Examining European SDI Initiatives in Anticipation of a SDI Framework for Turkey

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Key words: Spatial Data Infrastructure, ESDI, EU, Data Policy.

SUMMARY

Spatial information has an important role for development process of a country. It provides an economic value and also contributes to several policy areas. To use spatial information effectively, many governmental organizations started to perceive the importance of more integrated assessments because of environmental and social needs. Spatial Data Infrastructure (SDI) coordinates actions of nations and organizations that promote awareness and implementation of complimentary policies, common standards and effective mechanisms for the development and availability of interoperable spatial data and technologies to support decision making for multiple purposes. SDI with the contribution of Information Age promotes more effective delivery of services to public, government, business, and other related sectors. European countries are in the process of developing SDIs at national and/or regional/local levels. The institutional and cultural heterogeneity of Europe results in variations of SDI activities. Europe becomes economically and socially more integrated. EU countries and also accession and candidate countries promote Europe-wide frameworks of spatial data with some common initiatives and activities. Most initiatives are developing the legal framework needed to underpin the creation of a European SDI, starting from priorities in the environmental field, it is clearly important to evaluate the extent of progress of SDIs in Europe, and to identify key issues that need to be addressed to ensure complementary between European and national/regional developments. Turkey is aiming to become a member of EU. Current situation about the use of spatial information is examined for Turkey in view of organizations, legal framework, data, technology, standard, and metadata. Depending on these European Spatial Data Infrastructure (ESDI) initiatives, differences and the common issues between the countries will be determined, prospects for further developments provided and necessary future activities and policy recommendations were done. As a result of this, general criterion is determined for building a Regional/National SDI on EU candidate countries.

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1. INTRODUCTION

Geographic Information (GI) refers to any information that has a reference to the Earth's surface. It includes information on underground networks and geological features, as much as objects and features on the Earth's surface such as parcels, buildings, rivers, transport networks, and urban and rural settlements (GINIE, 2003). GI has a major role to play in addressing societal demands and exploiting the opportunities opened up by policy and technology. GI has economic value as a major component of Public Sector Information and has social and policy value for providing the basis to integrate policies and to provide tangible benefits to citizens, business, and governments.

While Geographical Information Systems (GIS) were largely designed to serve specific projects or user communities, the focus is now increasingly shifting to the challenges associated with integrating these systems into a society perspective. An SDI encompasses policies, fundamental data sets, technical standards, access network (technologies), and human resources (including users, providers, and value adding sectors) necessary for the effective collection, management, access, delivery, and utilization of spatial data at different political/administrative levels (Budic, et al. 2004; Chan, et al. 2001; Coleman & McLaughlin, 1998). The ultimate objectives of SDI are to promote economic development to stimulate better government, and to foster environmental sustainability.

Many national governments and organizations throughout the world are in the process to develop SDI. As time went by, these countries tried to find cooperation with other countries to develop multinational SDIs to assist in regional decision-making that has an important impact across national boundaries. This has resulted in the development of the SDI concept at a perspective that starts at a local level and proceeds through state, national and regional levels to a global level (Rajabifard, *et al.* 1999).

There is an increasing recognition across Europe, and indeed other parts of the world, that the availability and effective use of GI needs to be maximized to support good governance, economic and social development, informed public participation for e-Government, citizen protection, security and environmental sustainability (GINIE, 2004). Besides many SDI related activities in European countries, ESDI initiatives has become a hot topic as a European Union policy for decision making processes beyond UN borders. INSPIRE sets out the rules in its directive for wider use of geographic information in Europe. Besides two other important initiatives namely GMES and GALILEO, many initiatives can be though as key players for ESDI development processes. Turkey as a EU candidate country should determine requirements for National SDI strategies, depending on ESDI expectations at EU level after examining current situation in Turkey.

2. GLOBAL SDI ACTIVITIES

Since the late 1970s, many national survey and mapping organizations have begun to recognize the need to justify the large public investments they received by improving access, and encouraging a broader use of the information in their custody. In the 1980s and early 1990s, Canada, the United Kingdom, the United States, the Netherlands undertook extensive reviews and studies to demonstrate the cost effectiveness of their national survey activities (Groot, 2004). Today, these countries have executed their most SDI components like legal, technical, and organizations issues. Beyond many national and organizational SDI initiatives, some regional and global levels initiatives appeared.

