GIS ACTIVITIES IN TURKEY

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Many GIS activities and projects are going on in Turkey as it is happing in the modern World. For Turkey, these activities can be categorised under three main sections, which are public, private and education sectors. One of the project which is called National Spatial Information System has been designed under the Prime Ministry, national security based GIS projects were developed by the General Command of Mapping, Land Information Systems which are related to national property information systems and land management projects, environmental, earthquake based GIS works, and urban spatial information system projects are followed by local authorities can be given as main public GIS activities. However, private sector has been focused on more individual spatial information system projects which can help to develop of private investments. In addition, GIS education is also growing very rapidly, more specifically in universities. In this paper, GIS activities will generally be reviewed from the point of its potential use and current issues of GIS usage in Turkey.

1. INTRODUCTION

Geographical Information Systems (GIS) can be defined as an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information [*Yomralıoğlu*, 2000]. It manages census data, zoning and tax assessment maps, digital aerial photographs, and satellite images, providing public access to information that previously was difficult to use. GIS also provides tools for exploring information through maps and images, helping inquisitive minds to see things in a new way. Because of GIS is very important concept for today's world it seems to be about 2 million GIS users at present.

Not only in the world but also in Turkey, the importance of GIS has been realized by many government and non-government institutions. Especially after 1990's, many GIS related developments have been done in the country. At the beginning a few public projects has been came out by the General Command of Mapping for producing digital maps for army forces aims. Besides, some universities also started to GIS related researches at graduate level in order to explore GIS abilities in countrywide. The first national symposium on GIS has been held in 1994, and when universities pioneered to use and talk on GIS it is recognized by public bodies that GIS is a powerful information system.

Since, many GIS related activities are going around on Turkey in public and private sectors. Besides some national GIS based projects, local authorities are mostly trying to use it for organizing and taking care of their spatial data in order to collect tax, inspecting urbanization and to make a dynamic planning process available as well. But at this moment at the national level, there is not any standard accepted officially for GIS terminology, GIS feature and attribute coding, GIS data exchanges as well. As a result, even a rapid development ongoing for GIS use, complexity and misuse of data still exist. So, in generally, Turkey has a great potential for GIS hardware and software vendors, data producers and users. But there is also a considerable distinction between the public and private sectors in terms of qualitative and quantitative use of GIS technology.

2. CLASSIFICATION OF GIS ACTIVITIES IN TURKEY

Because of non-availability of data, it is not easy to classify GIS activities under a standardized content but it can be put under three main subjects. These are *public*, *private* and *education* sectors.

2.1 GIS in Public Sector

As mentioned before, public sector can be accepted as the leader of GIS activities in Turkey. As it has been thought in many other countries, in Turkey, national security information is important and more considerable than the others. Therefore, the army forces are the first user of GIS. On the other hand Turkish land registration system is required to collect and manipulate cadastral information. To make works very successfully on the national government levels, spatial data should also been needed so that a national spatial data structure was requested. On local level, municipalities are urgently needed spatially based information as well, in order to make better investments and planning activities. All these public bodies' requirements are tried to provided by using GIS. Some public sectors' GIS related activities in Turkey are summarized on the following.

General Command of Mapping Activities
General Command of Mapping (GCM) is the national organization of Turkey which is responsible to produce both printed and digital maps at medium (1:25 K, 1:50 K, 1:100 K) and small (1:250 K, 1: 500 K, 1:1 M) scales required by both military and civil organizations in Turkey. In GCM, GIS related activities including GIS projects and GIS related research studies have been started in 1986 whereas conventional mapping activities have been going on. GIS projects are composed of mainly two distinct projects, namely 1:25 000 scale GIS and 1:250 000 scale GIS projects. Some of the GIS research studies carried out in cooperation with the universities and international organizations are Updating of Digital Complex Topographic Databases, Design & Implementation of a GIS, Digital Terrain Model Applications, The Use of GIS in Computer Assisted Instruction, Urban Information Systems. GCM has started to digitize existing contour separates through raster scanning, vectorizing, editing and tagging processes, in 1986. In 1990, a GIS project called as "Multipurpose Geographic Database Project" has been initiated. This project has been then recalled as "National GIS project" composing two distinct project which are "1:25 000 scale GIS" and "1:250 000 scale GIS" [*Taştan vd*, 1995].

