

# The Role of National Mapping and Cadastre Agencies in Establishment of NSDI: Croatian Example

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**Key words:** spatial data infrastructure, NSDI, NMCA, Inspire

## SUMMARY

Nevertheless if the National Mapping and Cadastre Agencies (NMCA's) are only data providers or act as coordination bodies, their role in establishment of National Spatial Data Infrastructures (NSDI's) is significant. The level of involvement slightly differs from country to the country, but almost all European NMCA's are already aware of their role in NSDI establishment. At European level NMCA's are members of EuroGeographics, European organisation which purpose is improvement of the European Spatial Data Infrastructure (ESDI) development, including topographic information, cadastre and land information. This paper describes the role and activities of Croatian NMCA in establishment of NSDI. State Geodetic Administration (Croatian NMCA) took the first activities in the country producing several studies analysing situation concerning spatial data, providers, legal framework, and comparison with situation in other European countries. It led to the organising of spatial data community, firstly by adoption of the first regulation concerning NSDI. The Law on State Survey and Real Estate Cadastre which come into force in February 2007, actually the chapter about NSDI, defined the institutional framework which is already in place. The SGA acts as coordination body for NSDI establishment, giving technical support to NSDI bodies. One of the obligations is also establishment of metadata catalogue through national geoportal. The significant activities have been done in the field of awareness rising. The most important studies describing the way of NSDI establishment and current national as well as European situation have been translated into Croatian language and distributed on more than 1000 NSDI subjects. Several workshops were organised in order to transfer best practices from the countries that have made big steps in this field. Croatian way of NSDI establishment follows European Inspire directive, so in order to raise awareness and promote Inspire directive and benefits of NSDI, the first national NSDI and Inspire day was organised, where the recent activities on ESDI as well as Croatian NSDI were presented. NSDI leaflet with main information concerning NSDI and Inspire has been prepared. The main goals for the next time are fully transposition of Inspire directive, producing of model of agreement between NSDI subjects and also third users, adopting standards and specification in line with INSPIRE, but also capacity building and establishment of NSDI business model.

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## 1. INTRODUCTION

The Republic of Croatia is one of the successor States of the former Yugoslavia what means that upon winning its independence, Croatia did not have the developed State institutions that were ready to take over all the functions that a State fulfils. On the other hand a strong economic development, especially in the building sector, real property transactions, financial sector, tourism and transport started what increased need for accurate, reliable and up-to-date spatial data. Croatia lacked the required spatial information, and very often quality of data was not sufficient. The afore-mentioned especially concerned the land administration sector or more particular, official cartography, cadastral and land registers. The State Geodetic Administration (hereon: SGA), in charge of the official cartography and cadastre, and the Ministry of Justice in charge of the land registers have given huge effort to implement the necessary reforms in order to avoid such obstacles for the economic growth. Real Property Registration and Cadastre Project was launched in 2003 and co-financed by a World Bank loan, European Union assistance funds and State Budget totalling EUR 47 million. Its main goal was to accelerate land administration processes and to help operation of cadastral offices and municipal courts.

The changes did not happen in the land administration sector alone. All the laws lately adopted for which the spatial information was of relevance, contain the provisions about the obligation of establishing a GIS database whose platform are official spatial backgrounds. It was a prerequisite and stimulus to establish national databases and at the same time a huge need for SGA's data. Trough the above-mentioned Word Bank project it was foreseen to establish so called "multipurpose spatial information system", actually initialisation of National Spatial Data Infrastructure (NSDI). Croatia is on its way to join the European Union (EU) as well as European information society what means that policies, technical standards and operational facilities should be harmonized with European standards and Inspire. The first step towards establishment NSDI was achieved even in 2001, when the first study analysing situation concerning geoinformation in Croatia was produced "Review of EU Requirements for Geoinformation Infrastructure in Croatia" (Arponen 2001). Using the European Union grant under the CARDS 2002 Program as part of the Real Property Registration and Cadastre Project, in 2005 the Study on the National Spatial Data Infrastructure in Croatia was produced by a group of foreign and Croatian experts gathered by the German company Conterra. Based on the analysis of spatial information status given in the study, concrete steps were proposed regarding the NSDI establishment in Croatia (Remke et al. 2005). Using a grant by the Foreign Office of the Great Britain and Commonwealth in cooperation with Geolink Consulting Ltd. Conterra's study was evaluated as well as the development of the European spatial data infrastructure and Inspire which resulted in the third study entitled: "*Croatia: National Spatial Data Infrastructure and INSPIRE*" (Geolink Consulting Ltd, 2006).