GSDI – The Global Spatial Data Infrastructure Association is a non-profit global organization made up of members from more than 50 countries including industry and government organizations, and individuals. The GSDI supports ready global access to geographic information. This is achieved through the coordinated actions of nations and organizations that promote awareness and implementation of complementary policies, common standards, and effective mechanisms for the development and availability of interoperable digital geographic data and technologies to support decision making at all scales for multiple purposes (URL-1). Based on this model and current difficulties faced by many SDI initiatives at national and regional levels, the GSDI initiative determines future development and implementation phases. SDI activity at all phases can be explained with GSDI Cookbook.

ISO - International Organisation for Standardisation is a key player in international official standards. The ISO is a world-wide federation of national standards bodies from 135 countries. ISO TC211 (Geographic Information/ Geomatics) increases the usage and the sharing of geographic information; promotes the efficient and economic use of geographic information, and contributes to a unified approach to addressing global ecological and humanitarian problems (URL-2).

OGC- Open Geospatial Concortium is an international industry consortium of 270 companies, government agencies and universities participating in a consensus process to develop publicly available interface specifications. OGC Specifications support interoperable solutions that geo-enable the Web, wireless and location-based services, and mainstream IT (URL-3). The specifications empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications.

ISCGM - International Steering Committee for Global Mapping coordinates national, regional and international organizations to foster the development of Global Mapping. Global Map is a group of global geographic data sets of known and verified quality, with consistent specifications which will be open to the public (URL-4).

CEOS - The Committee on Earth Observation Satellites (URL-5) is an international coordinating mechanism charged with coordinating international civil spaceborne missions

designed to observe and study planet Earth. With 23 Members (most of which are space agencies) and 21 Associates (associated national and international organizations), CEOS is recognized as the major international forum for the coordination of Earth observation satellite programs and for interaction of these programs with users of satellite data worldwide.

FIG – International Federation of Surveyors, ISPRS–The International Society for Photogrammetry and Remote Sensing, IAC – International Cartographic Association with their sub commissions have research activities and provide professional awareness about SDI concept.

Many organizations such as GDIN- The Global Disaster Information Network, GLOBWINET- Global Water Information Network, CGIAR-CSI- Consultative Group for International Agriculture Research, Concortium for Spatial Information, are trying to provide coordination at global level for environmental issues. In addition to this, global level projects supported by NGA- National Geospatial Intelligence Agency and NASA- National Aeronautics and Space Administration are Digital Earth, Global Land Cover Facility, USGS EROS Data Center, and like these. Projects supported by United Nations are UNRISD-Research Infrastructure for Social Development, UNGIWG- Geographic Information Working group, Wide Earthwatch, and GRID- Global Resource Database –Europe.

3. EUROPEAN SDI ACTIVITIES

The European Union (EU) expanded recently from 15 to 25 Member States, with an increasing of the population from 380 million to 455 million, covering 3.9 million square kilometers, and 20 official languages. Environmental, economic, social, and political issues started to be difficult. Considering a broader perspective beyond European Union is required. These diversities among countries have led to a number of initiatives which aim to create a SDI at European level. Despite these many initiatives, the existing activities are not coordinated at European level very well. Encouraging basic European data sets, supporting technology and knowledge infrastructure have not been well co-ordinated across disciplines or national boundaries, making it difficult and expensive to fit data together from many different sources in a seamless way (INSPIRE, 2003).

As an intention, building ESDI was triggered by EU authorities. Building an ESDI requires policy/legal/organizational regulations together with technical dimension such as determining standard and the creation and maintenance of geographical information layers for a wide range of themes. The ESDI is to deliver to the users integrated spatial information services from a wide range of sources, from the local level to the global level, in an inter-operable way for a variety of uses. A fully operational infrastructure for spatial information in Europe can only be realized in the long run with stepwise approach. Action 2142–ESDI (IES, 2004) has the task to technically coordinate the Infrastructure for Spatial Information in Europe (INSPIRE) initiative and to shepherd it the various steps working towards the realization of a ESDI. This Action includes specific research activities on GIS interoperability, harmonization, geo-spatial data fusion, generalization. This Action also liaises with the European and International research communities, networks and initiatives.

