

National Spatial Data Infrastructure (NSDI) Feasibility Study and Apparent Risks in Turkey

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Key words: NSDI, Metadata, Data Sets, Feasibility, NSDI Organization, NSDI Management, Risk analysis

SUMMARY

Turkish National Spatial Data Infrastructure activities have been started by the motivation of Circular No. 2003/48 which was declared by Turkish Prime Ministry in 2003 within the context of e-Transformation of Turkey Short-term Action Plan. Action No.47 in the mentioned action plan implies that "A Feasibility Study shall be made in order to establish the Turkish National Spatial Data Infrastructure" whose responsibility has been given to General Directorate of Land Registry and Cadastre.

In 2005, by the coordination of State Planning Organization, e-Transformation Turkey 2005 Action Plan has been declared with the Supreme Planning Council decision of 2005 / 5. In that action plan, the responsibility of Action 36 with the subject of "Preliminary Works for Establishing The Turkish National Spatial Data Infrastructure" has been assigned to General Directorate of Land Registry and Cadastre. The implementation works of TR NSDI has been started with Modernization of Public Administration - 75 (KYM-75) and Geographic Information System - Infrastructure" project in 2007-2008. Finally, the service of preparing a feasibility study for the implementing Turkish National Spatial Data Infrastructure has been purchased directly from Turksat within context of the Law No. 67 of 5809 under Article.

Feasibility report of NSDI has been completed in 10th of December 2010. After decision of Steering Committee, feasibility report has been send to State Planning Organization for further evaluation. This paper perents some headlines, risk assessments and preliminary results of feasibility report as an indicator during implementation phase.

1. Introduction

Turkey has a long history of protection of property rights. More than 99% of land in Turkey is mapped and registered, and the Turkish Land Registry and Cadastre Agency (TKGM) completed the registration by 2008. Nevertheless, significant improvements are needed to fully modernize the TKGM and bring it to European standards. Depend on core data set cadastre; TKGM has been implementing some projects which will be support NSDI portal.

2. NSDI Related Projects

Metadata in Implementation Rules in INSPIRE as The First Step

“Metadata Portal for Maps” that is named as “Map Information Bank” is intended to be established by General Directorate of Land Registry and Cadastre (GDLRC). The aim is to Monitor Map Production in Turkey in one way and to prevent duplicate mapping activities. Metadata Portal in Map Production Monitoring Center (MPMC) is based on Articles 103, 104 and 105 in Large Scale Maps and Map Information Production Regulation (LSMMIPR) legally and the duty to establish this metadata portal is referred to GDLRC. Technically MPMC is embedded in Information System for Land Registry and Cadastre (TAKBIS). In this scope a web_based prototype has been developed. All institutions that are related with map production in Turkey are members of this study.

Web interface is designed accordance to the ISO 19115/TC 211 Digital Geographic Information System Standards. MPMC data sets and web services are saved in GIS PORTAL TOOLKIT of ESRI. Users can directly connect ArcIMS Web Service to present geographic data and ArcSDE/SQL Server is used as database. ESRI GIS Portal Toolkit provides technology and service solution for National Spatial Data Infrastructure in Turkey.

In Metadata Portal Project, Metadata User Interface is created for users to register, publish, query and access to the spatial information. It can be said that this national level GIS portal application has many type of functions on Metadata User Interface: Administration functions, online metadata registration functions, query metadata functions. In addition to these Ground Control Points (GCP) Function is developed to search information related to GCP. Metadata and GCPS are integrated with GoogleEarth to provide broad visual capabilities.

Continuously Operating Reference Stations Project- Tusaga-Aktif (Coordinate Reference Systems in Annex1)

Within the scope of this project: stationary 146 GPS stations established to serve the whole country, operating with Real-Time Kinematic (RTK) functionality, based on the network concept, and the capability to transform from ED50 datum to ITRFyy datum will be provided. Thus;

- Real-time usage of the system is possible;
- All users are able to get service from the centers to be established;
- Service is provided nation-wide;
- Basis of all geo-information technologies is constituted; and
- The relationships between ED50 and ITRFyy datums will be provided.

In brief, Tusaga-Aktif Project removed the necessity of ground construction in the field of mapping in our country to great extent; provided the users with high-tech's convenience and products.

