An approach to the development of a national SDI´s

Experiences from the IMPULS project in Western Balkan

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The IMPULS book wouldn´t been possible without your efforts.

Thank you!!

Forewords

Leading partners note

Spatial data has become an invaluable asset in policy formulation and evidence-based decision making in many sectors of society, not at least in the areas of physical planning, transport and environment. The demand for improved access to spatial data through well-developed spatial data infrastructures has likewise increased, and easily accessible spatial data of high quality is becoming a pre-requisite for sustainable development.

Increased globalisation and dependencies between countries has also resulted in clear demands for harmonisation and interoperability of national spatial data assets, also in a cross-border context. To this end, the European INSPIRE-directive provides a legal foundation for a far-reaching harmonisation of many important data themes and can also be seen as a breakthrough in the development of a common juridical approach to issues associated with the access to spatial data from different sources.

The IMPULS project was set-up to provide a step-by-step support to the 8 beneficiary organisations in developing their spatial data infrastructures according to the INSPIRE guidelines.

As national coordinators for the implementation of the INSPIRE directive in respective country, Lantmäteriet in Sweden and the State Geodetic Authority in Croatia have supported the work. Both have vast experience in cooperation with actors on local, national and international levels, and have through the IMPULS project shared this experience with the beneficiaries.

As a result of the cooperation between the participating actors, the beneficiaries of the IMPULS project have now successively developed their national spatial data infrastructures (NSDI) and implemented many of the components required. Lantmäteriet and State Geodetic Administration, with great satisfaction, have supported and together with the beneficiary organisations contributed to the development of their NSDI's.

This book summarises the work done in the IMPULS project and will hopefully be a future guide for the beneficiary institutions in further development of their NSDI's in their attempt to engage more stakeholders in the work.

Director-General's

Deputy Director-General Mr. Anders Lundquist, Lantmäteriet

Director-General Mr. Damir Šantek, PhD, State Geodetic Administration

Beneficiaries note – joint statement

One of the main challenges of the institutions responsible for cadastre and official cartography in the Western Balkans, which are also beneficiaries of the IMPULS project, is to provide accurate, up-to-date and transparent data of key registers within their jurisdiction: cadastre, land registry and spatial unit register.

The second, not less important, task is to coordinate the establishment of spatial data infrastructure in order, above all, to make the spatial data accessible, transparent and interoperable to institutions and all other producers. This is a particularly demanding task, but worth every effort since it directly contributes to a more efficient functioning of society, combating corruption, strengthening business investment, protecting the environment and protecting human rights. This ultimately leads to the fight for poverty reduction and a better life for all citizens, that is, the implementation of the UN Sustainable Development Goals as adopted in Europe through the long-term Sustainable Europe 2030 Strategy.

Sharing similar business and development circumstances, over the last twenty years, institutions, following the Scandinavian countries model, have intensified mutual cooperation with the aim of exchanging information in their areas of competence, building institutional capacity, sharing access to EU funds and donor organizations, and jointly implementing projects of regional importance, primarily to stop and prevent natural disasters, prevent forest fires, floods, etc.

This attitude has been particularly prominent in the implementation of the IMPULS project, whose core elements are collaboration, coordination, transparency and sharing to improve the quality of spatial data and ultimately benefit from the benefit of all citizens in the region.

Lastly, we take this opportunity to thank, first and foremost, the Government of the Kingdom of Sweden and Sida for the support they have given in the development of our institutions and for the benefit of our citizens. We would also like to thank the experts from the partner institutions, first of all the leading partner Lantmäteriet from Sweden and also the junior partner the State Geodetic Authority from Croatia for their unselfish help in the realization of this project.

We are confident that the results achieved will contribute to the development of a better and more secure society.

Director-General's

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Director-General Mr. Borko Drašković, Republic Geodetic Authority of the Republic of Serbia

Table of Content

1 Introduction

“An approach to the development of national a SDI – experiences from the IMPULS project” is an overview of the activities, lessons learned, and results of a project implemented in the region of Western Balkan (WB) from June 2014 till December 2019.

The main aim of the IMPULS project has been to assist beneficiary organisations in the region to develop cross-border compatible NSDI’s according to the principles of the INSPIRE Directive

The IMPULS project, implemented in the region of Western Balkan (WB) from June 2014 to December 2019, has been a SIDA-funded project (SIDA's contribution no: 55020189) with the aim of establishing core national spatial data infrastructures (NSDI's) in the Western Balkan region (figure 1).

The main aim of the IMPULS project has been to assist beneficiary organisations in the region to develop cross-border compatible National Spatial Data Infrastructures (NSDI's) according to the principles of the INSPIRE Directive.

Lantmäteriet has been the implementing partner for the IMPULS project, working together with the State Geodetic Administration of the Republic of Croatia (SGA).

The beneficiary organisations in the Western Balkan have been:

- State Agency of Cadastre (SAC), previously Immovable Property Central Registration Office of the Republic of Albania (IPRO)
- State Authority for Geospatial Information in Albania (ASIG)
- Federal Administration for Geodetic and Real Property Affairs of FB&H (FGA)
- Republic Authority for Geodetic and Property Affairs of the Republic of Srpska (GARS)
- Kosovo Cadastral Agency (KCA)
- Agency for the Real Estate Cadastre of the Republic of North Macedonia (AREC)
- Real Estate Administration of the Republic of Montenegro (REA)
- Republic Geodetic Authority of the Republic of Serbia (RGA)

The main aim of this book – "An approach to the development of a regional SDI – is to provide a comprehensive summary of the activities, lessons learned, and results of the IMPULS project for the beneficiary organisation of the IMPULS project to use for further development of their NSDI's in their attempt to engage more stakeholders in the work.

The book is structured in such a way it can be partly disseminated, translated and/or extended for specific purposes without substantially losing the context in which it is written. Target groups are Beneficiaries, stakeholders as well as other countries in the progress of developing NSDI's and it is free for anyone to use all or parts of this book for these purposes.

Chapter 2 in this book brings an overview of the concept of a NSDI and the requirements for data sharing, including a brief description of the different areas that needs to be addressed in order to develop a NSDI. Chapter 3 brings a description of the IMPULS project and how it was set up and run.

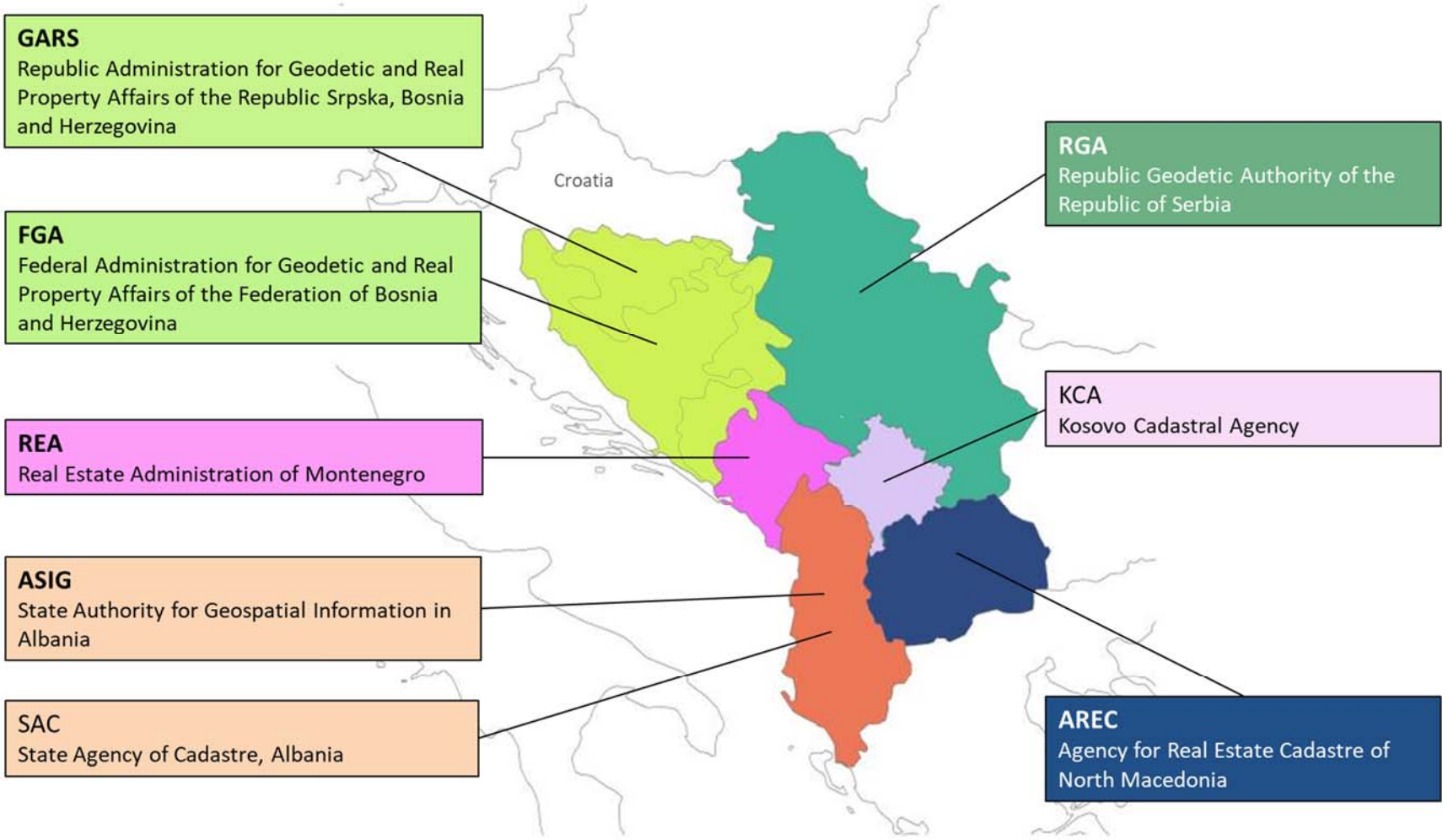

Figure 1. *Beneficiary organisations in the IMPULS project.*

Chapters 4-10 provide overviews of the activities, lessons learned, and results from different work packages and other activities within the project.

Finally, the book provides information on how the different NSDI's in the area are governed.

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

2 NSDI and the INSPIRE directive

Given the increasing pressure on land and water resources, planners and policymakers alike have an ever-increasing need for more data, from more sources, to solve every-day problems. Within this background, the development of an efficient national spatial data infrastructure (NSDI) is a mean to facilitate the access and reuse of data from different sources, to the benefit of planners and policy makers at all levels in society.

2.1 A NSDI facilitates data sharing

Human beings have always shared information with each other, from early cave drawings to modern day digital data using services on the Internet. Given the increasing pressure on land and water resources, planners and policymakers alike have an ever-increasing need for more data, from more sources, to solve every-day problems. Within this background, the development of an efficient NSDI is a mean to facilitate the access and reuse of data from different sources, to the benefit of planners and policy makers at all levels in society.

The bottom line of a NSDI is to remove barriers for data sharing between different organisations in a country or region (figure 2). Examples of barriers are;

- legal issues and frameworks that prevents data sharing between organisations,
- charging and licensing issues not allowing efficient reuse of data as receiving organisation may not have the funds necessary to access the data,
- or technical issues such as data are not complete, standards are not applied, poor documentation, etc.

The development of a NSDI aims at successively eliminate these barriers by adopting common standards and frameworks for data sharing.

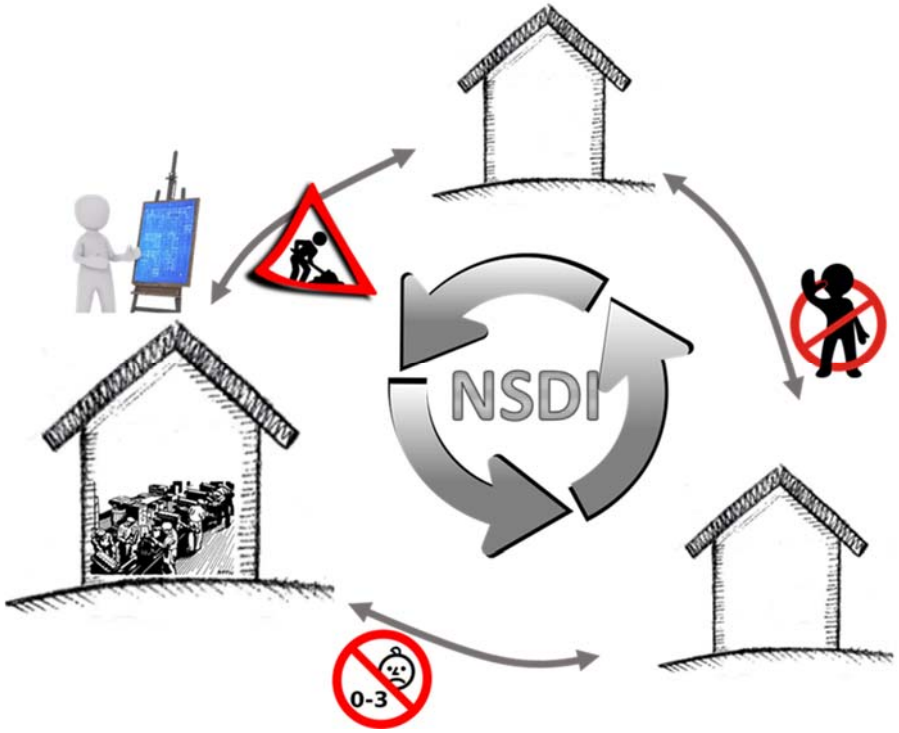

Figure 2. *The NSDI enables data sharing between different organisations by overcoming barriers for data sharing between organisations and doesn't interfere with each organisations' internal processes.*

It is important to keep in mind that the functioning of a NSDI doesn't by default need to interfere with each individual organisations' business processes although adoption to the NSDI concept and a change of business behaviour may help realise the benefits of the NSDI, through the access and reuse of data already captured by other organisations.

ach organisation regains control of their internal processes and the development of the NSDI must not necessarily affect the way an organisation operates. The objective of the NSDI is to ensure that data is provided according to agreed standards and protocols. The producing organisation will also retain the rights to the data they produce.

The development of a NSDI is underpinned by some basic principles. These are:

- Spatial data should be stored, made available and maintained at the most appropriate level.
- It should be possible to combine spatial data from different sources in a consistent way and share them between several users and applications.
- It should be possible for spatial data collected by a public authority at one level to be shared between public authorities at other levels.
- Spatial data should be made available under conditions which do not unduly restrict their extensive use.
- It should be easy to discover available spatial data, to evaluate their suitability for the purpose at hand and to know the conditions applicable to their use.

2.2 Components of a NSDI

To set up a well-functioning NSDI and remove barriers for data sharing between different organisations in a country, several different areas – components – of a NSDI needs to be appropriately addressed (figure 3). These components are:

- **Spatial data**: Spatial data is the basics of an NSDI and needs to be provided in a format and structure that can be easily ingested into any system a user may select. To that end, issues such as reference system, encodings, code lists, etc. need to be discussed and agreed upon.

Figure 3. *Different components making up a NSDI. Depending on the starting point, different focus may be put on different components to achieve the desired results.*

- **Services**: The making of data available through standardised services on the Internet is a key issue in a NSDI. Issues that need to be addressed in relation to data provision via services are, for instance, quality issues such as performance, availability and capabilities but also issues related to usability (naming, number of layers, visualisation, etc.) and accessibility (easy to find, authentication, etc.).
- **Metadata**: Data about data. Descriptions of data and services are important as it enables a user to evaluate the fitness of purpose of a particular dataset based on the content. Metadata for a data set or service can be compared with the specifications we expect to find when buying, for instance a new TV-set. We would expect to find out some basic specifications such as size, colour, prize, etc. before buying. To enable different systems to share metadata with each other, it needs to be structured in a standardised way, which is agreed upon by the stakeholders in a NSDI.
- **Geoportal**: A national Geoportal (metadata catalogue) enabling a user to search and find the metadata created for different data sets and services needs to be established. If there is no central place where to search and find metadata, there will be little use creating the metadata at all. Issues to address are, for instance whom will host and maintain the Geoportal, what software to use, ambitions levels (only for searching, also serve as a web GIS,

etc.), how shall metadata be created and maintained (centrally, by the data producers, harvesting, etc.).

- **Standards**: The application of relevant standards are required in several of the components making up a NSDI. Issues that need to be addressed are, for instance which standards to use, how to apply selected standards, development of standards, etc. An important issue to address is also how to make relevant standards available as standards generally comes at a cost.
- **Legal framework**: The development of legal frameworks (NSDI law or equivalent) helps the implementation of a NSDI by stating responsibilities and requirements on data producing authorities. It may also pinpoint a coordination authority and coordination structure. However, it must be kept in mind that to develop an efficient NSDI and make data sharing easier also other legal frameworks need to be addressed, especially those legal frameworks that for different reasons restricts data sharing.
- **Cooperation**: As the objective of the NSDI is to make data sharing easier for all involved stakeholders, both for data producers and data users, some cooperation mechanisms need to be put in place. Areas to cooperate around are, for instance the development of a common NSDI business model and data sharing agreements, licenses to apply, agreed technical frameworks, etc. A functioning coordination structure where all stakeholders take active part is also part of the cooperation.
- **Competences**: Although a NSDI builds on existing standards and knowledge, there is a need to address both short- and long-term competence gaps. On a short-term basis, the purpose and benefit of the NSDI must be known by the stakeholders to ensure they adopt the overall concept of sharing data through standardised services over the Internet, and work towards removing barriers for data sharing. On a long-term basis, competence within the different components must also be ensured and students must be made aware of how their skill will be required in the NSDI in their future professional life.

Depending on the starting point, different focus may be put on different components to achieve the desired results, just like a vehicle is assembled by parts of specific types and dimensions to make up a particular car brand.

The development of a NSDI doesn't however, ensure that anyone will use the NSDI. To that end, the NSDI must be promoted and use cases showing the benefits of the NSDI needs to be developed.

2.3 The INSPIRE directive

In most countries of today, NSDI's of different maturity levels are already developed – from data sharing based on simple bilateral agreements to sophisticated data sharing environments incorporating several stakeholders in common data sharing models. These NSDI's are based on national and international needs that influences the development (figure 4). However, documentation of available resources, agreed-upon access policies, services to access and download the data, etc. are all developed in isolation and are generally not fully cross-border compatible.

To ensure cross-border compatibility, the European Union has brought forward the INSPIRE directive (Directive 2007/2/EC). The INSPIRE Directive is a legal act that sets the frame for how the Member States' shall make their existing infrastructures compatible and usable in a community and cross-border context.

The INSPIRE directive is supported by a set of implementing rules (IR's) setting binding requirements on the following specific issues (from the INSPIRE web page):

- **Metadata (COMMISSION REGULATION (EC) No 1205/2008)**
  The IR for metadata specifies common metadata elements to be provided for all resources (spatial data sets and services) within the scope of INSPIRE to facilitate their discovery within the INSPIRE infrastructure.
- **Network services (COMMISSION REGULATION (EC) No 976/2009)**

  The IR for network services specify common interfaces for web services for discovering, viewing, downloading and transforming spatial data sets. Based on these common interfaces, generic client applications can be developed that allow users to search for INSPIRE data sets, to download them or to visualise them in interactive maps.
- **Interoperability (COMMISSION REGULATION (EU) No 1089/2010)**

  The IR for interoperability specifies common data models, code lists, map layers and additional metadata (for evaluation and use) to be used when exchanging spatial data sets. These IRs provide the semantic interoperability layer and ensure that users of data can unambiguously interpret the data they are accessing through the network services.

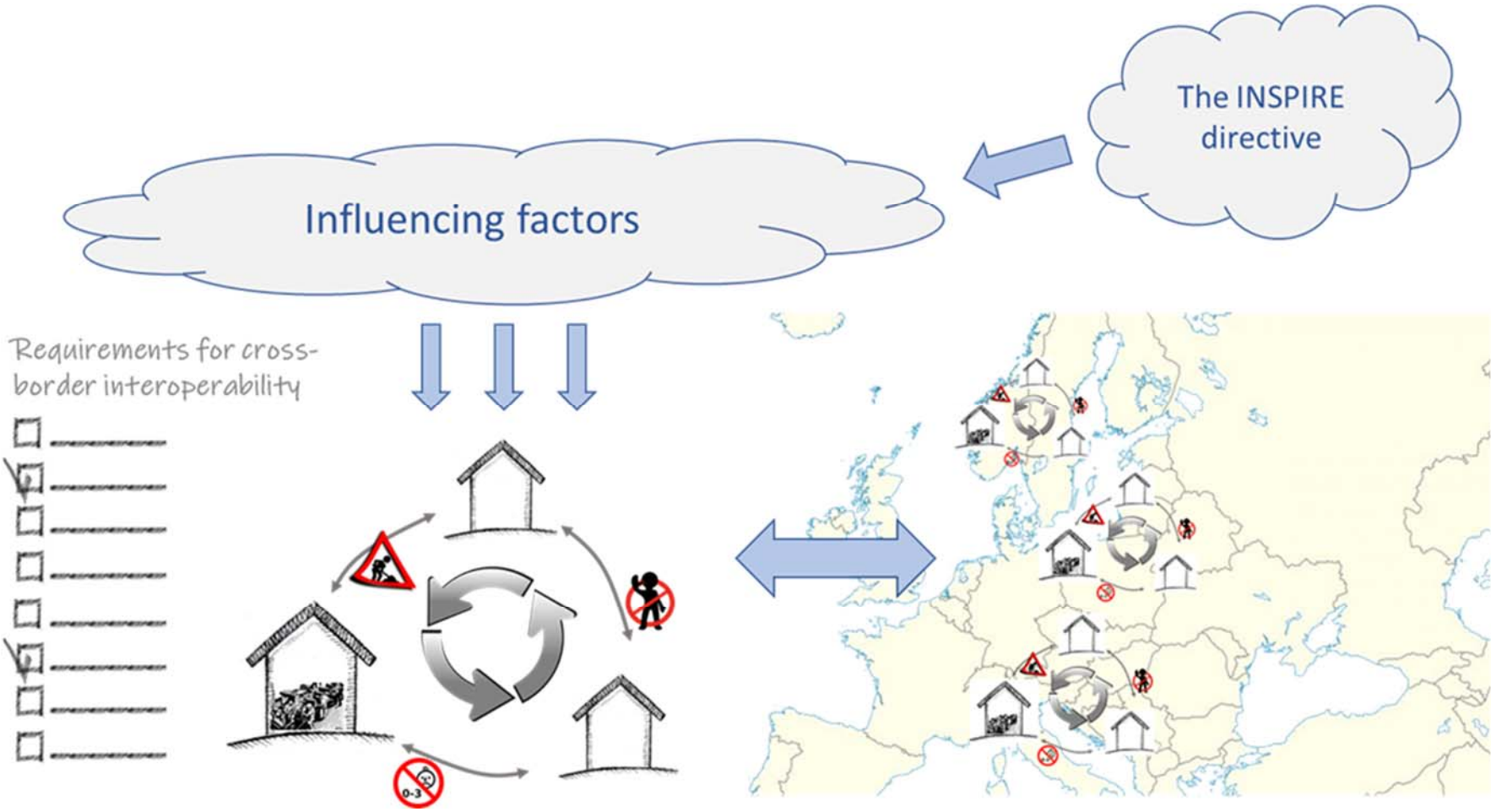

Figure 4. *Any NSDI has evolved as a result of national needs and influencing factors in a country. The Inspire directive builds on these already existing influencing factors and adds some requirements on the existing NSDI's, in order to make them cross-border as well.*

- **Data and service sharing (COMMISSION REGULATION (EU) No 268/2010)**

  The IR for data and service sharing define the conditions under which Member States shall provide the institutions and bodies of the Union with access to spatial data sets and services in accordance with harmonised conditions.

- **Monitoring and reporting (COMMISSION DECISION 2009/442/EC)**

  The IR for monitoring and reporting specify the rules on monitoring by Member States of the implementation and use of their infrastructures for spatial information and on reporting on the implementation of Directive 2007/2/EC.

The INSPIRE Directive also requires Member States to put structures and mechanisms in place for coordination, across the different levels of government, of the contributions from all those with an interest in the NSDI, including users, producers, added value service providers and coordinating bodies. Such contributions could concern the identification of relevant data sets, user needs, the provision of information on existing practices and the provision of feedback on the implementation of the Directive.

The INSPIRE Directive does not set requirements for the collection of new data, nor does it set requirements on specific quality standards.

More information about the INSPIRE directive can be found at: https://inspire.ec.europa.eu/

3 The IMPULS project

The IMPULS project has been moving from more general activities for raising awareness, making analyses and transfer high level knowledge to increase practical knowledge, capacity and supporting actual implementation of the INSPIRE Directive – all focusing on cooperation, hands on work and sustainability

3.1 Scope and implementing partners

The IMPULS project has been a SIDA-funded project (SIDA's contribution no: 55020189) with the aim of establishing core national spatial data infrastructures (NSDI's) in the Western Balkan region.

The original project activity period was from the May 30th, 2014 – December 31st, 2018 but was later prolonged to December 31st, 2019. The total project budget has been 38 million SEK.

The IMPULS project has, *de facto* been a continuation of the INSPIRATION project, which was financed through EU with Multi-beneficiary IPA 2010 funding. The aim was to promote the development of spatial data infrastructures (SDI's) and coordinating their implementation in the Western Balkans with a view to preparing beneficiaries to meet the objectives of the EU INSPIRE Directive. The INSPIRATION project was a 2-year project (2012-2013) and had a budget of 1 500 000 EUR.

Comparing the INSPIRATION and IMPULS projects, the aim of IMPULS is to continue the cooperation that was developed during the INSPIRATION project and increase it both to be wider (involving more stakeholders and more issues) and deeper (hands on workshops, joint development, sharing experiences etc.).

The IMPULS project has been moving from more general activities for raising awareness, making analyses and transfer high level knowledge to increase practical knowledge, capacity and supporting actual implementation of the INSPIRE Directive – all focusing on cooperation, hands on work and sustainability (figure 5).