3.1 Historical phases towards ESDI

In early 1990, many developed countries undertook extensive reviews and studies to demonstrate the cost effectiveness of their national survey activities. In 1989, the Commission of the European Communities (CEC) issued its guideline (CEC, 1989) explaining the economic importance of free access to databases created by public funds and the role of the private sector in adding value to the information production at the highest levels in the European Community.

The policy debate on the development of the Information Society in Europe can be traced back to the 1993 Maastricht Treaty that gave the Union responsibility in matters of trans-European networks in the transport, energy, and telecommunications sectors, thus providing the legal basis for the development.

The European Union followed in a similar vein with the Bangemann Report, a wide-ranging set of recommendations as to how the EU would provide leadership to its member countries for their entry into the information society (EC, 1994). The EC emphasized the emerging information society and geospatial information as a key enabler.

First discussion began in 1995 by the EC Information Society Directorate General (DG INFSO). "GI2000: Towards a European Geographic Information Infrastructure" (EC, 1995) documents were published in a meeting in 1995. It emphasizes the commercialization of government-owned geo-information to stimulate economic development and support a variety of policy initiatives. Workshops were held and GI2000 documents were published as the planned ongoing series in 1996 (EC, 1996), 1997 (EC, 1997). Last GI2000 document (EC, 1999) was published in 1999, but abolished.

After millenium, ETeMII (European Territorial Management Information Infrastructure) and GINIE (p.10/17) projects accompanied by EC appeared in 2001. GINIE aims to promote an European strategy for geographic information and propose several recommendations included in INSPIRE (Infrastructure for Geographic Information in Europe). And INSPIRE initiative (p.8/17) appeared in 2001.

As a current vision, european level policies accepted by European Commission, initiatives, agencies, commissions, and projects relating ESDI are examined. Figure 1 can provide insights about ESDI related activities. Items on the figure is explained briefly in next sections.

3.2 European Policy Level

Policies accepted by European Commission as a driving force determine the base of ESDI.

The Lisbon Strategy (URL-6) accepted in March 2000 as a ten-year strategy brings economic, social, and environmental renewal in the EU, The strategy is to make the EU the world's most dynamic and competitive economy. The first objective is to support the

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knowledge-based society requiring an emphasis on research and the development of competitive technologies .
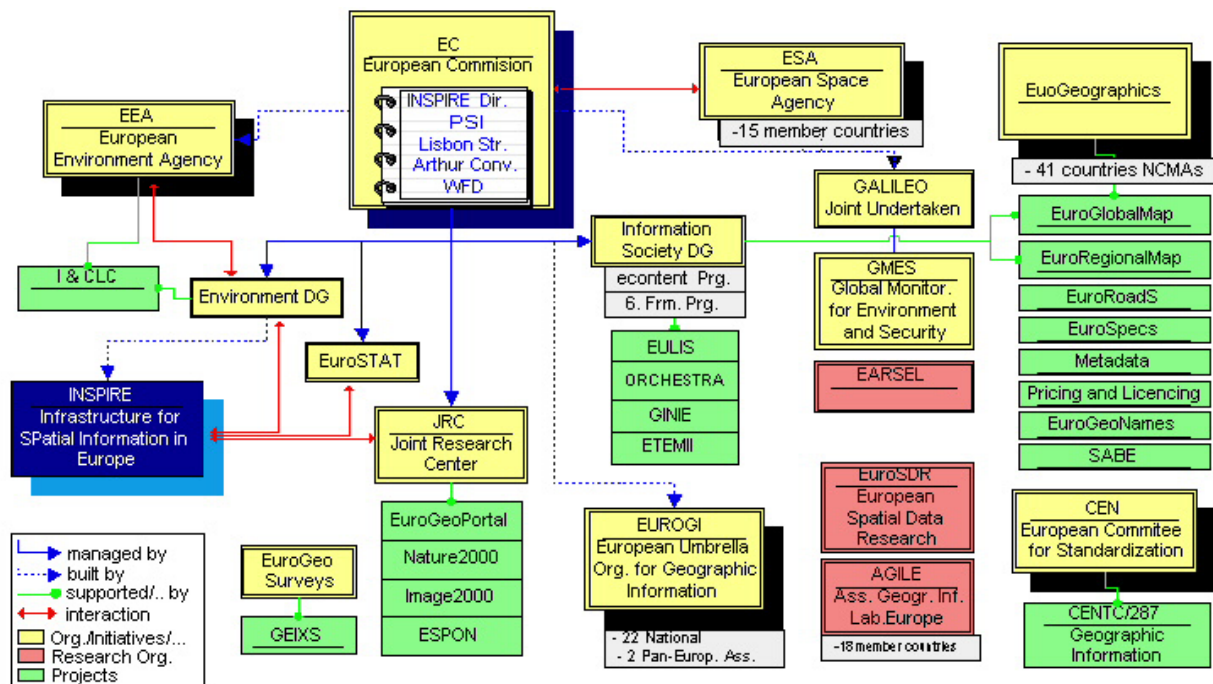

