Creation of an NSDI strategy – Case Study Croatia

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Abstract
This paper gives an overview of research conducted in Croatia to recognize the needs and expectations of spatial data producers and users at national level in the process of improvement of the existing NSDI. The results of the research make groundwork for creating an NSDI vision and an efficient national improvement strategy. For building such a strategy, a general model of improvement was devised, applicable in Croatia and in countries with similar circumstances. There are no two identical NSDIs in the world and it is important that each country, at national level, develops a strategy by itself, whereby experiences from countries with a developed NSDI can be of great help.

Keywords: NSDI, Web research, SDI Strategy, Croatia.

1. INTRODUCTION

Spatial data infrastructures (SDI) have always existed in a certain forms, but the level of their implementation has differed according to particular moment. In this context, building or establishing the SDI can be seen as improvement or enlargement of the existing one (Cetl, 2007). Improving the SDIs has benefits for both producers and users of spatial data, as for the society in general. The benefits are faster and simpler dissemination of spatial data and more efficient use of these at all levels of society. This is supported by experiences from many countries in which, according to the stage of development, the NSDI is about to reach or has already reached the second generation (Masser, 2004). To achieve the envisioned effect of the SDI improvement, it is necessary to consider the factors which bear influence on it, the most important ones being development of the SDI vision and of an implementation strategy (Rajabifard and Williamson, 2001).
Developing countries and countries in transition are challenged to improve their SDI and provide access to information in line with sustainable development. Croatia, being on its way to enter the EU, is among these countries, and has to improve its existing NSDI and become compliant with the INSPIRE Directive (2007/2/EC). The NSDI in Croatia is not developed enough to be considered as the first generation SDI (Masser, 1999). Certain parts do exist, which refer primarily to spatial data, legislative and technical infrastructure (Cetl et al., 2003). Spatial data producers create data in digital form, and a big amount of the existing analog data has been digitized. Access to these data is nevertheless limited to direct contact with the producer or sometimes to Web pages of a specific producer.

One of the biggest problems is fragmentation and existence of the double records and databases, which results in redundancy and inefficiency. In different systems, particularly the cadastre, there are such examples which obstruct their functioning and consequently the establishment of the NSDI (Cetl et al., 2006). Adjustments of the legal framework have been a great improvement in the NSDI development. For a very long time Croatia did not have any legislation regulating GI filed. The first legislation concerning SDI in Croatia came into force in February 2007. A separate chapter defining SDI was included in the new Law on State Survey and Real Estate Cadastre. At the time the Law was being prepared, the proposal for the INSPIRE directive was published, so all articles defining NSDI are fully in line with INSPIRE (Baćič et al., 2008). Through enforcement of that Law, the Croatian Government on 31st May 2007 appointed a chairman and the members of the NSDI Council (Official Gazette, 16/07). Further development of the NSDI will be full implementation of the institutional framework defined by the Law which requires an efficient strategy for its success.

For that purpose, the Chair of Spatial Information Management, Faculty of Geodesy, University of Zagreb, conducted a Web research at national level, to gather data and opinions of different subjects in the process of the NSDI improvement and thus support the creation of an efficient improvement strategy.

2. **NSDI STRATEGY**

It is essential to define what an NSDI strategy entails. If we compare the notion of NSDI strategy with the NSDI definition and policy, it is to be stressed that the strategy includes a much bigger scope of factors (EUROGI 2000). It involves awareness raising, promoting greater usage, capacity building etc. It also assumes that the main problems in the NSDI improvement are primarily political and institutional rather than technical in nature. The aim of the strategy at national level is to provide producers and users of spatial data with guidelines for (Kjellson 2007):
Development of the first generation NSDI into the second generation involves a change of the NSDI strategy. In today's rapidly changing world, strategies must be frequently renewed. In the second generation of SDI, the SDI development strategy is changing towards a more process-based approach (Rajabifard et al. 2003). This approach focuses on creation of a suitable infrastructure to facilitate management of the information assets instead of a link to the existing and future databases. Considering the above, the following basic steps in the NSDI strategy building can be defined:

- stimulating greater use of spatial data,
- raising awareness about spatial data and its associated technologies,
- promoting development of strong national GI associations,
- improving the existing NSDI,
- representing national interests in the regional and global SDI debate.

