

SOME ISSUES TO BE TAKEN INTO CONSIDERATION WHILE DEVELOPING A NSDI IN THE REPUBLIC OF MACEDONIA

Dimo TODOROVSKI¹

ABSTRACT

For most developed nations the problem today may be how to make their geo-information applicable in a much more efficient way, share the geo-information via appropriately developed National Spatial Data Infrastructures (NSDI). In developing world, on contrary, the problems start with making geo-information available. At the same time these countries are confronting problems of accessibility and applicability - development of their NSDI's. Experiences from other countries could be very useful and they could be utilized when developing NSDI for a particular country, in the case of the Republic of Macedonia too.

It is recommendable not to work in isolation, share the knowledge and experience and learn from each other. This would result with 'not inventing a wheel' for the second time, avoiding repetition of the same mistakes and development of better NSDI. From the lessons learned from countries that already developed their NSDI but also from the scientific gatherings where the NSDI topic is observed, explored and discussed, the following issues is recommendable to be taken into consideration: problems when introduce the concept of sharing spatial data, difficulties when exchanging data between databases, types of heterogeneity, workflow and workflow management, etc.

Finally this paper concludes that being aware of the issues above could be useful while developing a strategy for development of NSDI in the Republic of Macedonia, an implementation plan should have them included and task force appointed for implementation of NSDI should be familiar with them but also they should be taught with experiences, examples how other countries tackled solving the mentioned problems.

Key words: NSDI, geo-information, sharing data, exchange data, heterogeneity, workflow

¹ **Dimo TODOROVSKI, MSc**, dtodorovski@yahoo.co.uk, dimo.todorovski@gmail.com
Researcher in Land Administration Domain
Mob.: +389 70 461 450,
Pavle Ilik 2/3-12, 1000 Skopje, Republic of Macedonia.

1. INTRODUCTION

This paper addresses some of the important issues that should be taken into consideration while developing NSDI in the Republic of Macedonia, identified as possible problems in the experiences of the countries that already developed their NSDI's.

At the beginning this paper presents background and objectives that NSDI's are based on and objectives that they tackle and try to improve. It continues with description of the status of geo-information in the developing world. Possible models for development of NSDI strategy based on lessons learned from other countries experiences are presented in Chapter 4. Important issues like: problems when introduce data sharing concept, difficulties when exchange data between databases, types of heterogeneity, workflow and workflow management are discussed in Chapter 5. At the end this paper finalizes with deriving some conclusions and recommendations.

2. BACKGROUND AND OBJECTIVES OF NSDI's

The notion of a data infrastructures as a mechanism to provide more effective access to geospatial data first emerged in early 1980 in Canada (Groot and McLaughlin, 2000). The objective of NSDI is to support the availability and access to geo-information, and facilitate the data sharing by connecting different geo-information provider organizations together (Groot, 2000).

In order to combat the negative effects of multiple data collection, storage and dissemination, data sharing is a solution. This means that government bodies at all levels use data that is collected by one of them and that they don't spend money, on collection the same data by themselves. In fact this is the main challenge of the concept of the NSDI's (Molen, 2005).

When setting the objectives for development of NSDI it is recommendable to be acquainted with the basic concepts, cases and good practices of NSDI and in case of the Republic of Macedonia the INSPIRE directive.

If we summarize in general which goals are meant to be achieved by creation of a certain NSDI, we can extract the following list of objectives:

- increase data sharing / exchange;
- increase and control quality of public geo-information;
- reduce data duplication and duplication of activities;
- enhance organizational cooperation;
- reduce transaction cost to find, create, acquire, assess, appraise, exchange geo-information;
- improve use of geo-information;
- sustainable development.

If we observe the list above more carefully, it can be concluded that almost in all objectives the data or geo-information component is present. From here reveals the importance of the geo-information factor as one of the most important, most basic parts of a NSDI.