## 2. NMCAS UNITED IN EUROGEOGRAPHICS

Nevertheless how the SDI institutional framework is organized and which body is on the highest level, the common fact in all countries is that the role of national mapping and cadastral agencies (NMCAs) is significant, not only as producer of data but also as one of the important leader in SDI establishment. Their role is to collect, manage and distribute spatial information and knowledge how to use it to the whole society. NMCAs are mover of geoinformation society development and their early involvement is very important. Apart production of spatial information and services, raising awareness, sharing of best practices and communication with decision makers, NMCAs also give effort to influence in political system on direction and intensity of SDI development.

European NMCAs are united in EuroGeographics, a not-for-profit organisation formed in 2001 as the membership association and their representative body. It brings together 52 members from 43 countries across Europe (January 2010). Its mission is to further the development of the European Spatial Data Infrastructure through collaboration in the area of geographical information, including topographic information, cadastre and land information. Activities of EuroGeographics are:

- Engagement with European decision-makers in order to enables positive contribution to important initiatives, policies and projects.
- The exchange of best practice between members to understand and implement policies, procedures and technologies;
- Harmonising national spatial datasets into a portfolio of integrated pan-European products and related services;
- An ongoing programme of spatial data infrastructure projects, undertaken with academic and commercial partners, enables members to contribute to the creation of standard data specifications and policies [url:1].

Trough several projects EuroGeographics work with members, academia and commercial companies to develop specifications, products and services to fulfil its vision – one Europe united trough geographical information. There are four main pan-European products/datasets built upon national datasets provided by NMCAs:

- EuroDEM – a digital representation of the ground surface topography of Europe,
- EuroBoundaryMap – 1:100 000 scale administrative and statistical unit dataset covering 39 countries,
- EuroRegionalMap – 1:250 000 scale topography dataset covering 31 countries,
- EuroGlobalMap – 1:1 million scale topography dataset covering 32 countries.

Its most recent project is ESDIN - **E**uropean **S**patial **D**ata **I**nfrastructure with a Best Practice Network — a project supported by eContent+ programme. It is working to implement INSPIRE Annex I data specifications in NMCAs at large and small scales and to provide working INSPIRE services from the participating partners [url:1].

The main goal of the association is to meet the needs of a spatially enabled European society where government, business and citizens rely on geographical information provided by association, respectively its member – NMCAs. Eurogeographics delivers also expertise into

INSPIRE and provides the products to satisfy needs of the Commission and others. The newest field of activities is building alliances through Memorandum of Understandings with others to improve collective strength.

Finally, it could be concluded that the goals of NMCAs in SDI establishment are to provide as good as possible spatial information and services in frame of e-Government national program and satisfy national as well as European needs and Eurogeographics is the good platform for find the best methods to fulfil those goals.

### **3. STATE GEODETIC ADMINISTRATION - CROATIAN NMCA**

#### **3.1 Organisational Structure**

SGA is a state administrative organisation dealing with administrative and professional tasks in filed of geodesy, geoinformatics, relatively more precise state survey, cartography, real estate cadastre, spatial units register, spatial data infrastructure and also takes care about geodetic profession. The Ministry of Environmental Protection, Physical Planning and Construction represents the SGA in the Government of the Republic of Croatia. A part of historical legacy is system of cadastral offices which was not homogenous till the year 2000, respectively a part of local government. After SGA's reorganisation cadastral offices became part of SGA structure building a common organisation with 112 cadastral offices. SGA is today organised in Central Office and Regional Offices for cadastral systems.