The first step in creating a NSDI strategy is acknowledging the fact that in most environments there are different types of users who need different levels of functionality and access to spatial data. In addition to this, different users may have their own access rights and needs. On the other hand, spatial data producers have to be taken into consideration because at national, as well as global level, business and governmental interests are crucial for the success of a NSDI strategy (Riecken 2003). Preparation and elaboration of a NSDI strategy should follow from a thorough research which is to consider the needs and wishes of spatial data users and producers.

3. **WEB-BASED RESEARCH**

Improving the NSDI, given its complexity and extensiveness, is very challenging, and an appropriate methodology is required. The basic thesis upon which the research is based is that some form of NSDI at a specific level and at a specific moment always exists. The emphasis is therefore exclusively on improving the existing spatial data and their dissemination, and not on producing new data. The main goals of the research were the following:

- defining the current state of spatial data and setting the frame,
- defining the level of ICT use,
• examining readiness of different subjects to participate in and finance the improvement,
• examining the effect of the SDI on society.

To carry out the research, the method of an on-line Web questionnaire was used. Since the goal was to gather data and opinions of different subjects in the process of SDI improvement at national level, from producers to final users, two questionnaires were made, one for spatial data producers and one for users.

3.1 Overview of the questionnaires

In drawing-up of the questionnaires, all theoretical aspects of such research as well as other relevant factors were taken into consideration (Galešić, 2005). Each single question is a separate variable with the following features: number of a variable, name, range and value. In Each questionnaire the variables are grouped with regard to the SDI definition, i.e. depending on the target group, into appropriate sets: organization, ICT, SDI, and environment factors. Also, attention was paid to separate the “hard” variables (which refer to the institutional level of organization) and the "soft" variables (subjective perception of the respondent). The questionnaires were anonymous, i.e. there was no request for personal or company name, which often presents a limitation in filling questionnaires. Also, in drawing the questionnaires, priority was given to achieve the maximum balance between all important questions and the length of the questionnaire, and take into consideration various possible sources of mistakes which can occur in this type of research.

It must be said that the notion of spatial data producer is a very broad term and includes not only the primary (original) producers, but also those that on the basis of original data make new data, services, and perform different analyses. For the purpose of this research only the primary spatial data producers were taken into consideration, i.e. geodetic (surveying) firms. Considering the SDI structure, the questionnaire for producers included two important topics: organization and ICT, and SDI. The questionnaire consisted of 23 questions.

Spatial data users are all those who, directly or indirectly, use spatial data for their professional activities or personal needs. Spatial data are the groundwork for all those involved in space and spatial analyses: geographers, urban planners, economists, sociologists, law officials, agronomists, forestry workers, biologists, tourist workers, etc. Considering that 80 % of all information includes a spatial component (Grant, 1999; Østensen, 2001; Ryttersgard, 2001), it is evident that the notion of user is very broad, and that they are present at all society levels. This research dealt with those who use spatial data in their primary activities, and these are: architects, civil engineers, law officials, etc. Apart from the primary users, spatial data are important to others at all levels and from all
aspects of spatial analyses. As with the questionnaire for producers, the questionnaire for users included the relevant topics: organization, spatial data and ICT, and SDI. The questionnaire consisted of 21 questions.

3.2 Questionnaire implementation

For implementation of the questionnaires, a relational database and ASP (Active Server Pages) technology were used. The questionnaires were implemented as tables in a relational database according to a coding plan, and each question with its attributes as a specific variable. Access for the respondents was provided in a Web browser. A call to fill in the questionnaire was sent by e-mail on 29th May 2006 to addresses of previously specified respondents, and a 30-day period was set for receiving responses.

