PROSTORSKI PODATKI PRI RAZVOJU NACIONALNE PROSTORSKE PODATKOVNE INFRASTRUKTURE V REPUBLIKI SRBIJI

GEODATA MANAGEMENT BY DEVELOPING OF NATIONAL DATA INFRASTRUCTURE IN THE REPUBLIC OF SERBIA

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IZVLEČEK

Izmenjava prostorskih informacij med javnimi institucijami in zasebnim sektorjem, ki temelji na standardih za tehnično infrastrukturo prostorskih podatkov in storitev, je strateška usmeritev srednjeročnega programa dela Republike Srbije. Ta vključuje razvoj državne prostorske podatkovne infrastrukture ter njeno vzdrževanje v obdobju med letoma 2011 in 2015. Za uresničitev zastavljenih ciljev je bila izvedena raziskava. V članku so predstavljeni njeni rezultati, prizadevanja na področju prostorske podatkovne infrastrukture, ocena dosežene ravni razvoja in predlogi za prihodnje dejavnosti na področju izvajanja direktive INSPIRE v Srbiji. Izvedena je bila analiza razpoložljivih prostorskih podatkov v več kot 78 lokalnih javnih organizacijah, državnih upravnih enotah, javnih podjetjih in izobraževalnih institucijah. Analiza stanja je obsegala informacije o uporabi, vrstah prostorskih podatkov in pogojih oziroma razpoložljivosti podatkov za uporabo. Pri tem je posebej poudarjen vidik državne prostorske podatkovne infrastrukture, skupaj s stroškovno politiko, zakonodajni okvirom in koordinacijo na področju prostorskih podatkov v Republiki Srbiji.

ABSTRACT

Sharing of spatial information between the state establishments and private sector, based on standards for technical infrastructure of spatial data and services, is the strategic objective of the Mid-Term Program of Works of the Republic of Serbia, covering the National Spatial Data Infrastructure (NSDI) Instigation and the maintenance for the period from 2011 to 2015. With the objective to achieve the goals set, the research was performed, with the results published in the present paper. The paper shows the status in the Spatial Data Infrastructure instigation; with the evaluation of development level achieved and recommendations for the future INSPIRE Directive implementation in Serbia. Geodata status analysis was performed over the sample of 78 local government organisations, state administration bodies, public enterprises and educational institutions. Overview was given for use, the types and availability conditions for spatial data. The issues of NSDI concept implementation were particularly noted, referring to the pricing policy for spatial data use, for the legislation and issues in spatial data coordination in the Republic of Serbia.

KLJUČNE BESEDE

prostorski podatki, prostorska podatkovna infrastruktura, upravljanje podatkov, prostorski podatkovni portal

KEY WORDS

geodata, spatial data infrastructure, spatial data management, geoportal

1 INTRODUCTION

Interest for spatial data is particularly large, being held by the governmental bodies and organisations, private companies, along with the individuals. Nearly 80% of collected data contains spatial references, having the obvious significance in some cases, with the other ones having the spatial aspect concealed. Therefore, there is no wonder that spatial data are constitutive part of our lives. The Directive 2007/2/EC on Infrastructure for SPatial InfoRmation in the European Community (INSPIRE) came into force on May 15th, 2007. The so called INSPIRE Directive is aimed at instigation of spatial data infrastructure throughout the European Union, for the purposes of policies and activities, that may influence the environment (European Commission, 2007; URL1). The spatial data infrastructure covers instigation conditions for sharing, for access and use of interoperable spatial data and the services over various levels of governmental administration and throughout various sectors, with the focus on environment protection (European Commission, 2007). Being the candidate for European Union membership (since March 1st, 2012), Serbia is obligated to coordinate its legislation to the European Union system prior to entering the full membership. List of the European legislation to be transposed to Serbian legislation includes the INSPIRE Directive.