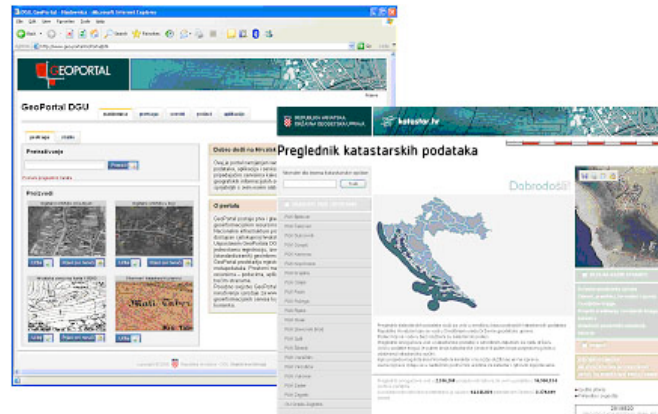
It represents Croatia in EuroGeographics as an active member. It has participated actively in Management Board activities. SGA's experts have been also participating in EuroGeographics Quality Knowledge Exchange Network Expert Group and Business Interoperability Group. SGA took part in EuroBoundaryMap, EuroGlobalMap, EuroRegionalMap and EuroDem projects.

#### **3.2 The Latest SGA's Achievements**

As a governmental body answerable for data collecting, processing and simulation in Republic of Croatia, SGA represent its datasets, products and services to the public, its customer. Political and historical factors in the field of Croatian territory resulted with numerous unlucky consequences related to property and legal rights as well as questions of spatial registers. Need for accurate and easily accessible spatial information was additionally empowered by intensive building and change of surroundings as well as getting closer to European Union. Intensifying of economy in all aspects and directions, investigation and also strengthening of private business pushed upon solving of questions of reliable and easily available spatial information as prerequisite of normal business activity.

Following the market needs SGA has produced several web services. Alphanumeric cadastral data are the first group of the SGA's data completely transformed into digital format and offered for public use via Internet on [www.katastar.hr](http://www.katastar.hr). Alphanumeric cadastral data are originally maintained by cadastral offices and their data can be accessed through the cadastral

map browser used for searching databases produced in the SGA central office. One of the basic principles of the browser is its „completeness“, thus it enables the possibility of accessing official data for all cadastral municipalities which exist in the country on a certain day. The data can be accessed by entering a certain parcel number in the selected cadastral municipality or by entering the proprietorship certificate number (Figure 1).



**Figure 1. geoportal and e-cadastre Home page**

Trough the Program of State Survey and Real Estate Cadastre for the period 2001-2005 several databases in SGA had been developed. The next step was development and establishment of SGA Geoportal which became operational in May 2009. SGA Geoportal is designed as geospatial portal according to Reference architecture of geospatial portals defined by Open GIS consortium (OGC), built on Service Oriented Architecture (SOA) principles and in-line with ISO/OGC standards and INSPIRE directive. The Geoportal offers a metadata-driven catalogue-service for publish-and-find functionality. The catalogue contains metadata descriptions of all resources and allows users and other applications/portals to query and find these resources. The metadata records are also accessible for engine-to-engine access in a standardized ISO-based structure. In the first phase five data sets have be put on the Geoportal: orthophoto, cadastral maps in raster format, Croatian base map at the scale 1:5000 and already existing geodetic points and register of spatial units systems are linked. At the same time Geoportal has web sale functionality (Figure 1).

At the end of May 2007, the Ministry of Justice and SGA contracted the creation of the Real Property Registration and Cadastre Joint Information System (JIS), which is essential for a significant number of other systems. The results of the projects will be alphanumeric and graphic databases and service, and the system should be in function in 2010. JIS represents one of the key NSDI systems because it unites the cadastral data that are under SGA responsibility and information regarding the legal relations on those real properties that are under responsibility of Ministry of Justice.