Figure 1 : Schema about ESDI related activities

Aarhus Convention (URL-7) was done on 25 June 1998 and came effective in 2001. This convention aims to allow the public greater access to environmental information held by public authorities, thereby increasing the transparency and accountability of government; it provides an opportunity for people to express their opinions and concerns on environmental matters and ensures that decision makers take due account of these.

WFD- **Water Framework Directive** (URL-8) published on 23 October 2000 establishes a framework in the field of water policy aiming to get polluted waters clean, and ensure clean waters are kept clean.

PSI- **Public Sector Information** (URL-9) published on 17 November 2003 is the directive to establish a minimum set of rules governing the commercial and non-commercial exploitation of existing information held by the public sector. The public sector collects, collates and disseminates information in many areas of activity such as social, economic, geographical, weather, tourist, patent and education information. It is hoped that if more use is made of such data, the general public and companies will be able to take greater advantage of the internal market.

INSPIRE Proposal has been adopted on July 23th 2004 by the EC. The proposed Directive creates a legal framework for the establishment and operation of an Infrastructure for Spatial Information in Europe, for the purpose of formulating, implementing, monitoring and

evaluating Community policies at all levels and providing public information. A key objective of INSPIRE is to make spatial data more available for Community policy-making and implementation of Community policies in the Member States at all levels. INSPIRE focuses on environmental policy but is open for use by other sectors such as agriculture, transport and energy.

It may eventually entry into force at beginning 2007. A three phased programme of work is proposed with a Preparatory (2005-2006), Transposition (2007-2008) and Implementation (2009-2013) phase (INSPIRE, 2005). This infrastructure shall be based on infrastructures for spatial information established and operated by the Member States. The composing elements of those infrastructures shall include: metadata, spatial data themes and services, network services and technologies, agreements on sharing, access and use; co-ordination and monitoring mechanisms; process and procedures. Member States will have to implement different measures to have these components into place (INSPIRE, 2004).

3.3 European SDI related Commissions/Agencies/Initiatives/Projects

EC- European Commission is the politically independent institution that represents and upholds the interests of the EU as driving force and is responsible for implementing the decisions of Parliament and the Council. EC has 36 Directorates-General (DGs) and specialised services which make up the European Commission.

Information Society DG is the eEurope initiative agreed at the Lisbon summit in March 2000. Its aim is to bring the benefits of the Information Society to all Europeans. This DG is the main EC funder of projects relating to GI. They are currently running two major programmes important for SDI; *6th Framework Programme (FP6)* contains two related areas, Information Society Technolgies Programme (IST) and Energy, environment and sustainable development (EESD). The other, *eContent Programme aims* at supporting the production, dissemination and use of European digital content and to promote linguistic diversity on the global networks.