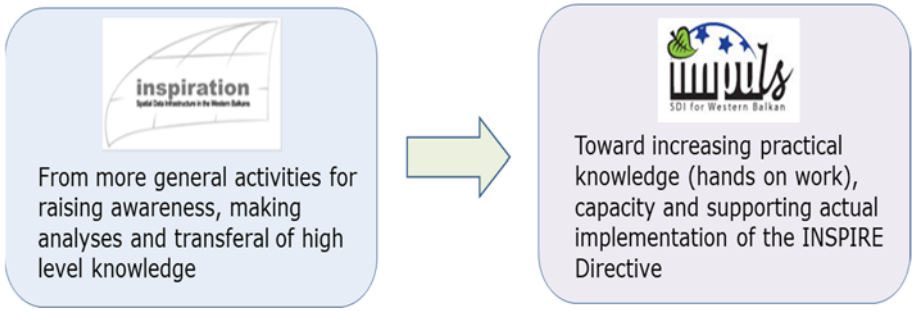

Figure 5. *The IMPULS project has been moving from more general activities to increase practical knowledge.*

Lantmäteriet has been the implementing partner for the IMPULS project, working together with the State Geodetic Administration of the Republic of Croatia (SGA).

The beneficiary organisations in the Western Balkan have been:

- State Agency of Cadastre (SAC), previously Immovable Property Central Registration Office of the Republic of Albania (IPRO)

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3.2 Work packages

The IMPULS project has been based on a result-based management approach where first the objective of the project is defined, followed by a list of main benefits expected (figure 6).

In order to realise and take best advantage of these benefits, participating organisations need to adapt to a new "code of conduct", i.e. they need to change some of their business behaviour. For instance, they should take care to describe their data and services and make these descriptions public to make it easy for other data users to understand what data and services are at offer, provide data and services in digital form to make it easy for other stakeholders to use their data, etc.

To facilitate this change, there are some measures that need to be put in place, both in the legal and policy domain, but it also requires some new technology to be deployed. The IMPULS project has focussed on realising these measures by separating them into different work packages and clearly define scope and outputs of each work package (Figure 7):

WP1 Project Management & Administration. The work package dealt with day-to-day operations of the project implementation.

WP2 Data sharing policies and regulations. The work package focused on issues related to the development of data sharing policies and regulations in support of a widespread use of existing data and services.

WP3 Data harmonisation. The work package focused on issues related to harmonisation of data according to the INSPIRE

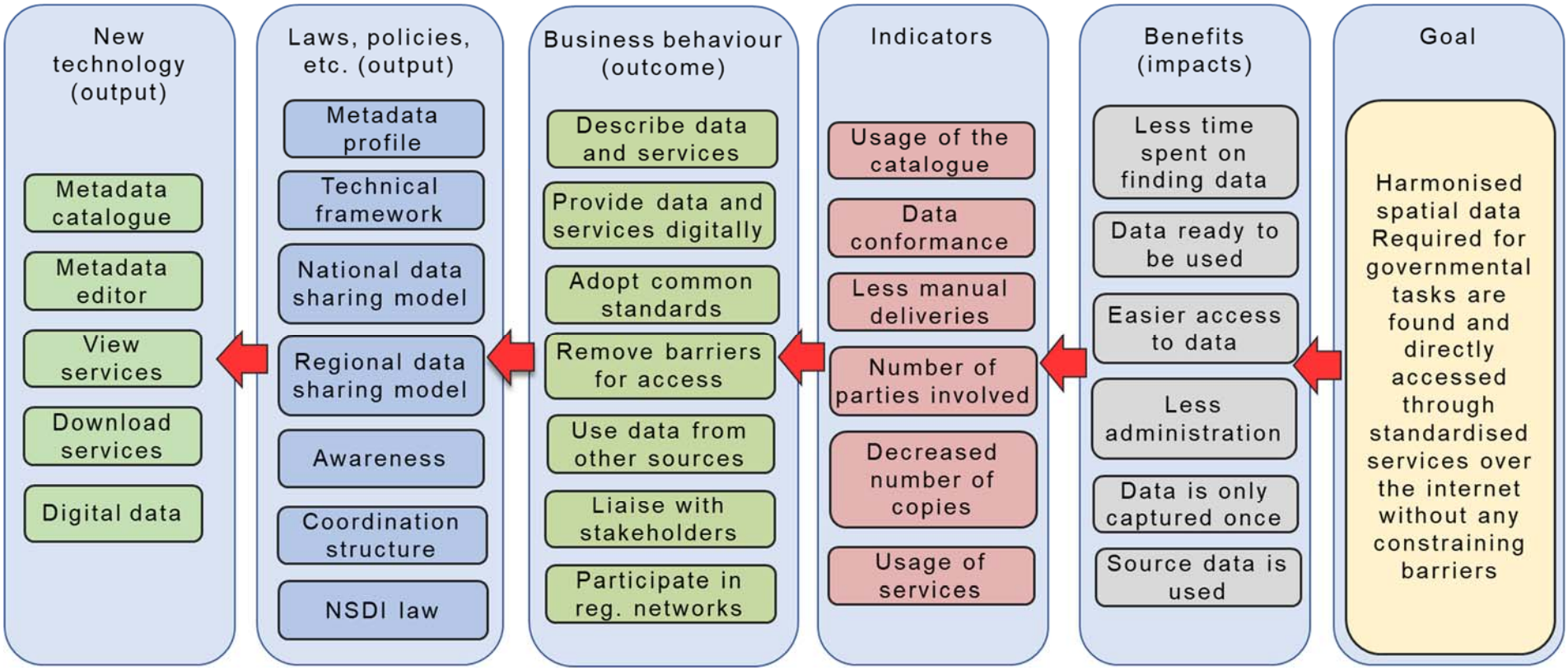


Figure 6. *An effect map showing how changes in business behaviour will contribute to the main objective of a NSDI, and the tools (outputs) required to facilitate a change of behaviour among participating organisations.*

specifications and provided training in the different steps required to transform data from an existing specification to an INSPIRE specification.

WP4 Metadata and quality evaluation. The work package focused on issues related to the development of an INSPIRE compliant metadata profile, which was to be adopted by each beneficiary organisation. The work package also addressed the need for quality assessment by identifying available resources for quality assessment.

WP5 Dissemination of data through services and portals. The work package focused on issues related to the development of INSPIRE compliant view and download services and provided training in the installation and operation of the GeoNetwork software for metadata management.

WP6 Benefits of the project as demonstrations and pilots (like Crisis management). The work package was designed as a test bed for the different outputs from the work packages 2-5. If the pilots didn't work as anticipated, the outputs from the other work packages would need to be reviewed and tested again.

After April 2017 the project components were changed in a way that WP1 is kept separate (with the same content as before) and WP2 to WP6 were merged in one work package named WP26. The structure was changed because in the last project phase the activities within individual work packages became very complex and overlapped with each other.

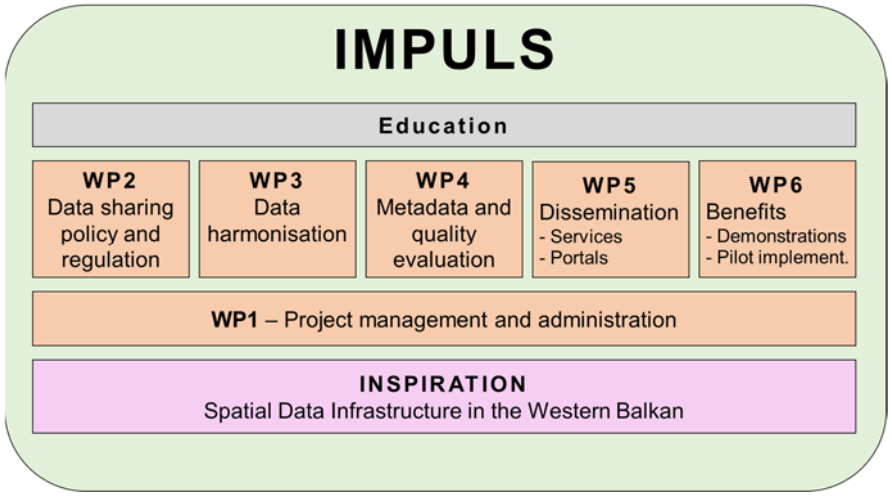


Figure 7. *The IMPULS project was divided into six different work packages, five of them addressing core issues related to the development of NSDI's.*

3.3 Implementing approach

The IMPULS project supported the beneficiary organisations through a number of different activities. These activities were:

- Seminars – Information activities, presentations, discussions for the purpose of increasing knowledge, preparing for tasks to be implemented, setting a base for next step;
- Workshops (National workshops and Regional workshops) – actual work, learning by doing, hands on work that will result with tangible results, e.g. specification, technical framework, draft law, first meta data profile etc.; and
- On-line training courses (basically LINKVIT training)

The biggest engagement of the experts from Lantmäteriet and State Geodetic Administration of the Republic was during the first two project years since these workshops and seminars were the initial places for knowledge transfer and to prepare the beneficiaries for further activities nationally (a training of trainer's approach). Gradually, the engagement of the experts was decreased, and the engagement of beneficiaries increased with the intention to work fully independently by the end of the project as shown in figure 8.

At the beginning of the project it was agreed that 90% of the work were to be done by the respective beneficiary organisations and 10% during the following joint activities. The responsibility for each beneficiary institution was to ensure availability and commitment of staff to the extent needed.

Before any activity were started, all project participants were invited to attend several online courses on different topics.

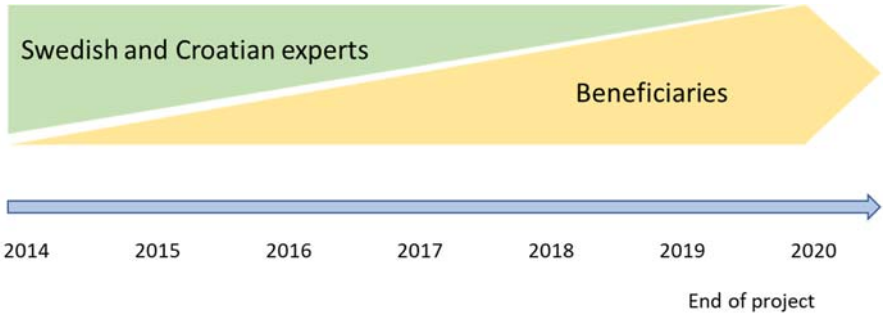


Figure 8. *The transition of responsibility from the Swedish and Croatian experts to employees from the beneficiary organisations in planning and carrying out workshops, seminars and training sessions in respective country.*

The courses were developed by the LINKVIT consortium and all courses can be found at http://www.linkvit.eu/training-modules/. Several tutorials are also available on the INSPIRE training library page, https://inspire.ec.europa.eu/portfolio/training-library. Access to these courses are free of charge, but registration may be required.

On-line training courses are available at, for instance:

http://www.linkvit.eu/training-modules/

https://inspire.ec.europa.eu/portfolio/training-library

Also, before any activity started a kick-off event during which involved staff from all beneficiaries met and get to know each other and to discuss and agree on content and action plans for each work package was organised. This was considered an important start-up activity as establishment of formal and informal networks would, in a longer perspective, ensure information exchange within the region and sustainability of project achievements. Figure 9 shows some pictures from a team-building exercise at the kick-off held in Gävle, Sweden.

3.4 Project organisation

The project was managed by a Management team consisting of a Project Manager (PM), a Project Director (PD) and a Coordinating Adviser (CA). A steering committee consisting of the Director General from each beneficiary organisation, the Director General of SGA, the Project director and the Project manager was also established. Additionally, each beneficiary organization appointed a National coordinator responsible for overall coordination of the IMPULS activities within respective organisation (figure 10).

Steering committee meetings have been held regularly twice a year, in total 11 meetings. Meetings with the Management team and the National coordinators have been held three to five times a year, in total 18 meetings.

Figure 9. *Following picture shows a team-building exercises during the IMPULS kick-off event that was held at the beginning of the project.*

The Steering Committee and the National Coordinators has also been representing the IMPULS project at the Regional conferences on Cadastre and Spatial Data Infrastructure that has been continuously organised since 2008. The IMPULS project has also been represented at other International conferences and meetings.

3.5 Trainees

Within the scope of IMPULS all beneficiaries had an option to hire trainees with the purpose to build human resource capacity. New and qualified local staff was engaged to work as trainees in assisting in development of efficient SDI according to mutually agreed Terms of References.

The trainees gain new valuable experience by participating fully in the project and worked full time for the beneficiary in order to be educated and prepared to become employees of the beneficiary in SDI field.

The limitation for trainees was the budget and there were different solutions when the beneficiary organisations engaged trainees.

Most BO´s hired 2 trainees but some had 2-5 trainees for the same cost. The period for trainees was said to be 30 months after which the beneficiaries was expected to hire their trainees and pay them by their own means. This has due to the project prolongation been changed and some trainees has been hired by the project also for the extension

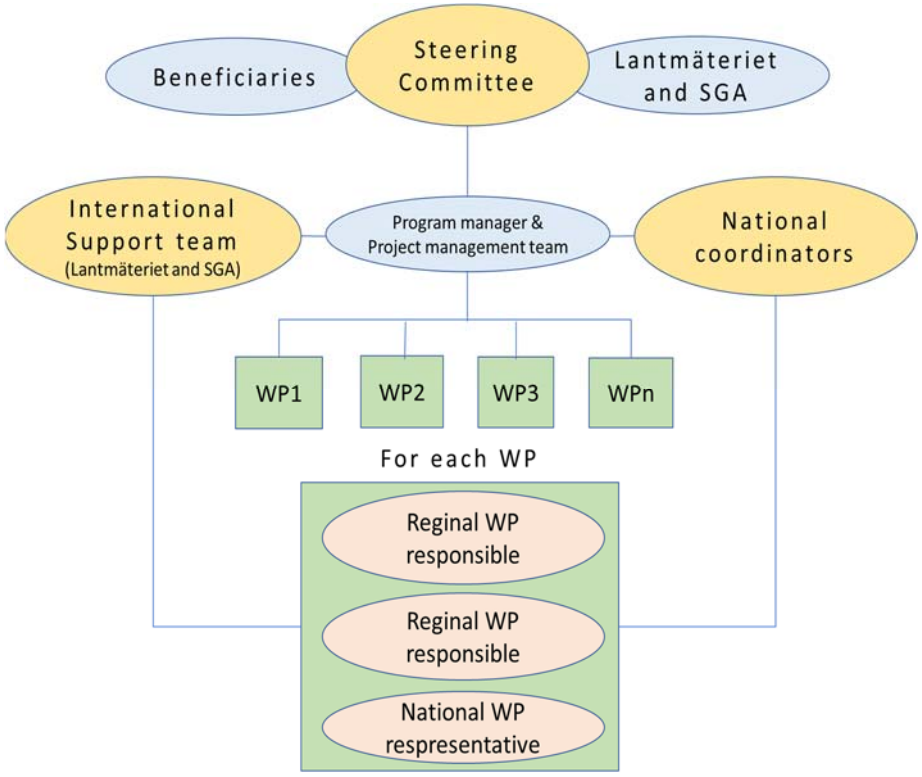


Figure 10. *The IMPULS project organisation.*

4 Data sharing policy and regulation

Legislation, rules and policies supporting an efficient use of geodata is an important part of an infrastructure. Such legislation must at the same time protect essential interests related to, for example, national security and personal integrity. The legislation should also clarify rights and responsibilities for data custodians.

Legislation, rules and policies supporting an efficient use of geodata is an important part of an infrastructure. Such legislation must at the same time protect essential interests related to, for example, national security and personal integrity. The legislation should also clarify rights and responsibilities for data custodians and other actors.

Also, issues related to licencing and use of data are important. The conditions for use of data and services should contribute to a widespread use of existing data and services. It must also be easy for the users to see and understand the conditions that apply to a specific use. These conditions must be relevant, non-discriminative and clearly described.

The work package 2 – Data sharing policy and regulation – has been addressing these issues with the aim of developing required data sharing policies and regulations in support of a widespread use of existing data and services.

4.1 Regional data sharing

One of the first task of the WP2 was development of a regional data sharing agreement to enable data sharing across the borders within the Western Balkan. “Data Sharing Agreement for the IMPULS Use Case” was signed by 7 beneficiary institutions (AREC, ASIG, FGA, GARS, REA, KCA, IPRO) on May 28, 2015 at the INSPIRE – Geospatial World Forum 2015 Conference in Lisbon and by RGA on June 16, 2015 in Pristina.

Figure 11. A session during a regional workshop within the work package “Data sharing policy and regulations” in Sarajevo, May 2016.

The Agreement describe in detail a set of data that will be exchanged in the framework of the IMPULS project, method of data exchange (technical solution) and conditions of use of this data. Spatial data to be exchanged under this Agreement are administrative units (AU), elevation (EL), geographical names (GN), and digital orthophoto (OI),

and will be distributed in accordance with the requirements of the INSPIRE Directive.

In a series of workshops, the content of the agreement was discussed and agreed. The agreement contained following articles:

- Article 1: Data to be shared
- Article 2: Obligations
- Article 3: Access and use
- Article 4: Force majeure
- Article 5: Conflict resolution
- Article 6: Final provisions
- Article 7: Annexes

The full text of the agreement can be found in appendix “IMPULS Regional agreement”

4.2 National data sharing

The work of developing a regional data sharing agreement was a first step towards developing national data sharing models by each BO.

The development of a national data sharing model requires some background information to be collected. First, all datasets that should be potentially included in the data sharing model needs to be listed.

For each potential dataset on the list, following information needs to be collected:

A. **Dataset name**: The name of the dataset
B. **Responsible authority**: The name of the authority providing the dataset
C. **Type of user**: If different answers to the questions in D-H apply to different users, the type of user should be indicated, for instance "all", "agencies", "private companies", etc.
D. **Request required**: If a user must formally request for the data in order to get access to it, it should be indicated here
E. **Income requirement**: If the responsible authority charge for the data, the total expected annual amount should be indicated here
F. **Conditions for use**: Indicate if the responsible authority states any conditions for use of the data, for instance "only for internal use", only for stated purpose", "only for non-commercial use", "no restrictions", etc.
G. **Restrictions apply**: Indicate if access to the dataset is limited (security, secrecy, integrity) due to law or regulation, for instance "to whole dataset", "to raw data", "to attribute information", etc.
H. **Name of regulation**: Name of the regulation that poses restrictions on the access to the dataset

Dataset name	Responsible authority	Type of user	Request required	Income requirement	Conditions for use	Restrictions apply	Name of regulation
The name of the dataset	The name of the authority providing the dataset	If different answers to the questions in columns D-H apply to different users, the type of user should be indicated, for instance "all", "agencies", "private companies", etc.	If a user must formally request for the data in order to get access to it, it should be indicated here	If the responsible authority charge for the data, the total expected annual amount should be indicated here	Indicate if the responsible authority states any conditions for use of the data, for instance "only for internal use", only for stated purpose", "only for non-commercial use", "no restrictions", etc.	Indicate if access to the dataset is limited (security, secrecy, integrity) due to law or regulation, for instance "to whole dataset", "to raw data", "to attribute information", etc.	Name of the regulation that poses restrictions on the access to the dataset

Figure 12. *A survey on which conditions that apply for each dataset could be presented as an Excel sheet for easy overview. Different surveys may be necessary for access to data through view vs. download services.*

A survey on which conditions that apply for each dataset could be presented as an Excel sheet (figure 12). Different surveys could be done for data access through view vs. download services as the conditions may be different. Different rows could also be created for different categories of users or usage, for instance governmental authorities, commercial use, educational sector, etc.

Based on the answers to the different questions for each dataset, a data sharing model that satisfy the different requirements on the different datasets may be developed. Some of the initial potential datasets may have to be omitted though, due to difficulties satisfying the requirements.

4.3 Data sharing model – a Swedish example

Data sharing may become problematic when some data producers need to charge for their data. In the Western Balkan countries, some of the beneficiaries have data that have cost requirements on them. With that background, requirements on a data sharing model was discussed at several workshops, using the Swedish data sharing model as an example (figure 13).

The Swedish data sharing model is based on two agreements. One agreement is signed by the data providers that need to charge for their data. The agreement states that the data providers will provide

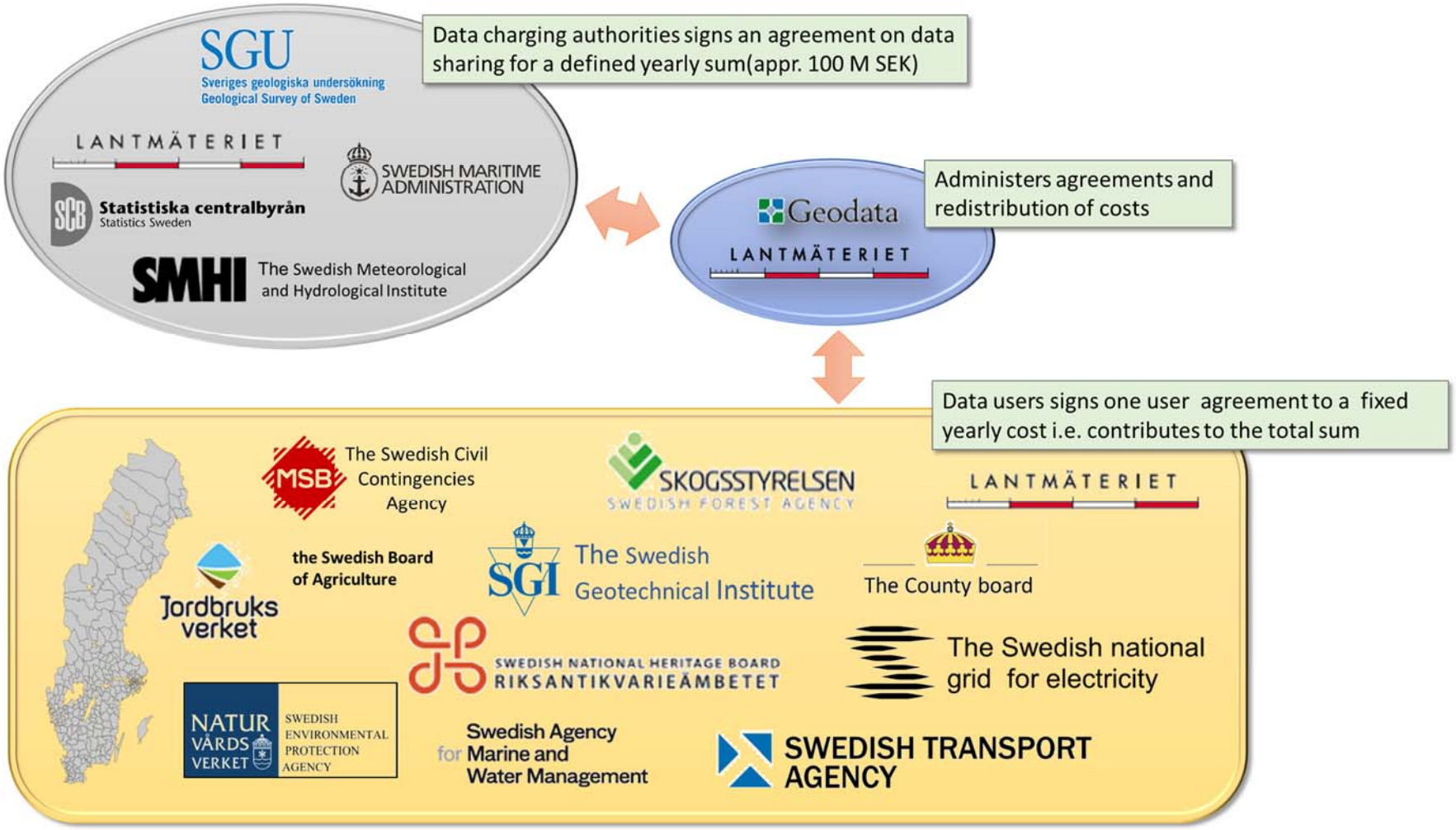


Figure 13. *The Swedish data sharing model. The model applies only to public authorities.*

their data “for free” provided they are compensated according to an agreed amount based on an estimated yearly revenue from a specified user category (i.e. municipalities and governmental authorities).

A second agreement is signed by all eligible data users (i.e. municipalities and governmental authorities) stating that they will contribute to cover this yearly loss in revenue in order to get “free” access to data from the data providers that need to charge for their data.

Figure 14 shows an example on how much each user authority must contribute with in a yearly payment to enable “free” access to data. The data sharing model is based on criteria’s shown in figure 15.

It should be kept in mind that although a business model describes:

- who can use the geodata;
- what geodata will be offered;
- how a customer will get access to geodata;
- which terms of use is applied; and
- the base for a pricing model.

it is generally complemented by a technical framework. The technical framework will describe:

- which standards that should be applied;
- formats and encodings of the data to share;
- reference system;
- code lists and registries;
- capabilities of services; and
- service level agreements.

Authorities			
Category	Rating interval	Yearly fee 2014	Yearly fee 2015
A	1 - 6	53 000 SEK	55 000 SEK
B	7 - 12	159 000 SEK	165 000 SEK
C	13 - 25	265 000 SEK	274 000 SEK
D	26 - 75	585 000 SEK	605 000 SEK
E	76 - 200	1 375 000 SEK	1 423 000 SEK
F	201	K	2 462 000 S
G	351 - 500	3 700 SEK	3 830 000 SEK
H	500	6 871 000 SEK	7 110 000 SEK

Lantmäteriet

Tax Agency

The Armed forces

Figure 14. *The figure shows how much each user authority must contribute with in a yearly payment depending on rating*.

Joint parameters for all:	
• Area of interest	(3 levels)
• Benefit	(2 levels)
Parameters only for municipalities and county councils:	
• Area	(5 levels)
• Population	(8 levels)
• Population density	(6 levels)
• Built up area (%)	(5 levels)
Parameter only for Governmental Agencies	
• Turn over	(6 levels)

Figure 15. *The criteria's used to calculate the rating on which the data sharing model is based on*.

4.4 Licensing schemas

In an NSDI, there is a need of legal interoperability as well as technical. If all agencies and municipalities have their own agreements, it is not certain that the conditions harmonise. It will become more complicated for users to access data but can also be more difficult to combine data if the conditions are not harmonised. Through uniform conditions, legal interoperability can easier be achieved.

There are many different licensing schemas although the Creative Commons (CC) is a well-known schema globally (figure 16).

The CC licenses defines how copyrighted data can be used by a user (licensee) and is based on four basic conditions. Based on these four basic conditions, six main CC licenses can be defined. These four basic conditions are:

(https://creativecommons.org/share-your-work/licensing-types-examples/)

BY (attribution): All CC licenses require that others who use your work in any way must give you credit the way you request, but not in a way that suggests you endorse them or their use. If they want to use your work without giving you credit or for endorsement purposes, they must get your permission first.