During 2008, the State Geodetic Administration was building the **CRO**atian **PO**sitioning **S**ystem: **CROPOS** (Bačić et al, 2009). The system is being built with the most advanced GNSS technological solutions and reflects the current technological state of affairs which

makes it, therefore, one of the most advanced systems of this kind. **CROPOS** was launched on December 9, 2008, and has already been widely used by the professional geodetic circles and beyond. The system encompasses 30 permanent GNSS stations and 2 control GNSS stations covering the entire Croatian territory with a network offering three services and guaranteeing high accuracy and surveying reliability. Main information about CROPOS could be found on [www.cropos.hr](http://www.cropos.hr) (Figure 2).



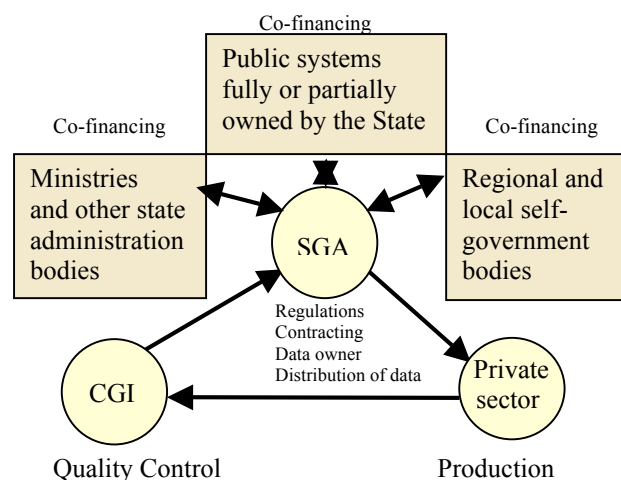
**Figure 2. CROPOS Home page**

### **3.3 SGA's Role in SDI Preparation Phase**

SGA was also one of the main initiators for SDI establishment in Croatia and took the first actions on fulfilment of prerequisite for SDI establishing. In 1996 SGA started a project, which led to establishing of topographic information system. Through CROTIS project (CROatian Topographic Information System) standardization of topographic spatial data is comprised, that gives main and detailed solutions of topographic spatial system in domain of data model, their collecting, processing, accuracy, way of presentation, topologic relations and their interchange. The basic purpose of CROTIS is its application in all spheres of spatial data management (Bačić et al, 2008).

In 2001 Croatian Government adopted the Programme for State Survey and Real Estate Cadastre for the period 2001-2005. At that time the term SDI was not so well-known but the similar principles and ideas can be seen in the mentioned document. According to the Programme SGA was obliged to establish so called Multipurpose Spatial Information System (MSIS), fostering national needs for efficient and rationale use of spatial data produced by governmental bodies and private sector. Establishment of MSIS anticipates development of national databases for the products under responsibility of the SGA and their connection into a unique information system that will allow the users to use the data effectively and expand them by their attribute data. The holder of the Program implementation was the SGA, responsible also for implementation of the Programme. It was defined that for each subprogram a co-ordination commission, consisting of representatives from different state bodies, should be appointed. The co-ordination committee co-ordinates interdepartmental activities, directs the implementation of subprograms and investments of funds. The

participant at the implementation of the Program are, apart from the holders SGA, ministries and state authorities included into the co-ordination committees, were also counties, units of local self-government at the territory of which the jobs from the Program are carried out as well as public enterprises. The participants at the implementation of the Program were also international institutions and competent agencies from other countries that deliver professional, technical and financial support to it on the basis of loan and technical collaboration agreements. The funds for the implementation of this Program were provided from several sources, like state budget, county and units of local self-government budgets, then from public enterprises, loan granted by the World Bank, donations and commercial loans. At the same time Croatian Geodetic Institute (CGI) was founded. One of the main tasks of CGI has been quality control of SGA data. The whole production has been outsourced, performed by private sector. The described process was a prototype of SDI (Figure 3).



