Information Infrastructure Approach: Spatial Data Infrastructure Implementation Issues in Turkey

Arif Cagdas AYDINOGLU, Tahsin YOMRALIOGLU, Turkey

Key words: e-Governance, GIM, GSDI, Turkey, II

SUMMARY

The countries including developing world are in the process to become Information Society (IS) as a part of economic and social development, and trying to use information efficiently on decision making processes and services aimed at citizens. Information Systems (IS) that support information management in concerned working group have been re-conceptualized as Information Infrastructure (II) concept that supports effective and corporate decision making by various institutions in a large user community. In this way, II includes varied technologies, networks, standards for many application areas over time and space. Similar to IS, Geographical Information Systems (GIS) dealing with spatial data can be re-conceptualized as Spatial Data Infrastructure (SDI) or SIM Infrastructure.

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, which were previously carried out in a decentralized and uncoordinated manner. As a sub section of this project, the actions devoted to building Turkey National GIS were initiated and activities are continuing towards National SDI vision. SDI Implementation issues in Turkey can be described as II concept. These issues include telecommunication infrastructure and related policies to encourage e-government, facilities to access and share information, ICT devices and software, technical standards on GIS activities, metadata usage, GI dissemination methods, organizations and policies to coordinate stakeholders related to spatial data. These issues are categorized and examined with the Access Rainbow, a socio-technical architecture and a seven-layer conceptual model of access to II. The aim of this paper is mainly to examine current situation on SDI development in Turkey in respect of the Access Rainbow.

Information InfrastructureApproach: Spatial Data Infrastructure Implementation Issues in Turkey

Arif Cagdas AYDINOGLU, Tahsin YOMRALIOGLU, Turkey

1. INTRODUCTION

Information has become vital importance in the development of a country and driving force on decision making processes. Geographic Information (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 noteworthy benefits to citizens, business, and governments (Craglia, 2004). Applying GIS functionality provides a powerful decision support in various application domains to planners and managers concerned with finding optimal solutions to complex problems (Longley etal., 2001, Yomralioglu, 2000).

The focus is changing toward integrating these systems into a society perspective. II has become increasingly used for providing integrated solutions with the helping of information and communication technologies (Georgiadau, 2003) and are described to subsume varied technologies, networks, standards to support a diversity of application areas over time and space (Hanseth, 2000). While GIS were largely designed to serve specific projects or user communities, SDI is special case of II, beyond using GIS. SDI encompasses policies, technologies, human resources for the effective collection, management, access of geographic information to stimulate better governance, and to foster environmental sustainability by reducing duplication and facilitating integration at different administrative levels (Aydinoglu etal., 2005). II approach can provide interesting and useful insights to understand and explain technical and institutional complexities within SDI. Access Rainbow, a metaphor approach reflecting II, includes a socio-technical architecture and a seven-layer conceptual model of access to II. In developing countries, the predominantly techno-centric thinking around SDIs continues to significantly impede the progress of the implementation efforts. However, socio-technical issues should be examined for a complete SDI perspective (Georgiadau etal., 2005).

In this study, SDI concept and components were examined within II concept. Rainbow methaphor with a seven-layer conceptual model including carriage, devices, software, content, provision, literacy, and governance was used to explain state-of-play in SDI development of Turkey.

2. RAINBOW METHAPHOR TO IDENTIFY SDI

A metaphor can be so pervasive that once it lodges in the imagination, it can successfully eliminate or discredit contradictory evidence (Miller, 1978). The rainbow metaphor for access to II was proposed by Clement and Shade (1998) with the intention to strengthen public policy perspectives in the Canadian II debate. Also, this metaphor was examined to analyze the dynamics of the Indian National SDI by Georgiadau etal. (2005).

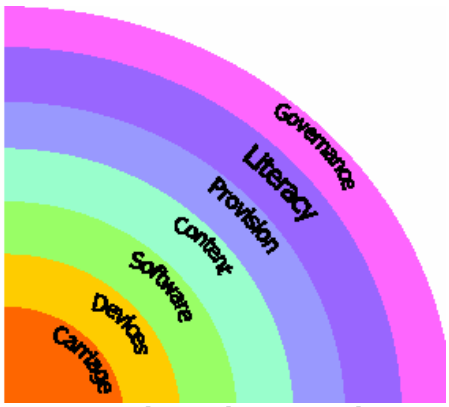


Figure 1. The rainbow metaphor for II (Clement and Shade, 1998).