SA (share alike): You let others copy, distribute, display, perform, and modify your work, as long as they distribute any modified work on the same terms. If they want to distribute modified works under other terms, they must get your permission first.

NC (non-commercial): You let others copy, distribute, display, perform, and modify and use your work for any purpose other than commercially unless they get your permission first.

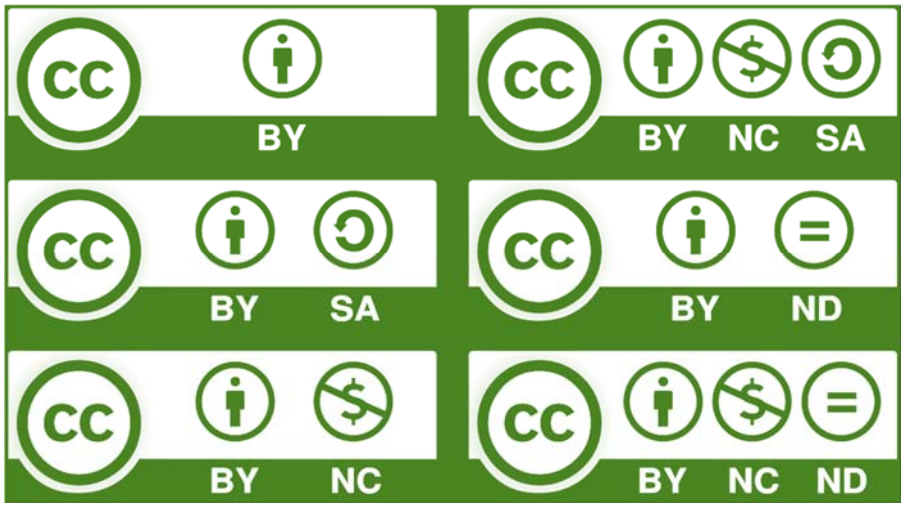


Figure 16 *The Creative Commons (CC) licensing schema.*

ND (no derivative works): You let others copy, distribute, display and perform only original copies of your work. If they want to modify your work, they must get your permission first.

European Commission encourages re-use of public sector data. They have developed guidelines to the member states. They are not positive to the development of customised licenses, which could break interoperability of public sector information across the EU. Instead they support free and open licenses such as Creative Commons schema above. This "Recommendation benefits from CC's free international licenses, saving governments time and money, and maximizing compatibility and re-use."

To consider before pricing and licensing

When discussing licensing and pricing of geodata, it is important to understand for what purpose the licensing and pricing is being implemented.

It is necessary to investigate and describe the prerequisites as described in national legislation. When creating a common licensing and pricing model for several stakeholders there is a need to describe the differences and the similarities between them. For instance:

- Will the major part of the usage of geodata be between stakeholders in the NSDI or are there also external users?
- Are there any differences in the regulations regarding data dissemination or financing between the different data providers?
- What type of data do different stakeholders provide?
- Who are the users of data from different data providers?
- Are different stakeholders financed differently?

Licensing of geodata can be implemented to fulfil two main purposes. When providing data as “open data” the often-used definition of the data is that it should comprise the following:

- Open License or Status
- Free of charge
- Accessibility
- Machine Readability
- Open Format

If there is a need to secure revenue from users of data, some other kind of licensing comprising more restrictive terms and conditions for use and re-distribution of geodata must be implemented. Those terms and conditions can be very different depending on what type of geodata are provided and what the revenue (license fees) are supposed to cover. When defining the objective of the pricing, some basic questions to answer are:

- Can data be free of charge?

If not:

- Should the fees cover only actual costs for delivery of data from the data owner to the user?
- Should the fees cover costs for long term maintenance of IT-infrastructure used for handling the data and maintenance of the data?
- Should the fees for data also create a surplus used for covering other costs in the organisation or for to refund money to the government?

The answers to these questions are fundamental when deciding the levels of fees and the terms and conditions for licensing the data to developers and end users.

It is also important to describe the type of geodata that is to be licensed. Some types of geodata are suitable for distribution under a license based on area. For such datasets it could be suitable to for example charge a specified amount per km^2 for a perpetual license or a smaller amount for an annual license.

The first option suits data that is stable over time and seldom updated, i.e. elevation data. An annual license can be used for data that is frequently updated and of which the users will need to download new versions frequently. Whether a license is annual, or perpetual is also depending on what the fees are supposed to be used for.

Other types of data, like addresses or buildings that are stored and often also used as objects can be charged per feature. Depending on updating frequency it is possible to implement either a perpetual license or an annual license also for the features.

Besides the type of data and corresponding pricing models, it is important to investigate how the data is being used, by whom and what ability of paying for geodata the user has. Can the intended type of usage bear costs for geodata only up to a certain level before other options or data providers are favourable? Is the most frequent use of geodata “long term” or temporary for a limited time, i.e. in a building project?

Some questions to discuss:

- Who are the users and what are they using the data for?
- What types of geodata are you intending to license, data by theme or compiled data in the form of maps?
- Is the data most suitable to license by area or by feature?

Another important issue regarding usage of geodata is whether it is mainly provided directly to end users or if it is used by developers and/or value-added resellers who create products or services that are sold or re-distributed to third parties (end users).

It might be necessary to apply different license terms and fees on the same data depending on the use of the data. Differentiation can be made between different categories of use, for example between non-commercial and commercial use. Sometimes it is stated by the government that public use should be free and the same can apply for research and education.

The means for distribution of geodata can also influence the pricing. There can be a differentiation between data delivered manually “off line” and data accessed by services for viewing or download. Manually handled data can have a “delivery fee” on top of the license fee. The same can be applied for distribution via services. It is possible to charge a “service fee” for access to the service on top of the license fee for data. Following questions need to be answered:

- Is the geodata distributed by manual deliveries or via services or both?
- Is there a need to cover costs for handling the deliveries separately, or can this cost be included in the license fee for data?

If entering international co-operations regarding distribution of cross-border harmonised data, it might be necessary to adjust the national licensing and pricing model accordingly. It can work with different

models, but to harmonise the terms for usage of data and the mechanisms for pricing might facilitate the work. To offer data as "open data" might be an option to facilitate international co-operation.

When the issues and conclusions above are described, it will be possible to go on with further work on licensing and pricing of geodata.

4.5 SDI law – a checklist

The development of legislation, rules and policies supporting an efficient use of geodata is the responsibility of respective country. However, the experts within the IMPULS project has supported the work of implementing the INSPIRE directive by contributing with knowledge on relevant issues.

During the project time, several of the beneficiary organisations have been involved in the development of the NSDI laws in respective country. The scrutiny of how well these laws meet the obligations of the INSPIRE directive has been discussed. Based on some EU pilot towards EU members states related to the implementation of INSPIRE in national law, some control questions have been put together, which could be used for verifying how well a drafted NSDI law have the necessary provision for an efficient implementation of the directive: These are:

- Question about how metadata is regulated in the law
- Question about authorities' rights to restrict access to spatial information
- Question about removal for barriers of sharing of data between public authorities
- Question about how to ensure that unproportionable fees are not charged
- Question about how to ensure that view services, as general rule, are free of charge
- Question about how to ensure that result from the monitoring and reporting are made available to the Commission and the public
- Question about definitions of:
    - Public authority
    - Spatial data infrastructure
    - Spatial object
    - Inspire geoportal
    - Third party
- Question about how data sharing is implemented as a requirement
- Question about how the coordination has been ensured and implemented.

5 Harmonisation of spatial data

In a national context, harmonisation of data makes it possible to combine data from different sources (data custodians) without extensive manual labour in terms of restructure and import of data into other systems.

Spatial data is an essential part of any infrastructure and it is important that the data follow commonly agreed standards and specifications in order to make them interoperable, i.e. it should be possible to combine data within different applications, irrespectively of their original intended use. INSPIRE, for instance, requires data to be harmonised according to specifications made available for the 34 INSPIRE themes (figure 17).

In a national context, harmonisation of data makes it possible to combine data from different sources (data custodians) without extensive manual labour in terms of restructure and import of data into other systems. This is supporting the reuse of data by all stakeholders in a country. Also, in a regional context, data is usually stored according to different "local" specifications and in different formats and database structures. Harmonised and interoperable data will enable cross-country applications throughout the region.

The work package 3 – Harmonisation of spatial data – has been addressing these issues with the aim of identifying data sets of a common interest for the region and develop methods for how these data can be harmonised and interoperable.

In the work package, beneficiaries were trained to harmonise their internal spatial data, from compliance with local specifications, to compliance with INSPIRE specifications. Tools used were Microsoft Excel and Humboldt Hale software's. Harmonisation was carried out by the beneficiary organisations themselves with support of Swedish and Croatian experts. The idea was, with experience gained through harmonisation of internal data, to prepare the beneficiary organisations to support "external" organisations (stakeholders) in their work with data harmonisation.

The training ended with validation in Hale ('live' validation). Additionally, to the hands-on-training beneficiaries where provided with attendance to the web-based LINKVIT courses on data harmonisation.

On-line training courses are available at, for instance:

http://www.linkvit.eu/training-modules/

https://inspire.ec.europa.eu/portfolio/training-library

INSPIRE data themes

Annex I

1. Coordinate reference systems
2. Geographical grid systems
3. Geographical names
4. Administrative units
5. Addresses
6. Cadastral parcels
7. Transport networks
8. Hydrography
9. Protected sites

Annex II

1. Elevation
2. Land cover
3. Orthoimagery
4. Geology

Annex III

1. Statistical units
2. Buildings
3. Soil
4. Land use
5. Human health and safety
6. Utility and Government services
7. Environmental monitoring facilities
8. Production and industrial facilities
9. Agricultural and aquaculture facilities
10. Population distribution – demography
11. Area management / restriction / regulation zones & reporting units
12. Natural risk zones
13. Atmospheric conditions
14. Meteorological geographical features
15. Oceanographic geographical features
16. Sea regions
17. Bio-geographical regions
18. Habitats and biotopes
19. Species distribution
20. Energy resources
21. Mineral resources

Figure 17. *INSPIRE requires data to be harmonised according to specifications made available for the 34 INSPIRE themes.*

In preparation for the trainings, the participants were asked to download and install the following:

- Dia software (http://dia-installer.de/download/index.html.en). Dia is an open source software for making simple drawings.
- HALE software: (https://www.wetransform.to/downloads/). HALE is an open source software for schema transformation, especially developed for INSPIRE transformations
- Relevant INSPIRE data product specification (https://inspire.ec.europa.eu/data-specifications/2892)
- A relevant GIS software with capabilities to import and read GML files. In the trainings, QGIS was the main GIS software used. (https://qgis.org/en/site/forusers/download.html)
- An XML editor. The open source XML Copy Editor was used in the trainings. (https://sourceforge.net/projects/xml-copy-editor/)

5.1 Schema matching

Harmonisation of internal datasets started with hands-on-training in schema matching and data transformation methodology regarding administrative unit and elevation data. All work was done on sample data brought by the participants, who had installed the software's necessary for the work in advance. Special session was addressed to increase the knowledge on how to read and understand the INSPIRE data specifications.

Harmonisation of data to an INSPIRE compliant application schema first requires a matching analysis of existing data as compared to the INSPIRE specifications (schema-matching) to be done. In this step the attributes and object types of the existing data is analysed and described and then compared with the attributes and object types required by relevant INSPIRE application schema.

This process is often done using mapping tables in Excel. Pre-done mapping tables in XML can be downloaded from the INSPIRE web page (https://inspire.ec.europa.eu/portfolio/data-models) and be opened in Excel (figure 18).

It can also be done visually using for instance Visio or DIA (figure 19). The DIA software is free of charge and can be downloaded at: http://dia-installer.de/.

Application Schema 'Cable Transport Network' (version 3.0)						
Type	**Documentation**	**Attribute Association role Constraint**	**Attribute / Association role / Constraint documentation**	**Values / Enumerations**	**Multiplicity**	**Voidable / Non-Voidable**
CablewayLinkSet Supertypes: *TransportLinkSet* *TransportObject* *LinkSet* *NetworkElement*	A collection of cableway link sequences and or individual cableway links that has a specific function or significance in a cable transport network.					
		geographicalName	A geographical name that is used to identify the transport network object in the real world. It provides a 'key' for implicitly associating different representations of the object.	GeographicalName	0..1	voidable
		beginLifespanVersion	Date and time at which this version of the spatial object was inserted or changed in the spatial data set.	DateTime	1	voidable
		inspireId	External object identifier of the spatial object. NOTE An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.	Identifier	0..1	
		endLifespanVersion	Date and time at which this version of the spatial object was superseded or retired in the spatial data set.	DateTime	0..1	voidable
		inNetwork	The networks in which a network element is a member.	Network	1..*	voidable
		link	The set of links and link sequences that constitute the link set.	GeneralisedLink	1..*	
		validFrom	The time when the transport link set started to exist in the real world.	DateTime	1	voidable
		validTo	The time from which the transport link set no longer exists in the real world.	DateTime	0..1	voidable
		post	Marker post along a route in a transport network.	MarkerPost	0..*	voidable

Figure 18. *A mapping table in Excel for the application schema "Cable Transport Network".*

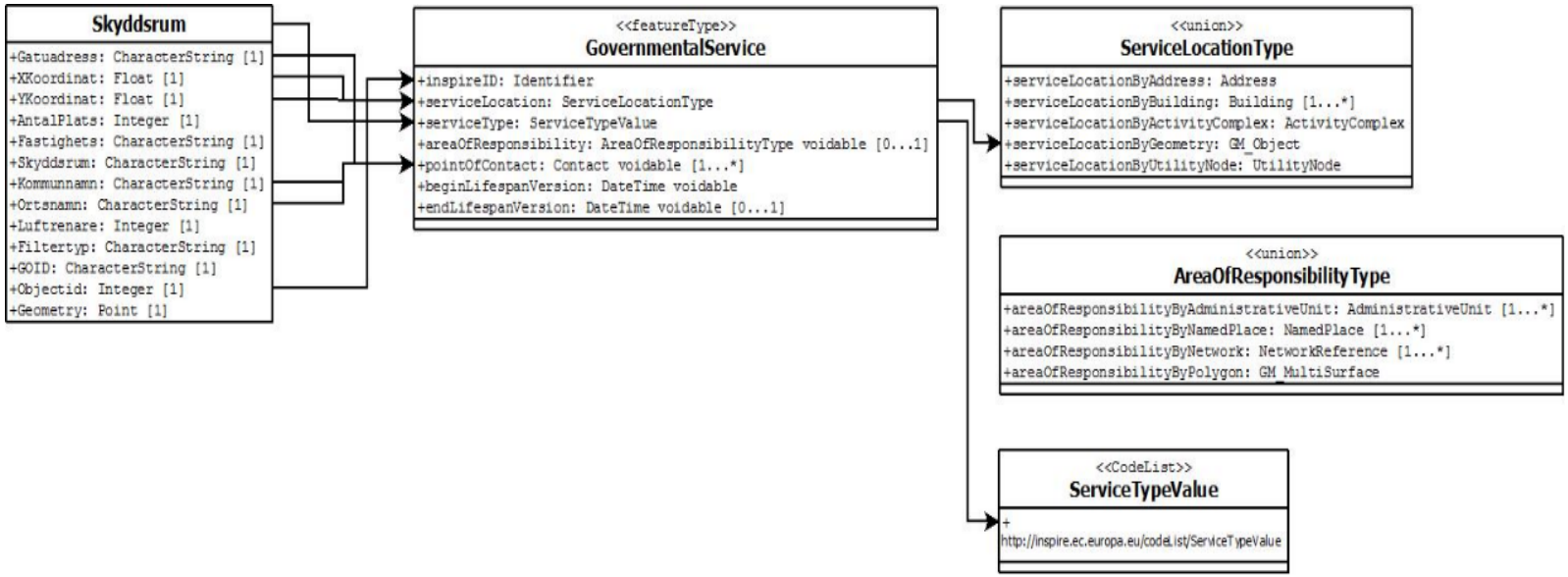


Figure 19. *Matching the dataset "Skyddsrum – (Shelter)" (to the left) to the INSPIRE specification for "Governmental Service" to the middle and right using the DIA software.*

5.2 Data transformation

Data transformation is the step whereby data is transformed into a structured GML file and made available through an atom feed download service or WFS service. Commonly used software's for this type of mapping are FME, MapForce, Humboldt HALE studio or similar. For an organisation that isn't already using a transformation tool like the ones mentioned above, it is recommended to have a look at the software Humboldt HALE studio at:

https://www.wetransform.to/downloads.

Humboldt HALE Studio is a free-of-charge software that is developed to cater also for transformation of spatial data to INSPIRE application

schemas. See further an introduction to Humboldt HALE Studio on: http://www.dhpanel.eu/humboldt-framework/hale-tutorial.html.

Using the transformation software, the data is “mapped” from one application schema to another (using the mapping table in the previous exercise), in this case from a current application schema to an INSPIRE schema. Figure 20 shows an example were un-harmonised data for roads has been mapped against the INSPIRE-specification for roads in the Humboldt HALE software.

Once the data has been mapped in a suitable software the actual transformation can be started. The output file will, after the transformation, follow the INSPIRE specification with the attributes, spatial object types, data types, code lists etc. as defined in the INSPIRE data specifications.

Note: Transformation to an INSPIRE compliant reference system and projection can be done in the transformation step, although it is generally advised to make coordinate transformation outside this part of the harmonisation process.

After transformation using the HALE software, validation of the GML files should be carried out. This can be done at different ambition levels.

At the lowest level, conventional XML editors may be used to verify that the structure of the output GML file is valid (well-formed), i.e. it should follow the general rules for XML files. In addition, structural compliance with the INSPIRE application schemas may be tested, for instance that all mandatory elements are included. These low-level validations can be successfully carried out using he built-in validator of HALE. This can be complemented by using an open source XML editor (for instance XML Copy Editor) for validation.

For more precise validations, JRC provides an online tool that can be used (http://inspire.ec.europa.eu/validator/). The tool is still under development and may not be applicable for testing all different INSPIRE schemas.

Independently on which test is applied, it is important to remember that error messages must be thoroughly analysed and evaluated. Some errors may appear due to well-known reasons and can be ignored. For instance, if the validator generates an error message for an erroneous reference system, it may not necessary be an error as

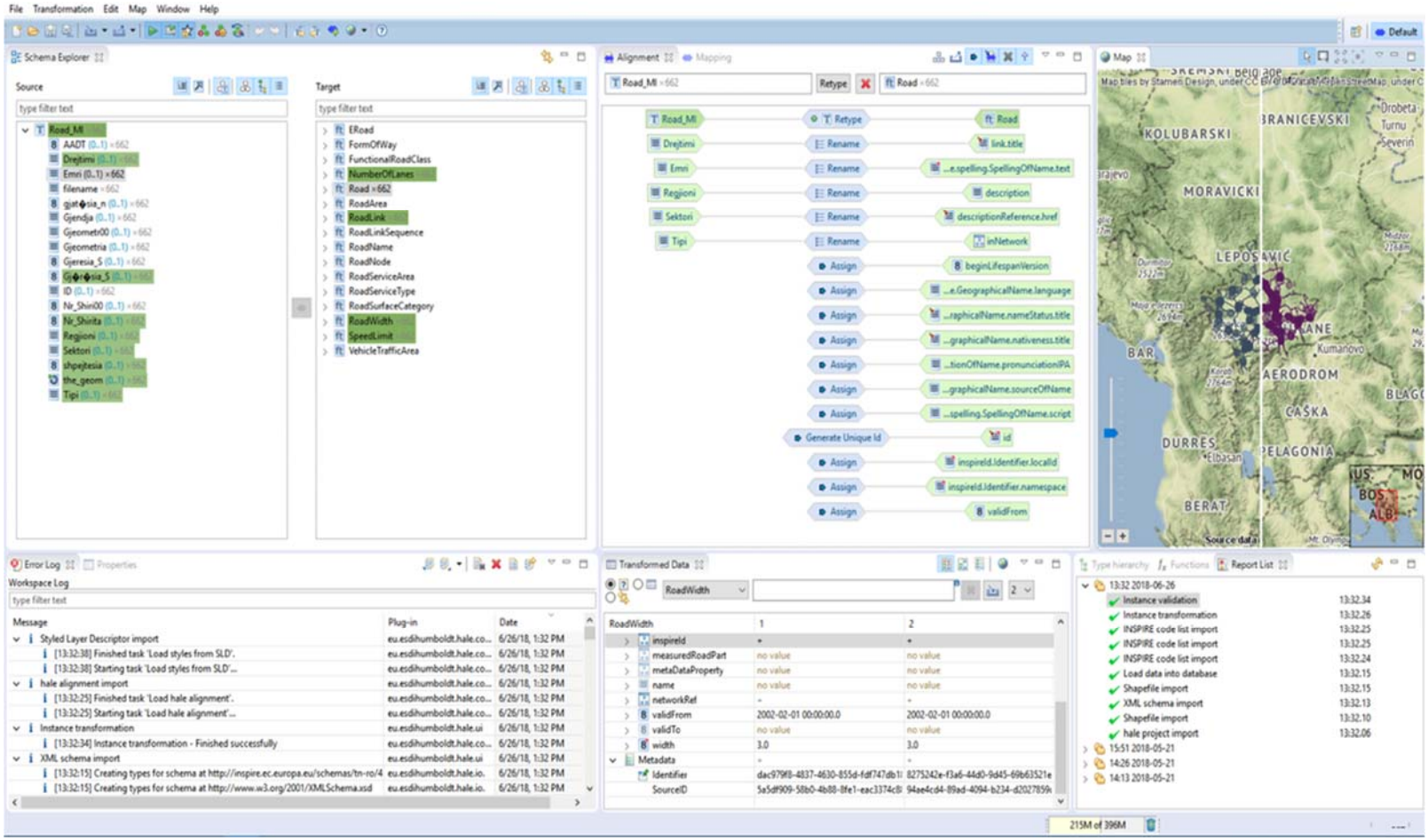


Figure 20. *A screen dump showing an example on how data for roads has been mapped against the INSPRIE-specification for roads in the Humboldt HALE studio software.*

the reference system put may be there intentionally. Also, some error messages may be of less significance for the intended use of a dataset and may for that reason be ignored.

5.3 INSPIRE ID

The INSPIRE application schemas require all data to have an INSPIRE ID. An INSPIRE ID is an identifier which makes an object in a dataset globally unique.

There are currently two different approaches to ID management in the INSPIRE data specification. One approach is based on a specific element named “inspireId”, having two sub-elements named **namespace** and “**localId”**. The other approach is based on the usages of the “**xlink”** element. Independent of which approach to be taken, a proper national system for management of ID’s must be established. This is also in accordance with other European initiatives within the e-government sector, for instance the PSI directive.

It is possible to establish a temporary system for ID management, before a national system is established. But then there is also a risk that the identifiers specified in the temporary system are not persistent and may change when the national system is established. An example of a temporary system may be that the namespace is managed at a central level. In addition, the “localId” may then be managed by the unit within an organisation responsible for a particular data set. Such a solution needs however to be analysed further before a decision is made.

More about “inspireID” and be found on:
https://inspire.ec.europa.eu/implementation-identifiers-using-uris-inspire-%E2%80%93-frequently-asked-questions/59309

5.4 Step-wise harmonisation

Although harmonisation often is associated with schema transformation, there are several aspects on harmonisation that should be considered in order to achieve interoperability. These are:

- **Uniform reference system.** A uniform reference system makes it possible to overlay different data without first having to transform the data geometrically.
- **Common application schemas.** Common application schemas make it easier to understand how data are structured, which attributes.

- **Geometric correspondence.** Geometric correspondence is required when data from different sources shall be merged, for instance roads need to meet at a country border. The process is often called edge matching.
- **Common scale and resolution.** Data of different target scales or resolutions are also often of different geometric or thematic accuracy. A road and a river, for instance, may not align when displayed on top of each other. Analysis based on such data will give different results and can usually not be used together.
- **Harmonised semantics.** Different features in a data set may have the same "name" but be defined differently by different source organisations. As an example, 1 US gallon equals to 3.7854 litres, while 1 UK gallon equals to 4.54609 litres.
- **Common styles.** Particularly when putting data together in order to produce maps, the symbology used for different features is very important

When working on harmonisation of data, it may be wise to consider which harmonisation aspects that are most important to start with, particularly when encouraging new authorities to harmonise and provide data in the NSDI. A common reference system and common code lists may be first start. Demand on further harmonisation may then increase successively as the targeted authorities start to build competence in the different aspects of harmonisation.

Since not all BO have the same referent system, first idea was to transform all data into unique system named IMPULS_829. After detailed analysis of such proposal, it was concluded that by using such IMPULS_8291 system sustainability will not be reached (data used in the project would not be maintained since on national level different referent systems are in use). Instead, this referent system will be used for combining the data between countries (see chapter 8.2). That is why it was agreed that each country continue to work in its national coordinate system that is registered in EPSG. This makes it possible for users from other countries (in the Western Balkans region) to transform their source data into their state system through the GIS tool. In this way, harmonized data sets could also be used after the completion of the IMPULS project. The aim of data sharing would be reached.

As a result of the project the beneficiaries harmonized AU, EL, GN and OI data sets in the first stage and after that started harmonization of TR, HY, PD and GO data sets. Figure 21 shows a hands-on session from a data harmonisation workshop in Sarajevo, 2015.

Figure 21. *Hands-on training in data harmonisation, in Sarajevo, January 2015.*

Harmonisation – hypothetical workflow

The structure of a dataset is usually specified by a schema. Sometimes the schema is embedded in the data file, as in the case of shape files (open format developed by ESRI Inc). In other cases, the schema is specified in specific schema files, as in the case of XML/GML files. The data specifications of INSPIRE also specify the INSPIRE schemas as XML schema files (XSD).

The objective of a schema transformation is to transform source data (data stored according to internal source schemas) to a target dataset structured according to the target schema, for instance an INSPIRE schema. To establish procedures for schema transformation, the following activities should be carried out.

1. **Selection of source and target schemas and pilot test data set.**

   It is here assumed that the source data sets are homogenous (compliant with the same schema). In such a case, this source schema should be selected, and a suitable pilot data set should be selected for testing purposes. If your target data sets shall be INSPIRE compliant, INSPIRE schemas should be selected as target schemas. The pilot data set may also need to be prepared in some way, for instance by a coordinate system transformation.