**Figure 3. Co-operation model as a SDI forerunner (Bačić et al, 2008)**

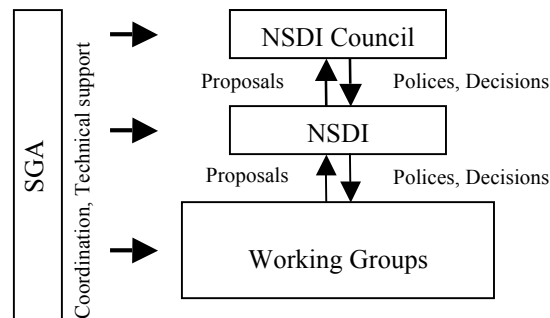
Another field where SGA was very active was education and awareness raising. In May 2008, the SGA issued a publication on the National Spatial Data Infrastructure in the Republic of Croatia that was printed in Croatian with the circulation of 1,000 copies (State Geodetic Administration, 2008). The production was aided by the European Union under the Real Property Registration and Cadastre Project. The main idea was to familiarize the professional audiences directly involved in the NSDI development, at the national, regional, local or commercial level, about the NSDI principles and current status in Croatia and European Union as well as to inform the wider audience, i.e. the users. Therefore, SDI workshops were launched to transfer best practices. Three workshops with the Swedish, Canadian and German colleagues were held in 2007 and 2008, where a crosscut through the whole GI market was made and more than 100 participants were invited.

## 4. ACTIVITIES ON SDI DEVELOPMENT

### 4.1 Organisational aspect

#### 4.1.1 Institutional framework

The Law on State Survey and Real Estate Cadastre defines SDI institutional framework for SDI establishment. Three-level organisation has been foreseen. The supreme SDI governing body is the SDI Council appointed by the Croatian Government. It is the body at the highest, political level. The Council is appointed by the Government and comprised beside president of 15 members coming from different ministries responsible for environment protection and spatial planning, defence, 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 (NMCA), statistics, then 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 (Figure 4). The SGA acts as the Secretariat of the SDI Council, coordinates all SDI bodies and provides technical support (Republic of Croatia, 2007). It has changed its organizational schema and introduced NSDI Sector as one of six sectors in SGA. Due some obstacles (ban on employment) NSDI sector is not in function at the moment (January 2010), only formal organisational structure has been set up.



**Figure 4. Institutional framework**

#### 4.1.2 Working groups

Until now five working groups have been established:

- Working Group on Technical Standards
- Working Group on Data Sharing
- WG E-Government
- WG Capacity Building
- WG Business Models.



Working group on technical standards and Working group on data sharing have been working for more than a year and have already achieved some results, while another three working groups are relatively new (from July 2009).

The mission of the WG Technical Standards is to coordinate and conduct the development and maintenance of technical implementation specifications that enable the interoperable operation of geo-services meeting the needs of Croatia's NSDI Subjects. Objectives of the WG for technical standards are to test, verify and mature as necessary the technical specification provided by Inspire connected to metadata and network services and also give feedback to Inspire Drafting Teams, to provide proposals for adoption in national regulations.

The mission of the WG Spatial Data Sharing Policies is to coordinate and conduct the development and maintenance of an interoperable and customizable license model which is in line with the Croatian Legislation and which allows NSDI Subjects to unambiguously define and publish access conditions for their data and service offers. It should provide a template agreement on spatial data exchange, usage and access among all NSDI subjects and in next step provide a harmonized template of rules and conditions for data and services access and re-use by third parties. All specifications shall be in line with INSPIRE Implementing Rules and Guidance documents.

The goal of Working group E-Government is to harmonise activities of e-Croatia and NSDI by supporting the identification and fulfilment of mutual needs. It should work on integration of NSDI in e-Government processes in order to connect the public sector to the spatial information.

Working group capacity building is dealing with problems resulted from lack of GI/NSDI professionals needed to expedite the NSDI establishment process as well as readiness of user communities to utilise NSDI concepts and to adopt those concepts into their workflows. The objectives of the working group is to identify gaps, produce best practice guidelines and work on NSDI-specific curricula for Geoinformatics courses on different educational levels.

