009)**

	<b>Cadastre in Urban Areas</b>		<b>Cadastre in Rural Areas</b>		<b>Cadastre in Both (Urban &amp; Rural) Areas</b>	
<b>Current Situation</b>	<b>No. of Units (District)</b>	<b>%</b>	<b>Number of Units (Village)</b>	<b>%</b>	<b>No. of Units (Village or District)</b>	<b>%</b>
Completed	17534	97,2	30728	88,7	48262	91,6
Continuing	401	2,2	2941	8,5	3342	6,3
Problematic	32	0,2	487	1,4	519	1,0
Remaining	66	0,4	502	1,4	568	1,1
<b>Total</b>	<b>18033</b>	<b>100</b>	<b>34658</b>	<b>100</b>	<b>52691</b>	<b>100</b>

**Figure 1: Distribution Map of Cadastral Works in Turkey (LRCD, 2009)**



In recent years (2005-2008), LRCD has developed a new style of working strategy to complete remaining cadastre works in a few years. Before this strategy yearly output of cadastre works was only 350 units (village or district) in average; with the precautions taken and changing the working method and buying of services from the private sector, the yearly output has increased around 10 times. Besides, the costs are reduced and higher quality results have been achieved by managing and storing the data in digital format which is more compatible with the information systems.

### **3.2 TAKBİS- Land Registry and Cadastral Information System**

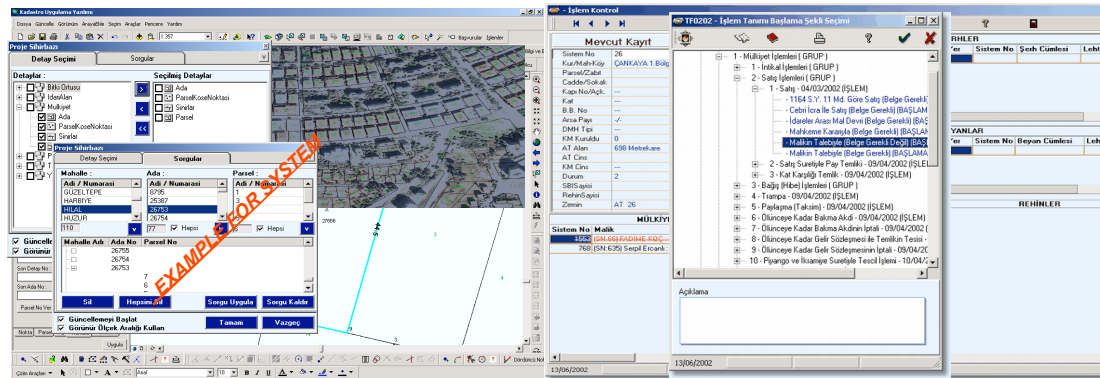
The TAKBİS project (Turkish LIS project), started 2000, aims at forming the basic data for all kinds of projects prepared based on positional map data in the standards of the Geographic Information System by creating correct, up – to – date, sharable and visible land register and cadastral survey data and thus offering service to all levels of users. In the contemporary time in which people have great expectations in accomplishing such services, users need accurate, reliable, easy and quick accessible land register and cadastral survey information, which makes the TAKBİS a highly important project.

TAKBİS project aims at creating a “Land Register and Cadastre Information System” throughout the country. Main objectives of TAKBİS are providing accurate, valid and reliable land information required for land and land – related activities of decision markers, transforming land register and cadastral survey works and associated information into a multi – purpose land information system, managing the services by the GDLRC in a better, quick, more reliable and more effective way, ensuring that the data disseminated to other institutions and organizations can be used more commonly, in this way, performing land register and cadastral survey services electronically, and offering correct, reliable and updated information for local administrations and relevant institutions.

So far, 370 land registry offices and 32 cadastre offices in counties of commercially popular provinces have been integrated with the TAKBİS. In these land registry offices, information on 25 million real estates and 45 million active right holders (owners) has been integrated with the TAKBİS. In Figure 2, samples from cadastre and land registry application interfaces are presented. In addition, the system includes some 6 million in active right holders’ information. In these cadastre offices, information on 3.5 million land parcels has been re-produced in accordance

with the standards specified within the TAKBİS. 95% of this information has already been integrated with land registry data. Initiatives for the extension of the TAKBİS to whole country have been continuing. It has been planned that all land registry offices be integrated with the TAKBİS within two years. As for cadastre offices, the target year for the full extension is 2014.

**Figure 2: Cadastre Application Interface (left), and Land Registry Application Interface.**



### 3.3. CORS-TR- Continuously Operating Reference Stations –Turkey

The project has been started in May 2006 as a joint initiative of Istanbul Technical University, LRCD and General Command of Mapping for establishing reference GPS stations throughout all country. The main purpose of CORS-TR project is to provide continuous real time precise (cm level) geodetic positioning throughout Turkey in order to serve for collecting geographic data for mapping activities. Its purposes are classified as follows:

- Serving the users for the production of precise geographic data in an economic and easy way,
- Providing precise positioning for navigation of transportation,
- Solving the problem of determining local transformation parameters for the use of the LRCD, GCM, and other public and private organisations,
- Monitoring tectonic movements precisely,

With the project, 145 reference stations are planned to be established for the services all over the country. This will enable geodetic coordinate transformations between ITRF96 and ED-50 Datums. CORS-TR Project will remove the necessity of ground construction in the field of mapping in Turkey to great extent; will provide the users with high-tech's convenience and products. Currently, there exist more than 2000 GPS receivers in the entire country. These GPS users, benefiting from static or RTK (real-time) techniques, are forming their own base stations, and then computing coordinates with the use of rover receivers. When the project concludes, expected contributions are;

- It can be a foundation for all geo-information technologies, nationwide; map production, cadastre, e-government, e-municipality, and like these.
- Great savings in money and time will take place for public institutions,
- LRCD will be able to transform their data easily, and great window of opportunity will be opened for the realization of various projects of GIS and LIS
- It will be used in the projects of planning, infrastructure, municipality, vehicle tracking, agriculture, forestry, GIS/LIS.