2. **Schema matching**

   In this task, concepts in the source schema are associated with related concepts in the target schema. This step requires a good understanding of the source schema as well as the target schema. A collaborative work involving different domain experts are often required. The schema mapping may be documented using UML diagrams.

3. **Schema mapping**

   The objective of this task is to specify transformation rules for making the schema transformation. The rules to be specified depends on the schema transformation software being used and there is no uniform terminology being adapted by different software vendors. The schema mapping specifications shall be stored and re-used in the automation step.

4. **Schema transformation**

   Based on the schema mapping specification, the schema transformation of the pilot data set may be executed. The output of this step may be a pilot GML file.

5. **Validation of target data set**

   The target data set shall comply with the INSPIRE schema and additional requirements specified in the data specification. Most XML editors have a built-in validator, where compliance with the target schema can be validated. In order to validate other requirements, the INSPIRE validator (http://inspire.ec.europa.eu/validator/about/) may be used.

6. **Automation of the schema transformation process**

   Most schema transformation software's have procedures for automation. If HALE Studio is used, automation scripts may be used, where new source data sets a continuously being used and together with the schema mapping specification transformed according to the target schema.

6 Metadata and quality evaluation

In a NSDI, spatial data and services need to be described in such a way a potential user can assess the quality and usability of a particular dataset, and get information on how to access the data using services

In an NSDI, spatial data and services need to be described in such a way a potential user can assess the quality and usability of a particular dataset and get information on how to access the data using services. Such descriptions are commonly stored as metadata documents in a central metadata catalogue accessible both by data users and the public. However, since the metadata documents should be compatible and usable in a cross-boundary context, it is necessary to agree on a common structure of these documents.

Other issues to discuss in a NSDI are quality aspects. Data produced by different data custodians, with different techniques may be different in terms of resolution (both spatial and temporal), completeness and geometric accuracy. Known “quality” of different types is essential for a user in order to be able to assess the “fitness for use” of a particular dataset for a particular purpose. There is also a need for quality measures for evaluation of fitness for purpose of services.

The work package 4 – Metadata and quality evaluation – has been addressing these issues with the aim of developing a common way of describing data and services to the benefit of all users in the region, as well as develop processes to assess quality of data and services.

6.1 A regional metadata profile

To enable cross-border exchange of metadata in the region it was agreed that a regional metadata profile should be developed. Following decision was taken:

- To meet the requirements for metadata of the INSPIRE Directive and Implementing Rules, the regional metadata profile (common metadata elements) should be based the core metadata elements defined by INSPIRE

The decision to just include core set of metadata elements in the regional metadata profiles didn’t preclude inclusion of additional metadata elements (extensions) for national purpose. It was decided that this is for each beneficiary to decide depending on national needs.

As a result, a regional metadata profile was agreed upon containing:

- a total of 11 categories and 32 metadata elements for Spatial datasets and spatial dataset series (figure 22) and,
- a total of 10 categories and 23 metadata elements for Spatial data services (figure 23).

No	Metadata element
I	**IDENTIFICATION**
1.1	Resource title
1.2	Resource abstract
1.3	Resource type
1.4	Resource locator
1.5	Unique resource identifier
1.7	Resource language
II	**CLASSIFICATON OF SPATIAL DATA AND SERVICES**
2.1	Topic category
III	**KEYWORD**
3.1	Keyword value
3.2	Originating controlled vocabulary
IV	**GEOGRAPHIC LOCATION**
4.1	Geographic bounding box
V	**TEMPORAL REFERENCE**
5.1	Temporal extent
5.2	Date of publication
5.3	Date of last revision
5.4	Date of creation
VI	**QUALITY AND VALIDITY**
6.1	Lineage
6.2	Spatial resolution
VII	**CONFORMITY**
7.1	Specification
7.2	Degree
VIII	**CONSTRAINT RELATED TO THE ACCESS AND USE**
8.1	Conditions applying to access and use spatial data sets
8.2	Limitations on public access
IX	**ORGANISATIONS RESPONSIBLE FOR ESTABLISHMENT, MANAGEMENT, MAINTENANCE AND DISTRIBUTION OF SPATIAL DATA**
9.1	Responsible party
9.2	Responsible party role
X	**METADATA ON METADATA**
10.1	Metadata point of contact
10.2	Metadata date
10.3	Metadata language
XI	**INTEROPERABILITY METADATA AND THEME SPECIFIC METADATA**
11.1	Coordinate reference system
11.2	Temporal reference systems
11.3	Data encoding
11.4	Character encoding
11.5	Spatial representation type
11.6	Topological consistency
11.7	Maintenance information

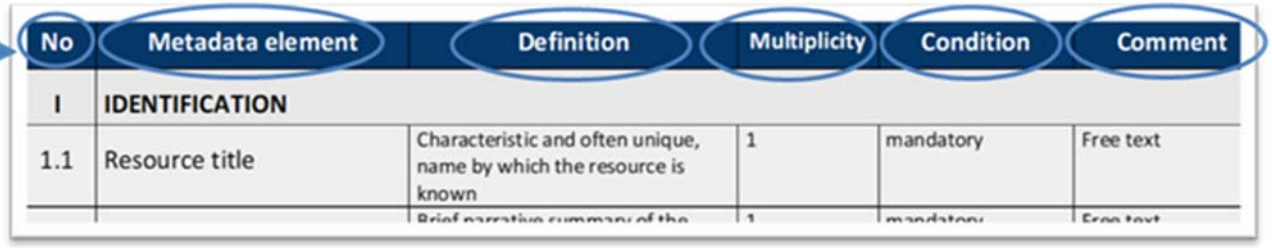
Figure 22. *The metadata elements for datasets and data series.*

No	Metadata element
I	**IDENTIFICATION**
1.1	Resource title
1.2	Resource abstract
1.3	Resource type
1.4	Resource locator
1.6	Coupled resource
II	**CLASSIFICATON OF SPATIAL DATA AND SERVICES**
2.2	Spatial data service type
III	**KEYWORD**
3.1	Keyword value
3.2	Originating controlled vocabulary
IV	**GEOGRAPHIC LOCATION**
4.1	Geographic bounding box
V	**TEMPORAL REFERENCE**
5.1	Temporal extent
5.2	Date of publication
5.3	Date of revision
5.4	Date of creation
VI	**QUALITY AND VALIDITY**
6.2	Spatial resolution
VII	**CONFORMITY**
7.1	Specification
7.2	Degree
VIII	**CONSTRAINT RELATED TO THE ACCESS AND USE**
8.1	Conditions applying to access and use spatial data sets
8.2	Limitations on public access
IX	**ORGANISATIONS RESPONSIBLE FOR ESTABLISHMENT, MANAGEMENT, MAINTENANCE AND DISTRIBUTION OF SPATIAL DATA**
9.1	Responsible party
9.2	Responsible party role
X	**METADATA ON METADATA**
10.1	Metadata point of contact
10.2	Metadata date
10.3	Metadata language

Figure 23. *The metadata elements for services.*

A technical guidelines document (figure 26) was also developed in which the different elements were better described (figure 24).

- **No** – the number of the metadata element in the table
- **Metadata element** – name of the metadata element
- **Definition** - definition of the metadata element
- **Multiplicity** - defines whether the element consists of only one value or may have several values
- **Condition** – defines whether the element is mandatory or conditional
- **Comment** – additional comment



No	Metadata element	Definition	Multiplicity	Condition	Comment
I	IDENTIFICATION				
1.1	Resource title	Characteristic and often unique, name by which the resource is known	1	mandatory	Free text

Figure 24. *A technical guidelines document describes each metadata element in the profile.*

The technical guidelines document is applicable for data providers, creators of metadata, publishers of metadata services and data users in general. Widespread use of the profile will facilitate interoperability within and between public authorities, both in the region and internationally, by providing a consistent basis for communicating information about geographic resources.

The importance of having different metadata elements for data sets and services are illustrated in figure 25.

The INSPIRE metadata profile and technical guidance documents are available at: https://inspire.ec.europa.eu/metadata/6541

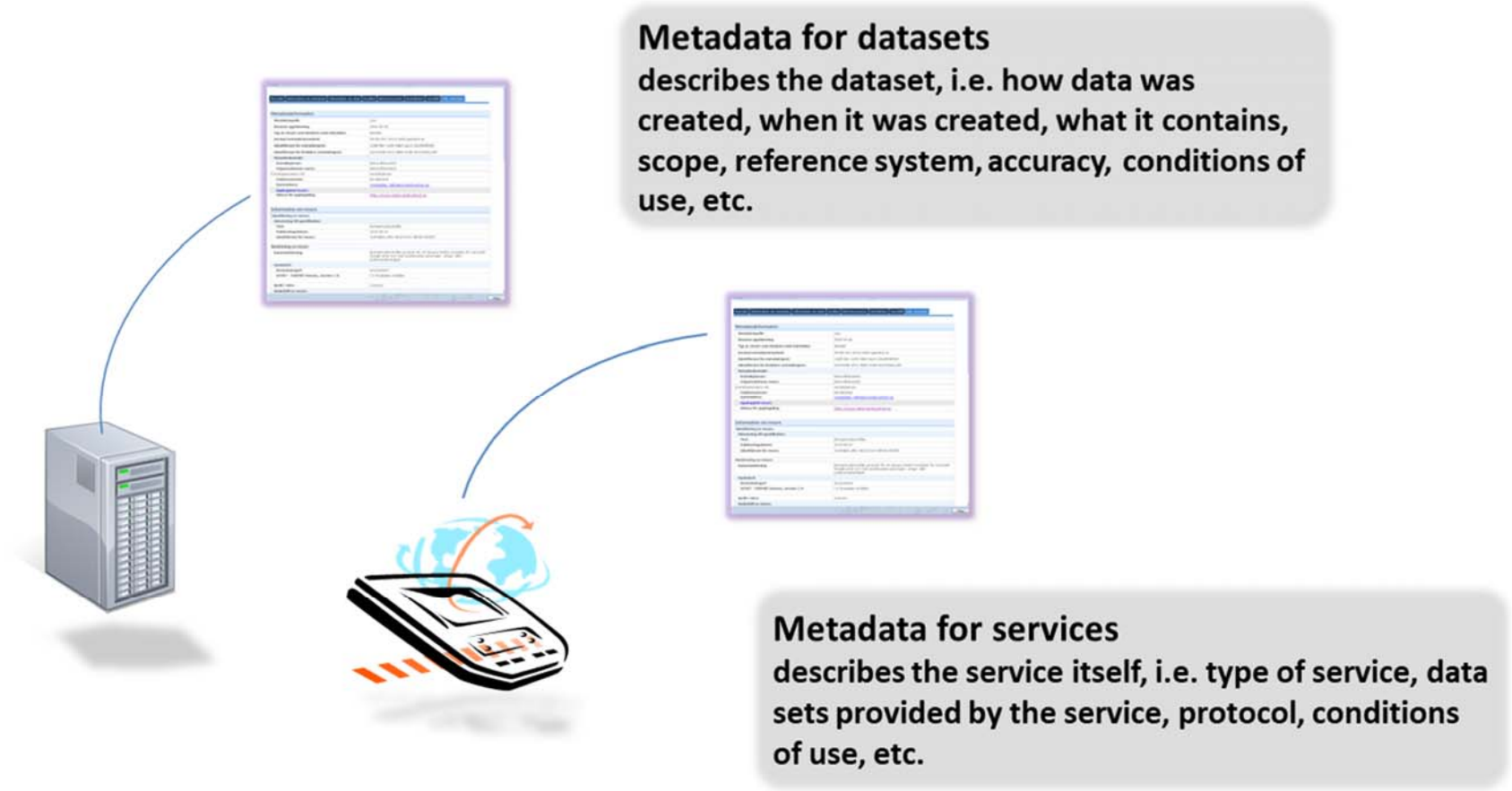


Figure 25. *It is important to understand that there is a difference between metadata for data sets and metadata for services. That is why both is required.*

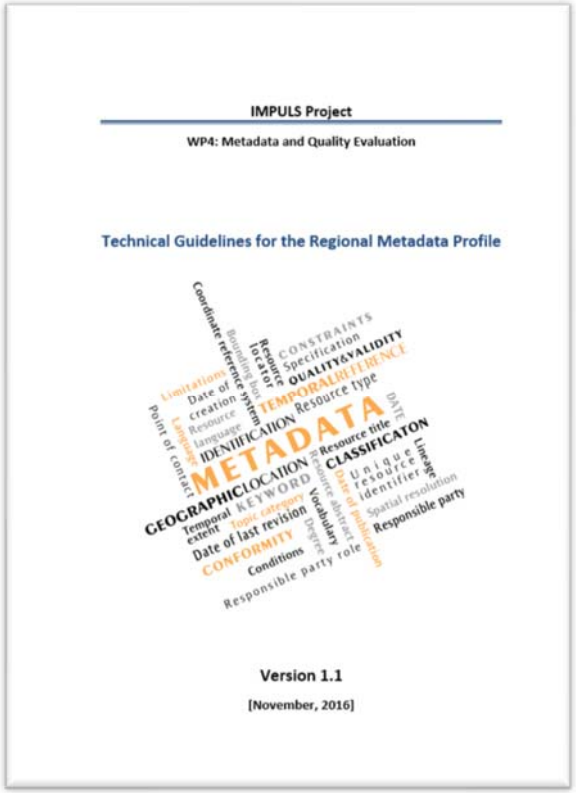


Figure 26. *Technical Guidelines were developed on how to interpret the different metadata elements in the regional metadata profile with practical information to better understand and implement the profile.*

6.2 Quality evaluation

The possibility to verify the quality of developed and harmonised data and services is a very important aspect when setting up an NSDI, i.e. do the data and services fulfil specified requirements.

To this end, the DG-JRC within the European Commission, has developed a series of tests which can be used to validate the conformity of metadata, harmonised data and services in relation to the INSPIRE directive (figures 27 and 28). The tests reside within what is called “the reference validator” and can accessed at:

http://inspire.ec.europa.eu/validator/about/

The validator is based on the Abstract and Executable Test Suites agreed between Member States and the Commission in the INSPIRE Maintenance and Implementation Group.

The reference validator validates metadata according to the INSPIRE metadata profile (version 1.3 and 2.0), data sets for the data in annex I of INSPIRE and for discovery, view and download services.

The reference validator can be downloaded and deployed in a national environment for customised use.

It should be noted that the INSPIRE validator tools only test specific aspects of metadata, data and services. Other aspects, like the geometric accuracy and completeness of data sets has to be tested by other means.

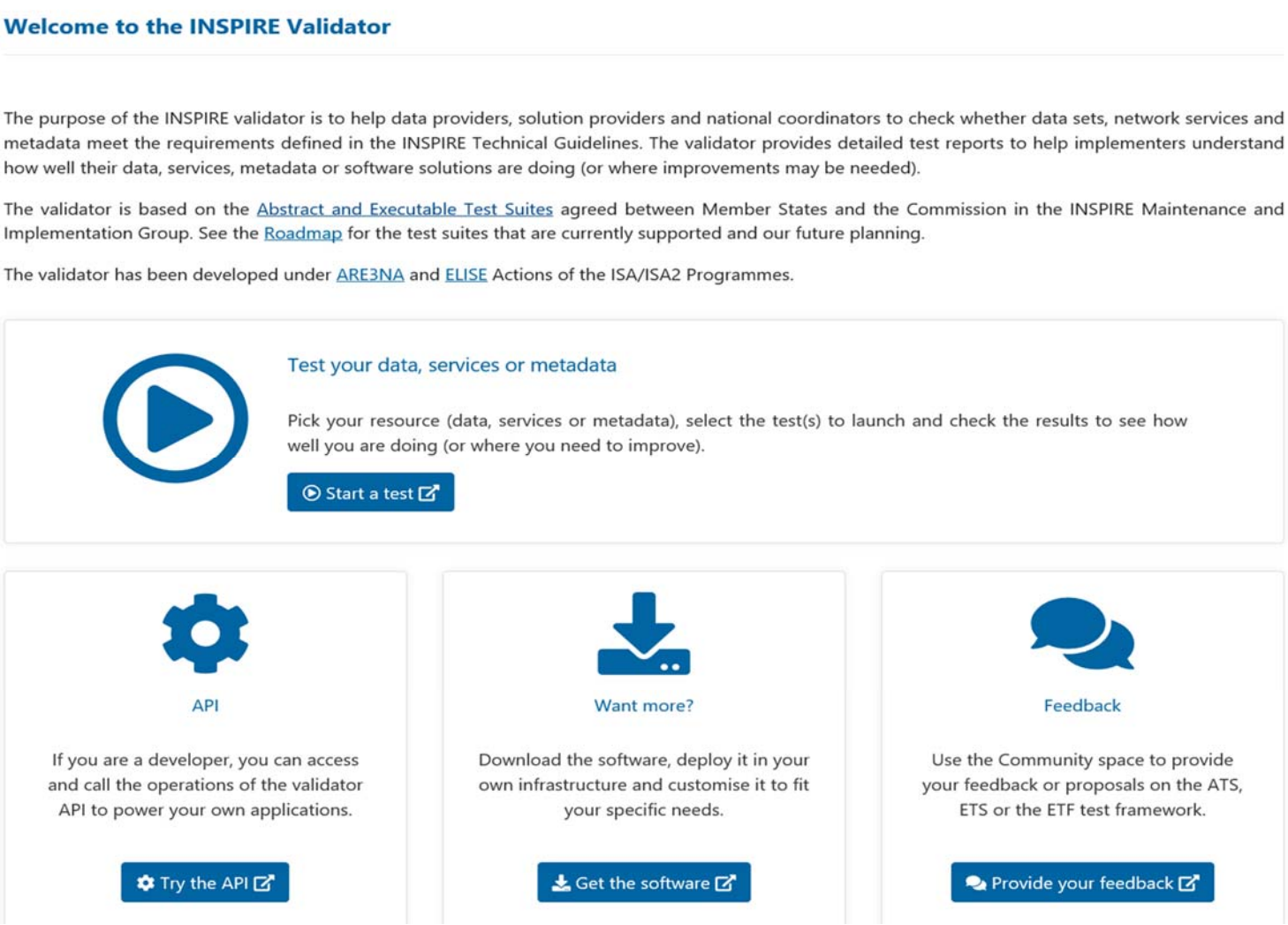


Figure 27. *The landing page for the INSPIRE reference validator*.

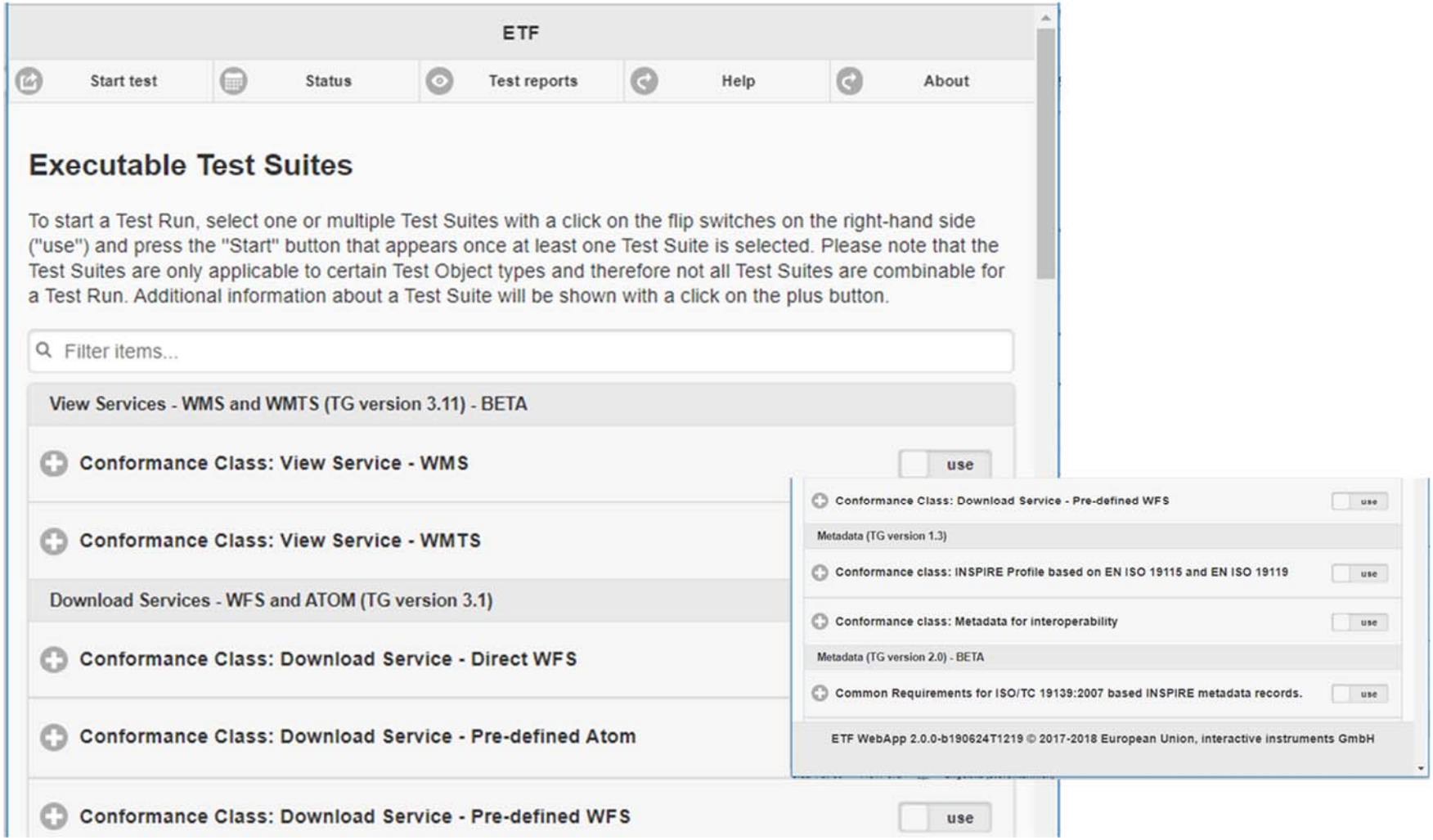


Figure 28. *The look of the reference validator*.

7 Dissemination

A national metadata catalogue (discovery service), which facilitates for users to search for, look at data, and capture data and services, is another important component of the technical infrastructure

Easy access to data is an underlying principle in any infrastructure. To this end, different types of web-based services for provision of data from producers to users need to be developed.

The provision of data is the responsibility of each individual data producer and in the NSDI this is commonly done by setting up view and download services. A national metadata catalogue (discovery service), which facilitates for users to search, find and evaluate data and services, is another important component of the technical infrastructure (figure 29).

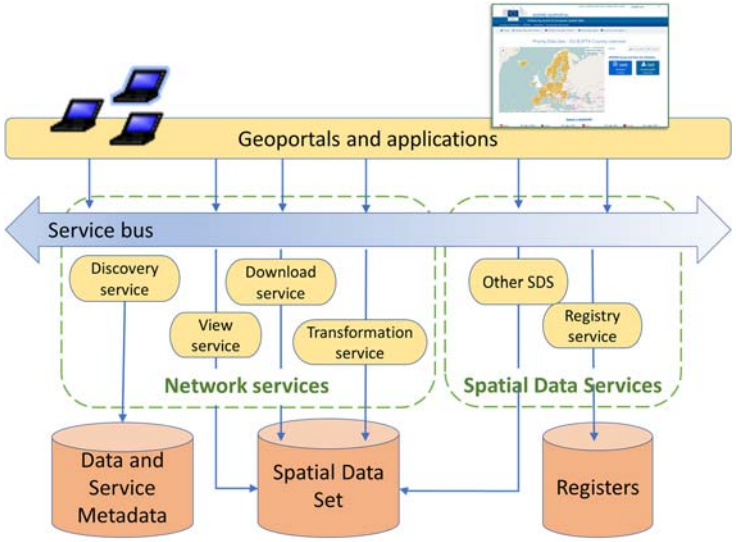


Figure 29. *The INSPIRE technical infrastructure*.

The work package 5 – Dissemination – has been addressing these issues with the aim of developing a common technical infrastructure enabling producers and users to interact in an efficient way through network services.

7.1 National metadata catalogue

The INSPIRE directive states that Member States shall establish and operate at least one discovery service (metadata catalogue) that should make it possible for a user to search for spatial data sets and services based on the content of published metadata, and to read and evaluate its fitness-for-purpose. The search interface to a national metadata catalogue is commonly a national Geoportal.

A National metadata catalogue is a single instance of a discovery service and is commonly hosted by the organisation that is also the national NSDI coordinator. The catalogue host metadata from all involved stakeholders (but no data) and can be considered as a national register containing metadata for all data and services in a country (figure 30). The metadata itself, and its content, is owned by respective data producer, whom should enter metadata for their data and services in the National metadata catalogue.

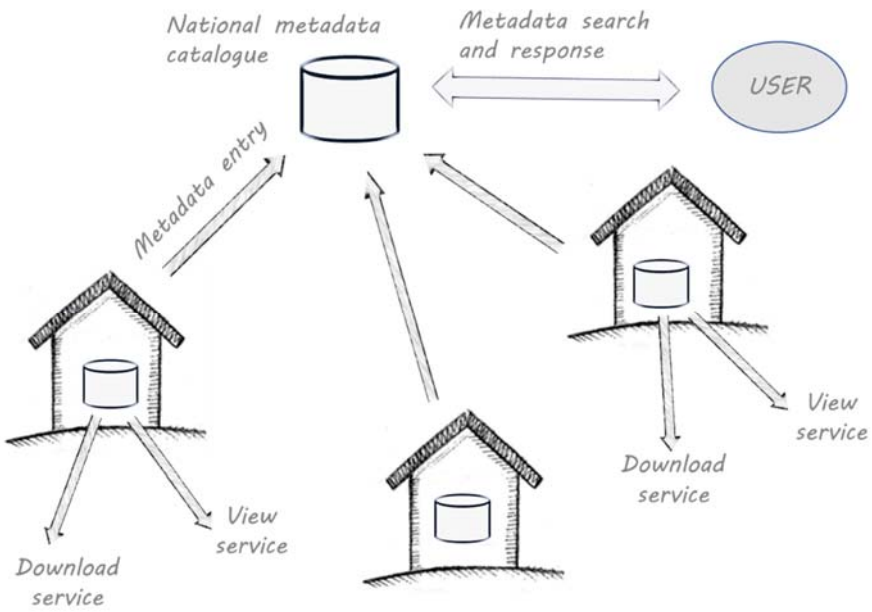


Figure 30. *The main technical components of a NSDI are (1) a National metadata catalogue allowing a user to search and find where data can be retrieved and (2) view and download services for provision of data.*

One of the most used tools for creation of metadata catalogues and geoportals in many SDI's is the software GeoNetwork. GeoNetwork is an open-source catalogue application developed for management, editing and search of georeferenced data. It also has as an interactive web map viewer. GeoNetwork can run either on MS Windows, Linux or Mac OS X.