Working group business model should develop business models for establishing sustainable partnerships and business networks and particularly for operating common services like catalogues etc. Due to the complex range of tasks that make up the market-oriented provision of public spatial data, networking with technology partners, content partners and business partners is necessary (Wytzisk, 2008).

#### 4.1.3 Education and Awareness Raising - First Croatian NSDI and INSPIRE day

It was before mentioned that the SGA acts as the Secretariat of the SDI Council, coordinates all SDI bodies and provides technical support. Being aware how education and informing of the NSDI subjects is important for the successful NSDI establishment SGA organised the First Croatian Inspire and NSDI day on November 26th, 2009. The conference was organised in cooperation with the Croatian Cartographic Society in frame of the Fifth Conference of the Croatian Cartographic Society. About 200 experts from various administrative structures

(State, regional, local), commercial sector (public, geodetic, geo-information, IT) and education (high and higher education) as well as from abroad, who are interlinked in performing their activities involving the spatial data and, therefore, the NSDI concept were informed about the latest Inspire development as well as Croatian achievement in NSDI field. A Joint Research Centre representative was invited to participate in these activities. The wider context of this event can be seen in the fact that, following in the footsteps of other European countries, Croatia has invested efforts to establish the NSDI compatible with the EU INSPIRE Directive with the objective of developing an efficient, geo-enabled society. In the past years, the activities of developing an establishing the NSDI have been supported by the European Union through the projects financed out of the CARDS 2002 and CARDS 2004 assistance funds as well as other countries with which we have developed bilateral technical assistance. In this context, three presentations of national SDI's were held before and on the First Croatian Inspire and NSDI day the fourth one was held as part of the CRONO GIP (CROatian-NORwegian GeoInformation Project) cooperation by presenting the Norwegian model of SDI establishment. The main topics of the conference were INSPIRE & European experiences, Croatian NSDI – concept, purpose, goal and status, perspectives in the State administration as well as perspectives in the local government units and economic sector. For this occasions a leaflet with main information about INSPIRE and NSDI in Croatia was prepared and distributed to the participants.

## 4.2 Legal aspect

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 (Republic of Croatia, 2007). At the time the Law was preparing, the proposal of Inspire directive was published, so all articles defining NSDI are fully in line with Inspire. The Law gives definition of NSDI and metadata, content of metadata information, services, NSDI 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. NSDI subjects are responsible for the regular maintenance of the data regarding their spatial data sets and services and are obliged to make available the spatial data information under their jurisdiction or authority for the national geoportal. The content represents only a part of the topic comprised by the Inspire directive because it was assessed that the entire directive would not be feasible in Croatia at this moment, or rather it would set up very high criteria that might be rejected by the stakeholders. The SDI part of the Law is harmonized with Inspire, the main Inspire idea is accepted, but only basic Inspire principles are defined.

Croatia as a candidate country for European Union was not obliged to implement Inspire directive till 2009 as member states, but the directive is subject of accession treaty. Development of NSDI in Croatia follows Inspire directive. In 2009 for the first time Inspire directive was included in the National Program for Accession European Union and transposition of Inspire directive was monitored. Unfortunately, since 2007 no further steps in transposition of Inspire directive into national regulation has been done, but some preparation activities were accomplished.

Working group for Metadata has analyzed Metadata Regulation coming from Inspire and has proposed for adoption in Croatian legislation metadata and metadata services specification based on Inspire regulation. Working group of data sharing has produced final draft of agreement for data exchange, sharing and use between NSDI subjects.

### **4.3 Technical aspect**

One of the main tools for NSDI is national geoportal. According to the above mentioned Law SGA is responsible for the establishment and maintenance of the metadata public service on the Internet (using a geo-portal), in a way that enables NSDI subjects to interactively maintain NSDI data. NSDI subjects are responsible for the regular maintenance of the data regarding their spatial data sets and services. On the request of the SGA, they are obliged to make available the spatial data information under their jurisdiction or authority (Republic of Croatia 2007).