Environment DG's main role is to initiate and define new environmental legislation and to ensure that measures, which have been agreed, are actually put into practice in the Member States.

INSPIRE – Infrastructure for Spatial Information in Europe (URL-10), launched in 2001 by the European Commission under responsibility of Environment DG, aims at making available relevant, harmonized and quality geographic information to support formulation, implementation, monitoring and evaluating European policy, beginning with environmental policy, and later extending to agriculture, transport, and other sectors, whether at local, regional, national or international levels. It intends to trigger the creation of an ESDI that delivers to the users integrated spatial information services. The ultimate goals are to contribute to good governance through more and better-informed public participation in decision making by policy makers, and environmental improvement resulting from better-informed decisions by individuals and businesses.

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EUROSTAT- Statistical Office of the European Communities (URL-11) is the Statistical Office of the European Communities, established in 1953. It gather and analyse figures from the different European statistics offices in order to provide comparable and harmonised data to the European Institutions. It manages administrative activities and behaves as permenant secretary of INSPIRE. It also monitors the implementation and use of the infrastructure, assure correct implementation of ESDI related activities.

JRC- Joint Research Centre (URL-12) functions as a reference centre of science and technology for the Union as a service of the EC. The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies.

JRC, Institute for Environment and Sustainability, Land Management Unit is supporting EU policies and programmes linked to sustainable land management practices in the fields of forestry, weather-driven natural hazards and urban development. The JRC, through the action 2142-ESDI, has the task to technically coordinate the INSPIRE initiative and to shepherd it the various steps working towards the realization of a ESDI starting with Forest, Natura2000, Image2000 and ESPON.

EC GI&GIS web portal (URL-13) on figure 2 provides EC activities, projects, organizations, documents , events, people relating to GIS and SDI. It was prepared by The JRC as the EC GI Technical Office.

The INSPIRE European Geo-Portal (URL-14) is Europe's Internet access point for Spatial Data and Services. From here, you can search for spatial data, services, and organizations. This is an experimental prototype version of the EU Geo-Portal, aiming at better understanding user requirements and at defining the standards-based technical specifications of the future operational system.

EEA- European Environment Agency , located in Copenhagen and established by the EC, has 31 member countries in operational since 1994. The EEA's core task is to provide decision-makers with the information needed for making sound and effective policies to protect the environment and support sustainable development (URL-15). EEA handles the European environment information and observation network (EIONET). It operates environmental activities for ESDI process.

ESA- European Space Agency is Europe's gateway to space with 15 member countries. The ESA is entirely independent but maintains close ties with the EU through an ESA/EC Framework Agreement. Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe.

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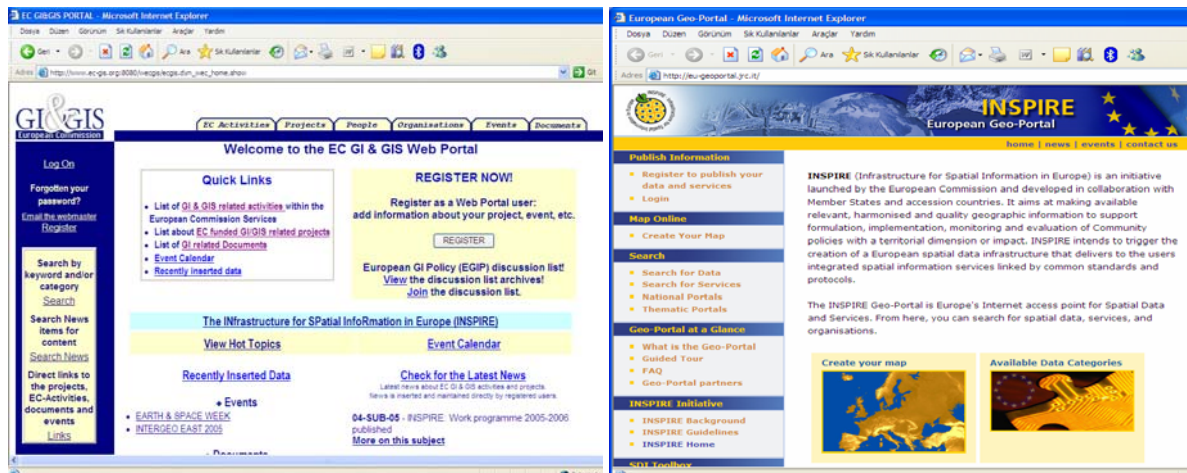Cairo, Egypt April 16-21, 2005