The planned sample included 100 producers and 100 users. In defining the sample, attention was paid to the following factors: covering the whole area of Croatia, different profiles and sizes of particular producer and user firms. The producers were selected from the list of authorized surveyors at the State Geodetic Administration (SGA) that is national mapping and cadastre agency in Croatia, and the users were chosen through a Web search.

3.3 Results of the questionnaire research

The questionnaire research was carried out in June 2006. The returned sample was the following:

1. spatial data producers 73%,
2. spatial data users 60%.

Higher percentage response from the producers was expected since these are geodetic firms familiar with the SDI.

The returned sample for the two questionnaires is representative, considering the expectations and the fact this was a targeted research, and the research results are to be considered valid. What follows is an overview of the results of the research.

3.3.1. Spatial data producers

On the basis of data gathered in the research, we can briefly outline the following:

1. Considering the organizational structure, small geodetic firms with less than 10 employees make the biggest number of spatial data producers in Croatia. The level of their activities is mostly national or local. In Croatia a
lot of effort is yet to be put into arranging the spatial records, particularly the cadastre and land registries, and this is to be expected in the near future.

2. The producers’ activities and services provided to the users are mostly: cadastre and land registry, location based services, GIS, cartography and photogrammetry.

3. The main criterion for defining the policy on prices of products and services is, as in other European countries, cost recovery.

4. 58% of the producers are not satisfied with the existing spatial data market and prices.

5. For the creation, use and maintenance of data mostly a combination of analog and digital format is used. Consequently the ways of data storage differ. The percentage of using exclusively analog data in the creation, maintenance and storage of spatial data is still high, and on average amounts to 20%. Data records are mostly kept on computers, and digital spatial data have the biggest distribution through different media.

6. 27% of the producers create metadata, which is a significant factor of adjustment to new technologies and services and the users' needs. However, for harmonization with the future European market, this percentage should be increased.

7. Use of the ICT in businesses is high, but not to its full potential when it comes to providing products and services on the Internet, which directly improves the existing NSDI. A rough estimate of investment into the ICT amounts to 10% of the annual gross revenue.

8. The biggest obstacles in spatial data exchange are lack of knowledge, opposition to and uncertainty about sharing data with others, and varying quality. These obstacles and dealing with them are limiting factors in the NSDI improvement and should be removed.

9. All producers agree that the NSDI should be improved. As many as 92% are prepared to take part in the improvement, and 90% believe there are economic benefits from it.

10. The state budget and public-private partnerships are proposed as the most appropriate model of financing the NSDI.

11. Propositions for further maintenance of the NSDI are user subscription and payment after a completed transaction.

Spatial data producers and holders are challenged to bring their products to market. To fulfill this request they need to be user oriented, original and creative. They have to replace their old business models with new more efficient ones. A possibility to solve these problems is through NSDI implementation and adoption of new technologies as facilitator for new business models. The existing NSDI legislation is fitted to Croatian realities and general institutional framework that defines the spatial data, their rights, standards, harmonization and leads to interoperability of collected spatial data (Bačić and Šainović, 2006). Of course
some open topics that seek for regulations are pricing policy, maintenance and quality control of data, support of NSDI in technology and staff, removing slow administrative procedures and limitations of access to spatial data.

3.3.2 Spatial data users at national level

On the basis of data gathered in the research, we can briefly outline the following:

1. On the part of the users in the research, mostly big private firms with more than 50 employees participated. Reasons for such distribution lay in the fact that big organizations such as INA oil company, Croatian Roads, Croatian Telecom, etc. have their special public relations offices which readily participate in this type of research.

2. The primary activities of the users filling the questionnaire are: transport and infrastructure, architecture, civil engineering, environment and ecology, telecommunications, tourism, law, and real estate.

3. Use of the Internet is high, and mostly all users have access to it. The Internet services are most commonly used for: communication, marketing, administration and sale. This indicator shows professional and technological competence of the users for accepting new services through the SDI improvement.

4. In their activities the users mostly use spatial data for defining locations in space and ownership boundaries, i.e. they use the cadastral and other spatial data as the basis for planning different projects in space. Spatial data are mostly used in a combination of analog and digital format.