3. GEO-INFORMATION IN DEVELOPING WORLD

Although NSDI's have a substantial component of ICT, the most fundamental asset is the data itself, because without data there is nothing to have access to, to be shared, exchanged or to be integrated (Molen, 2005).

For most developed nations the problem today may be how to make their geo-information applicable in a much more efficient way, share the geo-information via appropriately developed NSDI. In developing world, on contrary, the problems start with making geo-information available. At the same time these countries are confronting problems of accessibility and applicability - development of their NSDI's (Borrero and Lemmen, 2002).

If we observe carefully Chapters and Act in the INSPIRE Directive (INSPIRE, 2007) regarding the spatial data component there are very precise directions, what could be important for the development of the Macedonian NSDI in the General Provisions are: spatial data should be in electronic format and that the directive does not require collection of new spatial data set.

The following findings are from the cases of the status of the geo-information in the developing world, and these topics require specific attention and improvement in order to have a functional and operable NSDI:

- not 100% percentage of the geo-information themes required are in digital form;
- geo-information is not developed in appropriate formats and data models;
- file based storage of the geo datasets not database concept in use;
- metadata catalogues not developed;
- standards/protocols not fully implemented;
- organization of the spatial data in geo-data bases;
- security mechanisms required;
- copyrights also required;
- introduction of sharing, exchange and integration of geo-information;
- development of methods for distribution geo-information via standardized digital channels.

This paper finds the geo-information component within the NSDI as one of its key elements, that's why it is recommendable to put a specific attention to this issue and the quality analyses of this component. After performed analyses redesign of existing data models and design of new ones could be made which would result with more effective and efficient data sharing and exchange.

4. DEVELOPMENT OF NSDI STRATEGY AND USE OF LESSONS LEARNED

Strategy: It is a course of actions involving logical combination of actors, factors, and action chosen to reach a long-term goal or vision. Strategy incorporates a logical sequence of steps (ISNAR, 1998).

The strategy for development of NSDI for Republic of Macedonia should be based on prior analyses of the user requirements, and having the good overview of the ‘As-Is’ situation, and then describe the path – the strategy – to the desired improved ‘To-Be’ situation (Todorovski, 2006). This strategy should contain clearly defined Mission and Vision statements, and via ‘step-by-step’ approach predict as much as possible required activities divided in a short, mid and long term period for implementation.

Conceptual framework for development of ICT strategies for cadastral and land registration organizations was developed by Todorovski (2006) which was based on the MIT Strategic Alignment Model. The same model could be adopted and used as a model for development of the NSDI in Macedonian context.