The rainbow metaphor recognizes the multiple usage patterns, in retrieving and creating relevant content, it encompasses conventional and new media, and emphasizes the interplay of social and technical dimensions in infrastructure development and defines which services are essential to whom. Mostly it helps identify "access gaps", those social segments likely to be left out by market forces acting alone and hence emphasizes the need for protection via collective public initiatives. The seven layers of the rainbow include carriage, devices, software, content, service/access, literacy, governance – also correspond to important regulatory distinctions between carriage and content.

3. EXAMINING STATE-OF-PLAY TO IMPLEMENT SDI IN TURKEY

ICT started to be used commonly in 1990s, after hardware prices became cheaper and computer usage became easier with technology development. Public Institutions started to transform their paper format works to digital format. Public Institutions increased investments for ICT hardware and software since 1995s. Turkey has speeded up her efforts to transform into an information society with eTurkey initiative identical to eEurope+. After 2002, actions have been combined in Urgent Action Plans. e- Transformation Turkey Project aims at fostering the evolution and coordination of information society activities in a participatory manner, which were previously carried out in an uncoordinated manner (OECD, 2004).

According to The Networked Readiness Index (NRI) by World Economic Forum that defines the degree of preparation of a nation or community to participate in and benefit from ICT developments, Turkey ranks 52nd out of 102 countries in 2005, ranked 56th out of 104 countries in 2003 and 2004 (WEF, 2005). According to eEurope 2005 evaluation (INSEAD, 2005), Turkey ranks 24th out of 28 European countries. Turkey ranks 26th in Internet usage, 9th in Modem Online Public Services, 27th in Dynamic e-Business, 28th in Broadband as sub-components out of European countries. It was understood that Turkey stay behind developed European countries for Information Society development.

The earliest GIS projects were initiated by the General Command of Mapping (GCM) to produce digital maps for military aims in 1986. GCM as a main map producer conducted National GIS Project in accordance with NATO Data Standards in 1990 and executes Topographic Database Building Projects. The importance of GIS has been realized by many public and private organizations within Turkey since 1990s. The private sector has been focused more upon individual GIS projects, which stimulate private investments. A variety of GIS Project unaware of each other was produced by different public organizations. But, there projects were developed independent from each other because there was no accepted standard or policy framework. *TAKBIS* Project named National Land Registry and Cadastre

Information System began to be developed as the biggest GI Project in public organizations in 2000. A variety of universities have been exploring through research related activity at the graduate level. Turkish Government, GCM, and Turkish Scientific Agency (TUBITAK) initiated to produce standards and coordination mechanisms to enable data sharing online after milennium. And, as a sub section of e-transformation Turkey project, in 2003, actions were initiated and activities are continuing towards NSDI vision.

3.1 Carrige

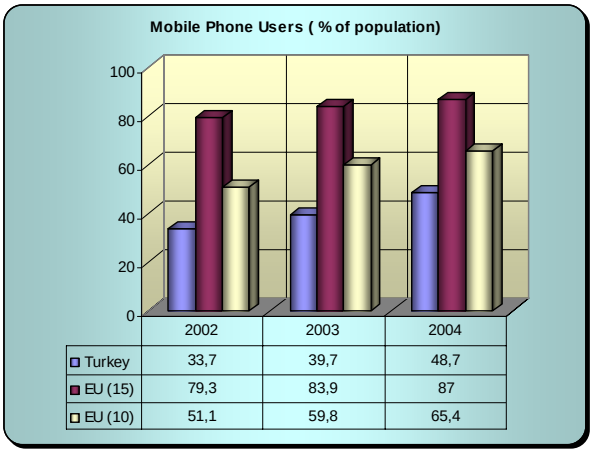
Carriage component of SDI can be explained with telecommunication infrastructure, related policies to encourage e-government, and facilities to access and share information. In reality, these components have not been taken into consideration until now. But, this approach will be effective to implement a SDI framework at any level in Turkey.