The digital maps to meet requirements are provided by the GCM, the fact is that a number of software are hard to use as being of foreign origin and closed to further development to meet the new requirements of the Turkish Armed Forces as well as expensive as containing the extra functionality not needed. Also it is know that the majority of this software requires a comprehensive training and expensive computer hardware. So GCM developed a GIS software which called "Digital Map Aided Military Applications (DMAMA)" in order to save money, personnel and time by enabling all the maps users in the forces to perform military applications on maps easily by using digital maps on CD-ROMs in a simple PC environment without any computer knowledge [*Taştan vd*, 2000].

Because of Turkey is a member of NATO, GCM is mostly follow the NATO mapping standards. So, while GCM is producing analogue or digital maps for Turkish Institutions, some disputes on spatial data use and standards are still issue in Turkey because of national security consideration. In same cases, this might prevent the exploring of GIS usage in Turkey. Due to data on small scale maps not available or not permitted to use, many organizations could not succeed in their GIS projects. This confidential approach to use spatial data mostly affects negatively to private sector in Turkey.

TAKBIS - Land Information System Project of Land Title and Cadastral General Directorate
Land Title and Cadastre General Directorate (*in Turkish* TKGM) is the only institute of Turkey which is responsible for surveying all land parcels boundaries and registration land properties to owners. In

Turkey, the cadastre is a compulsory task, and TKGM holds all records. Because of the obligation to registration every land parcel and transaction with land and property, the cadastral system plays an important role in the land taxation, real estate market, land development and all types of planning activities. So always cadastral information is needed in Turkey.

There is a legal principle that no transaction in land and property (buildings and constructions) is valid until it is proper registered in a register of land title. From the beginning the cadastral systems were based on two things. The first is the graphic part, the cadastral maps, which can be considered as a land inventory that functions as an information system for all kinds of activities of the government and private persons with land and property. The second is the legal/registrative part, called the 'Grundbuch' (*tapu kütüğü*). These two parts are combined into one cadastral system under supervision of TKGM. So, naturally there two types of information which are graphical (parcel boundaries) and non-graphical (land rights). This information should be linked before available for the other organizations' use. To provide cadastral information for public use, TKGM, involved in the intention to digitise the cadastral maps. In the process, the old maps (mostly on scale 1:1000, 1:2000 and 1:5000) had difficulty to transform into the National Co-ordinate System. These maps are sometimes in poor condition, and contain a lot of superfluous information and a vague legal status for the majority of the parcel boundaries.

To solve such problems and provide land information to interested people, an automation system in cadastre has been adapted. The project, called TAKBIS "Land Title and Cadastral Information System", is first started in 1990. Because of financial issues, almost 10 years later the project can be activated. The main objective of the TAKBİS is as follows:

- To provide all land and land related information for all interested bodies, updating land titles and cadastral maps, creating a database to collect, store and present land information,
- To share land information usage with external intuitions for creating a multipurpose land information system and store these information in secure media,
- To provide the services more quickly, in safety and in effective way for planning and re-organization of TKGM, and working more reliable with other governments' units.

The development of TAKBIS project was started with needs and inventory phases, then system design and software development phases have been done. But the project is still under development and as a pilot project it is being tested in in the city of Ankara its neighbor's cities. TAKBIS project links all cadastre and land title offices in a region, so that land information can easily be transferred between TKGM district's bureaus. After testing works, personnel training then the expanding of the project will be taken part (www.tapu.gov.tr). The main duty of the project also is to serve to a National Information System which is also under the development by the Prime Ministry of Republic of Turkey.

National Information System

Turkey actually has a governmental organization system which is a complex bureaucratic structure. Lack of political determination and insufficient administration bodies mainly have prevented decision-making process and national implementations. As a result, the state could not provide contemporary service for the public. The duties, authorities and responsibilities of governmental institutions could not be determined and this resulted in expecting all services from the state. Restructuring of public management will provide for bringing the state organization to most appropriate level using the information and communication technology. To give an effective role to the state branches three main structures have been defined and linked to achieved in a national data use frame. These are; Administrative structuring, Legislative structuring and Personnel Structuring [*Banger*, 2000].