5. 70 % of the users are not satisfied with the existing spatial data market and prices.

6. Contact with the spatial data producers is mostly made by telephone or e-mail, and the amount of time spent on obtaining spatial data is recognized as a problem.

7. The users are mostly familiar with different activities aiming at the NSDI improvement, especially with the cadastre digitization and the land registry database, which have recently been spoken about in public. Also, a big number of the users, namely 83 %, are ready to participate in different activities aiming at the NSDI improvement.

8. If the NSDI included a portal or an online service for spatial data, 97 % of the users would use it, and 93 % believe it would improve their businesses through saving money and time needed for obtaining spatial data. Such high percentages undoubtedly point out justifiability of the NSDI improvement.

A demand from users for services providing various types of spatial data is growing rapidly. Real estate market in Croatia, due to liberal regulations on transactions valid also for foreigners is growing exponentially and therefore
additionally generating pressure on spatial data services. Generally, users pointed out that the most important issues are availability of good quality and up to date spatial data.

4. STRATEGY GUIDELINES

The results of the research conducted prove that improving the NSDI is totally necessary and justifiable. Further preservation of the current state and the current spatial data market is not acceptable, neither on the part of the producers nor the users. The main priority of the NSDI must be to ensure that data are accurate, up to date, of good quality, and easy to find, together with providing sustainable systems of continuation of such processes. The NSDI strategy must be oriented towards users and providers of services of relevant data. The ICT development results in changes in the business activities and the way of life, and requires changes in all segments of society. Efficient spatial data management is to follow this trend and be prepared to meet all challenges and future social needs in line with sustainable development.

The goal of improvement is to create an environment in which the existing spatial data and the linked services will be available in the simplest and most efficient way to all interested users. Improvement of the existing NSDI is to be treated as a public project of permanent character, in which before defining the particular activities and resources, both at global and national level, an efficient improvement strategy should be created. Each country or society should build such a strategy by itself. Creation of an improvement strategy is to follow certain guidelines:

1. Review of the existing state and evaluation of the development stage of the existing NSDI;
2. Examination of the needs of spatial data producers and users;
3. Clear definition of the goals which are to be achieved by the improvement;
4. Plan of the activities, an initial time-limit, and the resources needed for successful implementation of the improvement project.

A review is to examine the state of existing spatial data and their availability, and possibilities for improvement, i.e. their adjustment and harmonization according to the appropriate standards, for the purpose of their wider dissemination and more efficient use. An analysis of the existing state should evaluate the development stage and organization, which can be done using the maturity matrix (Kok and Van Loenen, 2005).

Examination of the needs of, primarily, the spatial data users, but also the producers, is of key importance in envisioning the NSDI improvement. The spatial data users not only want to obtain data, but also use different services and
analyses, which require interoperability by combining various heterogeneous spatial databases and other sources. On the other hand, the producers have interest in creating added value and generating revenue.

On the basis of the review of the existing situation, the evaluation of the development stage and the examination of the producers' and users' needs, it is possible to define improvement of the existing NSDI as a public project of permanent character. Here it is necessary to define goals of the improvement clearly, plan the activities, provide the initial time frame and the resources needed for successful implementation of the improvement project.

Creation of a strategy is to be harmonized with an improvement model, which is to include eight clear activities (Figure 1).

Through creation of a strategy, an appropriate model of the NSDI improvement is to be defined. A general model of improvement covers all the activities mentioned. It is necessary to stress that these activities are not to be carried out one at a time, but certain activities can and have to be carried out simultaneously. Adjustment of the general model to a particular one depends on the NSDI
development stage in each national case. Depending on the development stage evaluation, the spatial data producers’ and users’ needs and the existence of particular NSDI components, particular activities may be omitted, which results in a specific improvement model that could be adjusted to a particular country.

