NSDI in SR – current condition, technical point of view

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Key words: National spatial data Infrastructure /NSDI/, geospatial information, NSDI geoportal, metainformation catalogue, NSDI community.

SUMMARY

The contribution describes a specification of elements of NSDI in Slovak Republic /SR/ us important part of e-Government policy, characteristics of their current situation in SR and introduces coordination activities of NSDI implementation in SR. The elements of NSDI are: geographical information and metainformation, catalogue services, geographical informational services, rules of sharing of geographical information sources and coordination and monitoring mechanisms, processes and procedures.

Current situation in SR is being evaluated based on web survey of NSDI representatives according to particular elements of NSDI. The contribution presents research activities in relation to NSDI – task Tools for integration and distributed use of geospatial information and results of first phase of solution of this task – concept of metainformation catalogue, of NSDI geoportal and of NSDI community. The contribution contains specific proposals of the coordination activities related to GI, metainformation, metainformation catalogue, information services and rules of sharing of these information sources within the NSDI in SR.

1. INTRODUCTION

At this time there are a number of large-scale, multi-interest GIS projects [1] operational in the SR and there are some examples of National Spatial Data Infrastructure /NSDI/. Although GIS and geo-information /GI/ are widely used terms among the Slovak organizations, the term NSDI does not appear to be commonly used. Some initiatives have a few NSDI-like characteristics and to the extent possible or useful these organizations are referred as potential "building blocks" of an NSDI (e.g. the Geodesy, Cartography and Cadastre Authority, the Ministry of Agriculture, the Ministry of Defense, the Ministry of Education, the Ministry of Environment, the Slovak Association for Geoinformatics, etc.).
The central body of the state administration of the Slovak Republic /SR/ responsible for the informatics is the Ministry of Transport, Posts and Telecommunications where a function of the mandatory of informatics. Within the framework of the eEurope+ initiative, the Ministry has developed two dossiers, which have been approved by the government. The first one, the Strategy of the Slovak Information Society, defines the preferred areas and the strategic goals of the informatics in the SR. The second one, the Action Plan, contains related tasks and projects of which the results are expected for 2005 - 2006. The Government of the SR

has developed the National Lisbon Strategy in which the development of information technologies is highlighted.

2. COORDINATION AND LEGAL FRAMEWORK ON NSDI IN SR

For a number of historical, political, legal and economic reasons, there are a wide variety of inefficient practices used to manage GI. The Paper [2] sets out a strategy for establishing:

1. A coherent European Spatial Data Infrastructure.
2. Consistent Europe-wide reference and thematic data.
3. Consistent Europe-wide data quality.
4. Users have direct and free access to discovery level metadata and therefore a route of access to all public sector data and information.
5. Uniform components of reference data, including: units of administration, property rights, addresses, topography, ortho-imagery, geodetic reference systems, & geographic names.
6. Access to and delivery of thematic data literally at a few clicks of a mouse button.
7. Efficient and effective data and information delivery of a range of user needs from citizens and academics to policy-makers and commercial users.
8. Harmonized use of INSPIRE data and information – across public and private sectors.
9. Efficient development and implementation of INSPIRE gives the initiative an appropriate level of legitimacy.

Taking into consideration strategy above the co-ordination of the NSDI in SR at the national level has several actors involved:

- The Informatics Council of the SR Government,
- The Slovak Institute for Standardization, which deals with related technical standards,
- The Geodesy, Cartography and Cadastre Authority of the SR /GCCA/,
- The Ministry of Environment, leading the Inter-ministerial Group for INSPIRE in SR,
- The Ministry of Transport, Posts and Telecommunications,
- The Ministry of Agriculture,
- The Ministry of Defence.

Awareness of the need for an NSDI is growing and the main promoter is the GCCA SR, which leads the Working Group for GIS in the Public Sector (WG GIS) us committee of the Informatics Council of the SR Government /established in the year 2000/. The WG GIS takes over the coordination of the NSDI development and consists of the representatives of the GCCA as well as representatives of the Ministry of Defence, the Ministry of Environment, the Ministry of Agriculture, the Ministry of Interior, the Ministry of Transport, Posts and Telecommunications, the Statistical Office and others. It is a high-level co-operation between ministry departments and national institutions and members belong to the key stakeholders in the area of GI.