2 INSTITUTING AN INTEGRATED SPATIAL DATA SYSTEM

Spatial data are defined as data being directly or indirectly related to a certain location or a geographical area. Spatial data refer to the particular themes being systemized per groups, collected and maintained by the competent public administration bodies. Spatial information, unified in the integrated infrastructure, that are managed and published, constitutes the NSDI (National Spatial Data Infrastructure) (Law on the state survey and cadastre, 2009). There is a multi-annual trend in Europe to produce studies on spatial data status. Ever since the year 2001, the status has been evaluated and research results have been subsequently published, in the format of European Commission annual reports, which serve as the foundation for decision making on future plans and projects.

In the year 2008, the Republic of Serbia initiated the activities on the integrated spatial data system (NSDI) instigation, under leadership of the Republic Geodetic Authority (The Strategy for National Spatial Data Infrastructure Instigation for the period 2010–2012, 2010). The NSDI development shows tangible results: the initial geoportal "GeoSRBIJA" (Figure 1) has been launched for operation, the entire organisational structure has been set, the strategy adopted and mid-term program of the works has been promulgated.

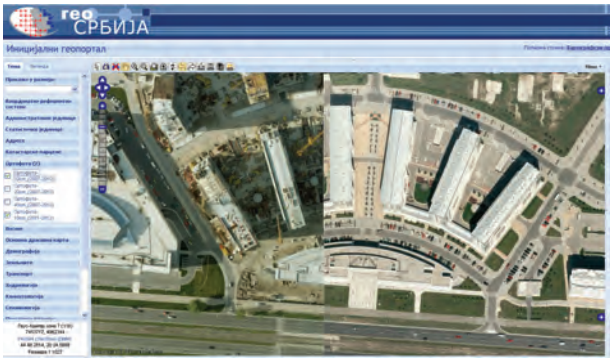

Figure 1: National geoportal GeoSrbija: cartographic view – orthophoto (URL2)

For the period 2011–2015, an overview of legislation status has been produced and the drafting of the Law on integrated spatial data instigation has been initiated, with the objective of complete transposition of the INSPIRE Directive to the national legislation (Aleksić, 2013a; Rašković and Aleksić, 2013). Legal framework for the NSDI Instigation in the Republic of Serbia consists of the following acts: Law on Ministries, Law on State Survey and Cadastre, Strategy for NSDI Instigation for the period 2010–2012, and the laws covering free access to the public sector information: Constitution of the Republic of Serbia, Law on Free Access to the Information of Public Importance, Law Verifying the Convention on Information Availability, Public Participation in Decision Making and Legal Protection Right regarding the Environment Issues, Law on Environment Protection (URL3).

For cadastral system modernization and harmonization with the systems in other countries, during the past decade numerous international projects have been implemented in the Republic of Serbia. As for the spatial data infrastructure development, the most important projects include the following: Capacity development for digital state map preparation in the Republic of Serbia (in cooperation with Japan International Cooperation Agency), Geographic information for development and the EU integration (in cooperation with the Kingdom of Norway), IGIS project (with the Republic of France) and Real Estate Cadastre and Registration Project (financed by World Bank Loan) (URL3). The NSDI development in the Republic of Serbia was under major influence of the INSPIRATION Project implementation. This project has been implemented in the Western Balkan countries (Albania (Gjata, 2013), Bosnia and Herzegovina (Ključanin, 2013), Croatia (Poslončec-Petrić, 2013), Macedonia (Gjorgjiev, 2013), Serbia (Aleksić, 2013a), Montenegro (Aleksić, 2013b) and Kosovo[1] (Loshi, 2013)), with the objective to promote spatial data infrastructure and coordination of their implementation in these countries. One of the most important tasks of this Project is to prepare the participating countries to meet requirements of the European Union INSPIRE Directive. This project has contributed to instigation of the favourable environment for provision of accurate, updated, high quality, well-structured and available data for local, regional and state-level bodies in Balkan countries. The national "GeoSRBIJA" geoportal is the indicator that shows how far the services are integrated and how consistent they are.