The target here is to establish one station in each province, in order to provide a system that will cover the whole country, functioning 24 hours / day, and able to provide the capability of accurate position determination

Tusaga-Aktif system is being used in projects of planning, infrastructure, municipality, vehicle tracking, agriculture, forestry, GIS/LIS... etc. This system will be highly beneficial for measuring Ground Control Points necessary for the operations of photogrammetric map production, ortho-rectification, ortho-photo production... etc.

Tusaga-Aktif Project has significant implications for GDLRC:

- GDLRC guaranteed great savings in time and cost regarding its geodetic activities.
- GDLRC is be able to conduct its cadastral works in a much better fashion, with higher quality, less cost and faster execution speeds.

Turkish Land Registry And Cadastre Information System-TAKBIS (Cadastral parcels-Annex1)

People have great expectations in accomplishing such services, they need correct, reliable, easy and quick accessible land register and cadastral survey information. The importance of the LR&CIS (Land Registry and Cadastre Information System) project is arisen from such a reason.

The project aims to form the basic data of all kinds of projects prepared based on positional map data in the standards of the Geographic Information System;

- to provide accurate, valid and reliable land information required for land and land related activities and decision markers,
- to transform land register and cadastral survey works and information into a multi purpose land information system to plan, manage and activate the services by the organization in a better, quicker, more reliable and more effective way to ensure that the data given to other institutions and organizations are used more broadly.

The LR&CIS is a parcel-based Land Information System. It contains geometric cadastral information and property information with respect to ownership. It covers all activities carried out in the General Directorate of Land Registry and Cadastre, in Regional Directorates (22),in Land Registry (957) and Cadastral (81) Offices.

The main objective of TAKBİS is to form the property/ non-property rights and cadastre data on the basis of locality dimensional information. Today, for these kind of services; correct, reliable, easy&fast-to-access land registry and cadastre data are needed. The importance of TAKBIS project for the development of the country originates from this reason. In this wise, it is possible to share the data generated in standard and electronic media to local authorities, about 50 fields and sectors such as transportation, forestry, agriculture, energy, justice, finance in a reliable and updated way.

Turkey has been started to develop and put into applications very large e-government projects. Turkish Land Registry and Cadastre Information system is one of most important part of Turkey's e-government structure those servers to other state information systems that has been developing or

deploying by other state offices. In near future, system will be deployed to whole Turkey step by step.

There are two main projects which are support TAKBIS. These projects are “Agricultural Reform Implementation Project” and “Land Registry and Cadastre Modernization Project”.

Agricultural Reform Implementation Project has been completed. Ongoing project is Land Registry and cadastre Modernization Project. The overall goal of the project is to contribute to government agenda to improve quality and effectiveness of public services through spreading and making effective e-government applications. The specific objective of the proposed project is to improve the effectiveness and efficiency of the land registry and cadastre services. This objective will be achieved through: (i) renovating and updating cadastre maps to support digital cadastre and land registry information; (ii) making the digital land registry and cadastre information available to public and private entities (iii) improving customer services in land registry and cadastre offices; (iv) improving human resources in the Turkish Land Registry and Cadastre Agency (TKGM); and (v) developing policies and capacity to introduce best international practices in property valuation.

As a top project of mentioned project above, the service of preparing a feasibility study for the implementing Turkish National Spatial Data Infrastructure has been purchased directly from Turksat within context of the Law No. 67 of 5809 under Article.

3. NSDI Feasibility Study

Before starting feasibility study, project management organization established. Depending on decision of e-Transformation executive committee, a steering committee and a technical committee established by agreed stakeholders officially. On the other hand a Project Coordination office and institutional contact person organized by officially. Steering committee person who are top level manager of leader institutions and technical committee twenty five person who are experts in geographic information related area. A regulation prepared and confirmed by the steering committee for committee’s duties and rules. Technical committee was responsible for investigation of technical documents and preparation reports for steering committee. Steering committee was responsible to take decision and confirmation, advising or rejection the reports prepared by technical committee. More than 120 people who are contact person elected by their instution to provide relationship during the feasibility study. Five people aimed for project coordination office as a secretariat. NSDI Project considers eleven Ministerial, more than fifty institutions and four major municipalities. After that a contract signed between TKGM and TURKSAT A.Ş in 16 December 2009 including following works;

- Investigating and reporting of Institutional Roles, policies, funding, relations, GIS based objectives and activities of organizations in Turkey due to preparation of implementation tender documents,
- Investigating and reporting of current used software/hardware, network infrastructure, services and securities of relevant institutions,