A series of studies are being carried out for making a better administration and establish a new public management idea for the state. Many descriptive data produced and collected under the authority and responsibility of public institutions and organizations by the Prime Ministry of Republic of Turkey, be accessible and useable in a distributed information systems environment. In these studies, the basis is the formation of the data produced by relevant institutions, in the databases in national standards.

Turkish National Information System (NIS) is the group of country information systems that aims connecting, sharing and using the information about the country management in the relevant institution and between the institutions. NIS will be formed by combining the information systems, which will be formed in order to provide a fit structure for the administrative and technical operation of the institutions, on national computer networks. NIS will arrange the data infrastructure of the institutions that will be included in the system. The purpose of NIS is providing a set of relations having different priorities in the system, with its components being; *Policies, Institutions, Technology,* and *Data (standards, networks, databases, sources, and users).* Since the system is planned to provide countrywide service, NIS includes all public institutions and organizations, other sectors and finally individuals in national level.

In the scope of the establishment of NIS, Prime Ministry Management Information Centre has been formed in order to open all data to users in a way to keep the institutions to date in the databases, taking into account the access authorizations and to coordinate the production of such data in appropriate standards. The Prime Ministry Presidency of Administrative Development centre that has been brought to the agenda in order to restructure the administrative, technical and personnel structure of Turkey, to open all data that has been produced by the public organizations to date, to the access by the users in a systematic and effective way, will be the centre of institutional arrangements that will be base to the activities necessary for public restructuring. The NIS project have an important role in the progress of Turkey in the new century not as a country where information is kept as a secret, but as organized country where such data is shared and used in a beneficial way [*Banger*, 2000].

Land Cover Types of Turkey by Remote Sensing

A project has been carried out by State Institute of Statistics (SIS) in Turkey is to determine land cover types using remote sensing techniques. SIS has exclusive responsibility for producing and disseminating official statistics in Turkey. It conducts, among others, agricultural census once in ten years and publishes yearly agricultural production statistics which are based on data collected by the regional offices of Ministry of Agriculture. These figures are found to be not reliable. Because of the discrepancies between the yearly grain production figures of Ministry of Agriculture and results of Agricultural Census, State Planning Organization (SPO) has delegated SIS to conduct the "Estimation of Grain Production by Remote Sensing Project" in 1991. The objective of the project is to use advanced technology with minimal human intervention for better estimation of the cereal production in Turkey. That's why whole country must be covered by the satellite images to give information of entire country via remote sensing technique. On this purpose, 52 Landsat MSS images recorded between in 1987-1990 were processed. In this study, 8 classes were determined by visual interpretation and then number of classes was reduced to 4. These classes are given below:

1. Agricultural Areas (35% - 27,294,086 ha.): Arable land (non irrigated, irrigated, rice fields), permanent crops (vineyards, orchards, olives and mixed agricultural areas)
2. Natural Vegetation Cover (28% - 22,281,104 ha.): Forests (broad leaved and coniferous forests, mixed) maquies, shrubs, bushes, spared vegetation and bare land
3. Water Bodies (1% - 1,079,650 ha.): In land waters (river, lake, and dam) and seas
4. Non-agricultural Areas (36% - 27,374,270 ha.): Artificial areas (residential, industrial, commercial and transportation units, mining, dumped and construction sites), pastures, marshes, rocky and the other non-agricultural areas.

The classes obtained at the end of this study show the general land structure of Turkey. These results have been used to create sample plan of "Cereal Acreage and Yield Estimation Project for Turkey". In addition these results have been used as sample frame at the other studies of SIS. By 1998, this study has been updated with "Land Cover of Turkey" project in which high spatial resolution images were used [*Demirbüken vd*., 1994]. Since then a couple of projects especially on agricultural works are also continuously done by SIS relating to determine some statistical figures.