The Croatian NSDI Committee has a very complex task of managing the improvement and coordinating all relevant parties. The research presented in this paper serves as good groundwork for creating a vision and a national strategy of NSDI improvement. Taking into consideration the proposed general improvement model, in the case of Croatia we can briefly outline the following strategy guidelines, which can be useful to other transition countries as well:

1. One of the key factors in the improvement is creation of accurate legal regulations as a prerequisite for all further activities. The NSDI must not be seen as a product or technology, but improvement of the existing NSDI should be defined as a public project of general interest which will contribute to the overall social welfare. It is also necessary to define an institutional framework which will provide further coordination in the improvement process. The normative regulations are to provide directives for use of the appropriate, already existing standards, and adjustment of spatial data to those. Creation of new standards and specifications for spatial data is completely unjustifiable. At international and European level (INSPIRE), a series of ISO 191xx standards is applied, some of which are already assimilated in Croatia, and it is necessary to regulate and adjust their use at national level. It must be pointed that process of SDI establishment in Croatia has already started and with the new Law on State Survey and Real Estate Cadastre it got legal and institutional framework. The Law gives definition of NSDI services, content of metadata, spatial data and subjects that are obliged to participate in its establishment and maintenance, and what is very important gives institutional framework and defines NSDI bodies and their responsibilities. All articles defining NSDI are fully in line with INSPIRE.

2. Promoting importance of spatial data in society is of key importance, on which success of the improvement greatly depends. One of key factors is the degree of education of SDI subjects as well as whole GI market and community. Experts and those who use spatial data are aware of the benefits of improving the existing NSDI, but it is not the case in the society as a whole. Not acknowledging the importance and effect of spatial data on everyday decision making is a factor which casts the NSDI improvement as unnecessary.

3. In creation of an NSDI, coordination and cooperation should have the key role, because no organization by itself can establish nor improve the NSDI. Only cooperation between the public sector, the private sector, the academia, non-government organizations, civic associations and
individual users can give a clear vision of the NSDI improvement. Through enforcement of a legal act it is necessary to define an institutional framework, i.e. a responsible institution and a coordination body in charge of carrying out all further activities. Along with the coordination body, creation of an independent multidisciplinary body is to be considered, which would be independent of the government policy, and on the other hand represent the interests of a wider community of users and citizens. The institution for coordination of the improvement can be made up of a national mapping agency in close cooperation with other included parties. In Croatia, SGA (the national mapping agency) was appointed as SDI coordination body. The supreme SDI governing body is the SDI Council comprised of 15 members coming from different ministries responsible for environment protection and spatial planning, defense, land registry, transport and communications, agriculture, forestry and water management, science and education, culture, state administration body responsible for e-government, state survey and real property cadastre, statistics, Croatian Hydrographic Institute, Croatian Geodetic Institute, geodetic and geoinformatics economic community, IT economic community as well as Croatian Chamber of Architects and Civil Engineers. On the managerial level, there is the SDI Committee appointed by the Council and consisting of three representatives from the Council, two from SGA and heads of working groups. On the operational level there are working groups. In 2008 two working groups were formed: WG Technical Standards and WG Spatial Data Sharing Policies.

4. A mechanism of financing improvement of the existing NSDI has to include both short-term (initial) and long-term (permanent) period. Spatial data and information are quasi-public good, and improvement of the existing NSDI is to support an efficient government and e-government. Moreover, the government is generally the most frequent user of spatial data. This leads to conclusion that the initial funds for improvement are to be granted from the state budget. Further financing requires additional sources, and considering the research results, public-private partnership seems to be the optimal mechanism. Creating a price policy is another very important factor in dissemination of spatial data. The issue of data price and fees for use of them is debatable, but the main NSDI principle should be "As Cheap as Possible". In line with that there should be a combination of: open access and cost recovery, use of spatial data for non-commercial purposes free of charge or with minimum costs of dissemination and maintenance, and charge for commercial purposes. In Croatia, so far the main funding mechanism is state budget through SGA.