- Investigating and reporting of International works, International Geographic Information Infrastructure and data contents and data standards at sample countries due to develop Geographic Information System Infrastructure at national level,
- Study visit of technical committee to sample countries,
- Purchasing of ISO 191XX standards from TSE and deliver to TKGM in digital form and prepare of a national draft standard in Turkish Language based ISO 191XX (translated standards as a Turkish or original standards as a current situation) and OGC standards, deliver national standards to TKGM after discussion and revision in the workshop,
- Purposing alternative NSDI Strategies and models to develop CBS-A at national level
- Preparing of feasibility report,
- Preparing of a report which include legal requirements of institutional geographic data production, data sharing, development and management of NSDI at national level
- Preparing of tender documents for implementation of NSDI
- Organization of a workshop

3.1 Needs and Capacity Analyzing Methodolgy

A web based analysis form which contains eight category and 109 questions were prepared to estimate needs, current stiuation and expectation of institutions. At the begining of the project analysis form are discussed at the two awerness workshop by attending top level mananger of all related institution, tecnical committe, contact person and representetive of other intitutions and confirmed by the both committies. These eight category and context are;

- **administrative infrastructure:** questions of institutional responsibility, interest area, activities, GIS units and human resources.
- **legal infrastructure:** questions of current legal status related gegraphic data, legal responsibilities and expectation of organizational NSDI structure.
- **financial infrastructure:** quetions of institutional invesment for GIS related software, hardware, education and data collection and beneficiary.
- **institutional infrastructure:** questions of institutional GIS related projects, used standards, human resources and expectation of geographic data and metadata
- **Software infrastructure:** questions of number of open source or licenced GIS related software, databases, operating systems and purposes.
- **Data infrastructure:** **questions** of institutional raster and vector data needs, owned datas and data structure, type of safeguard, formats, projection and providing type.
- **Hardware infrastructure:** questions of used hardware for data production and data presentation.
- **Network infrastructure:** questions of current used network structure and security of institutions.

Not only filling analysis forms by institutions but also NSDI awerness, clarification and discussion of analysis forms has been implemented by face to face meeting at the ministry level with all related institutions.

On the other hands two different web based analysis forms prepared for local governments and universities as additionally of the related institutions due to determine current situation and needs. Local government analysis form has 57 questions and Universities analysis form has 37 questions.

3.2 Some Headlines of Feasibility Report

After filling analysis forms by institutions, visiting and discussion with stakeholders and visiting to the best successful six sample countries (Spain, Italy, Germany, Holland, Norway and Finland) implemented NSDI due to investigate technical infrastructure, administrative infrastructure, legislative infrastructure and to realize alternative strategy and models by technical committee feasibility report has been prepared by TURKSAT A.Ş.

Some proposed headlines are indicated below from feasibility report which is included needs and capacity analysis, socioeconomic analysis, risk analysis, implementation budget, NSDI institutional structure, technical infrastructure and related tender documents, legislative infrastructure, etc...

- There should be GIS units which collect data, manage data, serving data and having GIS experts in every GIS related institutions.
- There should be a unique institution which is responsible for NSDI management based a law.
- There should be more investment for GIS education
- Duplication in hardware, software and data production investment should be prevented.
- National standards should be revised according to ISO and OGC standards
- There should be a legislation for data access, data sharing and data pricing, etc
- There should be more awareness activities about NSDI
- Base data theme and data producer are identified
- Duplicated data production should be prevented
- Central or distributed system model are proposed

3.3 Risk Analysis of TURKISH NSDI

Risk analysis has been carried out as part of feasibility report of NSDI project to describe apparent risk sources in the implementation phase due to prevent or to reduce risk effects or to eliminate the risks. A risk analysis form which contains twenty five questions was prepared for investigation. Risk analysis form has been filled by project related institutional contact person clarifying in the face to face meetings.

Process of risk analysis has three phases. Preparation phase, implementation phase and evaluation phase. Risk analysis related questions prepared by results of international experiences. During the feasibility study a experienced consultant support to feasibility study and reviewed all prepared documents.

Each question has a probability and its impacts as a structure and summarized risk analysis questions are shown on the below (Table-1, Table-2).