GIS Use in Local Authorities

In Turkey, besides national institutions, many GIS activates are on going by local authorities too. Local bodies can be thought as in provincial government level and municipality level. In the province level, in order to organize spatial information and having the updated data on about whole province, some governorship are establishing GIS sections under their commitments. While their main purpose is to be familiar with entire provinces thematically, topographical and administrative structure, they also try to manage the other city activities such as healthy, security, population, communication and road network works etc. The Governorship of Sakarya, Kocaeli, Bursa, Ankara, Istanbul, Amasya, and Trabzon can be given as example to use GIS in the provinces level.

Municipalities are the other local authorities that use GIS actively. Especially, in urban planning, land development, urban management, supervision, and tax collections are main issues in the cities. Therefore, using computerized systems are very important. In order to collect, store, manipulate and display spatial data in an effective way GIS is very helpful for municipalities. Under the name of "Urban Information System", most of the municipalities in Turkey are trying to establish and use GIS systems. For this, digital topographical maps have been prepared initially. It should be pointed out that, main financial resource of municipalities in Turkey is the land taxes. So, they are actually considering the collect this tax very properly, therefore, GIS is very useful too. But on the other hand property information and zoning plans should be linked and updated in order to control taxing process. Because of limited budget most municipalities can not effort to provide digital data to practice a GIS. So, they want GIS but they don not have enough funds, professional personnel and time as well. As a result, a complexity and waste of resources are unfortunately going around in Turkish municipalities. A few municipalities, for example Istanbul, Bursa, Ankara, Izmir, Aydın and Antalya, are using GIS in a more realistic way than the others. But the standardizations and use of spatial data are still incomprehensively.

Others

General Directorate of Mineral Research and Exploration (*in Turkish* MTA) is another large public institution which is responsible mineral related works in Turkey. In recent years, MTA is also carried out some project based on remote sensing and GIS. First, Geological Map of Turkey has been digitized in 1998. A GIS and remote sensing branch has been settled under the institution to follow and use of GIS developments. In some part of Turkey, geological and mineral researches have been done by using remotely sensed data (www.mta.gov.tr). Especially, after the big Earthquake of August 17th, 1999 in Turkey, the area has been focused in order to take care of people more precisely. So many geological maps are produced by using GIS to serve local authorities and re-planning purposes as well.

Moreover, in Turkey, there are also some other institutions which are using GIS for their projects different than the above mentioned public organizations. But non-standardization and waste of spatial data in use can prevent understanding GIS in whole. This also have a negatively effects on GIS developments in other institutions. People most consider about in a short term and individual projects even they may duplicate data. So, links between the public organizations has not been established well yet. National Information Systems is one the project that aims to solve this issue, but to realize the project is too slow.

2.2 GIS in Private Sector

Turkish private sector is really having a dynamic structure in many ways of the economy. GIS is one of the interested subjects for them. Private sector has a great role to push public sector ahead in respect to have and use of GIS. They have responsibility to introduce GIS abilities to public sectors as well. Because of this sector is the mostly effected by the information technology, the new developments are kept and transformed to public society. Not only hardware and software requirements of GIS especially are provided by this sector, data collection, digitizing and establishment for the infrastructure of information technology to individual organizations are also done. Even economical crises appear often, it can be said that private sector is the dynamo of GIS activities in Turkey.

There is no data about GIS market in Turkey, but there are some individual GIS companies, mostly software distributors, which run GIS-based projects for public organizations. Most projects are taken from municipalities in order to establish a well urban information system for their needs. This approach is increasing very rapidly by development of Internet and open databases systems. Yet, internet is very suitable for local services and quick access way to information. While developing Web-based GIS or Internet Mapping concepts, local bodies such as municipalities demand are being in this way too. By GPS-GIS integrations, vehicle following examples are also applied in many non-government organizations. In addition, many digital orthophotos are produced for large cities too. All these are done by private sectors only.

Software development is also provided by private sectors. Especially Turkish Language based GIS software are most wanted feature by users. Special interface and specific requirements can be needed. In order to solve such problems, some GIS based software has been developed by private sector and had an important place in the market. One of the main disadvantages for private sector is that GIS really was not known by the people very well. For this reason GIS do not have enough activities in private projects themselves. Rather than telling about the GIS, a specific project which includes and hides GIS concept inside, is been telling the people. For example in telecommunication sector, “where is what?” and “where is it?” questions can be achieved by the GPRS technique based mobile phones even the users do not know GIS.