SGA's geoportal is described in chapter 4.1. According to the Inspire directive all member states are obliged to assure access to the NSDI data through a Geoportal operated by the Commission. Croatia as a candidate country for EU and future member state shall enable the access to Croatian NSDI through a Community portal operated by the Commission, as well as through Croatian access points. It is assumed that SGA's geoportal is forerunner of national geoportal and will soon form the basis for the NSDI Portal and thus be at least one of the national access points for INSPIRE. Therefore SGA has already undertaken activities on analysing current geoportal in order to achieve full compliance SGA's Geoportal with relevant INSPIRE Implementing Rules and related Technical Guidance Documents (Wytzisk, 2009). At the time the project of establishing SGA Geoportal started Inspire directive was not adopted (only Proposal was available), therefore it was necessary to analyse its concept and assure compliance with Inspire and its Implementing Rules. On the other hand, Geoportal principles have to be compliant with national regulations, firstly Law on State Survey and Real Estate Cadastre. One of the huge tasks will be production of metadata, especially in line with Inspire regulations for NSDI data that are not under SGA's responsibility as well as networking other key NSDI subjects.

## **5. CONCLUSION**

SGA as national mapping and cadastral agency through the new Law on State Survey and Real Estate Cadastre which come into force in 2007 become coordination body for NSDI establishment in Croatia. The first activities on SDI establishment were undertaken even before, through the Program of State Survey and Real Estate Cadastre. Huge stimulant for those activities came through SGA's early membership in Eurogeographics, a platform for sharing experiences, new ideas as well as united voice of European NMCAs. The role of NMCAs in establishment of their SDIs is significant, nevertheless if they act as coordination bodies, are data suppliers or provide experts in different fields of SDI and INSPIRE implementation. SGA gave huge effort in SDI establishment running especially in education, information and awareness raising. One of the tasks for the next time will be full

implementation of Inspire directive and transposition into national regulation as well as establishment of national geoportal. Since development of NSDI strongly depends of available funding, it is very important to strengthen political support.

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[url:1 - www.eurogeographics.org](http://www.eurogeographics.org)

## **BIOGRAPHICAL NOTES**

### **Ljerka Rašić, M.Sc., graduate geodetic engineer**

Graduated in 1993 from the Faculty of Geodesy, University of Zagreb. Immediately upon the graduation, she went to Frankfurt/M, Germany, where she worked until 1996 in the Institute for Applied Geodesy, now: Bundesamt für Kartographie und Geodäsie, processing the GPS surveying. In 1997, she became employed at the State Geodetic Administration in the Department for Basic Geodetic Works where she has been involved with the satellite geodesy. She obtained her M.A. degree in 2002 from the Faculty of Geodesy of the University of Zagreb, specialization: satellite geodesy. At present, she works at the Photogrammetry and Remote Sensing Department and has been participating in the recent years in the activities related to the NSDI establishment in Croatia. Since 2008 is member of Croatian National SDI Board. She has co-authored over 20 papers.

### **Prof. Željko Bačić, Ph.D., graduate geodetic engineer**

Graduated in 1986 from the Faculty of Geodesy, University of Zagreb, and obtained his Ph.D. at the Institute for Applied Geodesy and Photogrammetry at the Technical University in Graz in 1997. He started his professional career as a teaching assistant at the Faculty of Geodesy in Zagreb. In 2002, he was elected Professor at the Satellite Positioning and Navigation Chair of the same Faculty. In 1999, he was appointed Deputy Director and in 2000 Director-General of the State Geodetic Administration of the Republic of Croatia. Since 2002, he is member of the EuroGeographics Management Board and served as President in 2005-2007 period. Since 2008, he is a member of the Croatian National Spatial Data Infrastructure Council and President of the NSDI Committee. He authored or co-authored more than 50 papers in various fields of geodesy and geoinformatics.

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