PROBABILITIES					IMPACTS				
QUESTIONS	No	High	Middle	Low	QUESTIONS	No	High	Middle	Low
Q1					Q1				
Q2					Q2				
.....								
Q25					Q25				

Table 1- Risk probability and its impacts structure

RISK ANALYZIS RELATED QUESTIONS			
1	lack of institutional contribution	14	increase cost because of Incorrect / incomplete software and hardware choices
2	lack of Inter-agency cooperation?	15	Lack of dataset production determined based on standards and quality
3	lack of sharing existing datasets	16	intensive use of technical terms is likely to remain poor?
4	not to be used / preferred National portal	17	lack of user-friendly portal interface
5	governance changes	18	inadequacy to improving staff training and qualifications?
6	turnover of staff assigned to Project	19	insufficient network infrastructure
7	Giving staff assigned to another task	20	lack of defination of standards (contents, metadata, etc)?
8	doublecated data production because of lack of cooperation and coordination between agencies,	21	satisfaction of the needs by choosen software
9	lack of senior management support	22	lack of reporting/monitoring tools
10	unnecessarily Institutional competition	23	rejection of purposed legislative infrastructure?
11	losing prestige of the project because of insignificant works	24	occurance of coplexiton on authority and data
12	insufficient budget for proposed institution	25	copyright problems (copying, reproduction, distribution)
13	negative decisions of managers because of changes of project needs or budget		

Table 2- Summarized estimated risk analysis questions

After getting all answers from the stakeholders evaluation process is done. We have some initial acceptance for evaluation. Each answer has a probability impact value as shown below (Table-3).

<i>Ranges of values</i>	
Probability/Impact Answers	Probability / Impact Value Range
High	0,67 - 1
Middle	0,33 – 0,67
Low	0,1 - 0,33
No	0

Table 3- Accepted initial value ranges

Sample given answers are shown following table (Table-4);

N	INSTITUTIONS	Q1-PROBABILITY	Q1-EFFECTS
1	Milli Emlak GM	Middle	Middle
2	TÜBİTAK	Middle	High
3	Sanayi Tic. Bak. KSSBK GM	Middle	High
4	TCDD	High	High
5	BOTAŞ	High	High
6	OGM	Low	High
7	Kültür Varlıkları ve Müzeler GM	Middle	High
8	İller Bankası	Middle	Middle
9	KGM	Middle	High
10	Koruma Kontrol GM	Middle	High
11	Turizm ve Yatırım İşletim GM	Low	Low
12	TAGEM	Middle	Low
13	TÜİK	Low	High
14	TPAO	Middle	High
15	DSİ	Middle	High
16	ÖÇKKB	High	High
17	Petrol İşleri GM	High	Middle
18	Yapı İşleri Genel Müd.	Low	High
19	TEDAŞ	No	High
20	EÜAŞ	Middle	High
21	TEİAŞ	Middle	High
22	TRGM	High	High
23	Türk Telekom	Middle	High

24	İçişleri Bak. Bilgi İşlem Dairesi BŞk.	Low	High
25	Maden İşleri GM	Low	High

Table 4- Sample risk analysis answers

Other results are calculated using this acceptance and number of answers. Calculated Probability Analysis Table and Impact Analysis Table are shown below (Table-5).

<i>Probability Analysis Table</i>				<i>Impact Analysis Table</i>			
Probability Level	Number of answers	probability multiplier	probability value	Impact Level	Number of answers	Impact multiplier	Impact value
High	6	1	6	High	28	1	28
Middle	18	0.67	12.06	Middle	7	0.67	4.69
Low	10	0.33	3.3	Low	2	0.33	0.66
No	3	0	0	No	0	0	0
Probability Values			21.36	Impact Values			33.35
Probability Percentage			0.577297297	Impact Percentage			0.901351351

Table 5- Probability Analysis and Impact Analysis Table

Risk percentage is calculated using “**Risk = probability of threat realization x impact value of the threat to the project**” formula;

All risk categorized with their percentage and their types as administrative, technical, financial and legal. Results of evaluation, high risks of Turkish NSDI are shown following table and graphic (Table–6, Figure-1) in there categories as administrative, financial and legal issues.