3 OVERVIEW OF THE SPATIAL DATA EXISTING STATUS

The analysis has been elaborated through several phases. During the first phase, a listing is made, covering online or directly all institutions using and offering spatial data, from the governmental and from private sector. The second phase entails a selection of data and application of evaluation criteria. Services have been evaluated, both at national and at local level. Analysis of the spatial data current state in the Republic of Serbia has been performed using questionnaires for organisations assumed to have some links to spatial data acquisition, processing, to the usage and storage. The INSPIRATION Project implementation in the Republic of Serbia was aimed at the following: Analysis of political, establishment and legislative framework; the Capacity building; Knowledge transfer; and Instigation of mutual communication between the stakeholders. Realization of the goals set has entailed a research with an objective to show the state in the field of spatial data infrastructure instigation, to evaluate the achieved level of modern development and to provide recommendations for further implementation, in accordance with the INSPIRE Directive.

[1] This designation is without prejudice to positions on status and is in line with UNHCR 1244 and ICJ Advisory opinion on the Kosovo declaration of independence.

The national geoportal (URL 4) provides a single access point to public services for the users, which entails the implementation of following characteristics: data security, data access, content searching and navigation, dynamical content and personalization.

4 ANALYSIS OF THE SPATIAL DATA ACQUISITION, OF ITS USE AND THE DISTRIBUTION IN THE REPUBLIC OF SERBIA

The analysis has been performed over the sample of 78 organisations. Structure of organisations surveyed consists of the state administration, autonomous province and local government bodies, public enterprises and scientific-educational institutions. Table 1 indicates that the majority of answers has been received from local government units (37 %), followed by the state administration bodies (22%) and public enterprises (19%).

Table 1: Structure of organisations surveyed, per type

Institution	Number	Percentage
Local government organisation	29	37%
State administration organisation (ministries, special organisations)	17	22%
Public enterprises	15	19%
Other	6	8%
Scientific-educational establishments	5	6%
Private organisations	3	4%
Territorial autonomy organisation	2	3%
Public agency	1	1%
Designing-urban planning organisation	0	0%

The questionnaires have covered 33 questions, grouped per themes covering questions on: responding organisation, data production, cooperation between spatial data producers and users, standardization in the field of spatial data and miscellaneous questions (Aleksić, 2013a; Rašković and Aleksić, 2013). Analysis of the provided answers covers spatial data preparation, acquisition, distribution and use. Data processing has been performed by working team, staffed by representatives of various state and local administration bodies. The reports contain results and recommendations for the future activities. Results of the research performed in the Republic of Serbia were presented in the study *INSPIRATION: Country report SERBIA*, national report on geo-sector status in the Republic of Serbia. Results of the study are the foundation for the NSDI Law drafting in the Republic of Serbia.

4.1 Spatial Data Preparation and Acquisition

Spatial data creation is performed by 69 % or respondent organisations at the national, regional and local level. Pursuant to the INSPIRE Directive provisions, spatial data shall be in digital format, to be owned by public institutions. Data are grouped in 34 spatial data themes. The most frequent spatial data producers/distributors are Republic Geodetic Authority (33%), Military-Geographic Establishment (7%), Serbian Nature Protection Authority (3%), the Republic Statistics Office (3%) and PE PTT Serbia (Postal services) (2%). Table 2 displays an overview of number of the organisations producing spatial data, sorted per administration levels and per adopted spatial data themes.