Figure 2: EC GI&GIS Web Portal and INSPIRE European Geo Portal

GMES - Global Monitoring for Environment and Security is a joint initiative of the EC and ESA, designed to establish a European capacity for the provision and use of operational information for Global Monitoring of Environment and Security. In 2008 the foundations and the structuring elements of the European Capacity for Global Monitoring of Environment and Security should be in place and operating. It aims to disseminate information in support of EU policies, build the mechanisms needed to ensure a permanent dialogue between all stakeholders, and the legal, financial, organizational and institutional frame to ensure the functioning of the system and its evolution (URL-16).

GALILEO Programme is a joint initiative of the EC and the ESA to provide Europe with its own independent global civilian controlled satellite navigation system. When fully deployed, Galileo will consist of a constellation of 30 satellites in 3 orbits offering unprecedented accuracy and reliability of positioning. This allows for a range of many applications, products and services to be developed for use in a variety of sectors (URL-17).

EuroSDR- European Spatial Data Research, (URL-18) established in 1953 and members from 18 countries, is a Research Platform for national mapping agencies, academic institutes, the private sector, industry and other groups concerned with European spatial data infrastructures vital to sustainable spatial planning and development.

EUREF - European Reference Frame (URL-19) is a sub commission of the International Association of Geodesy which is responsible for the maintenance of the European Reference System (ETRS89). EUREF deals with the definition, realization and maintenance of the European Reference Frame in close cooperation with the International Association of Geodesy (IAG) components and EuroGeographics.

EUREF has been developing a set of activities related to the establishment and maintenance of ETRS89 (European Terrestrial Reference System) and EVRS (European Vertical Reference System). A key instrument in maintaining ETRS89 is the EUREF Permanent

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Network (EPN), covering the European continent, whose stations observe continuously with high accuracy GPS/GLONASS receivers.

GINIE- Geographic Information Network in Europe (GINIE, 2004) supported by IST programme aims to bring together industry, government, research, and the European Commission for developing and promoting a coordinated European strategy for geographic information. It is consistent with major policy and technological developments at the European and international level. This is completed project and Its partners are EUROGI, OGC, JRC, and the University of Sheffield (Coordinator).

I&CLC2000- Image2000 & Corine Land Cover 2000 Project (URL- 20) is a joint project between the EEA and the JRC. Image2000 covers all activities related to satellite image acquisition, ortho-rectification and production of the European and National Mosaics. CLC2000 covers all activities related to the update of the CORINE Land Cover Database, based on Image2000 data, and the detection of land cover changes. These products are intended to be the main source of data for updating the European Land Cover database, as reference.

EuroGeographics (URL-21) has members from nearly all European National Mapping and Cadastral Agencies (NMCAs). EuroGeographics focus on some projects regarding reference datasets, improved metadata service, and specifications, policies, and procedures to devolop sustainable solutions for building the ESDI within 10 years.

EuroGlobalMap and EuroRegionalMap projects supported by EC e-content programme can be accepted as reference data in future ESDI vision. EuroGlobalMap is a topographic dataset that covers almost the whole of Europe at the scale 1:1 million. EuroRegionalMap is a geo-topographic vector reference database at scale 1:250 000 (medium-scale) suitable for spatial analysis and for visualisation and is based on the harmonisation of existing national data bases of the NMCAs. A first production phase covering seven countries is now initiating to cover Europe.
EuroSpec is to achieve interoperability of NMCA data with models and specifications for reference data for developing the ESDI.
SABE is producing and maintaining the Seamless Administrative Boundaries of Europe product.
EuroMapFinder Metadata provides an alternative solution to the existing GDDD, based on a distributed architecture and technology allowing for easier and remote metadata content maintenance.
Pricing&Licencing creates guidelines for a common Data Policy.
Euro Roads is a standardised, seamless, updated and quality assured digital road data.