Turk Telecom, currently a 100% state-owned enterprise, had been a monopoly for long years in Turkey. Its privatization process is underway, but, obviously, the process will take time. The need for a new Telecommunications Law has been recognized to renovate the structure of old laws. Electronic Signature Law which explains "Secure electronic signature has the same conclusiveness with signature signed by hand." and is certified by Telecommunication Authority legalizes electronic signatures. The Law regarding access to Public Sector Information accepted on October, 2003 identifies the principles about the rights of citizens with regards to basis of transparency, openness, and equality of public management. Public Institutions are responsible for presenting all kinds of information and documents to applicants with some exceptions. Besides, Personal Data Protection Law, secondary legislation regarding Consumers Protection Law, legistation regarding protection of intellectual property rights, legistation regarding informatics crimes, Universal Service Law, Interoperability Circular, and National Information Security Law are under way to put into practice.

As telecommunication facility, while telephone line capacity stayed stable since 2003, mobile phone became widespread after 2002. But, high and various taxes are executed to mobile phones. Internet access has been provided with dial-up connection until 2003. But broadband access through DSL infrastructure with telecom investment is slowly taking off with the help of recent developments sine 2003. ADSL users started to increase enormously since 2004 but not at expected level. ADSL unlimited tariff prices are so expensive than some other developed countries of the world in view of speed and monthly fee (URL-1,2, 2005).

3.2 Devices

Telephone lines, mobile phones, and internet usage can be accepted as base device of ICT sector behind SDI. The population of ICT users are about half lesser than 15 EU countries and lesser than 10 accession European countries. According to Telecom's subscription analysis, the population of internet users increased last years enormously. But as seen figure 2, while 15 EU countries have 41,7 % and 10 EU accession countries have 27,1 % internet users of population, Turkey' internet user population stayed low level.



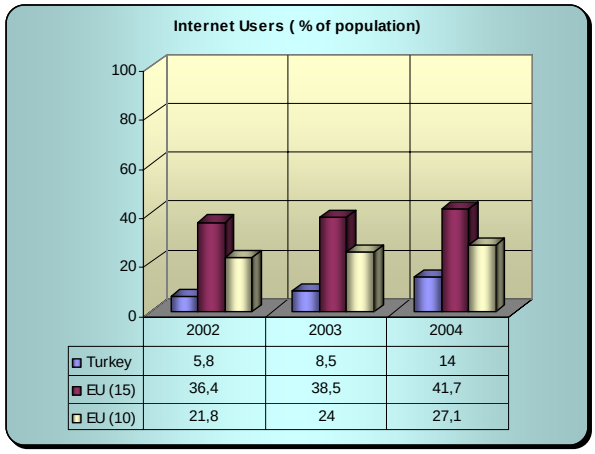


Figure 2. Mobile Phone and Internet users (URL-1, 2005)

According to the results of ICT Usage Survey of Households and Individuals 2004 by State Statistics Institute (2004), 7.02 % of households have access to the Internet. 83.53 % of which has an access to Internet via PC with the using Modem dial up access especially. In the period of April-June 2004, of all the individuals in 16-74 age groups, proportion of computer use is 16.80 % and Internet use is 13.25 %.

Table 1. Availability of ICT equipments in households

Availability of ICT equipments in households (%)		
Device	Proportion of housholds having ICT equipments	Proportion of households having equipments for Internet access
PC	9,98	5,86
Laptops	0,85	0,55
Handled computer	0,13	0,06
Mobile phone	53,64	2,08
Television (including satellite dish, cable TV)	92,19	0,13
Games console	2,85	0,24

9.98 % of the households have PC and 5.86 % of the households can access to internet via PC. 53.64 % of the households have mobile phone and 2.08 % of households can access to internet via mobile phone.

3.3 Software

According to the survey executed in public institutions relating to GI, Microsoft architecture is very common in Turkey as operation system. Public institutions are not familiar with open source codes. Besides Microsoft based DBMS, Oracle is the most common DBMS in public institutions as seen figure 3 (LRCD, 2004a).