The WG GIS has a number of tasks: to analyze a wide range of existing thematic GIS, to act as official advisory board in GI related affairs, to promote wider use of GI and identify unnecessary overlapping activities, to foster the preparation of the proposals for the standards of the of the Primary Data Base for the GIS (PD GIS). The WG GIS thus has a mandate to give recommendations and elaborate strategies concerning the implementation of the SDI, but

not to make decisions that directly bind single stakeholders. The WG GIS proposals are submitted to the Informatics Council of the Slovak Government for approval and in this time deals with the Object catalogue PD GIS.

Important role within the negotiation process of final shaping of INSPIRE directive plays Inter-ministerial co-ordination Group of the Ministry of the Environment of the SR with cooperation of GCCA.

Legal framework on NSDI in SR is mainly determined by the Act No. 215/1995 on Geodesy and Cartography, as amended by the Act No. 423/2003 and the PD GIS is considered to be the core geo-referenced data set for building the State Information System by the public authorities. In this legislation the following issues are dealt with: maintenance, liability, funding and the obligations imposed on users and producers. The category of the core data sets is rather static and no fundamental changes are being planned.

3. KEY NSDI STOCKHOLDERS IN SR

The GCCA (http://www.geodesy.gov.sk) is a central body of the state administration which provides for the building and updating of the Automated Information System of Geodesy, Cartography and Cadastre /AIS GCC/, which forms a part of the State Information System. It is also responsible for creating and editing the state map series for civil needs. As a central body it methodically manages the cadastral departments of regional authorities, and the cadastral departments of district authorities. It is responsible for creating of the PD GIS.

The GCCA is implementing the national initiative for developing the NSDI. In this respect, the GCCA promotes the shared use of the geo-information such as the relief, land use, land ownership, GI about traffic, municipal infrastructure networks and for the state of the environment and GCCA actively on international forums in co-operation with other European National Mapping Agencies (NMAs) in both mapping and real estate activities, participates in the international work in mapping through EuroGeographics and is also a member of the Working Party on Land Administration dealing with real estate systems which functions under the United Nations Economic Commission for Europe.

Work on a new cadastral system is fundamental for GCCA. Since 1993, a new type of the real estate cadastre is being built in a distributed way. The information system of the real estate cadastre at district level is administered by district cadastral registries and on central level by the Geodetic and Cartographic Institute Bratislava. The central database of the information system of the real estate cadastre is interlinked with district databases by the transmission network. The interlinking aims at the updating of the central database of the real estate cadastre information system in a one-week (gradually a one-day interval), the securing (backup) of district databases, the securing of unity, the data quality improvement using check runs, providing, accessing and publishing information on the Internet. Since February 2004 the Cadastral Portal is available on the Internet for authorized access holders. It contains the whole documentary information on the real estate cadastre and about 30% of graphic information. From July 2004 the private network which links the central database with 98

regional workplaces has operated. NSDI related tasks and projects have been entrusted with specific tasks comprise:

- development of the cadastre and providing the cadastral data via Internet;
- legislative and technical assumptions for the creation of the PD GIS;
- creation of the 3-D digital terrain model as a base for GIS in the public administration in agreement with the standards and principles of the European SDI;
- to work out and issue the standards of the geo-referenced base for the NSDI as well as for the objects catalogue of the PD GIS.

For cadastral data there is on-line access service (http://www.katasterportal.sk) and on-line available the GCCA Geoportal (http://www.geoportal.sk/) as a pilot project which contains meta-information about documents, databases, vector spatial data and raster spatial data. Some of the reference and core thematic data and their metadata can be found there. An on-line access service for metadata of reference data & core thematic data is partially functional but the national Geoportal does not exist.