The GeoNetwork software can be downloaded at:
https://www.geonetwork-opensource.org/downloads.html

Within the frame of the IMPULS project, a reference installation of GeoNetwork was done as a practical example on how a metadata catalogue could be implemented. The reference installation was used for training and most beneficiaries also installed GeoNetwork within their own organisations (see an example in figure 31). During training, each organisation developed an INSPIRE compliant ISO metadata template for easy metadata capture.

It was agreed that the metadata catalogues developed by each beneficiary should consist of following three components.

Metadata catalogue: The metadata catalogue itself which should cater for metadata according to the developed regional metadata profile.

- **Publication interface**: A publication interface making it possible for stakeholders to create, publish, update or manage of metadata in the catalogue. The interface should preferably be developed as a web interface as it would enable publishing and editing of metadata via the Internet. IMPULS recommended the

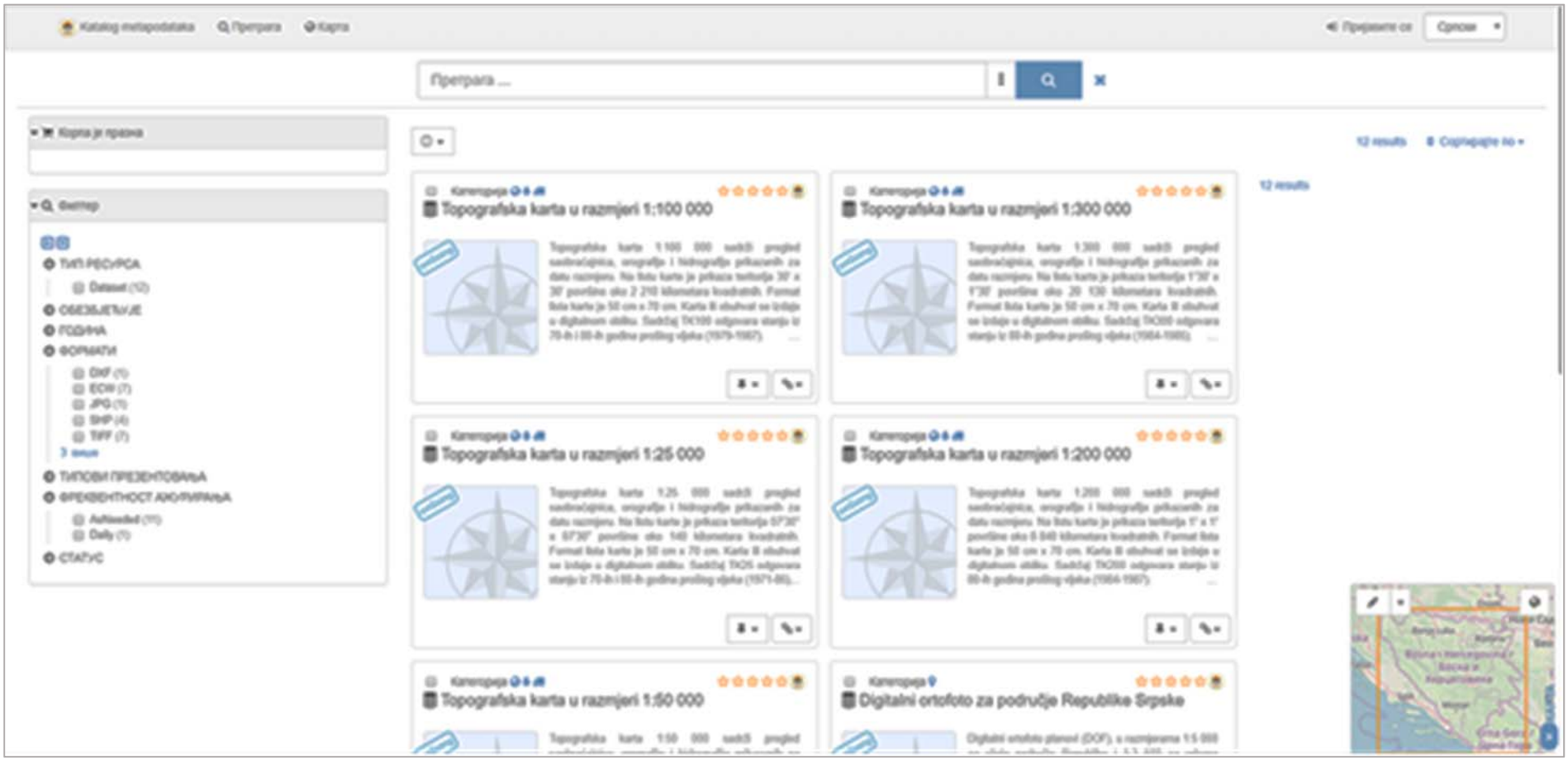


Figure 31. *The GeoNetwork search interface illustrated by the national metadata catalogue hosted by GARS*

- use of GeoNetwork for the national metadata catalogue but ESRI Geoportal and Erdas Apollo were also used.
- **Search interface**: A search interface that enables stakeholders and the public to search the catalogue based on a number of pre-set criteria. To be INSPIRE compliant, a wide range of search criteria's need to be fulfilled. However, within the IMPULS project, it was decided that at least following minimum search criteria should be implemented:
    - Resource title
    - Resource type
    - Unique resource identifier
    - Topic category
    - Keyword value (INSPIRE theme)
    - Responsible party

To fulfil national needs, extra search criteria's, on top of the ones listed above, are recommended.

The INSPIRE technical guidance document for discovery services is available at:

https://inspire.ec.europa.eu/document-tags/network-services

Within the frame of the IMPULS project, unless these three basic components were in place, it was assumed that there were no national discovery service available fulfilling specified requirements. The metadata catalogue should also be available to the public and open for any stakeholder to publish metadata for their data and services.

Additionally, to make metadata harmonised and possible to harvest between the different metadata catalogues the metadata should follow the regional metadata profile developed within the frame of the WP 4 of the IMPULS project.

Each data producer should enter metadata for their datasets in the National metadata catalogue. Individual organisations may establish their own metadata catalogues (or geoportals) containing information about organisational-specific data (and documents if relevant). If this is done, the National metadata catalogue can harvest metadata directly from the catalogues hosted by each individual data producer.

An advantage of setting up an independent national geoportal is its neutrality, i.e. no conflicts with other interests. It will be a national register only and can be connected to the EU geoportal for fulfilment of the INSPIRE directive. In the geoportal, metadata will be stored and managed centrally but all physical data and services will stay at

respective organisation. Nor will any organisation have to provide data to another organisation.

The Geoportal should have a built-in map viewer, as in GeoNetwork. This is not required by INSPIRE but most countries in EU have implemented this functionality in their national discovery services. The map viewer makes it possible to display WMS-services from the involved organisations. The map viewer is for view of WMS services.

Other organisations may have other software's as management tool for their spatial data and will continue to do so. They will then act as thematic portals, which is financed and managed by respective organisation, and the national geoportal will function independent on the management of these. Harvesting routines between the national geoportal and the metadata documents stored in respective thematic portal could be developed in order to make metadata editing as automated as possible.

Note: A main challenge is to encourage data producers to enter metadata into the national metadata catalogue. This needs to be given special attention and outreach activities, such as individual visits, seminars and workshops are essential.

Within the IMPULS project, the beneficiaries' organisations have successfully produced metadata for their datasets according to the regional Metadata profile (mostly in GeoNetwork) and have educated other data producers in their countries to do the same.

7.2 View services

View Services allows users and computer programs to view spatial datasets. The INSPIRE technical guidelines prescribes OGC WMS-services (Web Map Service) as the standard protocol for serving georeferenced map images (raster images) over the Internet. See the OGC WMS implementation specifications at:

https://www.opengeospatial.org/standards/wms

A view service should make it possible, as a minimum, to display, navigate, zoom in/out, pan, or overlay viewable spatial data sets and to display legend information and any relevant content of metadata.

Within the frame of the IMPULS project, view services for the data within the INSPIRE themes Administrative boundaries, Geographical names, Elevation data (DEM) and Orthophotos was developed in the first stage. In the second stage services were developed for Demography, Hydrology, Transport and Geology data sets. The

selection of the themes was based on requirements from the selected test case (see chapter 8 – Pilot and Demonstration).

> **Note**: INSPIRE has additional requirements on top of the OGC standard. This implies that that full compliance with INSPIRE may not be possible without some additional work. See further
>
> http://inspire.jrc.ec.europa.eu/documents/Network_Services/TechnicalGuidance_ViewServices_v3.11.pdf

To optimise the use of view services, it was recommended that:

- The functionality "Feature info" with main information about the different objects in a layer provided by the service (not required for raster data) is implemented
- Styles implemented should allow different services to overlaid each other. It is further recommended to use styles that follow good cartographic practice.
- Zoom levels may be applied when required for good viewing (and loading time).
- The service should support the national reference system. The service should also support neighbouring countries UTM zones.

It should be kept in mind that view-services delivers a raster image illustrating the content of data that might be downloaded at a later stage. This means that full harmonisation of the data itself isn't always necessary. For instance, not all attributes to an object must be in place as these will not show in the raster image.

> **Note**: A view service must not operate on fully harmonised data as it only delivers a raster image

The development of view-services must consider portrayal rules, i.e. how data is presented in the raster image. INSPIRE proposes some minimum portrayal rules in cases no other rules are available. These minimum portrayal rules are found in chapter 11 in respective "data specification".

> Minimum portrayal rules for view services are found in chapter 11 in the data specifications.
>
> See https://inspire.ec.europa.eu/data-specifications/2892

However, for efficient use of view-services a set of more developed and tailored portrayal rules should be discussed and agreed by involved stakeholders. Of special importance when providing view-services is to make it possible to overlay different layers on top of

each other without a layer covering another layer, i.e. void areas must be transparent (see figure 32).

7.3 Download services

A download service allows users and computer programs to download copies of spatial data sets for consumption by a third part. The INSPIRE technical guidelines suggests some different protocols for the implementation of the download services required by the directive. These are OGC WFS-services and Atom protocols. The WFS-service can operate on a predefined dataset, or directly access the database in which the data resides.

> See the INSPIRE technical specification for download services at: http://inspire.jrc.ec.europa.eu/documents/Network_Services/Technical_Guidance_Download_Services_v3.1.pdf

Both works on GML-data which is the format currently recommended by INSPIRE for publishing harmonised data.

> **Note**: The GML format is the format currently recommended by INSPIRE for exchange of data between organisations.

Several options for vector data download services are possible:

- **WFS**: Web Feature Service (WFS) Interface Standard provides an interface allowing requests for geographical features across the web using platform-independent calls. The XML-based GML furnishes the default payload-encoding for transporting geographic features, but other formats like shapefiles can also serve for transport.

  See the OGC WFS implementation specifications at:

  https://www.opengeospatial.org/standards/wfs

  The service should support the National reference system TM. It is also recommended to have fixed extent to avoid heavy downloads.

- **WCS**: Web Coverage Service (WCS) provides access to coverage data in forms that are useful for client-side rendering, as input into scientific models, and for other clients. As with WMS and WFS service instances, a WCS allows clients to choose portions of a server's information holdings based on spatial constraints and other query criteria.

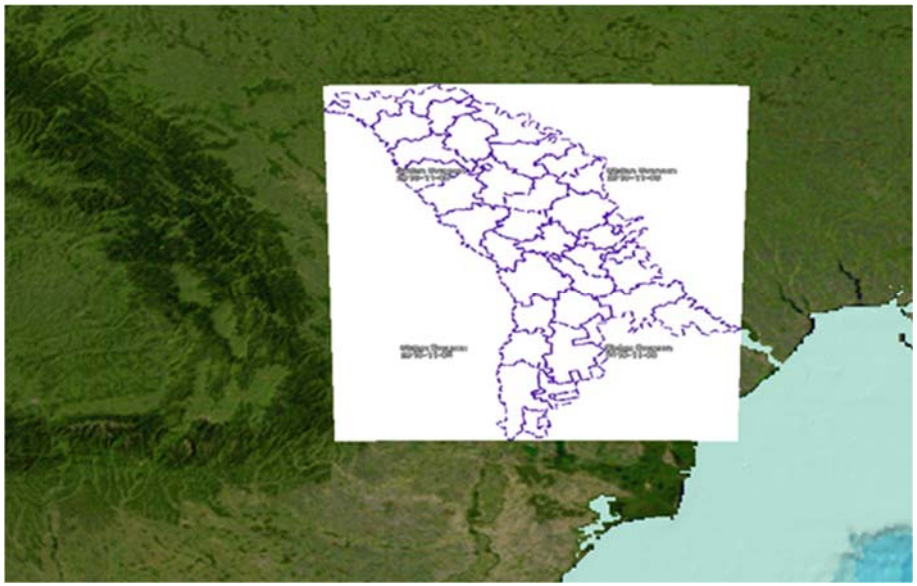


Figure 32. *The figure shows how the background of an administrative boundaries layer provided as a WMS-service is blocking a land cover WMS-layer from General Bathymetric Chart of the Oceans (GEBCO).*

The service should support the National reference system TM. It is also recommended to have fixed extent to avoid heavy downloads.

- **Atom**: An Atom feed is a web feed that uses the Atom Syndication Format and the Atom Publishing Protocol. Atom feeds allow software programs to check for updates published on a website. The Atom Publishing Protocol specifies the way that users can add, delete, edit, or view individual Atom entries in an Atom feed by making HTTP requests to a server that stores the entries.

Use of WFS-services is the preferred way of providing harmonised data although WFS-services are not always suitable for download of large datasets. However, in a developed SDI, a user should not need to download large datasets, only access the portion of data required for a particular use.

Note: FTP is not by definition a service as it is not machine-readable. However, if there are no resources available to develop services, at least ftp or cloud solutions should be implemented for download.

For raster data, the OGC WCS is recommended. See the OGC WFS implementation specifications at:

https://www.opengeospatial.org/standards/wcs

Similar to the view services, within the IMPULS project, the beneficiaries have started with development of download services for AU, AD, EL and OI and then continued with developed for TR, HY, PD and GO data sets. Additionally, several WS's were organized in order to support other data producers, in each beneficiary country, in development of services.

8 Demonstration and pilot implementation

The development of a NSDI is a mean to facilitate the access and reuse of data from different sources, to the benefit of users in many different sectors of society. The NSDI will reduce duplication of effort among data custodians and data users, improve quality and reduce costs related to collection, storage and access to spatial data.

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When developing an NSDI, it is important to make sure that the measures put in place will make it possible the access and reuse data from different sources and test the feasibility of accessing harmonised data through the services developed. It is also important to show benefits to both the data producers and data users and encourage them to take active part in the development of the NSDI.

The work package 6 – Benefits – has been addressing these issues with the aim of illustrating the possibilities and benefits of the infrastructure applied to current use cases in the region, selected by the stakeholders. The use cases selected also provided input to the work by the other work packages, i.e. the work in these work packages aimed at fulfilling real case requirements as related to access and reuse of data from different sources (figure 33).

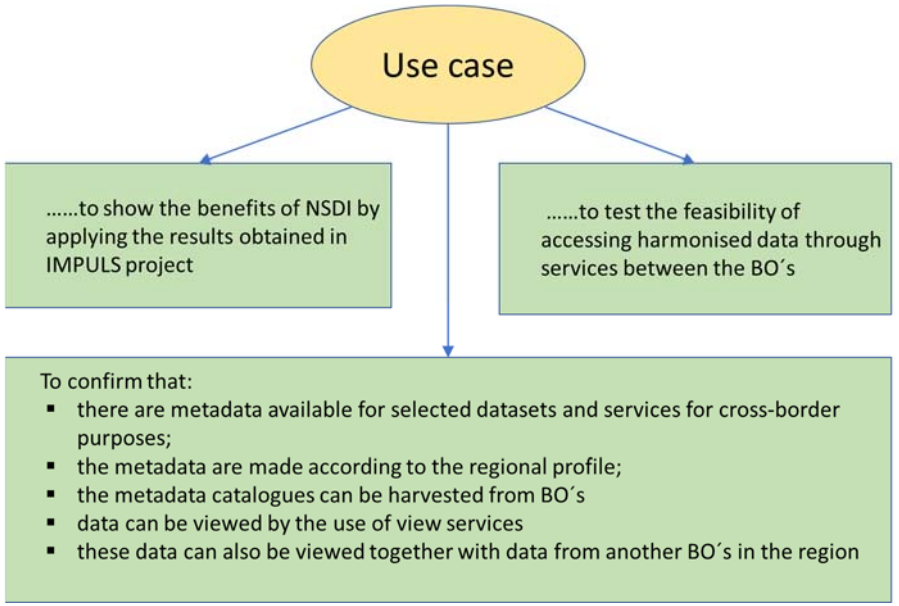


Figure 33. *When developing an NSDI, it is important to make sure that the measures put in place will make it possible, the access and reuse of data from different sources.*

8.1 Use case selection

In most countries in the region, due to the flooding that occurred during the years 2013 and 2014, crisis management became an area of interest in the field of spatial data usage. It was therefore at the very beginning of the IMPULS project decided that the provision

of data relevant to flooding would make a good use case for testing and illustrating the benefits of the NSDI.

In order to identify the most needed data sets for the use case, a couple of workshops were held together with representatives from the respective country's crisis management centres.

Not to overstretch the mandate and resources of the beneficiary organisations, it was decided that a first phase should focus on making accessible and show benefits based on the datasets that are the responsibility of the beneficiary organisations, and how they can be accessed and used (figure 34).

The following key data sets from the beneficiary organisations were identified in the second phase.

- Administrative boundaries
- Geographical names
- Elevation data (DEM)
- Orthophotos

In a second phase, major stakeholders should be engaged and encouraged to make harmonised data available through services.

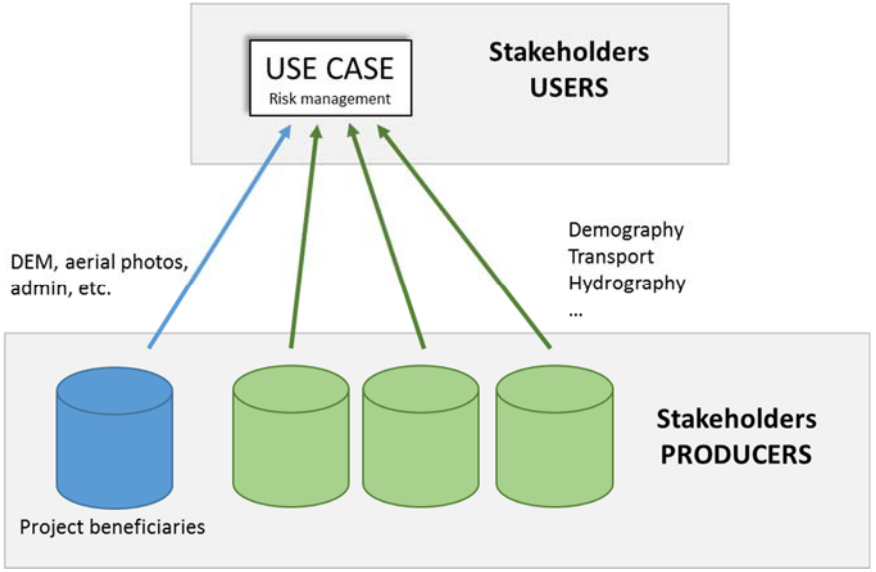


Figure 34. *In the first phase focus has been on showing the benefits using the datasets that are the responsibility of the beneficiary organisations*.

Following key data sets from major stakeholders were identified:

- Demography
- Hydrology
- Transport
- Geology

8.2 Pilot demonstration

To make sure the results from the different IMPULS work packages makes it possible for one organisation to find and access data from several other organisations, a pilot demonstration was done.

In the first phase, access to data from the themes Administrative Units (AU), Elevation (EL), Geographical Names (GN) and Orthoimagery (OI) was tested.

Figure 35 shows the result when merging the theme Administrative Units (AU) in the Qgis software.

The demonstration was carried out in following sequence:

1. Connect to a national geoportal in a web browser
2. In the geoportal, search for the agreed themes
3. View the metadata for the agreed themes
4. Copy the published online-link (url), for each view service, from the metadata to a GIS application, i.e. QGIS or ArcMap and connect to the view services using the projection ETRS89 IMPULS TM
5. Download the datasets
6. Add the datasets (raster and vector) to the GIS application
7. Connect to neighbouring national geoportals and do the steps 2-6 above.

Note: Many software's project data of different projections and reference system on-the-fly.

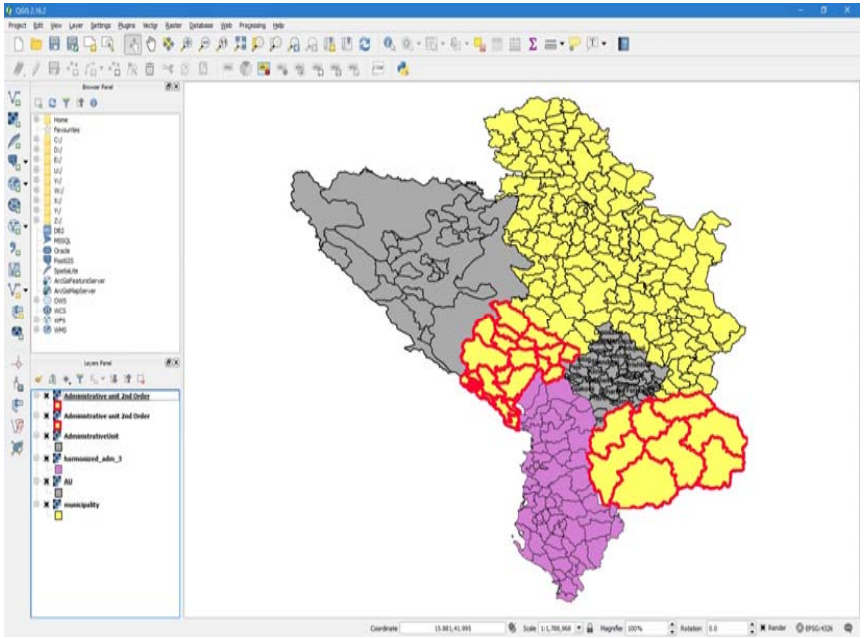


Figure 35. *The figure shows the result from adding the theme Administrative Units (AU) in the Qgis software.*

8.3 Process map

To make all the steps shown in the demonstration, a lot of work has been done within the data producing organisation. First, the data provided has been described with metadata. This metadata has then been published in a national metadata catalogue in order to make them discoverable. When the data later become harmonised, new metadata had to be published for the harmonised data. Then the data had to be provided through services. When a service is developed, metadata must be published also for the service. The service must also point at the metadata for the data in metadata catalogue. Parallel to this work, relevant agreement for usage of the data must be developed. Otherwise the data cannot be accessed. To get an overview of all those steps and interlinkages, an IMPULS process map was drawn illustrating the complexity of these activities. The IMPULS process map is shown in figure 36. Following activities are shown:

Actions - Working package 1

Note 1 – Publish status report on the web

Note 2 – Establish a WIKI

Note 3 – Responsible persons

Note 4 – National coordinators

Actions - Working package 2

Note 5 – Regional data sharing agreement for the organisation's participation in the pilot

In case an agreement is needed, it must be in place. The agreement will explain which resources (data and services) that will be included in the pilot.

Note 6 – Data sharing agreement with new stakeholders

In case an agreement is needed it must be in place. An agreement with stakeholders that are not part of the IMPULS project is made. The agreement will assure that the user can access data from the stakeholders (data producers).

Note 7 – Ensure that National laws/laws can fulfil the INSPIRE directive

The Inspire directive describes what must be in place to establish an SDI. It can be both technical issues e.g. that metadata, data and services should follow a common standard (Inspire IR). But there should also be a data sharing mechanism in place and that there should be a national coordinator. These requirements can be fulfilled in an existing law, but if not, a new law should be established to support an SDI.

Actions - Working package 3

Note 8 – Harmonise data

To be able to combine data, cross-border or nationally, data should be based on the same standards. Inspire has developed a standard for this, common schemas for the different 34 themes.