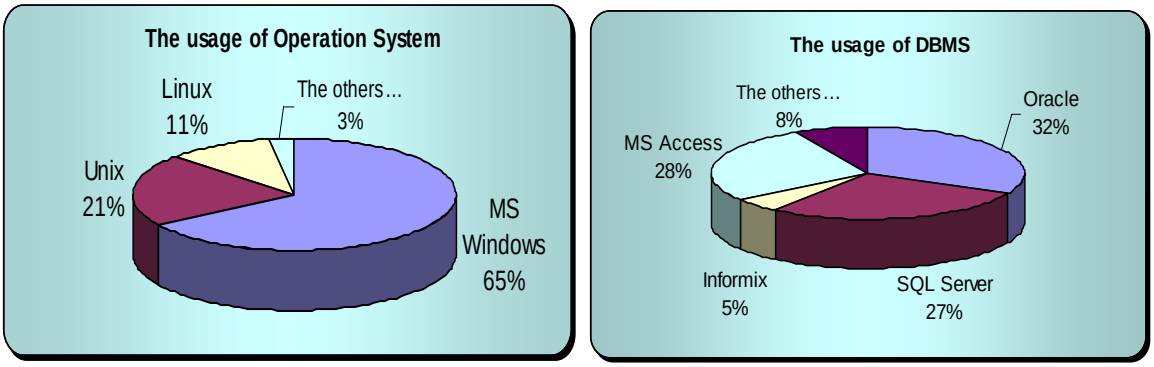


Figure 3. The usage of Operation System and DBMS

According to LRCD Survey (2004a), it was declared that 81% of public institutions using GI have GIS software. As seen in figure 4, institutions use different kinds of GIS software. Because national software NetCAD is popular because it produces user friendly interfaces acceptable legally. But, this software started to perceive passing from CAD to GIS after millennium. As seen in figure 4, there are no accepted international or de-facto standards in public institutions. Public Institutions generally use institutional standards in intra-organizations and accepted national standards but base level.

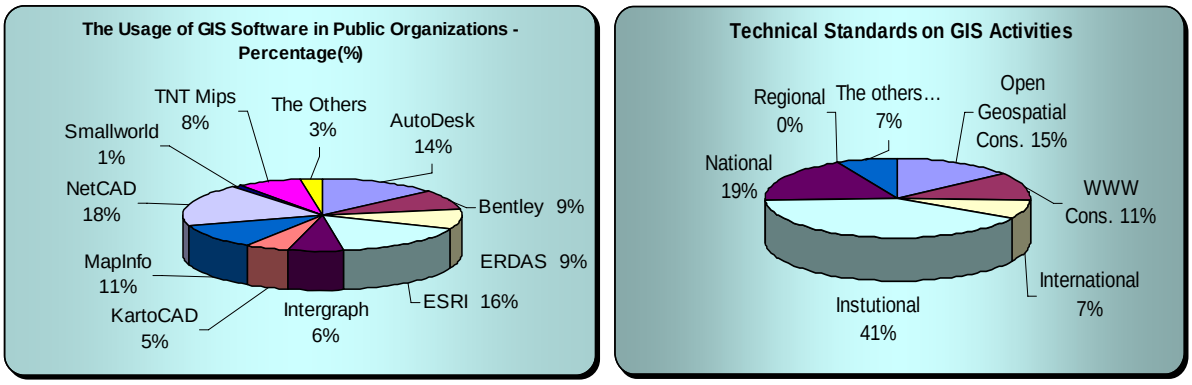


Figure 4. The usage of GIS software and Technical Standards on GIS activities

3.4 Content/Services

GCM pioneered digital map production especially since 1990s. Small scaled maps (1/25000 and smaller) was produced and archived under responsibility of GCM only. Other public institutions can't benefit from small scaled maps effectively because these are secret in accordance with the laws and these maps can not be qualified for different usages. Large Scaled Maps (1/5000 and larger) are produced by LRCM and State Provincial Bank. Some other public institutions also produce spatial data serving their own needs. On table 2, it can be seen what kinds of spatial data can be produced by which public institutions. Central public institutions produce small scaled spatial data and combine the data depending on their needs. As Local Administration, almost all municipalities, especially in big provinces, are trying to build Urban Information System (UIS) applications and to transform all maps to digital format. Local Governments focused on reconstruction plans, mapping, cadastre at

large scales like 1/5000, 1/1000 etc. and have a tendency to access information about infrastructure, real estate, environment cleanup, and like this.

Table 2. Existing Data and Contents (LRCD 2004a, 2004b).