The Slovak Environmental Agency (SEA) has been established within the Ministry of the Environment. The SEA covers the national territory and focuses environmental protection, development of environmental and sustainable development policy. Important activities from the view of the NSDI include:

- Co-ordination of individual partial monitoring systems;
- Establishment of SDI within the environmental sector as an part of NSDI in SR
- Creation of the Information System of SEA as a subsystem of the Integrated Environmental Information and Monitoring System of the SR;
- Development of methodologies for individual layers of the geographic information system within the framework of SEA's information system;
- Maintenance of the register of basic settlement units;
- Creation of the Territorial Information System (TIS) in co-operation with other legal mandated organizations in the SR;
- Professional supervision and co-ordination of the Integrated Environmental Monitoring and Information System of the SR in national as well as international context;
- Administration of Slovak Environmental CDS (Catalogue of Data Sources) – metadata service providing information about data sources which exist for the Slovak environmental sector.

The environmental and NSDI related information's, including the Catalogue of Data Sources can be accessed via the Internet: http://www.sazp.sk/index_en.html, http://www.iszp.sk/isu, http://www.sazp.sk/slovak/struktura/ceev/DPZ/CLC2000/,

The Ministry of Agriculture manages a wide range of GIS activities and operates a portal deals with:

- Soil Geographical Information's;
- Remote Sensing Soil Survey and Control;
- Soil Monitoring;
- Accredited Soil Analysis Performances.

The Ministry is responsible for projects with EU dimension like the Land Parcel Identification System and the control of area-based subsidies and for the forestry section of the State's Information System: http://www.lesoprojekt.sk/english/default.htm.

The Ministry of Defence is responsible for designing, establishing and managing of the Land Military Information System. Its basic component is the Central Space Database (CSD) in the scale of 1:25.000 which currently covers 12% of the territory of the SR. There is a close cooperation with GCCA in building of CSD and PD GIS: http://topu.army.sk/

The Slovak Association for Geoinformatics could serve as an example of a non-governmental organization whose mission is to support the use and the development of the GI including GIS in the SR: www.sagi.sk

NSDI activities specific to the **local and regional levels** are limited, only a few municipalities and cities have a presence on the Internet, but they are not present in the current NSDI framework. Local Government Information System is designed for municipal and local offices and offices of self-governing regions. The product covers all office agendas. Its uniqueness arises out of the employment of a single data base which prevents multiple insertions of identical data and comprehensively solves the transfer of competencies within an office and enables maximum data employment and visualization by means of geographic applications: http://www.gisportal.corageo.sk, http://www.mesto.sk.

4. POLITICAL SUPPORT FOR NSDI

One of the most significant findings in several researches, e.g. GINIE, is the strong evidence that for development of NSDI political support at all levels, national, regional and local is absolutely critical because [3]:

- Most of GI are collected, maintained, and used by public sector.
- GI is a high-value commodity as well as one, which underpins a large number of government services to the citizen.
- NSDI is not primarily about technology, but about developing a clear framework of agreements among government agencies, and between government, the private sector and citizens on terms through which the use of public sector information can be maximized for the benefit of all.
- Governments therefore play an absolutely crucial role in the development of an NSDI because they are at the same time data producers, users, policy setters, and regulators who provide guidance to major public sector organizations.

Wide ranges of national and international experiences have confirmed this statement. An other aspect is that the political support needs to be sustained over time. Political support is needed to endorse and propagate the vision, establish the legal framework, and allocate resources to get and maintain results. This requires permanent political support.

Creation of NSDI is meant to help avoid fragmentation, gaps in availability of GI, duplication of data collection, and problems identifying, accessing, or using the available data. Moreover,

people need to share geo-information to avoid duplication of expenses associated with generation and maintenance of data and their integration with other data. The most important benefits are enumerated below:

1. Significant benefits for a wide range of activities in relation to national policy-items. For preparation, implementation and monitoring of these policy-items an NSDI is very useful. Thus wider social benefits should result from overall improvement in the quality of policy and decision-making across Slovak Republic at local, regional, national (and international) level. Furthermore, working together in a geographic area can also provide data coverage in a common format over a wider area. This aids cross-jurisdictional or cross-national analysis and decision-making.
2. If GI are produced for one application can be applied in others, it will save money. For many nations, use of GI for special applications at the regional level requires enormous amounts of current and accurate digital data. Therefore, significant time, money, and effort can be saved when the GI and its maintenance is shared among others. This is important, not only to the nations looking for the data, but also for the nations with the data. The more partners there are, the more the savings and the greater the efficiency.
3. The impact on commerce is expected to lead to the creation of new high-quality employment.
4. It creates good prospects for gains by private sector and anticipates efficiency savings for industries active in the surveying, insurances, cable laying, architecture and engineering sectors.
5. It alludes to opportunities for the commercial exploitation of public sector data and information and for the development of added-value services.
6. It's difficult to quantify the benefits of an NSDI.
7. Sharing data can also improve the data quality by increasing the number of individuals who find and correct errors. Resources that would be used to collect repetitive data can be used for quality control, data management, and collection of other needed geo-information.