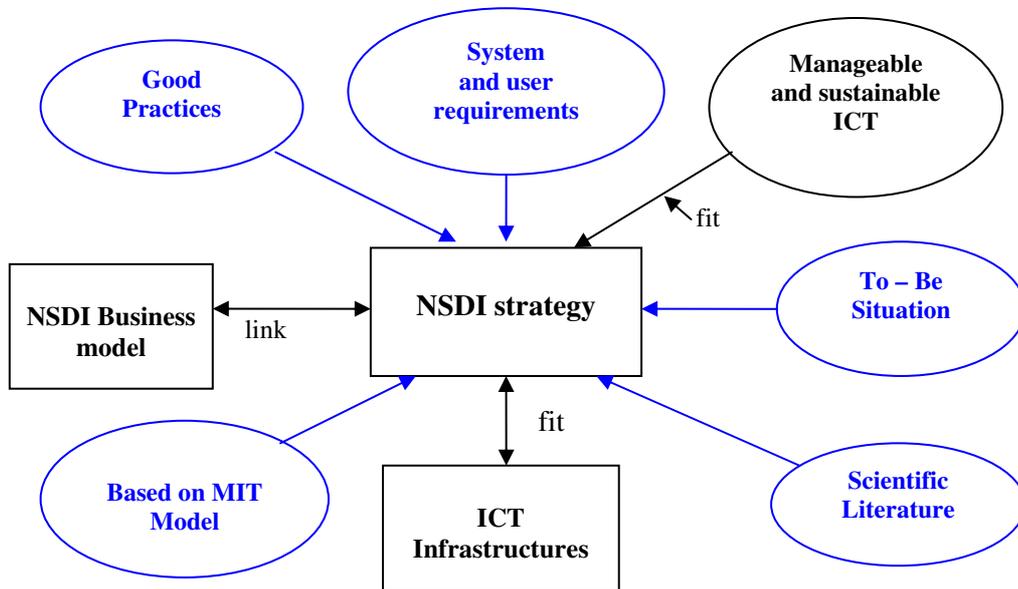


Figure 1: Conceptual framework for developing a NSDI strategy

Experiences from other countries could be very useful and they could be utilized when developing NSDI for a particular country, in the case of the Republic of Macedonia too.

It is recommendable not to work in isolation, share the knowledge and experience and learn from each other. This would result with ‘not inventing a wheel’ for the second time, avoiding repetition of the same mistakes and development of better NSDI.

5. SOME ISSUES TO HAVE IN CONSIDERATION WHILE DEVELOPING A STRATEGY FOR NSDI IN REPUBLIC OF MACEDONIA

From the lessons learned from countries that already developed their NSDI but also from the scientific gatherings where the NSDI topic is observed, explored and discussed, the following issues is recommendable to have into consideration:

5.1 Problems when introduce the concept of sharing spatial data

From the experiences of the countries that have in place functional NSDI's we could list some of the problems that they faced when introduced concept of sharing spatial data:

- Lack of culture for data sharing and the supporting regulations and policies
- Lack of mechanisms to advertise the data in a standard form
- Lack of standards for data exchange
- Lack of supporting tools to extract data from remote databases, re-structure harmonize data
- Lack of adequate use of ICT and database technologies to support information management within the organizations providing Geo-Information (Radwan, 2005).

5.2 Difficulties when exchanging data between databases

Here follows a list of difficulties when exchanging data between databases:

- Different rules for real world object's categorization and definition
- Different database models and data structures
- Data sets are collected, processed and presented by different standards and methods
- Hosted by in different GIS platforms
- Different institutional constraints for data access, right of use, cost of data and many more (Radwan, 2005).

5.3 Types of heterogeneity

A geospatial database is a computer representation of a real world features or phenomena using various abstraction mechanisms. Heterogeneity problem occur when different communities want to share their data with each other have to contend with different views on a real world features, different modeling schemas, and different tools to represent, store, process and manage geospatial data sets (Groot and McLaughlin, 2000). Bishr (1997) describes these heterogeneity issues as syntactic, schematic and semantic heterogeneity.

- *Syntactic heterogeneity* refers to the differences in software and hardware platforms, data base management systems, and the representation of geospatial objects (raster or vector, co-ordinate system, geometric resolution, quality of geometric representation, methods of acquisition, etc.)

- *Schematic heterogeneity* refers to differences in database models or schemas, e.g. a particular feature may be classified under different object classes in different databases, or an object in one database may be considered as an attribute of another. The classes, attributes and their relationship can vary within or across disciplines.
- *Semantic heterogeneity* is the way a same real world entity may have several meanings in different databases. This will also influence the geometrical representation of objects, because abstraction of the world is based on semantics of each discipline. It is intimately tied to the application context or discipline for which the data is collected and used (Bishr, 1997).

5.4 Workflow and workflow management

A workflow is an automation of a process, in whole or part, where tasks are assigned and documents and data are passed from one to another for action, according to the procedural rules (Morales, 2005). It is recommendable that workflows should be introduced and accepted as part of activities for improvement of the performance of all key stakeholders in the future NSDI. First an inventory and analyses of the current workflow processes should be done. Standards should be developed and according to them further development of standardized workflows should proceed. UML could be used as a standard modeling language when representing the workflows into diagrams. When basic working processes are standardized in workflows they are easier to be managed, better and faster chaining of the current working processes is possible and development of new flows is more feasible. ICT processes should be also standardized and represented with workflows.