Contents	Producer	Spatial	Non-Spatial
Address	Local Administrations	Road, Street, and Building from The Present Time Map	Numbering, District, Road, Street
	The Post Office		Post Code
Reconstruction Plans	Local Administrations	Border of land use, Symbology	Plan Notes, Definition of usage type
Cadastre and Ownership	Gen.Dir. Of Land Registry and Cadastre Directorate	Cadastre Maps	Land Registry and Cadastre data
Infrastructure	Local Administration	Electricity, Water, Natural Gas, Sewer System	Related attribute data like elevation,type…etc.
	Gen.Dir. Of Provincial Bank		
	DSI- Gen. Dir. Of State Hydraulic Works	Canal, Irrigation	Related attibute data
	Turk Telecom	Telecom lines, Cable TV	
	Gen. Dir. Of Highways	Highways, Crossings, Road building Works	
	TEIAS-Turkey Electricity Works Company	High Tension Lines	
	DDY- State Railroads	Railroads	
	BOTAS- Petroleum Pipeline Corp.	Pipelines	
Geophysics / Geology	MTA- Gen. Dir. Of Minaral Research & Exploration	Geology Maps	Earth layer data
	Local Government	Microzon Maps	Microzon data
The Present Time Map	Local Government	All details in Regulation of Large Scaled Map Production	Related attibute data
	Provincial Banks		
Standard Topographic Map	Gen.Dir. Of Land Registry and Cadastre Directorate	All details in Regulation of Large Scaled Map Production	Related attibute data
	HGK- General Command of Mapping		
OrtoPhoto Images	in most organizations	Raster Images	Attribute requirements
Meteorologic	Gen. Dir. Of Meteorology	Temporal symbol, line, and areal presentations, depending on meteorologic data	Heat, Humidity, Wind,... etc.
	DSI- Gen. Dir. Of State Hydraulic Works		
	EIEI		

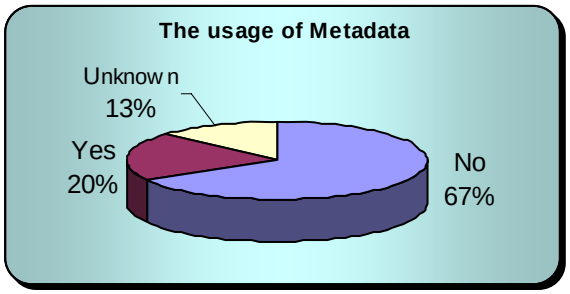


Figure 5. The usage of metadata.

According to the survey, it was understood that the usage of metadata is not at expected level as seen Figure 5 (LRCD, 2004a). In most cases, metadata encoded in proprietary formats, which makes general access difficult or impossible. Rarely, standards are used, and only in very few cases, metadata can be accessed online.

Projects executed by different public institutions and organizations have not reached required level as needed. Also, as coordination among GIS projects has not been provided, there are many overlaps between these. There were no data exchange and sharing standards. Institutional responsibilities have not been determined and spatial data was produced repeatedly. Using spatial data from different institutions in a project as GIS nature has not been activated. Indefiniteness in spatial data quality appeared. Feature and Attribute Coding Catalog and Spatial Data Standards have not been concluded yet. UVDF-National Data Change Format determines data types and data flows, based on XML format, compliant with OGC Specifications. Geodetic control points are at local system, 1/5000 scaled Standard Topographic Maps are at ED-50 system.

3.5 Service/Access Provision

According to the survey, it was asked which dissemination method is used for data sharing in Public Institutions. Data are provided either on CD or on paper. Other digital distribution methods are used to a lesser extent. Internet for data distribution is rarely used as seen Figure 6. In Intra-Institutions, CD and paper are also common to exchange spatial data. Access database from local network provide an effective method to exchange spatial data as seen Figure 6 (LRCD, 2004a). GCM website provides description about their maps and digital products, but online dissemination is not possible. All provinces and many municipalities browsed the information on internet. Some big cities and institutions have some e-government services for citizens. There is not any clearinghouse for data sharing and distribution and it is also difficult to understand the requirements to access data.