Political support and awareness on all levels has to be improved. Politicians must be convinced of the importance of GI as such and the availability, accessibility, and usage of geo datasets. Describe advantages for society, decision making process and economic development. Mention the importance of international directives, like INSPIRE, Public Sector Information, EULIS (European Land Information Service), and so on. A clear policy framework needs to be developed that maximizes the use of GI. In this respect it may be appropriate to distinguish between key reference datasets that underpin core government, commercial and democratic processes, or "general interest GI", and value-added products for particular users. Each category may have different financial regimes, and conditions for access and use. The NSDI stockholders should clarify and strengthen the role of core geographic datasets and the administrative organizations concerned in the legislation and administrative decisions.

It is also important that schools, education and research centers, and universities will be involved. They are not only users of GI, but they can also do some interesting studies regarding GI, e.g. new and broader use or quality improvement. Moreover they need to educate people about the value and importance of GI and NSDI. In the SR, the educational aspects regarding GI (and we can assume NSDI) are felt to be important. Additionally,

Slovak universities are very active in GI research and education and several national seminars are organized regarding GI-technology and applications every year by the scientific associations.

5. NSDI AND BUILDING OF INFORMATIONAL SOCIETY

Multiple project activities are oriented in to NSDI in SR. GCCA project [3] specifies assessment of the EU requirements for advanced geo-information, assessment of impact of the new INSPIRE Directive, description of present current situation in Slovakia and user needs analysis for geo information.

Cross sectional state program of research and development the *Building of Informational Society* and its section *Tools and methods for informational* society is present activation platform for forming of national spatial data infrastructure (NSDI) in SR. Administrative guarantor and coordinating authority of this section is Ministry of Education. The *Board of Research and Development State Program* for building-up of informational society is professional coordinating body for introduction of related projects.

Project of research and development - *Tools for integration and distributed use of geospatial information* [4], which is granted from year 2004, relates technical points of NSDI implementation. Beneficiary of the project is Ministry of Education of Slovak Republic. Supplier (coordinating authority) is Comenius University in Bratislava, Faculty of Natural Sciences. Collaborating institutions are: Research Institute of Geodesy and Cartography in Bratislava, Slovak Agency for Environment in Banská Bystrica, Forest management institute in Zvolen, Espace Morava s.r.o. Duration of project is 34 months and is divided in to two phases: 09.2004 - 03.2006 and 01.2006 - 05.2007. This paper introduces most important results related to technical implementation of NSDI.

5.1 Tools for integration and distributed use of geospatial information – results of Phase 1

Main objectives of project are:

- specify the concept of NSDI in SR,
- develop on commercial platform independent tools for distribution of geospatial data,
- develop on commercial platform independent tools for integration of distributed data,
- apply developed technological tools in pilot applications,
- establish coordinating process of NSDI,
- propose guidelines for NSDI implementation,
- form NSDI society in SR.

There are three levels of results achieved in first phase: initiation of coordinating process, implementation of OpenGIS standards, and development of special tools – metainformational catalogue.

5.1.1 Initiation of coordinating process

Coordinating process of NSDI forming started with defining of NSDI. Elements of NSDI referring to INSPIRE [5] create: spatial data and data services, metadata and catalogue

services, geographic informational services, rules for data and services sharing and coordinating and monitoring mechanism, processes and procedures.