Table 2: Spatial data creation per INSPIRE themes in the Republic of Serbia

Theme (INSPIRE)	National level (No)	National level (%)	Regional level (No)	Regional level (%)	Local level (No)	Local level (%)
ANNEX I (∑)	**36**	**25**	**4**	**31**	**43**	**30**
Coordinate reference systems	6	4	1	8	3	2
Geographical grid systems	2	1	0	0	2	1
Geographical names	4	3	0	0	2	1
Administrative units	2	1	0	0	4	3
Addresses	2	1	1	8	7	5
Cadastral parcels	2	1	0	0	9	6
Transport networks	4	3	0	0	5	3
Hydrography	8	6	0	0	5	3
Protected sites	6	4	2	15	6	4
ANNEX II (∑)	**20**	**14**	**1**	**8**	**11**	**8**
Elevation	6	4	0	0	2	1
Land cover	4	3	1	8	1	1
Orthoimagery	6	4	0	0	7	5
Geology	4	3	0	0	1	1
ANNEX III (∑)	**86**	**61**	**8**	**62**	**90**	**63**
Statistical units	5	4	0	0	4	3
Buildings	13	9	1	8	12	8
Soil	2	1	0	0	1	1
Land use	5	4	2	15	12	8
Human health and safety	2	1	0	0	3	2
Utility and governmental services	7	5	0	0	6	4
Environmental monitoring facilities	7	5	1	8	11	8
Production and industrial facilities	6	4	0	0	9	6
Agricultural and aquaculture facilities	8	6	0	0	9	6
Population distribution and demography	2	1	0	0	4	3
Area management / Registration / Regulation zones & reporting units	6	4	0	0	7	5
Natural risk zones	6	4	1	8	2	1
Atmospheric conditions	2	1	0	0	1	1
Meteorological geographical features	4	3	0	0	1	1
Oceanographic geographical features	-	-	-	-	-	-
Sea regions	-	-	-	-	-	-
Bio-geographical regions	3	2	0	0	2	1
Habitats and biotopes	4	3	2	15	2	1
Species distribution	0	0	1	8	1	1
Energy resources	3	2	0	0	2	1
Mineral resources	1	1	0	0	1	1
∑	142	100	13	100	144	100

Majority of organisations has responded that they produced spatial data on buildings (26 or 47%), to be followed by land use and the environmental monitoring facilities data (19 or 35% of organisations). The lowest number of organisations collects spatial data covering species distribution, mineral sources (2 or 4%) and soil (3 or 5%) themes, while data on oceanographic characteristics and maritime regions are not collected. Very high percentage of spatial data (91%) is in digital form. Spatial datasets format is mostly analogue for the data collected by the local government units (6% of spatial datasets in analogue form). Spatial data scale ranges from 1:250 to 1:2,200,000 with the state coordination reference system (Gauss-Krüger and ETRS89/UTM) for 84% of data. Only 23% of datasets have metadata. The greatest share of datasets has been produced in years 2012 (22%) and 2011 (13%). A half of the spatial data are not being updated at all, 31% is being updated as needed, 12% pursuant to the norms and 5% is being continuously updated. Majority of datasets consists of the data categorized under urbanism (30%) and environmental protection (10 %). Table 3 displays the most and the least frequent spatial data categories.

Table 3: The most and the lest frequent spatial data categories

The most frequent spatial data categories	Product category	Frequency	Frequency (%)	The least frequent spatial data categories	Product category	Frequency	Frequency (%)
	Urbanism	68	30		Demography	1	0.5
	Environment protection	22	10		Gravimetry	1	0.5
	Transport	17	8		Cartographic publications	1	0.5
	Topography	15	7		Aerial imagery	1	0.5
	Hydrography	12	5		Laser scanning	1	0.5

Apart from producing spatial data, organisations also acquire data from other organisations, for the purpose of more efficient realization of working activities. As much as 79% of organisations provide the data from others. Majority of organisations (60%) acquire 1 to 5 products from other organisations. The Republic Geodetic Authority produces majority of spatial data and at the same time acquires the most of data from others. Data are mostly acquired by the following institutions: Administration of the City of Belgrade, public enterprises on national or provincial level scope of work and the ministries. The following products are most commonly acquired: topographic maps (7%), orthophoto (7%), cadastral maps (6%), cadastral parcels (4%), address data (3%), real estate sheets (2%), conditions and consents (2%) and the spatial plans (2%) (Aleksić, 2013a).

4.2 Spatial Data Distribution

In the Republic of Serbia, spatial data are distributed via postal services; over e-mail; downloaded over the internet or is sent directly. Answers of the respondent entities have also entailed combinations of data distribution methods. Table 4 displays the frequency of spatial data distribution methods in the Republic of Serbia.