No	Risk Type	Risk (Threat)	Probability Percentage	Impact Percentage	Risk Percentage	Risk Level
3	ADMINISTRATIVE	lack of sharing existing datasets	0.76	0.88	0.67	HIGH
11	ADMINISTRATIVE	losing prestige of the project because of insignificant works	0.85	0.86	0.73	HIGH
14	FINANCIAL	increase cost because of Incorrect / incomplete software and hardware choices	0.85	0.8	0.68	HIGH
24	LEGAL	occurrence of coplexiton on authority and data	0.75	0.89	0.67	HIGH

Table 6- High risks of Turkish NSDI

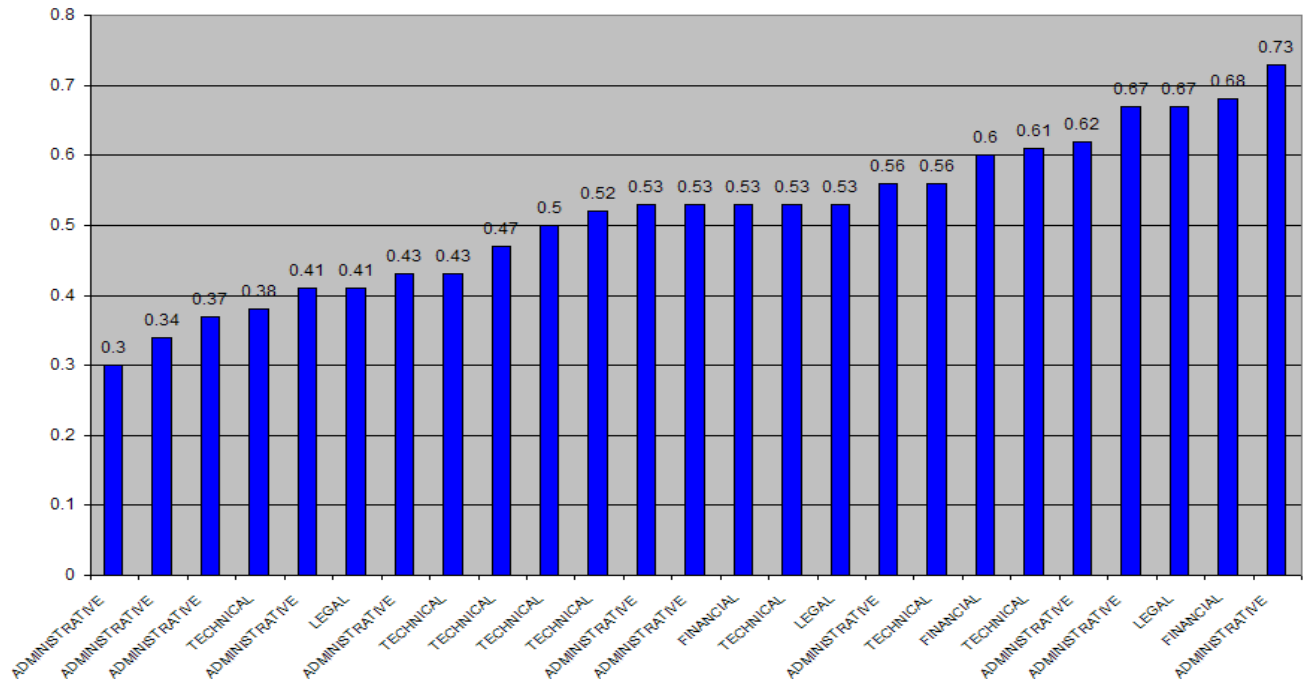


Figure-1 Turkish NSDI risks ranked by lower to high

4. Results

After discussion feasibility in the workshop that attended more than 200 people and sending to State Planning Organization the new legislative arrangements launched as a preliminary results of NSDI feasibility report.

First arrangements is related to Ministry Level. Now there is only one Ministry which is Ministry of Environment and Urbanism responsible for establishment, operating and all national level activities of NSDI.

Second arrangement is related to institutional Level. The most important law with related NSDI is the establishment of General Directorate of Geographic Information System under the Ministry of Environment and Urbanism

Turkish NSDI has twentyfive risks. Four risk is high level, twenty risks are in middle level and one risk in low level. Two of four high level risk is in administrative, one is financial and one is in legal issues. All technical risk are in the middle level risk.

This risk analysis show us that NSDI is not only technical issue but also administrative, financial and legal issues. According to our risk study the administrative topic is very important. Understanding of NSDI in the ministry level, institutional level and management level within the whole stakeholders will play very important role during the implementation phase of NSDI.

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- Eylem 36 - Türkiye Ulusal Coğrafi Bilgi Sistemi (TUCBS)
- Eylem 47 - Türkiye Ulusal Coğrafi Bilgi Sisteminin Oluşturulabilmesi İçin bir Ön Çalışma Yapılması

BIOGRAPHICAL NOTES

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