Functionality of NSDI is conditioned by set of data, services and sharing rules. According to *data and open data services* NSDI asks for availability of core reference spatial data, core thematically data and other spatial information, clear definition of data models, unified specification of object catalogues of data models, open access to data models, harmonization of data models on the base of valid standards. According to *metadata and catalogue services* implementation of NSDI asks for clear definition of metadata for data and services, unified structure of metadata object catalogue, open access to metadata, central or distributed metainformation catalogue, catalogue services – tools for open communication with central or distributed metainformation catalogue. According to *Open WEB GIS services* implementation of NSDI asks for creating set of partial and composite services geographic informational services (http://www.opengeospatial.org), partial services (Registry services, Portrayal services, Processing services, Data Services, Encodin services), composite services (Application Services, Web Map Services, Web feature Services, Web Coverage Services…). According to *Data and services sharing* implementation of NSDI will address types of rights (rights of ownership, rights of use, copyright), types of access (retaining, sharing and trading), types of use (discover, view, download).

Next coordinating activities related to data, services and sharing rules have to be realized.

Data and metadata*:** to establish content of core data NSDI object catalogue, to apply unified form of data model description, to set up rules and forms for distribution of data model, to appoint common registers of identifiers (+ addresses), to appoint of common metadata profile, to appoint common central or distributed meta catalogue of NSDI.Geographic informational services:*** to develop and operate tools for spatial data and metadata distribution, to develop and operate central point for integration of data and, to develop and operate client application to publish, access, use, view and process of spatial data/metadata.

Rules for geographic information services sharing: to appoint registers for identification of topographical objects, metadata profile for NSDI according ISO 19115, public access to metainformation catalogue, authorized and public access to geoportal client applications, possibility of e-commercial use of spatial data and services via geoportal of NSDI.

***Coordinating authority of NSDI*:** to appoint coordinating authority (legal, financial, organizational), to appoint responsibility of CA for implementation of strategy and policy of NSDI according spatial data and services distribution and integration.

5.1.2 Design and development of NSDI web sites

Project proposed two types of web sites – NSDI geoportal (www.geonet.sk) and NSDI society portal (http://geonet.fns.uniba.sk). NSDI geoportal function is to access important documents related to metainformation catalogue, to manage geospatial portal client applications. NSDI geoportal will contain set of client applications for accessing of metainformation catalogue services in the end of first phase of the project.

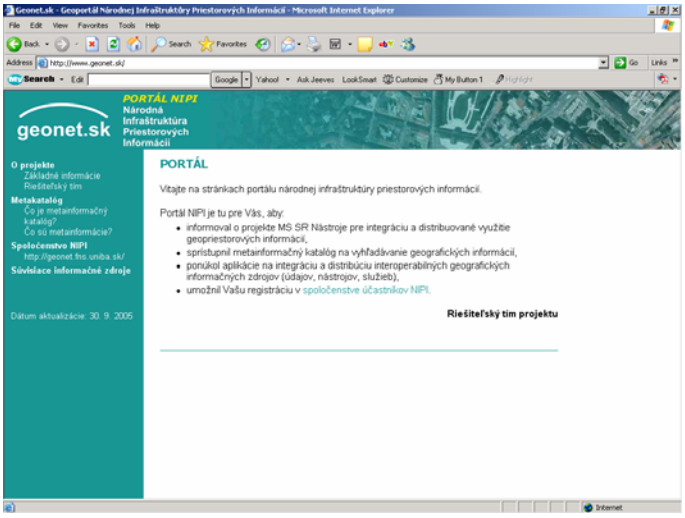

Fig 1. Design of NSDI portal (HTTP://www.geonet.sk)

Mission of NSDI association portal is to manage of coordinating activities according to set up of NSDI society, publishing and sharing of special geographical information resources (spatial data, GIS, geographic information services). Present NSDI society portal functions are: publication of interactive application form for registration of NSDI association member in form of questionnaire (types: user, data provider and solution provider), publication of profile of each member of NSDI association, authorized account for members of association to all public documents, creation of interactive NSDI dictionary on the base of Media WIKI technology, entry in to NSDI terminological dictionary, moderation and evaluation of discuss forum related to NSDI user needs.