The most of organisations have stated to have distributed spatial data via postal services (23%), postal services and by direct takeover (10%) and by all of the above (9%). The vast majority of organisations (72%) have selected direct takeover as one of the products distribution methods (always combined with

another distribution method), while nearly equal number of organisations have selected distribution via internet, e-mail and postal services (33%, 32% and 31%).

Table 4: Spatial data distribution method (N = 78)

Distribution method	Frequency	Frequency (%)
Over the internet	3	4
Over e-mail	1	1
Postal services	18	23
Other	3	4
Internet & e-mail	2	3
Internet & direct	6	8
Internet & other	1	1
e-mail & direct	4	5
Postal service & direct	8	10
Internet & e-mail & direct	3	4
Internet & Postal service & direct	2	3
e-mail & Postal service & direct	5	6
e-mail & direct & other	1	1
All of the above	7	9
All of the above & other	2	3
No answer selected	12	15

4.3 Spatial Data Use

Spatial data use has been defined against a product type. The product type involves the following: Data Discovery and Viewing Services, Web Map Services (WMS), Raster Images, Web Feature Services (WFS) and Vector Images. The Data Discovery and Viewing Services involve the services enabling search over metadata and the public metadata viewing. Web Map Services (WMS) are the standard protocol for geo-referenced maps provision in the raster format. Raster images download involves spatial data downloading, for the direct data access. Web Feature Service (WFS) is the standard protocol for vector data access. Vector data download involves download of vector data copies, with attributes. As for the spatial data way of use, the usage classification has been prepared as following (Aleksić, 2013a):

— Data used by public institutions;
— Data used for education, research and sciences;
— Data used by other non-profit organisations (NGO, etc.);
— Data used for commercial purposes;
— Data used by registered public users;
— Data used by unregistered public users.

Table 5 displays the exploitation manner for each product type.

Most of the respondent organisations have experience in geo web services use for the data exchange (44%), with all of organisations in this group noting the positive experience in the usage of these services. 31%

of respondent organisations have no experience in using these services in data exchange, with 25% or organisations noting that they have no experience in the usage of these services, having however a need for the data exchange. Organisations do have capacities to create these services and a need for daily spatial data exchange. Some of the organisations noted that they were planning to establish the GIS within their organisations, while some have initiated geo-portal instigation projects.

Table 5: Products way of use (Aleksić, 2013a)

<table>
<tr><th></th><th>Data Discovery and Viewing Service</th><th>Web Map Services (WMS)</th><th>Raster</th><th>Web Feature Service (WFS)</th><th>Vector</th></tr>
<tr><td>Data used by public institutions</td><td rowspan="6">Free, with certain limitations</td><td colspan="4">Pursuant to the agreements and protocols on cooperation</td></tr>
<tr><td>Data used for education, research and science</td><td colspan="4">No fee charged, for limited data level and area</td></tr>
<tr><td>Data used by other non-profit organisations</td><td colspan="4">Under commercial conditions, or by signing the contract in the particular situations</td></tr>
<tr><td>Data used for commercial purposes</td><td colspan="4">Commercial conditions, special agreements for greater data volumes, etc.</td></tr>
<tr><td>Data used by registered public user</td><td>Commercial conditions</td><td>Not applicable</td><td>Commercial conditions</td></tr>
<tr><td>Data used by unregistered public user</td><td colspan="4">Not applicable</td></tr>
</table>

5 RECOMMENDATIONS FOR THE FUTURE DEVELOPMENT

The basic NSDI concept consists of sharing of spatial data sets and services. Spatial data sets and services are shared with or without a fee, depending if users are financed from the budget or not. Achieving the NSDI objectives faces numerous obstacles in the Republic of Serbia: inexistence of spatial data in digital format, inexistence of data that the competent bodies are obligated to keep, tardiness in spatial databases maintenance, lack of funds, unclear division of competences, having for consequence that the same data can be kept by different state bodies. The major problem in the NSDI concept implementation is the pricing policy for the spatial data utilization. In order to adopt the NSDI Law, it is required to facilitate cooperation between state and other bodies regarding data sharing and use, to define rules under which the spatial data sets and services are to be exchanged and to establish a clear methodology for calculation of the fee for usage of spatial data held by other state bodies. Table 6 displays the National Spatial Data Infrastructure status in the Western Balkan countries participating in the INSPIRATION Project.