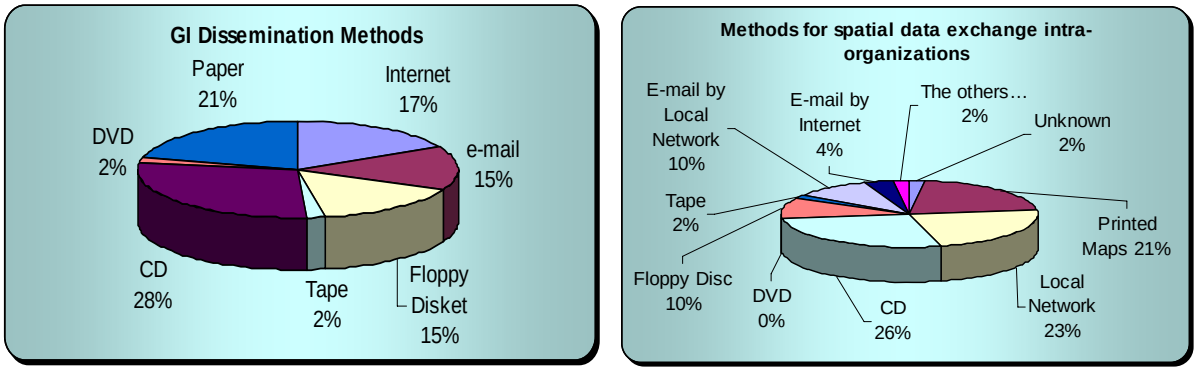


Figure 6. GI dissemination methods

3.6. Literacy

Central Public Institutions have more eligible and well-educated personals about GIS (LRCD, 2004b). Local Government can not employ personals who are well educated on GIS to use the programs very well. According to YTU AFAYBIS Project, GIS personnel in Public Institutions, especially graduated from universities last years, were educated on GIS. And, most of them are experienced on GIS and half of them graduated from Dept. of Geodesy & Photogrammetry Engineering as seen Figure 7. Because computer use, programming, and english knowledge are supposed to be more important than professional capacity, surveyors can not control GIS sector. Data/information sharing is not at expected level because of security considerations and poorly

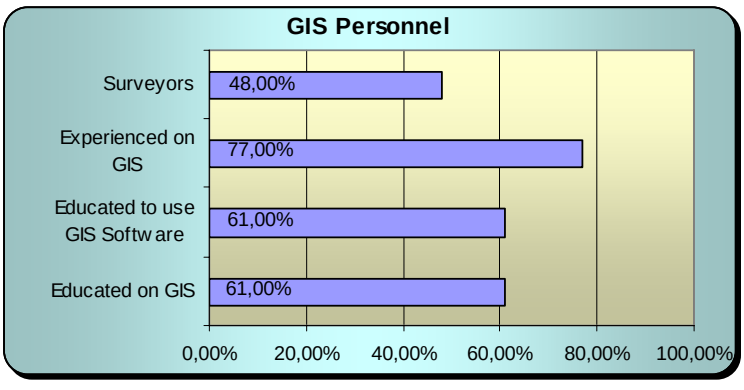


Figure 7. GIS Personals working in Public Institutions

understood technical issues. Several Turkish universities are involved in teaching curricula through the use of GIS, especially in Department of Surveying Engineering.

3.7 Governance

Prime Ministry Office initiated the Public-Net project in 1998 to enable ministries and other public institutions for working in coordination on computer networks, later named NIS-National Information System. There is no centrally management authority among associations and organizations as a mediator to built NSDI in Turkey. There is no coordination body working compliant with EUROGI. Therefore, it is felt to be weakness in communication and coordination because of the deficiency on institutional frameworks and public administration.

In e-Transformation Turkey Project, Action 47 in 2003 was initiated with the aim of preparing a priliminary work to build Turkey National GIS under the responsibility of LRCD. Action 47 report determined current situation for building National GIS. After July 2005, Action 36 was brought into force. Standards, Technical, and Institutional Infrastructure Committees were constituted under responsibility of LRCD. These committees include representatives from universities, private sector, municipalities, and public authorities. On this process, national SDI strategy as policy encouragement was determined. However, legal and technical regulations for distributing, distributing, pricing, and managing spatial data have not been put into practice yet.

4. CONCLUSION

Identifying SDI components with rainbow metaphor makes arguing socio-technical and II related paradigms possible. A layered approach like this to the SDI development needs to be adopted. With this way, the existing policies and telecommunication infrastructure that inhibit access to maps and other sources of spatial information by the civil society need to be urgently and realistically reviewed. This study can provide a general perspective to examine SDI or National SDI development at macro level. To implement state-of-play analysis at local level or national level, surveys or interviews which are more detailed and acceptable are needed.