EUROGI - EURopean umbrella Organisation for Geographic Information (URL-22) unifies geographic information associations from 6500 separate organisations in 20 different countries. With this capacity, it aims to maximize the effective use of geographic information and can be efficient in lobbying organizations to facilitate the development of the ESDI at policy level in the future.

CEN – European Committe for Standardization (URL-23) has become an important organization with the growth of pan-governmental activity at the European level. Many of its standards are referenced by European Commission documents. About 40% of all European standards are direct adoptions of ISO standards under Vienna Agreement for each to ratify the other's work. Related standard body is <u>TC/287-Geographic Information</u>.

EuroGeoSurveys (URL-24) is formed by the Geological Surveys of the European Union. The organization represents the European National Geological Surveys from 26 member countries. It pursues to promote the contribution of geosciences to European Union affairs and action programs; to provide a permanent network between the Geological Surveys and a common, but not unique, gateway to each of the Surveys and their national networks. With GEIXS, the Geological Electronic Information Exchange System was presented as a Metadata Service.

AGISEE- Association For Geospatial Information In South-East Europe (URL-25) aims at promoting geospatial data use and building SDI in the region of South-East Europe including Turkey. The study project **GISEE** (GIS Technology and Market in South East Europe) aimed at investigating the status of the spatial data infrastructures in South East Europe and in providing information about this status, laying the foundation for the further development and for the establishment of SDI in the region of South East Europe.

3.4 European National Level

None of the countries has in place a complete operational SDI as defined in the GSDI cookbook. Most countries are aware of the importance of SDI and are planning, or taking initiatives to develop elements, or components of SDI. The Netherlands and Portugal were accepted as well developed NSDI initiatives. SDI developed differently not only between countries but also regions and organizations within countries. SDI initiatives in Europe are managed by public sector more than private sector.

SDI related issues in 32 European countries scored well according to the SDI State of Play study (SADL, 2003). Geodetic reference systems and reference systems are standardized. Metadata was created for certain data sets and generally free of charge. Only half the 32 countries have SDI components reaching a significant oparitional level. A few countries have a legal structure for the developing SDI initiatives. Even fewer countries maintained financial situation for long period. Some countries built operational map services. Harmonization between different data producers is hot topic. While there are many web mapping application, It is difficult to find successful web services applications, also having compliance with CEN, ISO, and OGC standards. Sharing datasets between government bodies has been difficult in view of legal procedures (Vanderhaegen & Groof, 2004). If we compare with member states, accession countries have more advanced policies among public sectors than operational and technical activities.

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4. CURRENT SITUATION OF SDI ACTIVITIES IN TURKEY

4.1. Policies

E-turkey initiative was started on September 9, 2001, depending on the aims of e-Europe+ action. After February 27, 2003, the project was named as "E-Transformation Turkey Project" and a committee including representatives from related public associations and organizations was built to manage and direct activities (URL-26). Besides known information society policies, e-europe+ strategies and expectations from member states were determined as a main target. *Action 47-"Making Preliminary Works for Building Turkey National GIS"* was started within e-transformation Turkey project under the responsibility of Land Registry and Cadastre Directorate (LRCD). On this process, national SDI strategy as policy encouragement has not been determined yet.

4.2. Organizations

Public sector actors, especially Ministry of National Defense, General Command of Mapping (GCM) as a member of EuroGeographics, are involved in mapping and SDI related activities. *BHİKPK - Inter-ministries Coordination and Planning Committee* **for Mapping** coordinates map making activities for 1/5000 or larger scaled maps and all kinds of mapping and planning needs. The committee distributes these duties to GCM and LRCD, depending on their capacities. This committee unifies most public authorities and is managed by GCM. Regulations Commission as a sub division of this committee aims to prepare legal base and legal draft regulations to build Turkey National GIS. They prepared a draft Turkey National GIS Policy and Strategy Principles. Also, regulations for producing and dissemination maps were created.