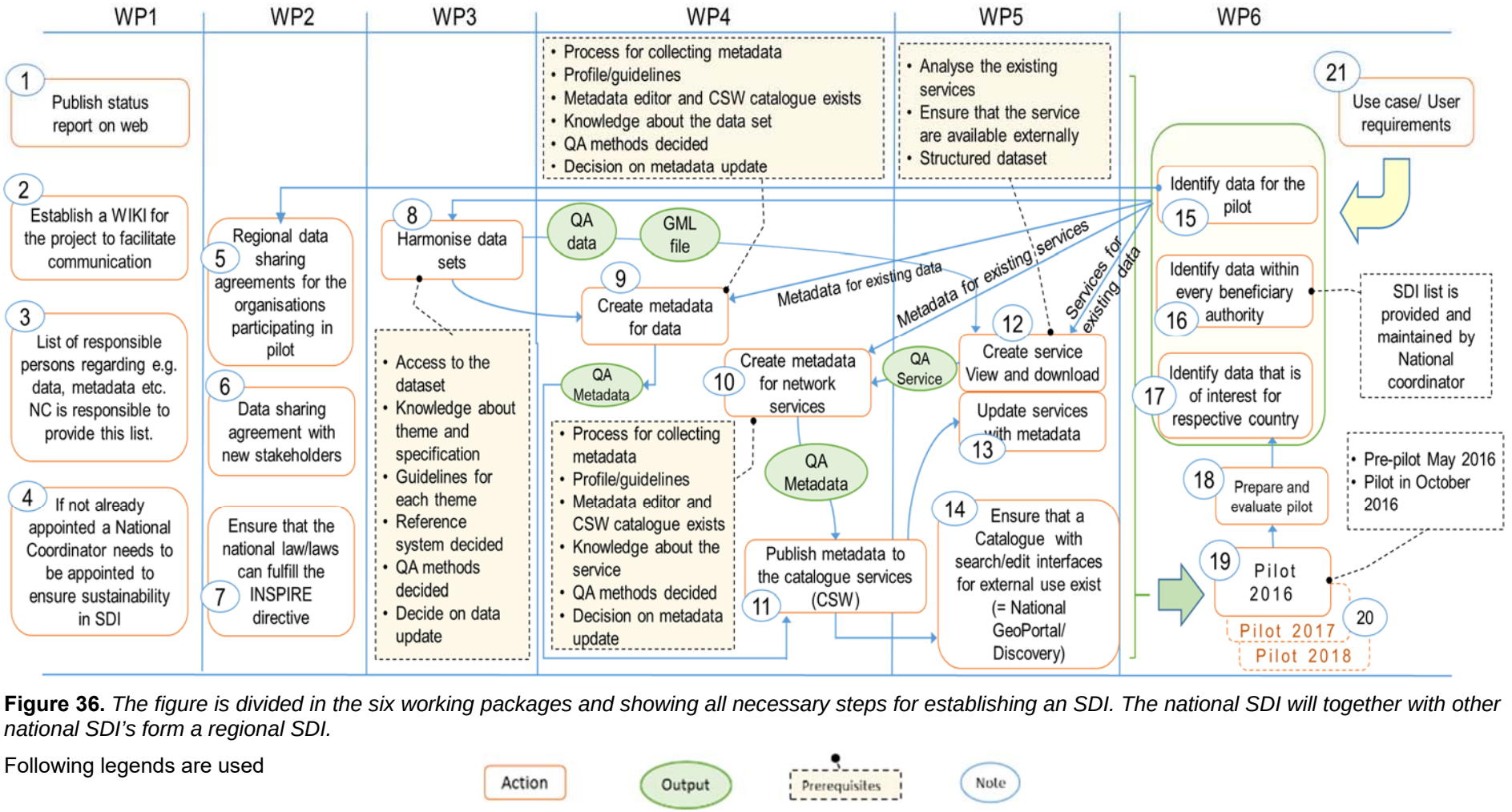


Figure 36. *The figure is divided in the six working packages and showing all necessary steps for establishing an SDI. The national SDI will together with other national SDI's form a regional SDI.*

Following legends are used

Existing data should be transformed to these common schemas. In the project the software Hale studio has been introduced. The result of the harmonisation GML files according to one of the 34 themes.

Each organisation must also decide if there is a need to keep data in the existing structure (using the local specification or if the harmonised data, using the Inspire specification) should be the new official data set.

WP3 transfer data and store it in persistent storage (database) with support of WP5

Processes for how the data will be updated should be established to ensure the quality in data.

Actions - Working package 4

Note 9 - Create metadata for data

Every data set must have metadata to be searchable. The data set should be described according to the regional metadata profile that is conformant with Inspire. To be able to create metadata WP4 need to have knowledge about the data that will be described and access to a tool, a metadata editor. This activity should therefore be done in cooperation with WP3 (knowledge about data) and WP5 (knowledge about services and metadata editor). This cooperation should be documented as a process since it will be repeated for all data sets.

Processes for how metadata will be updated should be established to ensure the quality in metadata.

Note 10 - Create metadata for the service

Every service should be described according to the regional metadata profile that is conformant with Inspire. To be able to create metadata WP4 need to have knowledge about the service that will be described an access to a tool, a metadata editor. This activity should therefore be done in cooperation with WP3 (knowledge about data) and WP5 (knowledge about services and metadata editor). This cooperation should be documented as a process since it will be repeated for all services.

Processes for how metadata will be updated should be established to ensure the quality in metadata.

Describing a service involve metadata for the service, metadata for the data and a link within the service to these metadata. The metadata created by WP4 should be inserted into the Discovery service (CSW) managed by WP5. WP3, WP5 and WP4 together verify that the service(s) created by WP5 is in line with metadata created by WP4 and data created by WP3.

WP3, WP4 and WP5 jointly that services, data and metadata are properly referenced

Note 11 – Publish metadata to the catalogue service

Metadata is published into the Discovery service that is created by WP5.

Actions - Working package 5

Note 12 – Create service, view and download

WP5 analyses existing services together with WP3 and checks if any of these 34 themes are covered by an existing WMS/WFS service.

If there is no service to view or download a data set, a WMS service and download service, WFS or Atom, is created based on data that is stored in a persistent storage (database). WP5 discuss data properties with WP3 when creating service. WP5 describes the service for WP4 that then will create metadata for the service.

Note 13 – Update services with metadata

WP4 will return info on related metadata for the service that should be integrated into the actual WMS-service.

Note 14 – National Geo Portal/Discovery

A national geoportal is set up for each country. A geoportal is the national discovery service where a user can search for data sets and services via metadata records. Metadata for all spatial data should be published in the portal and any user should be able to search in the geoportal. Since the objective for the IMPULS project is to establish a Regional SDI, there should be a possibility to search for data and services in other national NSDI's.

Actions - Working package 6

Note 15 – Identify data for the pilot

When the use case for a pilot is decided, the data sets required for that use case should be identified.

Note 16 – Identify data within every beneficiary authority

All data that the beneficiary authorities are responsible for should be identified and listed. All these data sets should have metadata and be accessed using services.

Note 17 – Identify data that is of interest for respective country

In an SDI, all spatial data should be included. An SDI-list should be established where all relevant existing data sets are identified. To support this activity the Inspire directive, annex I-III, can be used to analyse if existing data corresponds to any of the 34 themes.

Note 18 – Prepare and evaluate pilot

To test that the concept works and to promote the work that are developed in the IMPULS project, pilots should be used. A pilot should present a specific use case. This use case should be described; objectives, timetable with milestones, how the pilot performed etc.

After the pilot is done, the result should be evaluated. The result should then be an input to prepare the next pilot.

Note 19 – Pilot 2016

The objective with this pilot is to show that it is possible to search for data in at least 2 states using a national geoportal that has a connection to a neighbouring national geoportal. An organisation outside the IMPULS project, from risk management, will do the search.

A pre-pilot will be conducted by the Beneficiary organisations in May. At least one organisation should be able to search for AU and EL from two countries by using its own national geoportal.

In October, a user from risk management will be able to search for 4 themes AU, EL, OI and GN. This user should be able to view the data and to download them.

Note 20 – Pilot 2017, 2018 etc.

Future pilot must be decided and described by WP6

Note 21 – Use case/user requirements

An SDI is established to facilitate usage of spatial data. It is therefore important to understand user's requirements. What data is of most importance? That information will be used to make the priority of which data sets will have a priority when harmonising, publishing metadata and setting up services

9 Coordination and monitoring

The development of a NSDI will not run by itself. It must be some type of coordination body ensuring that issues within the different components of a NSDI are addressed and that stakeholders have necessary support in their work of setting up services and harmonising data.

9.1 Coordination tasks

The development of a NSDI will not run by itself. It must be some type of coordination body ensuring that issues within the different components of a NSDI are addressed and that stakeholders have necessary support in their work of setting up services and harmonising data. Within the frame of the IMPULS project, a special workshop was arranged for that purpose, in which the different tasks of a coordinator were discussed.

There are no “right” or “wrong” way of coordinating the development of a NSDI, and the different beneficiaries have developed their own approaches on how to coordinate the development of their respective NSDI’s. However, independent on the physical set-up of the coordination, and the number of staffs involved, there are some general building blocks that need to be put in place (figure 37). These are:

- **Overall NSDI coordination**: A national NSDI coordinator overseeing the development of the NSDI should be appointed. The main task of the coordinator is to ensure that issues within the different NSDI components are addressed to the benefit of all stakeholders. The coordinator should also monitor and communicate the development of the NSDI to relevant stakeholders and act as the main contact point towards stakeholders for NSDI issues.
- **Metadata and metadata profile**: Staff should be assigned to maintain the content in the metadata catalogue and support data producing authorities in the production of metadata. If necessary, also conduct interviews for metadata capture in cases where data producing authorities don’t have competence or possibilities to do it themselves. There should also be staff identified to develop and maintain a national metadata profile, together with relevant data producers and users.
- **Data specifications and harmonisation**: The coordinating body should be able to provide support to data producers on data specification and data harmonisation issues. The specialists need to be up-to-date on developments in the areas of spatial data, spatial data specifications and standards and preferable participate in relevant working groups at national and international level.
- **Data sharing and legal frameworks**: Staff should be assigned to administer relevant data sharing agreements and business

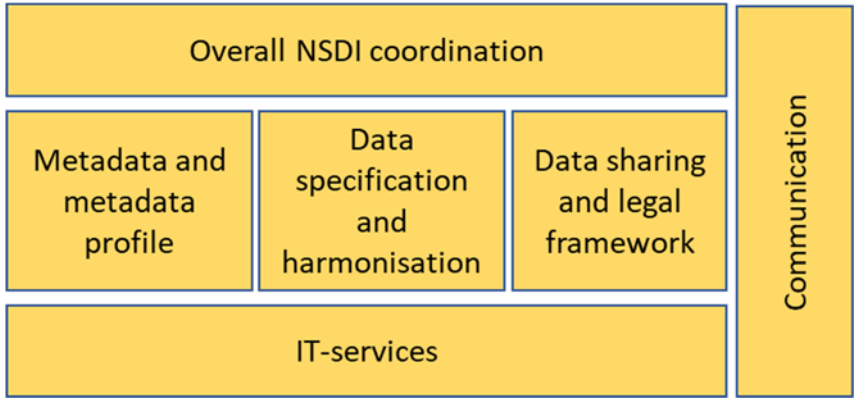


Figure 37. *Independent on the physical set-up of the coordination, and the number of staffs involved, there are some general building blocks that need to be put in place to ensure that the different components of a NSDI are addressed, and that stakeholders have necessary support to effectively contribute to the NSDI.*

models on behalf of the NSDI stakeholders and provide support to stakeholders on these issues. The staff should also be able to provide support on licensing issues and, when required provide input on legal issues related to the NSDI.

- **IT-services**: Staff should be assigned to ensure that the software needed for running the metadata catalogue and Geodata portal are up and running and administer access rights and permissions for publishers. The IT-services should also ensure that data can be provided through services on the Internet and make sure these services are functioning. The staff need to be up-to-date on developments of standards within this area and provide support to data producers on these issues.
- **Communication**: Communication is a very important component in the development of an NSDI and the coordinating body needs to communicate different issues related to the NSDI. In that respect, the coordinating body should be able to produce and publish information related to the NSDI implementation, for instance explanations, best practices, guidelines, etc, but also inform and promote different types of events. If needed support the preparation of seminars, workshops and similar activities

9.2 Monitoring progress

Monitoring progress of the NSDI implementation is a key task for the coordinating body. Monitoring results will show progress at stakeholder level with reference to the work of harmonising data and setting up services for data provision.

Within the frame of the IMPULS project, several different monitoring exercises for different purposes have been launched. It must be kept in mind, though, that the monitoring should be a simple exercise, giving a snap-shot of current situation and indicate areas needing

attention. Detailed information can be acquired later for further analysis.

Indicators selected for monitoring NSDI progress is at the choice of the coordinator. Important to remember is that the indicators should indicate a change of some type. Examples of such change indicators are shown in figure 38.

Indicator	Shows
1	Increase of identified datasets distributed by category/theme
2	Increase in percentage of identified datasets with metadata
3	Increase in percentage of identified datasets with metadata in the metadata catalogue
4	Decrease in ratio analogue/digital data
5	Increase in percentage of identified datasets possible to download
6	Increase in percentage of downloadable datasets available to the public
7	Increase in percentage of identified datasets with view services
8	Increase in percentage of view services possible to view by the public

Figure 38. *Examples of change indicators to show NSDI progress.*

Monitoring changes of the indicators will indicate how the NSDI is progressing. This is most easily done by comparing the results from different time stamps, although more elaborated monitoring schemas can be developed. In order to calculate these indicators, for each data set following information must be collected:

- Source organisation [*name*]
- Dataset name [*name*]
- Format of data [*analogue, digital*]
- Category/theme the dataset belongs to [*code list*]
- The dataset has metadata [*yes, no*]
- Metadata is published in the metadata catalogue [*yes, no]*
- The dataset can be downloaded [*no, ftp, atom, WFS, other*]
- The dataset can be downloaded by the public [*yes, no*]
- The dataset has a view service [*yes, no*]
- The view services can be used by the public [*yes, no*]

Figure 39 shows an example on how captured information can look like in an Excel sheet. The information in the Excel can also be used to show a snap-shot of the availability of data through services at any given time (figure 40).

Source organisation	Dataset name	Format of data [*analogue, scanned, digital*]	Category/theme the dataset belongs to [INSPIRE *code list*]	The dataset has metadata [*yes, no*]	Metadata for the dataset is published in the national metadata catalogue [*yes, no*]	The dataset can be downloaded [*no, ftp, atom, WFS, other*]	The dataset can be downloaded by the public without any registration or other type of barrier [yes, no]	The dataset can be viewed using a view service (a WMS service) [*yes, no*]	The view service can be accessed and used by the public without any registration or other type of barrier [*yes, no*]
Kosovo Cadastral Agency	Lartesite (Elevation)	Digital	Elevation	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Kosovo Cadastral Agency	Ortofoto (Orthophoto)	Digital	Orthoimagery	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Kosovo Cadastral Agency	Kufiri Shteteror (State border)	Digital	Administrative Units	No	No	No	No	No	No
Kosovo Cadastral Agency	Kufijte Administrativ (Administrative boundaries)	Digital	Administrative Units	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Kosovo Cadastral Agency	Parcelat (Parcels)	Digital	Cadastral Parcels	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Kosovo Cadastral Agency	Zonat Kadastrale (Cadastral Zone)	Digital	Cadastral Parcels	No	No	No	No	No	No
Kosovo Cadastral Agency	Emrat gjeografik (Geographical names)	Digital	Geographical Names	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Kosovo Cadastral Agency	Sistemi Koordinativ Referent KosovaRef01 (Coordinative R	Digital	Coordinate Reference Systems	No	No	No	No	No	No
Kosovo Cadastral Agency	Rrjeti lartësive (Elevation Grid)	Digital	Geographical Grid Systems	No	No	No	No	No	No
Kosovo Cadastral Agency	Rrjeti i ortofotove (Orthofoto Grid)	Digital	Geographical Grid Systems	No	No	No	No	No	No
Kosovo Cadastral Agency	Ndërtesat (Buildings)	Digital	Buildings	No	No	No	No	No	No
Kosovo Cadastral Agency	Adresat (Addresses)	Digital	Addresses	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Ministry of Environment and Spatial Plan	Lumenjte (Rivers)	Digital	Hydrography	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Ministry of Environment and Spatial Plan	Liqenet (Lakes)	Digital	Hydrography	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Ministry of Environment and Spatial Plan	Pellgjet lumore (River basins)	Digital	Hydrography	No	No	No	No	No	No
Ministry of Environment and Spatial Plan	Nenpellgjet lumore (River sub-basins)	Digital	Hydrography	No	No	No	No	No	No
Hydrometeorogical Institute	Lokacionet e monitorimit te ajrit (Air monitoring locations)	Digital	Environmental Monitoring Facilities	No	No	No	No	No	No
Hydrometeorogical Institute	Surface water monitoring stations	Digital	Environmental Monitoring Facilities	No	No	No	No	No	No
Kosovo Environmental Protection Agency	Mbulueshmëria e sipërfaqes së Tokës (Coverage of the Ea	Digital	Land Cover	No	No	No	No	No	No
Kosovo Environmental Protection Agency	Zonat e Mbrojtura (Protected areas)	Digital	Protected Sites	No	No	No	No	No	No
Kosovo Environmental Protection Agency	Zonat e Veçanta (Specific Areas)	Digital	Protected Sites	No	No	No	No	No	No
Kosovo Environmental Protection Agency	Hotsoptet e Reduktuara (Reduced Hotspot)	Digital	Protected Sites	No	No	No	No	No	No
Kosovo Environmental Protection Agency	Zonimi i Parkut Kombetar Mali i Sharrit (Zoning National P	Digital	Protected Sites	No	No	No	No	No	No
Ministry of Culture, Youth and Sports	Objektet e Trashëgimisë Kulturore - Arkeologjike (Cultural Heritage - Archaeological Objects)	Digital	Protected Sites	No	No	No	No	No	No
Ministry of Culture, Youth and Sports	Objektet e Trashëgimisë Kulturore - Arkitekturale (Cultural Heritage - Architectural Objects)	Digital	Protected Sites	No	No	No	No	No	No
Kosovo Agency of Statistics	Shtrirja e popullsise (Population coverage)	Digital	Population Distribution	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Kosovo Agency of Statistics	Dendesia e Popullsise (Population density)	Digital	Population Distribution	No	No	No	No	No	No
Kosovo Agency of Statistics	Popullsia sipas Komunave (Population by Municipalities)	Digital	Population Distribution	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Kosovo Agency of Statistics	Popullsia sipas Vendbanimeve (Population by Settlements	Digital	Population Distribution	**Yes**	**Yes**	WFS	No	**Yes**	**Yes**
Kosovo Agency of Statistics	Numri i Femrave sipas Komunave (Number of Women by	Digital	Population Distribution	No	No	No	No	No	No

Figure 39. *Shows how information required for monitoring can be captured in a simple Excel sheet. Some of the information may not be required, i.e. Source organisation name and Dataset name. However, from a follow-up perspective, this information would be very useful to have.*

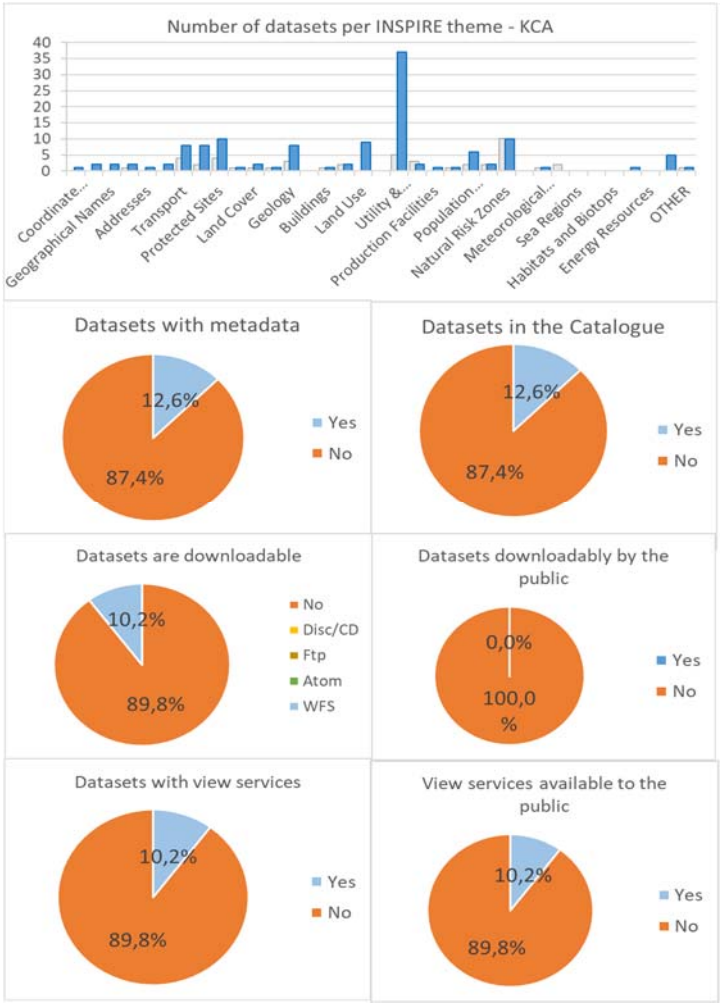


Figure 40. *An example of a snap-shot of current NSDI situation. Detailed information can be acquired later for further analysis.*

9.3 NSDI status assessment

Assessing the overall NSDI status is another important task for the coordinating body. Without a good understanding of the current situation it is difficult to plan for activities ahead.

Figure 41 shows an example on how NSDI status may be assessed and presented. The assessment is based on pre-defined criteria's indicating the current NSDI situation in a country, keeping in mind that variations do exist on a case-by-case basis within different organisations.

The assessment in the graph can be used as a benchmark on which future achievements can be measured and activities planned. A more detailed status for each leg may be described separately. The assessment in the chart measures status in three different domains; Regulation and Steering, Technical Implementation and Data Sharing. Within each area, the status for several areas are assessed.

These are:

<u>Regulation and steering</u>

- Existence of legal NSDI framework
- Maturity of NSDI coordination
- Usage of NSDI monitoring information

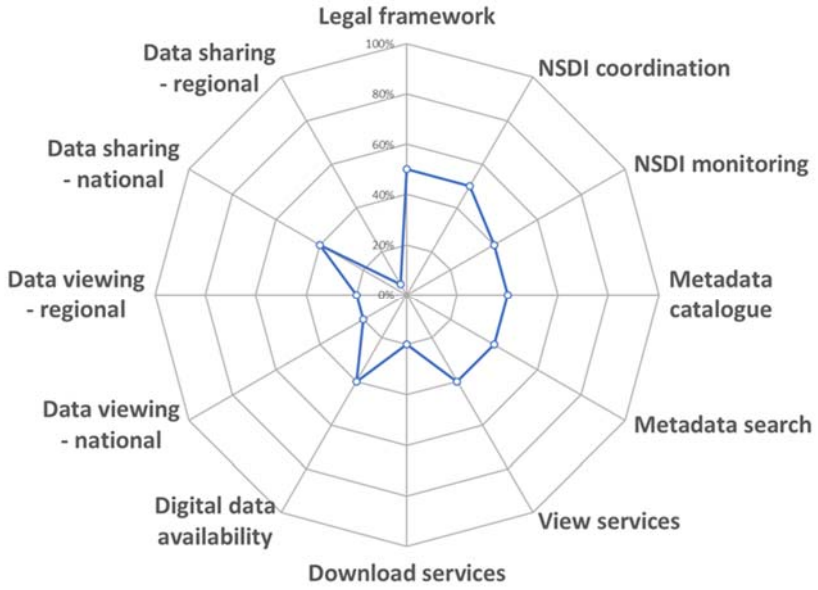


Figure 41. *An example on how NSDI status may be assessed and presented. The set of criteria used for the assessment can found in chapter 14 - NSDI status evaluation criteria's.*

Technical implementation

- Existence of a metadata catalogue
- User friendliness of the metadata search (portal)
- Availability of view services
- Availability of download services
- Availability of digital data

Data sharing

- Maturity of data viewing – national
- Maturity of data viewing – regional
- Maturity of data sharing (download) – national
- Maturity of data sharing (download) – regional

The assessment in figure 41 shows a situation where:

- The NSDI is indirectly regulated by other legal frameworks, although work to develop a dedicated NSDI law has started and is at an advanced stage.
- A coordinating structure has been established (not only stated in law or some other type of documents) although there is no coordinating unit established yet.
- Data and services within the scope of the NSDI for each relevant spatial data producer has been identified and listed although the status for the data and services are not documented.
- A cross-organisational "national" metadata catalogue has been identified (formally or informally) although it is basically used only to host metadata from the hosting organisation

- The metadata catalogue has an interface that allows viewing of metadata in a readably and user-friendly matter although the search interface may not be is easy to find and publicly available on a web page
- Some organisations (1-3) have developed and made available standardised view services for provision of spatial data.
- One or several organisations make spatial data available through different types of FTP-sites.
- Some organisations (1-3) have much of their spatial data in digital format
- On a national level, view services are generally shared on an informal basis only or by permission given from case-to-case
- On a regional level (cross-border), view services are generally shared on an informal basis only or by permission given from case-to-case
- On a national level, spatial data is shared (provided) based on bi-lateral agreements between two organisations
- On a regional level, spatial data is not shared (provided) cross-border.

10 Cost savings calculations

Looking at the development of a NSDI as a natural process towards a more efficient approach for data acquisition and usage, it shouldn't be necessary to calculate the benefits in monetary terms.

However, it may still be of interest to give an idea on how much can be saved thanks to different value-added activities within the NSDI.

Looking at the development of a NSDI as a natural process towards a more efficient approach for data acquisition and usage, it shouldn't be necessary to calculate the benefits in monetary terms.

However, it may still be of interest to give an idea on how much can be saved thanks to different value-added activities (figure 42).

Below follows some reasoning on how to assess (roughly) how much some of the key components of a NSDI may save the stakeholders.

Metadata in a national geoportal

Metadata published in an easy-to-find national geoportal adds value to the NSDI as data sets and services are searchable and well described. The value of standardised metadata in an easy-to-find national geoportal can be indicated by calculating:

- How much time a stakeholder saves in average per organisation and year not having to search and find data and services needed for a particular application.

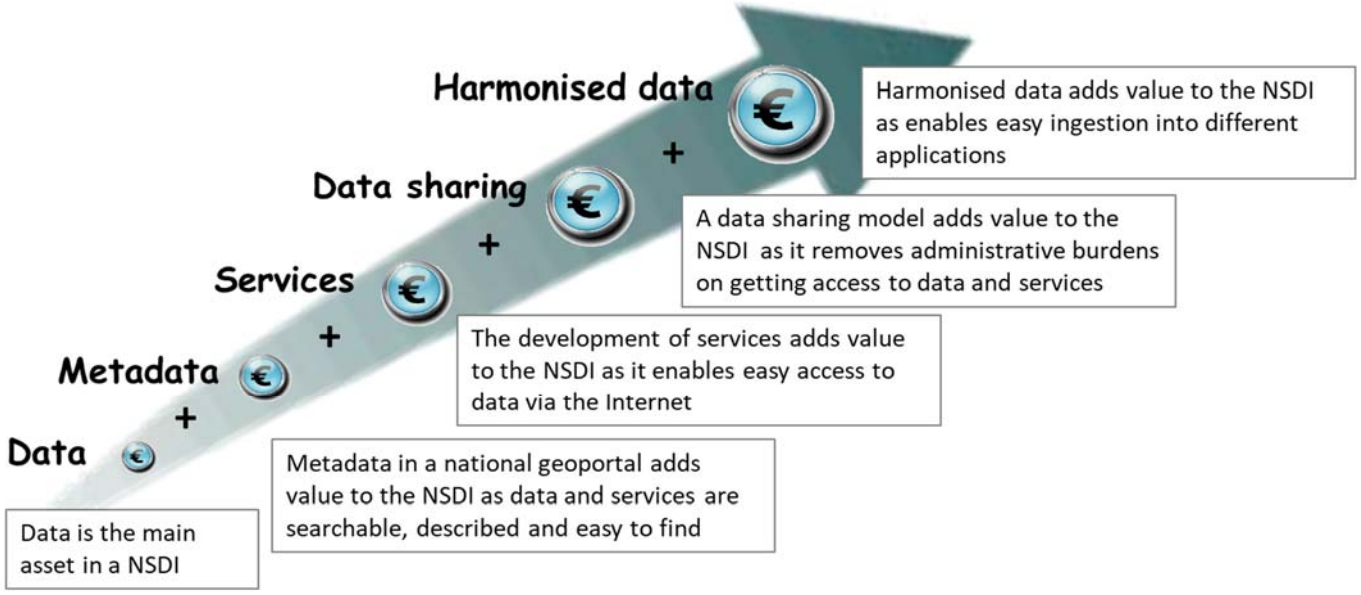


Figure 42. *The NSDI value chain.*

- How much time a data provider saves in average per organisation and year not having to provide telephone support to stakeholders about available data sets and services (figure 43).