### **3.4. HBB- Map Information Bank**

The purpose of the Project is establishing a country wide large scale spatial data repository and thus preventing duplicate map production. With the project, it is aimed at establishing a portal structure which is planned to be established by entering, updating all map related metadata on large scale maps produced by different institutions, organisations and also by private sector through the internet.

Within the scope of this project:

- Organizations will be responsible to submit a copy of information and documentation that they produced to the LRCD in digital form.
- The coordination and post production activities will be executed by the Map Production Monitoring Centre within the LRCD.
- All map related information (maps and metadata) will be monitored and handled by Map Production Monitoring Centre.
- The metadata will be collected and presented through the internet.
- The copyright of public and private sector will be preserved.

Current condition of the project:

- The education is provided to the other map related public institutions and Entering the metadata is started.
- Entering metadata of 1/5000 scale Standard Topographic Map is completed.
- The updating of the Sheet Registration System and then the integration to MPFC are aimed for metadata of cadastral sheets.
- Searching Ground Control Points (with Datum ED50 and ITRF) is possible.
- Metadata areas and Ground Control Points are integrated with Google Maps.

Currently, organizations producing large scale map have been continuing submission of their data by using web based Map Information Bank Interface.

### **3.5. TARBIS- Land Registry Archive Information System**

The objectives of the project are:

- To scan the existing archive documents, which are in Ottoman language, by using the latest technology,
- To acquire the microfilms,
- To transcribe them and transform them into a digital media,
- By installing the archive automation software and establishing the framework, to ensure that the authorized people can easily access archive information and documents within the required security framework.

With the completion of TARBIS Project ( in 2010);

- The works will be executed on the digital copies or microfilms of these documents, which are mostly first degree cultural heritage and which should be preserved; and therefore the wearing of the originals will be prevented.
- Information and document support for other organizations will be provided (LRCD, 2009).

### **3.6. ARIP- Agriculture Reform Implementation Project**

ARIP was introduced for the implementation of some agricultural reform activities triggered by both World Trade Organization and the European Union. The project started in 2001 and finalized at the end of 2007.

The project has a total of four main components. These are: (a) Direct Income Support, (b) Farmer Transition, (c) Cooperatives and Unions, and (d) Support Services (Kutlu, 2002; WB, 2001). It focuses largely on the first component of the project—forming a National Registry of Farmers (NRF) via Direct Income Support (DIS) regime (Inan and Cete, 2006). The NRF system operates on an internet based central software application. It enables the provincial directorates of the Ministry of Agriculture and Rural Affairs to enter and update the information submitted by farmers.

NRF system is intended for the registration of both farmers and their land. Registration of land is closely related with the Land Registry and Cadastre system. In fact, land registry documents (titles) are used by farmers for their declarations. However, spatial cadastre data can not be used within the system because of either unavailability or insufficiencies in data storage and sharing procedures within the GDRLC. As a result, the majority of control procedures adopted by the European Common Agricultural Policy have not been implemented in Turkey. Therefore, initiatives of registration of unregistered land and development of land registry and cadastre archives have been started within the first component of the ARIP. For these initiatives, the GDRLC has overtaken a crucial role and started a new style of cadastre work by engaging the private sector in the technical part of cadastre works.

So far, within the NRF system, 2.76 million farmers (about 68% of the total) and 16.71 million ha of land (about 75% of the total) have been registered (EC, 2004). In addition, within three years (2005 – 2007), cadastre works started in about 3000 units (village or district) that cover some 3 million land parcels. The majority of these cadastre works has been completed except for some problematic regions. With the completion of this new style of cadastre works within a few years, almost 99% of land registry and cadastre coverage will be completed. However, old land registry and cadastre archives are still a problem both for the establishment of a spatial component for the NRF and also sharing the data with other potential users. Countrywide extension of TAKBİS project and cadastre related initiatives under the ARIP have been considered as a remedy for this problem.

After the completion of TAKBİS and the integration of cadastre data with the NRF, implementation of agricultural reforms will be carried out more effectively and will be in line with the European Common Agricultural Policy. Agricultural censuses and accordingly inventory of agricultural holdings will be more precise, which enables the government prepare more precise plans for further development of agricultural sector and rural areas. In addition, more effective agri-environmental measures will be able to be applied for the prevention of environment during agricultural activities.

#### **4. DISCUSSION**

When the land related projects in Turkey, introduced in this paper are evaluated, it is seen that all expectations from these projects may not be met during their implementations. However, they should be considered as necessary first steps and also importante milestones towards a National SDI of Turkey. The majority of the projects have focused on the completion of the cadastral works firstly, modernisation of land registry and their automation in LRCD. The reason for this is the fact that cadastre and land registry information is crucial for the establishment of a national SDI which may serve for a vast variety of users throughout the country. In this way, these projects should be examined and coordinated towards the National SDI vision that encompasses policies, technologies, standards for the effective collection, management, and access to geographic information by reducing duplication and facilitating integration at different administrative levels. TAKBİS should be further



developed in view of ARIP project, and other user needs should also be considered, which solves geographic data needs of other users as a part of e-government activities. As for other projects, while HBB support National GIS portal in a standardized way, CORS-TR should provide nation-wide geographic reference at also large scale. Possible interaction between these projects and with other GIS should be examined and designed. New expectations and process-based GIS strategy should be determined and carried out as next vision with respect to international spatial standards and developments such as INSPIRE.

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