Prime Ministry Office initiate the *Public-Net* project on 19.03.1998 to enable ministries and other public institutions for working in coordination on computer networks, later named *NIS-National Information System*. On this project, all institutions produce their own data according to national standards and collect on standard databases, and then they can share required data on NIS platform. Because of disorganized structure, the project was abolished on 19.06.2002 and government ministers take the responsibility about all e-Turkey related activities.

There are felt to be weaknesses in communication about and coordination with institutional frameworks and public administration. There is no centrally management authority among associations and organizations as a mediator to built NSDI in Turkey.

4.3. Standards

GCM and Turkey Science Association (TUBITAK) are trying to create "*National Data Standards*" with the participation of related instutions. Also, BHİKPK prepared "*Feature and Attribute Coding Catalog*" and "*Spatial Data Standards*" but has not been concluded yet.

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UVDF- National Data Change Format determines data types and data flows, based on XML format and, compliant with OGC Specifications. It was produced with wide participations based on current standards.

TUTGA- Turkey National Base GPS Network meets all kinds of positioning, reference information, and requirements and includes GPS based 594 points on ITRF coordinate system. It was executed to integrate international networks (LRCD, 2004).

4.4. Projects

In 1990's, digital maps were produced using CAD format. GIS related activities with the pioneering with GCM began in 1986 and consist of mainly two distinct projects. In 1990, National GIS project was conducted in accordance with NATO Data Standards (Yomralioglu, 2004). And GCM executes *Topographic Database Building Projects* scaled at 1:25000, 1:250000, 1:1000000. Public and private sector have spent so much effort to get benefits from GIS and Public sector. They put a couple of serious GIS related projects in country-wide to implement.

TAKBIS- Land Registry and Cadastral Information System **Project** began to develop a National Land Registry and Cadastre Information System in Turkey. The goal of TAKBIS is to establish a country-wide land information system (LIS) through the use of GIS and to develop several GI-based applications, using software required by the end-users (Poyraz & Ercan, 2002). This Project has not been completed yet, but it can be an integral part for SDI activities in Turkey. In addition to this, *MERLIS- Marmara Earthquake Region Land Information System* Project aims to restructure and develop Marmara Region after earthquake.

The General Directorate of Rural Services (GDRS) established a Land Information System, for soil and water termed as the *National Soil and Water Information System*. The project was commenced in 1999 with a pilot study for the Ankara province. This project with European standards and protocols will prove to be an important facet of the ongoing development (URL-27).

Also, there are many other projects executed by different public institutions and organizations, but they have not reached required level as needed. Also, as coordination among GIS projects has not been provided, there are many overlaps between mapping activities.

5. RECOMMENDATION AND CONCLUSION

GI can be seen as one of the most important tool for improving the quality of life in Turkey at varying levels and stages. As a new concept, sharing spatial information helps environmental management and regarding activities. Also, it can be seen as an economic development tool in the context of globalization. Turkey has realized and is actively involved in using GIS for

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public management. In view of SDI concept, there is an unorganized structure and determining spatial and technical standards have not been completed yet. Developed projects and produced spatial data could not be integrated for future use although Turkey has a great potential for GIS industry.

At European level, EC and its directorate-general and services has important effects to facilitate the development of ESDI. Driving policies accepted by EC can support the effective use of GI. This driving force should be a guide for EU and its candidate countries. Turkey should determine some brief pathways like other countries in EU and depending on INSPIRE and other European level policies as a EU candidate country.

At National Level, Turkey should provide the technical coordination of INSPIRE with Commission and Member States; to guarantee the exchange of information between INSPIRE working groups and facilitate the involvement of Spatial Data Interest Communities including the link with GMES, GALILEO and EuroGeographics,...etc.

Standardization initiatives like ISO/TC211, CEN/TC287, OGC play a leading role in awareness of SDI applications. Turkey can produce a harmonized structure at national level and European level in compliance with standardization approach.

Creating databases combined with pan-European spatial databases like Natura2000, I&CLC2000 and realizing interoperable services and components is necessary to support policies toward nation for forest regulations, risk management, and regional policies.

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