Telecommunication infrastructure with new regulations becoming law and some telecom investments are into process to reach Information Society level. But, Turkey needs governmental activities and more time to put e-government, II, and SDI initiatives into practice. To exceed IS vision, internet usage is not at expected level among citizens. Internet and network possibilities were developed in Public Institutions using GI. Data sharing among public and private institutions electronically are unable. Almost all central public institutions have possibilities to invest and use GIS software. However, these institutions do not have productive GIS working environment, because requirements did not identify at adjudication level and they do not use customized GIS programs. As explained above, GI users in public institutions and private companies can not use the data in corporated way to support decision making process because software and data standards were not decided yet. Data quality issues

should be examined to determine the usability of the data in various environmental areas from urban planning to waste management. People working in GIS industry are not capable to share and manage data socially and technically. The most critical problem is that there is no a coordination body to develop policies and build mechanism in SDI implementation.

REFERENCES

Aydinoglu, A.C., De Maeyer, P., Yomralioglu, T., 2005, Examining European SDI Initiatives In Anticipation Of A SDI Framework For Turkey. FIG Working Week, April 16-21, 2005, Cairo, Egypt.

Clement, A., and Shade, L. R., 1998, The access rainbow: Conceptualizing universal access to the information/communications infrastructure. Information Policy Research Program, Faculty of Information Studies, University of Toronto, Working paper No 10.

Craglia, M. etal., 2004, Introduction and Overwiew, Section1 of GINIE book: Geographic Information Network in Europe.

Georgiadau, Y., 2003, Access to information infrastructures: the rainbow metaphor. In Proceedings of the NSDI III workshop: Empowering people through geospatial data, Agra, India, 12–14 November 2003

Georgiadau, Y., Puri, S.K., Sahay, S., 2005, The Rainbow Metaphor: Spatial Data Infrastructure Organization and Implementation in India. Submitted to Int. Studies of Management&Org. on Cultural Metaphors, Symbols, And Paradoxes. 06.03.2005.

Hanseth, O., 2000, The economics of standards. in From control to drift, C. U. Ciborra (Ed.) with K. Braa, A. Cordella, B. Dahlbom, A. Failla, O. Hanseth, V. Hepso, J. Ljungberg, E. Monteiro, and K. A. Simon, Oxford University Press, Oxford: , pp. 56-70.

INSEAD, 2005, The Knowledge Economy in Economy: Integrating The New Member States. prepared by Soumitra, D., De-Meyer, A., Jain, A., and Richter, G., Springer Verlag, September 2005.

Longley, P.A., Goodchild, M.F., Maguire, D.J., Rhind, D.W., Geographic Information Systems and Science, Wiley Pub., ABD, 2001.

LRCD, 2004a, Survey executed Public Institutions Using GI to Build National GIS, The Registry and Cadastre Directorate of Turkey, December, 2004.

LRCD, 2004b, A Preliminary Report to Build National GIS- Action 47, The Registry and Cadastre Directorate of Turkey, December, 2004.

Miller, J. 1978, The body in question, Random House, New York.

OECD, 2004, e-Transformation Turkey Project: Turkish Case for e-Government. October 7-8, 2004, Istanbul, Turkey

SSI, 2004, ICT Usage Survey on Households and Individuals 2004, State Statistic Institute, Ankara, Turkey.

WEF, 2005, Network Readiness Index 2004-2005. World Economic Forum.

Yomralioglu, T., Cografi Bilgi Sistemleri Temel Kavramlar ve Uygulamalar. Seçil Ofset, Istanbul, 2000.

AFAYBIS, 2003, Disaster Emergency Management Information System Project. YTU.

URL-1, 2005, Web Site of Prime Ministery of Turkey, Information Society Directorate. available on www.bilgitoplumu.gov.tr

URL-2, 2005, Web Site of Turk Telecom, available on www.turktelecom.com.tr

BIOGRAPHICAL NOTES

Arif Cagdas AYDINOGLU works as a research assistant at the Department of Geodesy and Photogrammetry Engineering at Karadeniz Technical University (KTU), Turkey. He completed his MSc study titled as ”Internet GIS Strategy and Implementation” in 2003. He started his Phd study at KTU. In 2005, he followed his researches in Ghent University/Belgium for 1 year and in ITC/Netherlands for 2 months. His research interests are GIS, SDI, Semantic Interoperability of spatial data.

CONTACTS

Arif Cagdas AYDINOGLU
Karadeniz Technical University
Dept. Of Geodesy and Photog. Engineering
GISLab 61080 Trabzon TURKEY
Tel.:+90 462 377 3653
Fax:+90 462 328 0918
e-mail: arifcagdas@ktu.edu.tr
web: www.jeodezi.ktu.edu.tr/arifcagdas