2.3 GIS in Education Sector

It can be said that GIS use has been exploded by universities in Turkey. At the beginning just a few master thesis projects have been completed in order to understanding GIS abilities in 1990’s. By the time GIS related researches are increased very rapidly in the universities. Initially GIS studies are done by Geodesy and Photogrammetry Engineering Departments, but later on to use and display spatial information in a different way, many other disciplines have also used GIS.

Today GIS is taught in many university’s departments such as geography, geology, urban planning, civil engineering, computer science, biology, forest sciences and so on. In universities, GIS courses as usually consist of tutorials, readings, projects, and discussions concerned with how GIS can be used to integrate geographic data compiled from varied sources. Students are also complete the course are able to specify and perform the tasks involved in creating a digital geographic database, including geo-registering scanned base maps, digitizing vector features, entering attribute data, and compiling metadata. It has to be mentioned that GIS is more popular in graduate level than the undergraduate levels yet. According to the records of the Turkish Higher Education Council, 111 number of master thesis and 33 number of PhD theses have been submitted between 1991-2000 years (www.yok.gov.tr). Some special research projects have been carried out by university’s GIS research labs too [*Yomralıoğlu*, 2000].

Today GIS training is only be given by the universities, but outside the university many people are also interested in GIS. Especially professional person need in public and private sectors encouraged the people to be trained on GIS. Some short time period courses are started to given by university and private companies as well. Some sort of symposium and special discussions are also carried out in order to share the new development and ideas on GIS with people.

3. CONCLUSIONS

GIS are simply the information technology based system for capturing, storing, checking, integrating, manipulating and displaying data which are spatially referenced to the earth. The GIS component refers to the need to exploit the research potential of a new technology which has been hailed as "the biggest step forward in geographic information handling since the invention of the map". Turkey is a large country which has a bureaucratic governmental structure and dealing with a lot of management issues. In the past, information has not been taking care of as resources in many cases. But today, this idea is changing very rapidly, and every individual with respect to public and private sectors are trying to hold their information more precisely then the before. Therefore it is now most valuable and meaningful for people's life. Especially spatial information is now not only a need; it's needed to get new profits from it as well.

Turkey has realized that GIS is one of main tool for public management and to know the resources of the country in order to having a regular development. Therefore, in both public and private sector have spending too much effort to get benefits from GIS. Public sector puts a couple of new serious GIS related projects in country-wide to implement, while private sector proving technological support to them. But still unorganized developments on spatial information use are occurring in around. In data exchange and standardization issues, for example, are still exist. Developed projects and produced spatial data could not be integrated for the future use. In some cases data may not be available and to collect it is very expensive task. But sometimes it may be available but in this time a limited use can occur because of national confidential information. So even many uncertainties are present, use of GIS are going up very well in Turkey.

REFERENCES

Banger, G., "Turkish National Information Systems", Report, The Prime Ministry of Republic of Turkey, Ankara, (2000).

Demirbüken, H., Gemalmaz, A., Aztopal, H., Çalış, N., Ay, A., "Tarımsal Amaçlı Uygulamalarda Arazi Çalışması ve Elde Edilen Sonuçların Değerlendirilmesi", 1. Ulusal Coğrafi Bilgi Sistemleri Sempozyumu, KTÜ, Trabzon (1994).

Taştan, H., Maraş, H., Ulubay, A., Kopar, A., "GIS Related Activities in General Command of Mapping", in Proc. of the First Turkish – German Joint Geodetic Days, edited by M.O.Altan, L. Gründig, pp. 185-194, Istanbul, (1995).

Taştan, H., Maraş, H., Şahin, K., Kurt, M., Ünlü, T., Çağlar, Y., Yılmaz, E., "Sayısal Harita Destekli Askeri Uygulamalar (SAHADASU) Yazılımı", Harita Dergisi, Ankara, (2000).

Yomralıoğlu, T., "Coğrafi Bilgi Sistemleri: Temel Kavramlar ve Uygulamalar", Seçil Ofset, Istanbul, (2000).

www.mta.gov.tr

www.tapu.gov.tr

www.yok.gov.tr