A workflow management (WFM) is a technique to manage the flow of works such that the work is done at the right time by the right resource (Morales, 2005). Having standardized workflows is a precondition to develop WFM within one organization. WFM is integrating the processes resources and applications or matching the tasks with adequate staff which can finish the job with the required application. Automation of WFM results with workflow management system which is able to interact with workflow participants, keep the track of the progress of the work and, if required, invoke data tools and applications. Motivations and benefits from implementation of WFM are: improved efficiency, improved control on business processes and ability to manage processes.

Technology and standards could help introduction of WFM as a regular part of the working future NSDI stakeholders. WFM could improve performance of each single stakeholder in the NSDI environment and it would allow flexible integration of internal and external data producers.

6. CONCLUSIONS

This paper made an overview of the background and objectives of existing and in development NSDI's, description of the status of geo-information in the developing world and some possible models for development of NSDI strategy based on lessons learned. Important issues like: problems when introduce data sharing concept,

difficulties when exchange data between databases, types of heterogeneity, workflow and workflow management were also explored.

Finally this paper concludes that being aware of the issues above could be useful while developing a strategy for development of NSDI in Republic of Macedonia, an implementation plan should have them included and task force appointed for implementation of NSDI should be familiar with them but also they should be taught with experiences, examples how other countries tackled solving the mentioned problems.

REFERENCES:

- Bishr, Y., (1997). Semantics Aspects of Interoperable GIS, ITC Publication, No. 50.
- Borrero, S. and Lemmen, C., (2002). Take Advantage of Best Proven Practices - Interview with Santiago Borrero, GIM International Interview, pp. 8-10.
- INSPIRE, (2007). Act adopted under the EC treaty for establishing the INSPIRE directive, on 14 March 2007, Official Journal of the European Union. Brussels, EU.
- ISNAR, (1998). Strategic Planning. Annex 1: Glossary and Support Reference Materials. ISNAR.
- Groot, R., (2000). Corporatisation of national mapping agencies: challenges and opportunity. In: the 15th UN regional cartographic conference for Asia and the Pacific, Kuala Lumpur, Malaysia.
- Groot, R and McLaughlin, J.D., (2000). Geo Spatial Data Infrastructures. Oxford University Press.
- Molen, P.v.d., (2005). Authentic Registers and Good Governance. FIG Working Week 2005 and GSDI-8, Cairo, Egypt.
- Morales, J., (2005). Workflow Management, Module 11: Organisational Development, GIM 2/3 2005. International Institute for Geo-Information Science and Earth Observations, Enschede, the Netherlands.
- Radwan, M., (2005). Spatial Data Infrastructures, Module 6: Developing GIM Strategies in GDI context, GIM 2/3 2005. International Institute for Geo-Information Science and Earth Observations, Enschede, the Netherlands.
- Todorovski, D. (2006). A framework for developing an ICT strategy in Cadastral and Land Registration Organisations, XXIII FIG Congress, Munich, Germany.

BIOGRAPHICAL NOTES OF THE AUTHOR



Dimo Todorovski holds a diploma as a surveying engineer from the University of Kiril and Metodij, R. Macedonia and obtains MSc degree in Geo-Information Management at International Institute for Geo-Information Sciences and Earth Observation ITC, the Netherlands in 2006. He is a head of digitizing department, at the Agency for real estate cadastre, R. Macedonia, and has a practical experience in fields of land surveying and digital mapping, cadastral information systems development, ICT and ICT Strategies. He is a Macedonian delegate of FIG Commission 7 and from September 2008 President of: Mak Holl Nuffic Alumni Association, association of Macedonian students which studied in the Netherlands.

His current research interest focuses on land management/administration, analyses of users/system requirements, cadastral systems, system modeling and development of Spatial Data Infrastructures.