Services for easy access

Services for easy access to data adds value to the NSDI as data can be accessed directly over the Internet, thus eliminating the need for manual labour to put data on discs or memory sticks before delivery, and for costly data storage. The value of providing data through services over the Internet can be indicated by calculating:

- How much time a data provider saves in average per organisation and year not having to spend time on transfer data to discs or memory sticks before delivery (see figure 44).

Data sharing model

A data sharing model agreed by data providers and users, allowing direct access to data and services adds value to the NSDI due to less administration and financial transactions. The value of less administration can be indicated by calculating:

	Year 1	Year 2	Year 3	Year 4	Year 5
Numer of telephone enquires for data	520	395	260	210	150
Average no. of hours spent per call	0,5	0,5	0,5	0,5	0,5
Average staff cost/hour	5 €	5 €	5 €	5 €	5 €
Total amount	1 300 €	988 €	650 €	525 €	375 €
Hours spent on creating metadata	80	40	15	0	0
Average no. of hours for maintenance	0	8	16	24	24
Average staff cost/hour	5 €	5 €	5 €	5 €	5 €
Total amount	400 €	240 €	155 €	120 €	120 €
Total cost/year	1 700 €	1 228 €	805 €	645 €	495 €
Savings/year	-400 €	73 €	495 €	655 €	805 €
Cost recovery	-400 €	-328 €	168 €	823 €	1 628 €

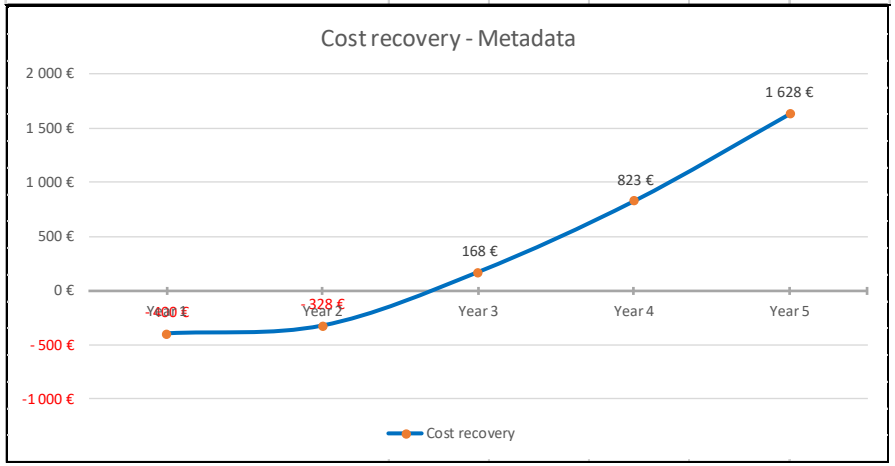


Figure 43. *An example from KCA of a cost recovery calculation for metadata in an easy-to-access Geoportal (metadata catalogue).*

	Year 1	Year 2	Year 3	Year 4	Year 5
Number of deliveries on discs/sticks	800	720	600	440	254
Average no. of hours spent per delivery	5	5	5	5	5
Average staff cost/hour	5 €	5 €	5 €	5 €	5 €
Total amount	20 000 €	18 000 €	15 000 €	11 000 €	6 350 €
Hours spent on developing services	115	100	85	70	50
Average no. of hours for maintenance	0	10	20	35	45
Average staff cost/hour	5 €	5 €	5 €	5 €	5 €
Total amount	575 €	550 €	525 €	525 €	475 €
Total cost/year	20 575 €	18 550 €	15 525 €	11 525 €	6 825 €
Savings/year	-575 €	1 450 €	4 475 €	8 475 €	13 175 €
Cost recovery	-575 €	875 €	5 350 €	13 825 €	27 000 €

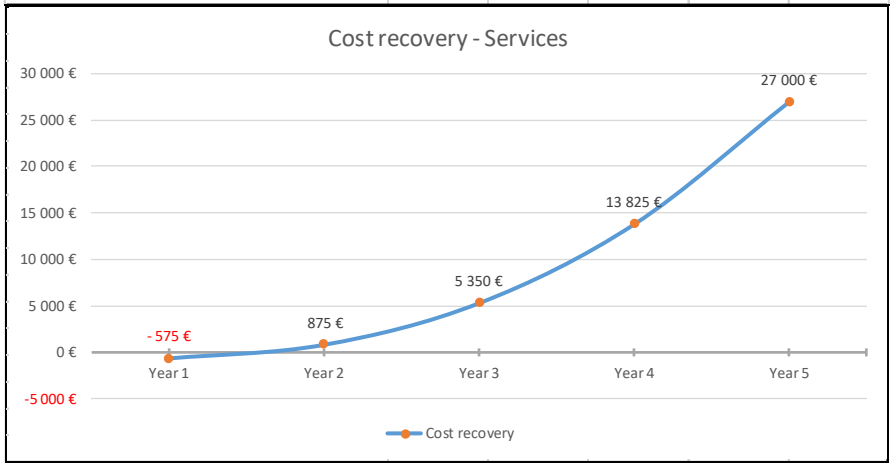


Figure 44. *An example from KCA of a cost recovery calculation on the provision of data through services on the Internet.*

- How much time a data provider/user saves in average per organisation and year not having to spend time on negotiating and administering agreements and financial transactions.

Harmonised data

Harmonised data, allowing direct ingestion into different system adds value to the NSDI due to less manual manipulation of the data before data can be used. The value of harmonised data can be indicated by calculating:

- How much time a data user saves in average per organisation and year not having to spend time on manual manipulation of the data before data can be used.

11 Reflections and concluding remarks

The development of a NSDI is a massive undertaking. It requires issues within several of different disciplines to be addressed, ranging from legal to very technical

The development of a NSDI is a massive undertaking. It requires issues within several of different disciplines to be addressed, ranging from legal to very technical. It also requires an openness by the stakeholders to work together and a willingness to provide resources for cross-disciplinary team to address these different issues. Some key factors for success are (figure 45):

1. A strong coordination body is essential for a well-functioning NSDI. Without a coordinator guiding the stakeholders in the work of building a NSDI limited achievement will be made. It is also important that the coordinator has the ability of step outside its own organisation and see the overall picture and work for the best of all.

2. Management support and willingness of the involved actors is crucial. A NSDI may easily be created but without users of data and services it will all be a paper exercise. It is also important that the stakeholders, both users and producers, contribute to the work which is needed.

3. Experience shows that stronger links between the building of a NSDI and e-governance improves the work. The work of removing barriers for sharing spatial data is very much the same as work towards removing barriers for any tope of data and cooperation between these initiatives will generate synergies and improve understanding of the benefits of making it easier to share information between different organisations.

It is very important to realise that all involved stakeholders do not have the same pre-requisites. It is not reasonable to expect that an organisation without previous knowledge and experience in the digital arena, overnight will start produce and deliver harmonised spatial data through standardised services of the Internet.

In a situation where small amounts of data are in digital format, it should also be considered to publish metadata for selected analogue data, as some analogue data may be of great importance some users. A user may even offer to support scanning or digitising the data. As time goes by, the data can then be made available, first as scanned pdf-files and later on as digital encoded data.

Harmonisation of data is commonly an issue which is much debated. At an initial stage of building an NSDI, it may be sufficient to make sure that all actors are using the same reference system, share data in format all can digest, and agree on using the same code lists for

important objects. A shared vocabulary (semantic reference framework) is essential for avoiding misinterpretations

As for data provision, initially, to enable digital access to data an organisation may settle for ftp-download before the necessary competence and resources for building download services is developed. This approach would at least make sure that other organisations are be able to access and re-use the information.

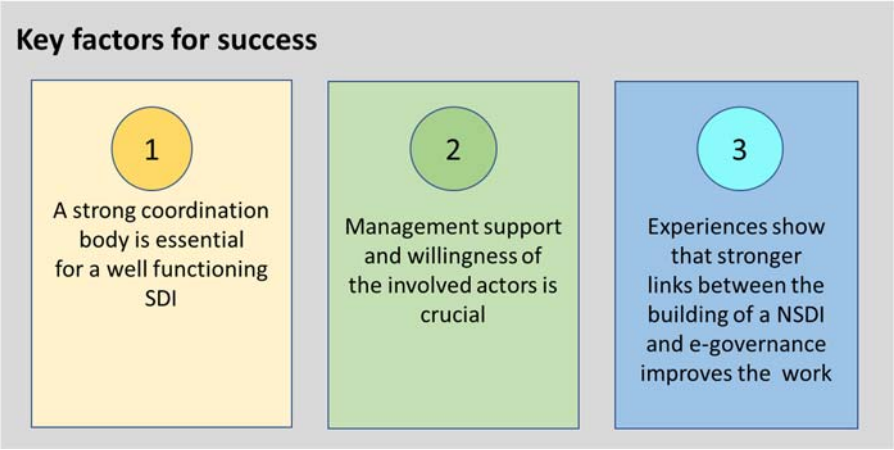
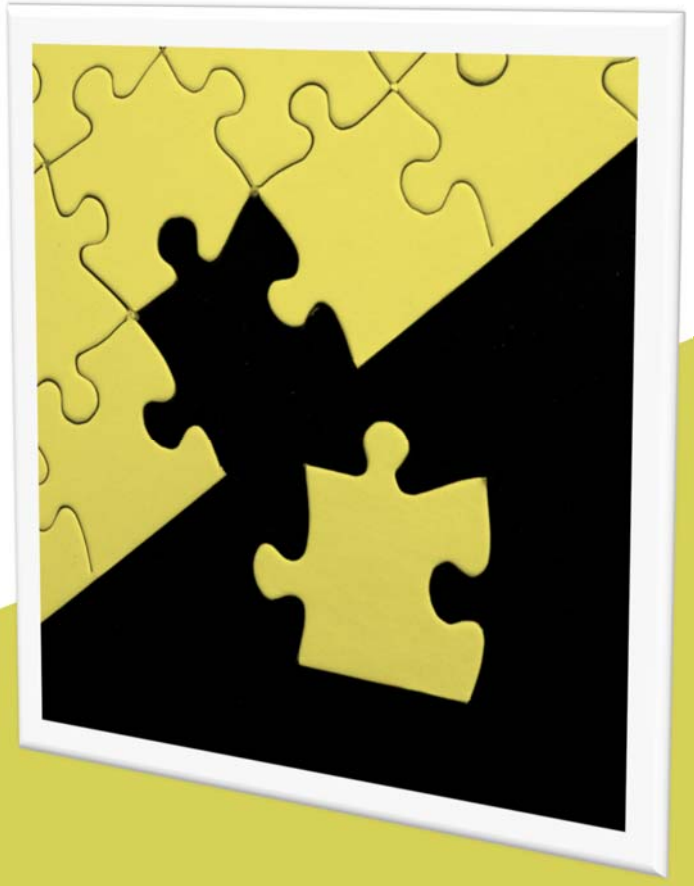


Figure 45. *Some key factors for success when building an NSDI.*

12 NSDI coordination

According to the Commission Decision 2009/442/EC of 5 June 2009 implementing the INSPIRE Directive, EU Member States must monitor and follow up the development of their infrastructures and report this to the European Commission.



With the adoption of the Implementing Decision on INSPIRE Reporting (C(2019)6026) at the end of August 2019, these reporting obligations are fulfilled through the approval of country fiches, which are based on summary reports on fulfilment of the INSPIRE directive and indicators automatically calculated from metadata in the EU geoportal

The following sections gives an overview of the set-up of the infrastructures for those BO that has a coordinating role for NSDI implementation.

12.1 AREC

Agency for the Real Estate Cadastre of North Macedonia

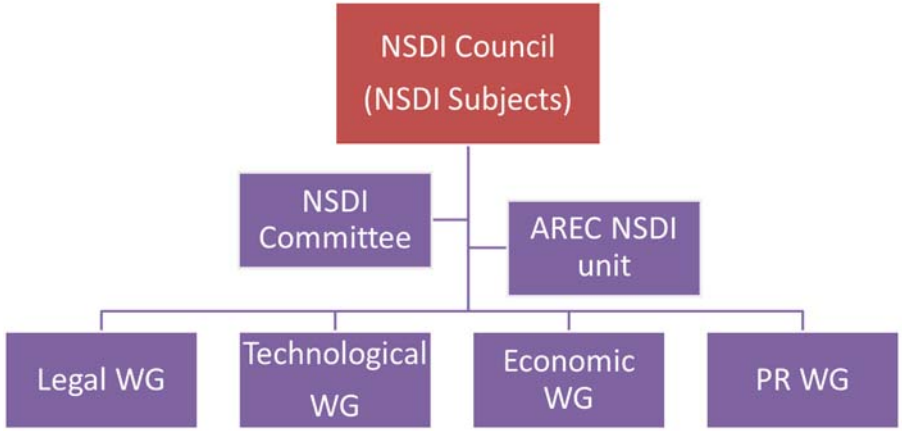
State of Play

Coordination

- National SDI coordinator
  - Name of Public Authority: Agency for Real Estate Cadastre (A
  - NSDI contact: Lidija Krstevska
  - Contact Email: l.krstevska@katastar.gov.mk
  - National SDI Website: http://nipp.katastar.gov.mk/geoportal/catalog/main/home.page

Coordination Structure & Progress

- The Agency for Real Estate Cadastre is the national NSDI coordinator, responsible for establishing, maintaining and providing public access to the NSDI Geoportal, maintenance of metadata services, a registry of metadata and associated trainings.
- An NSDI council was established in September 2014, this body is managed and chaired by the Vice President of the Government of the Republic of North Macedonia, responsible for Economic Affairs.
- The NSDI Council is composed of representatives from 20 institutions or representatives from 10 ministries, 7 government agencies, the City of Skopje, Economic Chamber of North Macedonia and North Macedonian Chambers of Commerce.
- The NSDI bodies are: NSDI council, NSDI Committee, Working groups (Legal, Technical, Economy, PR and awareness).



The NSDI coordination structure of North Macedonia

Functioning and coordination of the infrastructure

- The NSDI law, adopted 2014 and amended 2016, regulates the NSDI in North Macedonia. A bylaw for metadata was adopted in June 2019.
- Decisions, laws, bylaws, tariff lists, annual work plans, implementation reports and other documents and information of relevance to the NSDI are published on the web-page of the NSDI Geoportal

  http://nipp.katastar.gov.mk/geoportal/catalog/main/home.page;jsessionid=8BE4CFCCE92E9A4A093FB01C2666FD33
- The establishment, the maintenance and the management of the NSDI is performed based on a Strategy and an Annual program for implementation of the Strategy.

Usage of the infrastructure for spatial information

- View and download services are accessible through the national geoportal. Apart from AREC, the Ministry of Agriculture, Forestry and Water Economy, Ministry of Environment and Physical Planning, Geological Survey of the Republic of North Macedonia, State Statistical Office and the Crisis Management Centre have also posted their metadata and web services on the national geo portal.
- The published data in the national geoportal have multiple uses. In 2016, the data and services of AREC and the Crisis Management Centre - SSM were linked in the frame of the pilot project in order to prevent fires.

The national geoportal of North Macedonia.

Data sharing arrangements

- An agreement for data sharing has been developed which includes the usage of services. Out of 20 identified subjects about 50% have signed the agreement. All the data posted on the national geoportal can be used by the subject that have signed.

12.2 ASIG

National Authority for Geospatial Information in Albania

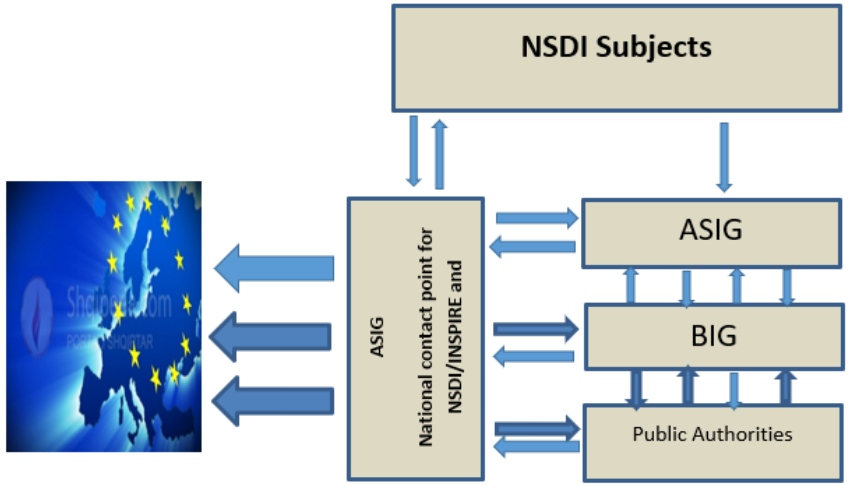
State of Play

Coordination

- National SDI coordinator
  - Name of Public Authority: State Authority for Geospatial Information in Albania (ASIG)
  - NSDI contact: Dritan Prifti
  - Contact Email: Dritan.Prifti@asig.gov.al
  - National SDI Website: https://geoportal.asig.gov.alalbmaps.asig.gov.al

Coordination Structure & Progress

- ASIG is the decision-making, executive and coordinating institution, which oversees the implementation of this law and regulations issued for its implementation.
- National authorities responsible for geospatial information are the National Authority for Geospatial Information (ASIG), Board for Geospatial Information (BIG) and public authorities responsible for collecting, processing and updating of geospatial information, according to the legislation in force.
- BIG, is an advisory body which operates part-time and meets as often as is necessary to realize the activity.
- Public authorities responsible for collecting, processing and updating of geospatial information are authorities, which are charged with these responsibilities according to the legislation in force.



The NSDI coordination structure of Albania

Functioning and coordination of the infrastructure

- The Law no. 72/2012 "On the Organization and Functioning of the National Infrastructure of the Geospatial Information of the Republic of Albania" regulates the NSDI in Albania.
- The establishment, the maintenance and the management of the NSDI is performed based on a NSDI strategy. The strategy is developed by ASIG and approved by the Board for Geospatial Information (BIG).
- The implementation of the INSPIRE Directive in Albania is done within the frame of the implementation of the NSDI strategy.

Usage of the infrastructure for spatial information

- The National Geoportal provide access to information and serve primarily state, central and local institutions. Citizen can also access information.
- The National Geoportal is the key link in the creation of a sustainable and effective National Infrastructure for Geoinformation in Albania.
- The development of the National Geoportal was funded by the Norwegian Government and was released in September 2017.

The national geoportal of Albania

Data sharing arrangements

- Data can be accessed without any obstacles and without registration from the public at no cost. State institutions through geotagging may download geospatial data and use them for purposes of realising their public functions.

12.3 FGA

Federal Administration for Geodetic and Real Property Affairs of FB&H

State of Play

Coordination

- National SDI coordinator
  - Name of Public Authority: Federal Administration for Geodetic and Real Property Affairs of FB&H (FGA)
  - NSDI contact: Slobodanka Ključanin
  - Contact Email: slobodanka.kljucanin@fgu.com.ba
  - National SDI Website: https://ippfbih.gov.ba

Coordination Structure & Progress

- FGA is the coordinator and contact point for the NSDI FB&H and support to the entire development process of the NSDI of FB&H.
- The NSDI Council of F B&H is responsible for strategies and guidelines for establishment and maintenance of the NSDI.
- Temporary or Permanent Work Groups are dealing with conceptual aspects, i.e. aspects of implementation and maintenance of NSDI FB&H.
- Subjects (Stakeholders) are bodies at all levels of public authority and public organizations in charge of establishing or maintaining spatial data covered by the INSPIRE Directive.

Functioning and coordination of the infrastructure

- The NSDI in the Federation of Bosnia and Herzegovina is regulated by a regulation adopted in 2014 (is the force of law until the appropriate law is enacted).
- A draft NSDI law was sent to the Government in mid-2018. In mid-2019 Government was sent to Parliament and is awaiting adoption.
- The implementation is guided by the Strategy for Establishment and Maintenance of Spatial Data Infrastructure of the Federation of Bosnia and Herzegovina, adopted by the government in 2016.

Usage of the infrastructure for spatial information

- According to the three-year plan by the SDI Council, a national Geoportal will be released for public use by the end of 2019. The portal will incorporate a national metadata catalogue.
- SDI Geoportal provides access to information about spatial datasets. The citizen can access the information.
- The SDI Geoportal is the key link in the creation of a sustainable and effective Spatial Data Infrastructure in Federation Bosnia and Herzegovina.
- The development of the National Geoportal was funded by the budget of the Federation B&H.

Metadata catalogue on SDI Geoportal FB&H

Data sharing arrangements

- Spatial data sharing is based on FGA agreements with other SDI Subjects. Currently sharing is not in accordance with the INSPIRE directive because SDI business model for data sharing has not yet been developed.
- SDI FB&H Council appointed a working group to develop a business model in February 2019. According to a Three-Year Work Plan SDI FB&H Council, draft of business model should be prepared by the end of 2019

12.4 GARS

РЕПУБЛИКА СРПСКА
РЕПУБЛИЧКА УПРАВА ЗА ГЕОДЕТСКЕ
И ИМОВИНСКО-ПРАВНЕ ПОСЛОВЕ

Republic Authority for Geodetic and Property Affairs of the Republic of Srpska

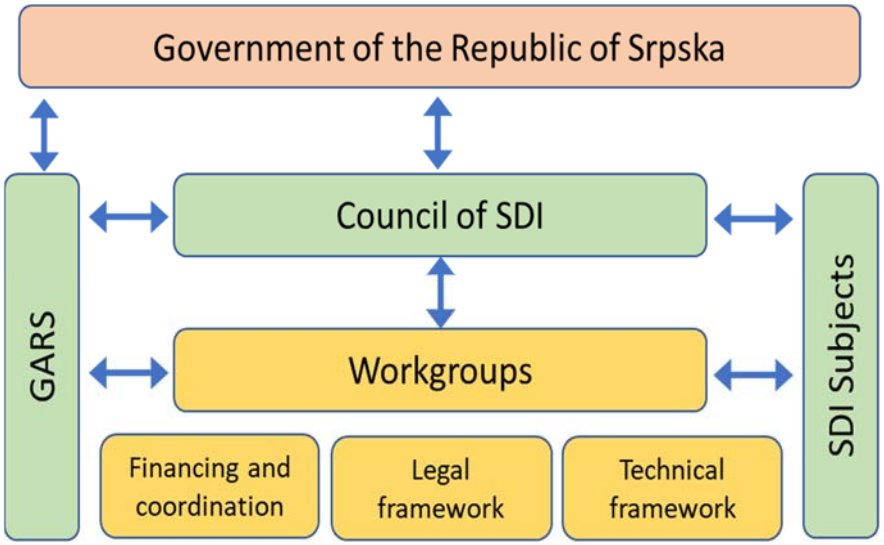
State of Play

Coordination

- National SDI coordinator
  - Name of Public Authority: Republic Authority for Geodetic and Property Affairs of the Republic of Srpska (GARS)
  - NSDI contact: Olivera Karanović - Ćirić
  - Contact Email: olivera.karanovic@rgurs.org
  - National SDI Website: http://www.geoportal.rgurs.org/

Coordination Structure & Progress

- The Republic Authority for Geodetic and Property Affairs (GARS) is identified as the national coordinator for the NSDI in Republic of Srpska.
- A NSDI Council, established by article 165. of the RS Law on survey and cadastre has the mandate to propose to the RS Government NSDI subjects, criteria's and standards for establishment and maintenance of the NSDI.
- The council has 10 members (7 ministries within the Republic of Srpska Government, national Statistical Administration of the Republic of Srpska and GARS) which are appointed on 5 years term.
- Current main stakeholders are 41 administrative institutions within the RS Government.



The NSDI coordination structure of Republica Srpska.

- There are three NSDI Working groups: for legal framework, for technical framework and for financing and coordination. Each group has 10 members (except the legal framework group).

Functioning and coordination of the infrastructure

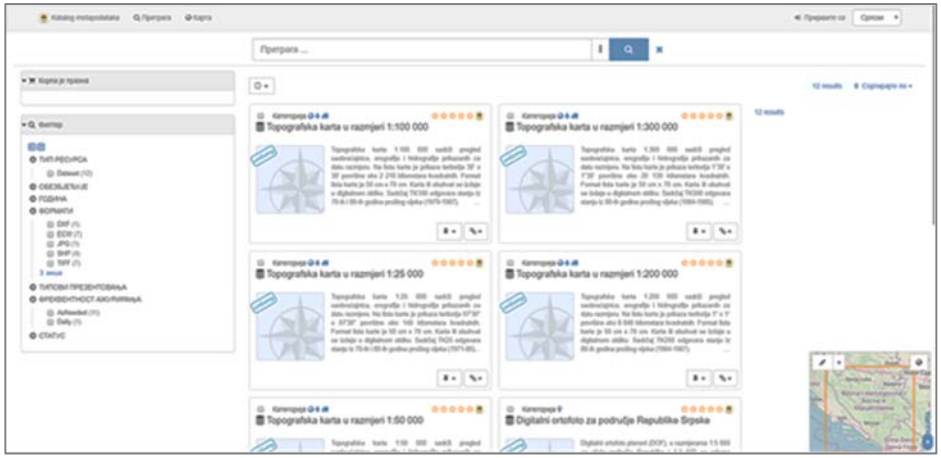
- The NSDI is regulated in the Law on survey and cadastre of the Republic of Srpska, adopted in 2012.