In all Western Balkan countries, the instigation of national geo-portal is under competence of the state bodies holding the competence to perform works in the field of survey and cadastre. The Republic of Serbia is one of the first countries that have established national geoportal. In that manner, access to the Discovery and Viewing Services have been provided for a limited number of metadata, spatial data sets and services under the competence of the Republic Geodetic Authority and other institutions. Viewing spatial data and services is provided through cartographic presentation of spatial data and services available, through such basic functions as: showing spatial data in the interoperable manner, regardless of the

coordinate and projection system used for their keeping; the viewing tools being provided for presentation and navigation through the spatial data and spatial data search per given attributes.

Table 6: NSDI instituting status in Western Balkan countries

State	Institution	Geoportal (national)	Est.in…	NSDI law
Serbia	Republic Geodetic Authority	"Geo-SRBIJA"	2009	in the process of adoption
Croatia	Croatian State Geodetic Administration	"NIPP GEOPORTAL"	2009	adopted in 2013[2]
Montenegro	Montenegro Real-estate	"Geoportal of Montenegro Real-estate"	2010	-
Macedonia	Agency for Real Estate Cadastre	"AKN GIS PORTAL"	2011	adopted in 2014
Bosnia-Herzegovina – Federation of Bosnia and Herzegovina	Federal Administration for Geodetic and Real Property Affairs	"Geoportal of Federal Administration for Geodetic and Real Property Affairs"	2013	-
Bosnia-Herzegovina – Republic of Srpska	Republic Administration for Geodetic and Property Affairs	"Geoportal of Republic administration for geodetic and property affairs"	2013	-
Bosnia-Herzegovina – Brčko District	Public register of Brčko District	-	-	-
Albania	Immovable Property Registration Office	-	-	adopted in 2012[3]
Kosovo	Kosovo Cadastral Agency	-	-	-

As to establish prerequisites for the complete implementation of the INSPIRE Directive provisions, it is necessary to adopt the NSDI Law, together with strategies, plans and mid-term programs of work related to the spatial data infrastructure instigation in the Republic of Serbia. In that manner, sharing of the high quality spatial data sets and services and the cooperation between public and private sector stakeholders and general public are to be facilitated. In the Republic of Serbia, NSDI Law is under the promulgation procedure. As for the other countries participants in the INSPIRATION Project, only Croatia and Macedonia have adopted such laws.

6 CONCLUSIONS

Majority of the spatial data in the Republic of Serbia was produced in the years 2011 and 2012. Data have been produced mostly in digital format, with wide range of scales. Nearly a half of spatial data is not updated, with only 5% of data having continuous updating provided. Organisations producing and using spatial data have the capacities to establish services and the need for daily spatial data sharing. Spatial data distribution is executed in various manners and the research shows that there is nearly equal percentage of distribution over the internet, e-mail and postal service. The percentage of data intake in

[2] *Source: URL5.*
[3] *Source: URL6.*

the NSDI is complex, requiring significant material and human resources. Inexistence of metadata for more than ¾ of data represents an obstacle for data integration in the NSDI. The second major issue is unclear division of competences and lack of factual cooperation. These issues will be mostly resolved by adoption of the NSDI Law and of development strategy, to specify the activities on NSDI Instigation in the Republic of Serbia.

The INSPIRE Directive 2007/2/EC on Infrastructure instigation for SPatial InfoRmation in the European Community has been partially transposed in the Republic of Serbia. Recommendations given for further NSDI development in the Republic of Serbia should assist and provide the added value for the community and development of information society. From the further implementation standpoint, recommendations were structured in three areas: legislative, institutional and technical area.

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