Fig 2. Presentation of NSDI society portal – terminological dictionary

5.2.3 Implementation of OpenGIS standard - Metadata

OpenGIS standard Metadata, which is Identical with ISO 19 115 NSDI was implemented in the firs phase of the project. Profile of metadata for NSDI was proposed on the base of this standard. Metadata Profile of NSDI specifies table 1. Template for creation of data for metadata catalogue in form of XML is public accessible in http://www.geonet.sk.

TABLE 1. METADATA PROFILE OF NSDI IN SR

Object class of metadata	**Description**
MD_DataIdentification	Identification of data set
MD_Keywords	Key words
MD_Constraints	Condition for access to data
MD_LegalConstraints	Legal needs for access to data
MD_SecurityConstraints	Constraints according to state security
DQ_DataQuality	Quality and origin of data
LI_Lineage	Linage of data
LI_ProcessStep	Description of data transformation process
LI_Source	Information about Source data
DQ_Scope	Data quality scope
MD_CRS	Metadata about coordination system
MD_Distribution	Data distribution and possibility to obtain
MD_DigitalTransferOptions	Technical tools for data distribution
MD_Distributor	Data about distributor
MD_Format	Description of digital format of data representation and transport
MD_StandardOrderProcess	Description of Standard order process
EX_Extent	Spatial extent of data
EX_BoundingPolygon	Boundary of spatial area
EX_GeographicBoundingBox	Specification of geographical Bounding box
EX_GeographicDescription	Geographic identification
EX_TemporalExtent	Temporal validity of data set
EX_VerticalExtent	Vertical extent of data set
CI_ResponsibleParty	Citation of communication body according to data set
CI_Citation	References
FC_FeatureCatalog	Specification of feature catalogue
FC_FeatureType	Specification of feature type
FC_AttributeDefinition	Specification of feature attribute

5.2.4 Development of metainformation catalogue

Concept of integrated metainformation catalogue was proposed. It contains navigational spatial data[1] and metadata. Conceptual, logical and physical model of integrated metainformation catalogue was defined on the base of metadata profile and profiles of spatial navigational data. Data model of metainformation catalogue (public accessible in site http://www.geonet.sk) was implemented in form of relational database - geographical database.

[1] Navigational data in metainformatianl catalogue present : vector layers of administrative borders of SR (state, regions, districts, municipalities), raster layers – base map 1:5 000 000, 1:100 000.

Examples of metadata sets were collected in form of XML template and were imported in to relational database. Navigational data were collected and imported in to database at the same time. Database procedures for import, edit, update, export and query with possibility of spatial filters were developed. Client applications for open access to metainformation catalogue and database procedures were developed.

Testing operation of Slovak metainformation catalogue started in February this year. Open access and use of metainformation catalogue will start in April this year by means of client applications which will be accessible in the site of NSDI geoportal. Figure 3 show functionality of integrated metainformation catalogue.

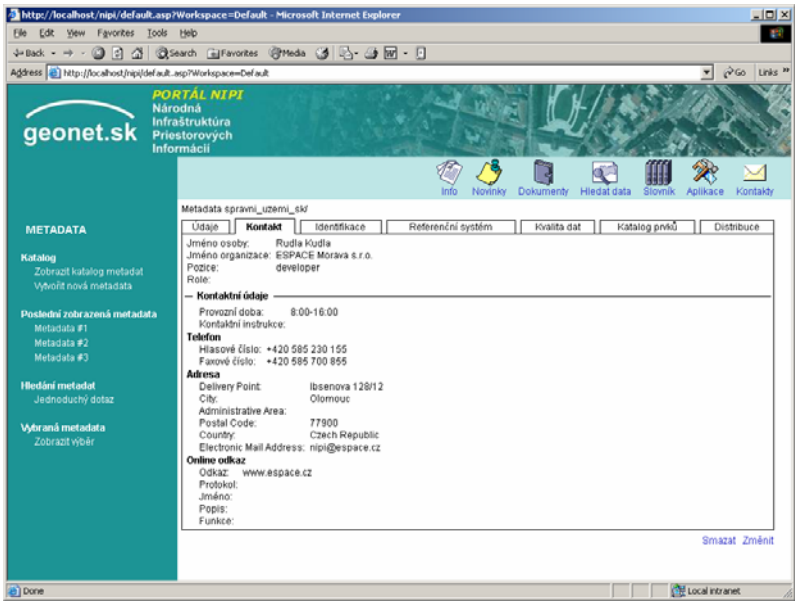

Fig. 3 Query by attribute: Contact person

5.3 NSDI – technical objectives in years 2006-2007.

Implementation of NSDI will continue in second phase of the project with next tasks:

- development of commercial platform independent tools for geographic information distribution in form of map servers and form of WMS and WFS map services,
- implementation of developed tools in collaborating institutions,
- distribution of geospatial information in form of OpenGIS standards,
- development of client application for portrayal, access and use of distributed data,
- development and set up of client application for integration of distributed data (WMS viewer, Gaia, …)
- implementation of client applications in the platform of NSDI geoportal http://www.geonet.sk,
- elaboration of guidelines for standardization, harmonization and integration of geospatial data inside NSDI,

- elaboration of technical guidelines for use of all developed tools for metainformation catalogue and NSDI geoportal client applications exploitation.

6. CONCLUSION

Common needs for NSDI are spatial data and metadata, easy access to the data and services, interoperability of standardized data and services, clear user/stakeholder principles (intellectual property rights, licensing, and guaranties for availability, price policy, and so on) and co-ordination. The goal of the development of NSDI is the same all over the world: to facilitate the availability of information in such a way that the needs of the agencies, organization, citizens, commerce and society in general are met. Many countries are involved in developing NSDI. Each country however has its own challenges. Different cultures and people with different ideas and beliefs influence the direction in which the NSDI develops.

The establishment of an NSDI is not, however, an end in itself. Policymakers increasingly recognize the growing complexity and interconnectedness of issues that affect the quality of life today; the complexity influences the way new policies are now prepared and implemented, including at the EU level. Many such policies need to be underpinned by information on spaces and places, that is to say, on geographic information to assess needs, inform policy, and evaluate impacts. Moreover, many different policies have a need for the same information [B. van Loenen, B.C. Kok, 2003].

REFERENCES

[1] Schramm, M., Hoek, K ., Mičietová, E, Stufken, K.,: NATIONAL SPATIAL DATA INFRASTRUCTURE (NSDI), Land Administration and Cadastral Infrastructure, EU-Phare Project SR2003-004-995-02-01.02, Final report, 2005
[2] INSPIRE Data Policy & Legal Issues Position Paper, DPLI Working Group, 2006
[3] Report 'NATIONAL SPATIAL DATA INFRASTRUCTURE - Needs for GI and EU Requirements to Advanced Geo-Information, Land Administration and Cadastral Infrastructure, 2005
[4] Mičietová, E., Vališ, J., Tuchyňa, M., Herich, I., Pavela, M., (2004, 2005) : Tools for integration and distributed use of geospatial information. Process reports 2004, 2005. Ministry of Education of SR.
[5] INSPIRE Implementing Rules Development Databases Preparatory stage 2005 – 2006. http://www.ec-gis.org/inspire/ir/index.cfm

BIOGRAPHICAL NOTES

Juraj Vališ, at present deputy director at Research Institute of Geodesy and Cartography in Bratislava, sector co-coordinator for Cadastre in Slovak Republic, member of Commission for informatisation of Slovak Government, leader of Slovak-wide project "Information system for geodesy, cartography and cadastre", member of the third FIG commission Spatial

Information Management, member of United Nation ECE Bureau of Working party on Land Administration, member of INSPIRE Expert Group established by European Commission and responsible person for co-ordination of activities in creation of information system of geodesy, cartography and cadastre within the framework of international activities in Geodesy, Cartography and Cadastre Authority of the Slovak Republic.

Eva Mičietová, at present head of Department of Cartography, Geoinformatics and Remote Sensing at the Comenius University in Bratislava, Faculty of Natural Sciences, co-ordinator of the project of research and development related to NSDI: *Tools for integration and distributed use of geospatial information*. Several national and EU project coordinating activities related to standardization, harmonization and integration of geographical information. Publications in area of concept of geographical database data model, proposal of coding system for hierarchical environmental systems, member of Cartographical association, Slovak association for geoinformation, Slovak geographical association.

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