5. The frame of spatial data includes basic and other data sets. Considering the diversity of spatial data, an accurate definition of frame affects many other factors including the financing of improvement. It should be emphasized that defining a frame is not a one-time process, but the frame
keeps expanding according to the users’ needs. The basic data are a
minimum data set, in the country’s and society’s interest, which the
country is ready to finance. This implies complete and accurate basic data
for the whole area of a state. Also, definition of a frame is directly
connected to metadata and their creation, since they are primarily to
document the basic data.

6. Efficient implementation of the SDI improvement greatly depends on the
potentials and aspirations of specific included parties. This is especially
important in an early phase of development and improvement, when it is
advisable to include as many parties as possible. The SDI improvement is
a dynamic process developing in a digital environment, in which new
insights and technologies are constantly introduced. In this context,
capacity building is to support the knowledge, skills, and advancement of
all individuals and groups included in the design, development,
management and maintenance of the SDI. These activities should be
focused on education, training and support of human resources, and can
be carried out as different congresses, seminars, workshops, etc. During
the 2007 and 2008 three workshops where organized by SGA in Zagreb
to transfer best practices. The first workshop "Presentation of Swedish
NSDI model" was in May 2007 in cooperation with Swedish International
Development Cooperation Agency (SIDA). The second workshop
"Presentation of Canadian NSDI model" was in September 2007 in
cooperation with Natural Resources Canada and Canadian GeoProject
Centre. The third workshop "Presentation of German NSDI model" was in
May 2008 in cooperation with Deutsche Gesellschaft fuer Technische
Zusammenarbeit (GTZ). Each workshop was attended by more than 100
participants from different Ministries and other state bodies, regional or
self-government bodies, private sector and public systems fully or partially
owned by the State. Participants agreed that key factors for successful
NSDI are clear vision, strategy and accurate, up-to-date and quality data.

7. Definition of the spatial data frame identifies the data sets for which
metadata will be created. The normative regulations for creation of
metadata are to enforce the appropriate standards that will completely
satisfy the needs at national level. Acceptance and application of the
standards is a prerequisite for creation of metadata through building of
metadata profile and an accurate catalogue, from which users will benefit
most, but also spatial data producers. In Croatia ISO 19115 Metadata
standard was adopted and metadata content is defined by Law.

8. Creation of a catalogue and a Web portal as the central access point is
the most extensive goal of the SDI improvement. It is necessary to
emphasize that the catalogue is not a storage for spatial data, but it
includes at national level an access network focused on searching and
accesing the data and other services. The Web portal is to enable users
to access metadata completely free of charge. In the creation of an
interface, primarily future users should be taken into consideration. The interface should therefore be "user friendly" and enable a simple and clear use and search of spatial data. Setting up of SGA's Geo-portal is the initial building block of Croatia's NSDI (Landek et al., 2006).

5. CONCLUSION

The NSDI must not be developed hastily, but a clear vision is needed, which is to be based on organizational, human and financial resources. This specifically applies to developing countries and countries in transition which are challenged to establish and improve the existing NSDI. It is important to emphasize there are no identical spatial data infrastructures in the world, and it is impossible to copy a model from one country to another. Each country, considering its distinctiveness, social needs and the development stage, has to develop its own model of the NSDI.

For the purpose of improvement of the existing NSDI, this paper proposes a general improvement model through different activities. These activities in synergy result in an efficient improvement of the existing NSDI, which is applicable at national level in Croatia, and could be used in other countries faced with the improvement. The most important is to create the right access policy, regulate the procedures, define the spatial data frame accurately, build the capacities and choose an efficient financing model. Depending on the development stage of a specific NSDI, certain activities can be omitted, which results in a specific improvement model adjusted to the particular case.

An improvement model adjusted to the particular national case should result from an efficient strategy which reviews the existing state and evaluates the development stage, examines the needs of spatial data users and producers and defines clear goals. Each country, at national level, has to develop such a strategy by itself, whereby experiences from countries with a developed NSDI can be of great help. Also, it should be stressed that the time component is to be taken into consideration, i.e. the developed strategy is to be updated frequently in line with technological and social developments and the users' needs.

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