Usage of the infrastructure for spatial information

- A national metadata catalogue is developed based on the GeoNetwork software.

Data sharing arrangements

- There is no common business model. Currently all subjects fall under their own regulations and share data based on individual policies.
- GARS established cooperation with some stakeholders in order to enable faster and better sharing of data. This cooperation is formulated and made official with the signing a Memorandum of understanding.



The national metadata catalogue of Republic of Srpska.

12.5 KCA

Kosovo Cadastral Agency

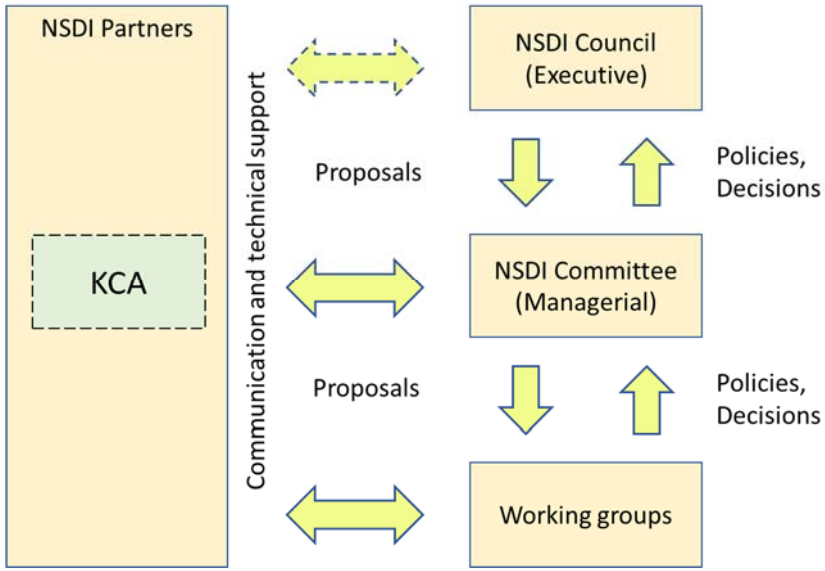
State of Play

Coordination

- National SDI coordinator
  - Name of Public Authority: Kosovo Cadastral Agency (KCA)
  - NSDI contact: Muzafer Çaka
  - Contact Email: Muzafer.Qaka@rks-gov.net
  - National SDI Website: http://geoportal.rks-gov.net

Coordination Structure & Progress

- According to the Law on Cadastre No.04/-L-013, article 23, Kosovo Cadastral Agency (KCA) is the coordinator of the NSDI in the country, awaiting the promulgation of NSDI law.
- There are about 26 institutions (in total identified based on the INSPIRE themes) that produce and use spatial data.
- The NSDI Council provide leadership and strategic direction for the implementation of the NSDI.
- The NSDI Committee serve as the operational delivery group ensuring that the appropriate activities take place, coordinated at the right time and to the right quality standard.
- Working Groups provide specialist expert knowledge and opinions for decision-making. There shall be working groups for the following themes: Institutional and Legal issues; Technological issues; Public Relations (PR), Communications and Capacity Building; and Business Model.



The NSDI coordination structure of KCA and other stakeholders

Functioning and coordination of the infrastructure

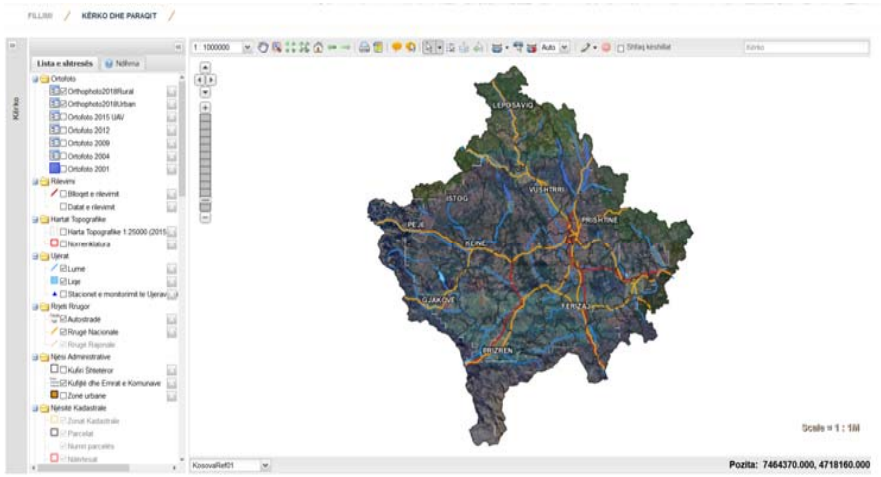
- The Law on NSDI was sent in September 2018 and is in the procedure for adoption at the Parliament, where has passed first reading.
- KCA is in the phase of preparing bylaws for implementation of the law on NSDI. Currently is doing the translation of the implementing rules of INSPIRE and later will adopt them as bylaws.
- A strategy for the development of NSDI was drafted by the Kosovo Cadastral Agency within the Ministry of Environment and Spatial Planning and adopted in June 2015.

Usage of the infrastructure for spatial information

- View and download services are accessible through the national geoportal. On the portal a user can work as an un-registered user or a registered user. There are 1 000 active users per day and about 2 000 registered users.
- According to the plan of the Kosovo Cadastral Agency, the new National NSDI Geoportal, is planned to be developed in 2020.
- The portal is presented in three languages, Albanian, Serbian and English.

Data sharing arrangements

- KCA provides data free of charge through view services. Downloading require separate agreements.
- Products can't be purchased on-line from public authorities. Fees can be different for different users. Charging is according to law.
- Currently sharing is not in accordance with the INSPIRE directive because NSDI business model for data sharing has not yet been developed.



The national geoportal done by KCA.

12.6 REA

Real Estate Administration of Montenegro

State of Play

Coordination

- National SDI coordinator
  - Name of Public Authority: Ministry of Sustainable Development and Tourism (until June 2017 REA was NSDI coordinating institution)
  - NSDI contact: Božidar Pavićević (REA)
  - Contact Email: bozidar.pavicevic@uzn.gov.me
  - National SDI Website: http://www.geoportal.co.me/

Coordination Structure & Progress

- Real Estate Administration was national contact point and coordinating institution for NSDI in Montenegro until June 2019, when new NSDI Law is adopted which transferred this role to Ministry of Sustainable Development and Tourism
- According to NSDI Law a NSDI Council should be established by now, but that activity is not completed. NSDI Council should consist of 9 members on 4 years term. Two members of Council will be from REA.
- NSDI Working groups should be formed on the basis of recommendation from NSDI Council: for legal framework and for technical framework.
- Regulations regarding metadata, data specification and services were adopted in 2018. Important strategic document – Specific Implementation Plan for ISPIRE Directive 2007/2/EC in Montenegro is also prepared in 2018.

Functioning and coordination of the infrastructure

- Main coordination body – NSDI Council is not established. Process of identification of relevant data producers is initiated.

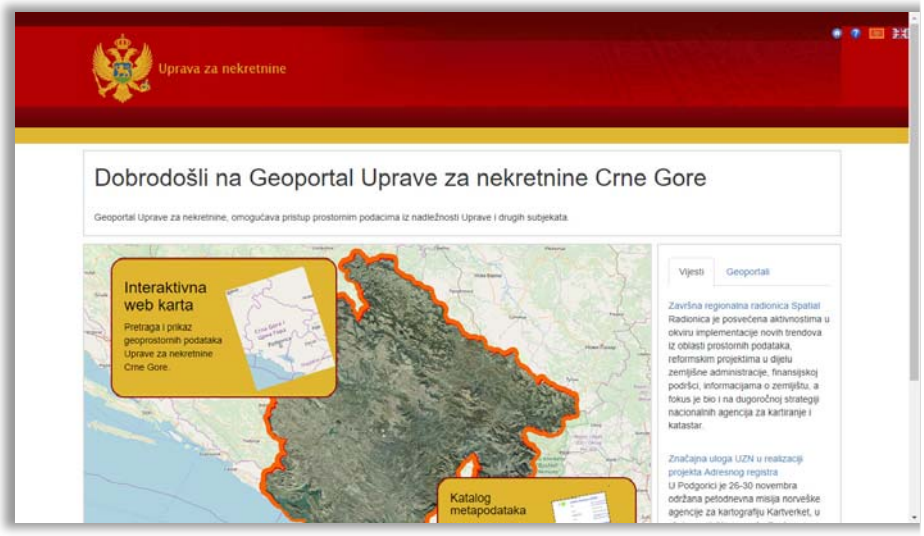
Usage of the infrastructure for spatial information

- A national NSDI metadata catalogue currently formally does not exists, but Geoportal and metadata catalogue implemented by REA is functional and used by number of stakeholders. In the future, this catalogue may become national NSDI metadata catalogue.

- Access to catalogue and view services on REA Geoportal is free for everyone, but user account is needed for use of services.

Data sharing arrangements

- Data between government and other public institutions is shared without charge if it is used for purposes based on specific Laws. There is no unified sharing agreement or similar policy, and data sharing is based mostly on specific requests by data consumers.



The interface to the REA metadata catalogue.

12.7 RGA

Republic Geodetic Authority of the Republic of Serbia

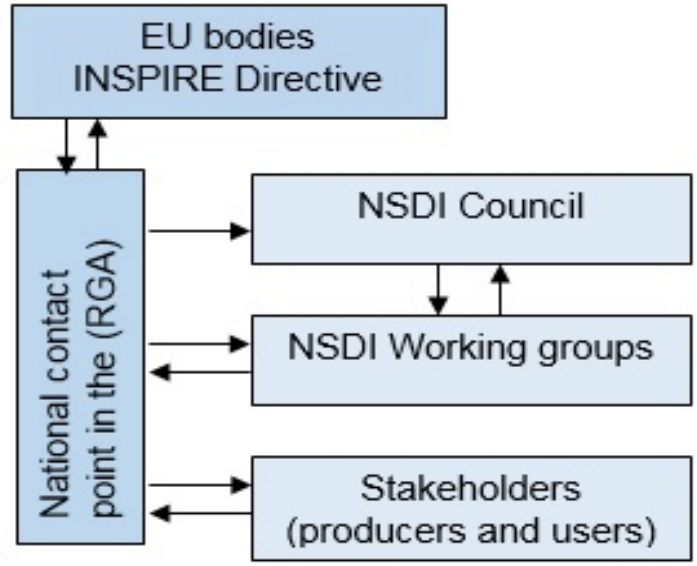
State of Play

Coordination

- National SDI coordinator
  - Name of Public Authority: Republic Geodetic Authority of the Republic of Serbia (RGA)
  - NSDI contact: Darko Vučetić
  - Contact Email: darko.vucetic@rgz.gov.rs
  - National SDI Website: http://www.geosrbija.rs/

Coordination Structure & Progress

- According to law, RGA is the National contact point responsible for communication and cooperation with the European Commission regarding the INSPIRE Directive implementation.
- The NSDI Council is a national level public administration board, consisting of 18 members appointed for five years. The Council is responsible for the overall implementation of the NSID. The NSDI Council president is Director of the RGA.
- The NSDI working groups are temporary work groups established by the NSDI Council for specific tasks.



The NSDI coordination structure of Serbia

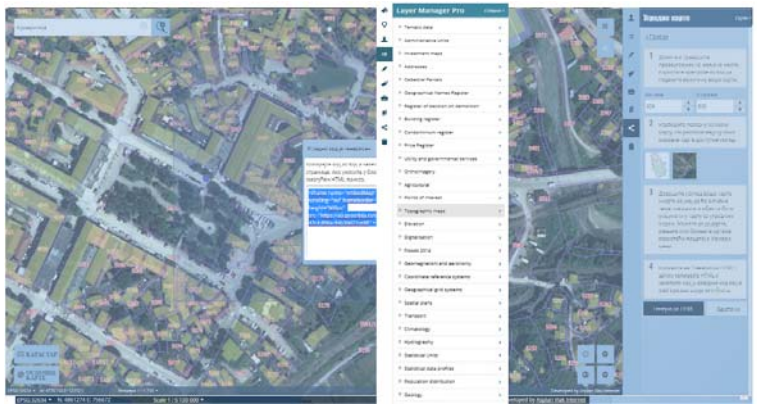
- The NSDI stakeholders are public administration organs, competent for creation, acquisition and maintenance of geodata.
- Responsible NSDI stakeholder is public administration organ responsible for certain geodata, pursuant to the law.

Functioning and coordination of the infrastructure

- The NSDI is regulated by the Law on National Spatial Data Infrastructure[1] which was adopted on April 6, 2018. This Law defines issues that make the provisions of the INSPIRE directive implemented in a national legislation.
- The Government of the Republic of Serbia adopted the Regulation on the metadata implementing rules of the National Spatial Data Infrastructure on July 25, 2019.
- The Strategy of RGA, as well as the Work Plan of the Government for 2019, foresee the adoption of a Strategy for NSDI development in 2019.

Usage of the infrastructure for spatial information

- A new geoportal Geosrbija was established in December 2017. In the Geoportal, more than 240 datasets divided into 29 themes (not INSPIRE themes) are published, also from other institutions. Metadata for 76 geodata sets are published on the national geoportal via metadata catalogue
- In the first half of 2019, 550.000 unique users with more than 2 million requests over the digital platform were recorded.



The national metadata catalogue of Republica Srpska.

Data sharing arrangements

- According to Law on NSDI, the responsible NSDI stakeholders shall make available all geodata sets and services to the other NSDI stakeholders for access, sharing and use.
- According to the law that regulates republic administrative fees, a fee is payable for using geodata sets and services. Law on NSDI defines exceptions to this rule,
- Currently the exchange of geospatial data and services is regulated by contract arrangement. The draft agreement on data sharing exists and waiting for the adaption by the Council.

[1] Official Gazette of the Republic of Serbia, no. 27/18, art. 34.

13 IMPULS regional agreement

DATA SHARING AGREEMENT FOR THE IMPULS PROJECT USE CASE

BETWEEN THE WESTERN BALKAN RESPONSIBLE PUBLIC AUTHORITIES

The parties of this agreement are beneficiary public authorities of the IMPULS project, who agree to share data according this agreement:

- Agency for Real Estate Cadastre of the Republic of Macedonia (AREC), North Macedonia
- Federal Administration for Geodetic and Real Property Affairs of the Federation of Bosnia and Herzegovina (FGA), Bosnia and Herzegovina,
- Kosovo Cadastral Agency (KCA), Kosovo[2]
- Republic Geodetic Authority of the Republic of Serbia (RGA), Serbia
- Republic Administration for Geodetic and Real Property Affairs Republica Srpska (GARS), Bosnia and Herzegovina,
- State Authority for Geospatial Information in Albania (ASIG)
- State Agency of Cadastre, previously Central Office for Real Estate Registration of the Republic of Albania (IPRO), Albania
- Real Estate Administration of Montenegro (REA), Montenegro.

Beside the agencies listed above State Geodetic Administration of the Republic of Croatia (SGA), Croatia, is also a part of this Agreement.

Considering the growing demand for cross-border data and services and a need to further enhance regional cooperation and regional consultation in the field of cross border crisis management as essential.

Considering that a common structure and terminology of agreement can play a role in stimulating the provisions of spatial data sets and services under harmonised conditions.

Reaffirming their commitments expressed in previous initiatives, the Memorandum of Agreement on the cooperation in the field of the spatial data infrastructure and the agreed IMPULS project scope, the above-mentioned parties have agreed to following:

[2] This designation is without prejudice to positions on status, and is in line with UNSCR 1244/99 and the ICJ Opinion on the Kosovo declaration of independence.

Article 1: Data to be shared

The parties agree to provide data as described in Annex I and according to the technical solution described in Annex II.

The national use can only be given to crisis management to secure the IMPULS project pilot use case implementation.

Article 2: Obligations

The parties shall aim for achieving agreed objectives of the IMPULS project use case.

In case there is no service data can be provided “as is”. With no warranties from the parties, nor expressed or implied.

The data and services according to this agreement should be “best effort”, meaning the parties will do their best to reach the goals of the IMPULS project pilot use case and this Agreement. There will be no legal consequences if a party “fails” and cannot fulfil or reach the aim of this Agreement and the IMPULS project.

Article 3: Access and use

Access will be managed by each party towards their national user in the use case in the IMPULS project, according to the End user agreement (license) in Annex III.

Signing parties will inform each other of when signing national End user agreements and the provisions stated in the signed document.

Article 4: Force majeure

No party is liable for failures falling outside their controllable scope (i.e. caused by force majeure).

The non-performing party shall as soon as possible inform the other party in writing about the situation, and as far as possible specify its nature and extent. As far as their fulfilment is prevented, the obligations under this Agreement are suspended if the situation endures.

Article 5: Conflict resolution

Any divergence in interpretation or implementation of this Agreement shall be resolved in settlement between the parties.

In case of any disputes in connection with interpretation of the contents of this Agreement, the English version shall prevail.

Article 6: Final provisions

This Agreement enters into force after at least two parties have signed it, and for other parties in succession when signing.

This Agreement is concluded for the period of three (3) years and is extended automatically thereafter by a following period of three (3) years.

This Agreement can be terminated by each party, with prior written notification, not less than 3 months in advance. When this Agreement

is terminated, data cannot be used further, and any data will be deleted by the signing parties, if not otherwise agreed.

This Agreement may be amended by signing specific Annexes and by mutually signed consent of the parties.

Article 7: Annexes

The documents that are listed below are Annexes and integral parts of the Agreement.

Annex I	Data set
Annex II	Technical solution
Annex III	End user agreement

Signed by…….

Annex I – Data set

Agency	Data set
AREC	Administrative Units
	Elevation
	Geographical Names
	Digital Ortho Photo
FGA	Administrative Units
	Elevation
	Geographical Names
	Digital Ortho Photo
GARS	Administrative Units
	Elevation
	Geographical Names
	Digital Ortho Photo
KCA	Administrative Units
	Elevation
	Geographical Names
	Digital Ortho Photo

Agency	Data set
ASIG	Administrative Units
	Elevation
	Geographical Names
	Digital Ortho Photo
RGA	Administrative Units
	Elevation
	Geographical Names
	Digital Ortho Photo
REA	Administrative Units
	Elevation
	Geographical Names
	Digital Ortho Photo
SGA	Administrative Units
	Elevation
	Geographical Names
	Digital Ortho Photo

Note:

As ASIG is the Agency responsible for coordination and all geodata sharing in the Republic of Albania, and international geodata sharing all data will be available by the mentioned Agency which implies that SAC, also beneficiary of the IMPULS Project will not be data providers.

Annex II – Technical solution

Data will be shared and available via services according to INSPIRE requirements/standards.

Services will be provided by each party for the data sets listed in Annex I – Data set.

Annex III – End user agreement (license)

The conditions for use are agreed on and signed between the parties.

The Subject (as defined below) is provided under the conditions for use stated in this End user agreement. By exercising any rights to the Subject provided here, the user accepts and agrees to be bound by this End user agreement.

Definitions

Spatial data	any data with a direct or indirect reference to a specific location or geographical area
Spatial data set	an identifiable collection of spatial data
Spatial data services	the operations which may be performed, by invoking a computer application, on the spatial data contained in spatial data sets or on the related metadata
Supplier	the data supplier that provides access to the Subject under the terms of this licence
User	the parties of this agreement that obtains the rights to use the subject under the terms of this licence

Subject

The spatial data sets provided under this End user agreement are components of the themes listed in Annexes I, II, III of INSPIRE, and are hereafter referred to as the Subject.

Grant

The supplier grants the user a non-exclusive and non-transferable right to use the Subject for IMPULS project pilot tasks that may have effect on people´s health or on the environment. Use for any other purpose than permitted by this End user agreement is expressly prohibited without the prior written permission of the supplier, who in its sole discretion may deny such permission or claim a separate additional charge for it.

Allowed use

The Subject shall only be used for public tasks purposed to prevent, reduce or stop activities which may have an impact on people´s health or on the environment.

The parties shall make every possible effort to prevent unauthorised use of the Subject and will ensure proper use by signing national Agreements in compliance with the provisions of this End user agreement.

Warranties and liability

The supplier warrants its authority to grant this End user agreement and that within the limits of its knowledge use of the Subject does not infringe any other entity's rights. The Subject is provided "as is" and with no other warranty.

Neither of the parties is liable for any indirect damage. The supplier is not liable for any reliance use, use or inability to use the Subject, or for any harm caused by network disturbances.

Irrespective of the above the supplier may be liable according to national liability law.

Security and monitoring

The users shall maintain adequate security measures to protect the integrity and security of the Subject and shall notify the supplier of any breach or suspected breach of these.

The users should provide proper feedback about the Subject.

Access, pricing and payment

The supplier shall ensure that the user gets access to the Subject in a timely and efficient manner free of charge only for usage described by this End user agreement and is granted by the competent authority.

Assignment, sharing and contracting

The user has no right to share the Subject to other parties and for other purposes.

Where the user contracts work which requires another entity's use of the Subject, this entity shall only use the Subject under the following conditions:

The contractor is bound by the same obligations as the user under this End user agreement and shall not be given the power to grant rights to the Subject.

The contractor has no right to use the Subject for purposes beyond the contract and shall not retain it after the end of the contract period or this End user agreement.

Force majeure

No party is liable for failures falling outside their controllable scope (i.e. caused by force majeure).

The non-performing party shall as soon as possible inform the other party in writing about the situation, and as far as possible specify its nature and extent. As far as their fulfilment is prevented, the obligations under this End user agreement are suspended if the situation endures.

Conflict resolution

The parties shall attempt to solve any dispute by negotiations. Either party may suspend the End user agreement until the dispute is resolved.

If the dispute has not been resolved after three months of negotiations, either party may bring it to the applicable national court.

Termination

This End user Agreement is concluded for the period of three (3) years and is extended automatically thereafter by the following periods of three (3) years. When this End user agreement is terminated any data will be deleted by the users if not otherwise agreed for use.

14 NSDI status evaluation criteria's

Regulation and steering

- **Legal framework**
  1. A legal framework that indirectly regulates the NSDI exists
  2. Work developing a dedicated NSDI law has started and is in progress
  3. Work developing a dedicated NSDI law has started and is at an advanced stage
  4. A draft law has been developed and is awaiting to be put in front of the parliament
  5. A draft NSDI law has been put in front of the parliament and is awaiting approval
  6. A NSDI law has been formally adopted by the parliament

- **NSDI coordination**
  1. A coordinating body is indirectly identified based on existing regulations
  2. A coordinating body has been formally identified either by law or some other means
  3. A coordinating structure has been established (not only stated in law or some other type of documents)
  4. A coordinating unit has been established within the coordinating body (formally or informally)
  5. Contact persons within each organisation involved in the NSDI have been identified
  6. Working groups are actively working on different issues related to the establishment of the NSDI

- **NSDI monitoring**
  1. Relevant spatial data producers that may have data and services within the scope of the NSDI has been identified and listed
  2. Data and services within the scope of the NSDI for each relevant spatial data producer has been identified and listed
  3. The status for the data and services within the scope of the NSDI for each relevant spatial data producer has been assessed and documented
  4. The list of spatial data and services within the scope of the NSDI is used to monitor the progress of the NSDI implementation
  5. The monitoring results are made publicly available on a dedicated web site or through any other suitable communication channel

Technical implementation

- **Metadata catalogue**
  1. One or several [theme specific] organisational metadata catalogues has been developed and made available.
  2. A cross-organisational "national" metadata catalogue has been identified (formally or informally)

3. The national metadata catalogue is used to host metadata also from other organisations (3 or more), apart from the hosting organisation
4. Other organisations (1-3) are independently publishing data on the national metadata catalogue
5. Several other organisations (>3) are independently publishing data on the national metadata catalogue

- **Metadata search (portal)**
  1. Metadata in the metadata catalogue can be searched and viewed through a dedicated search interface
  2. The search interface allows viewing of metadata in a readably and user-friendly matter.
  3. The metadata search interface is easy to find, understand and publicly available on a web page
  4. The search interface is frequently used by different organisations inside and outside of the government.

- **View services**
  1. One or several [theme specific] organisational map viewers have been developed and made available
  2. Some organisations (1-3) have developed and made available standardised view services for provision of spatial data.
  3. Several organisations (>3) have developed and made available standardised view services for provision of spatial data
  4. Most spatial data are available through standardised view services

- **Download services**
  1. One or several organisations make spatial data available through different types of ftp-sites
  2. Some organisations (1-3) have developed WFS and/or ATOM services for provision of spatial data.
  3. Several organisations (>3) have developed WFS and/or ATOM services for provision of spatial data
  4. Most spatial data are available through standardised download services

- **Digital data availability**
  1. Some spatial data is in a digital format
  2. Some organisations (1-3) have much of their spatial data in digital format
  3. Several organisations (>3) have much of their spatial data in digital format.
  4. Most spatial data are available in digital format

Data sharing

- **Data viewing - national**
  1. View services are generally shared on an informal basis only or by permission given from case-to-case
  2. View services are also shared based on bi-lateral agreements between two organisations
  3. View services are shared based on a multilateral agreement among three or more organisations
  4. View services are freely available for governmental organisations without any further agreements

5. View services are freely available for all actors (open data) without any further agreements

- **Data viewing - regional**
  1. View services are generally shared on an informal basis only or by permission given from case-to-case
  2. View services are also shared based on bi-lateral agreements between two organisations
  3. View services are shared based on a multilateral agreement among three or more organisations
  4. View services are freely available for governmental organisations without any further agreements
  5. View services are freely available for all actors (open data) without any further agreements

- **Data sharing (download) - national**
  1. Spatial data is generally shared on an informal basis only or by permission given from case-to-case
  2. Spatial data is also shared based on bi-lateral agreements between two organisations
  3. Spatial data is shared based on a multilateral agreement among three or more organisations
  4. Spatial data is freely available for governmental organisations without any further agreements
  5. Spatial data is freely available for all actors (open data) without any further agreements

- **Data sharing (download) – regional**
  1. Spatial data is generally shared cross-border only by permission given from case-to-case
  2. Spatial data is also shared cross-border based on bi-lateral agreements between organisations in respective country
  3. Spatial data is shared cross-border based on a multilateral agreement among three or more organisations
  4. Spatial data is freely available cross-border for governmental organisations without any further agreements
  5. Spatial data is freely available cross-border for all actors (open data) without any further agreements

15 Figures

16 Abbreviations

AREC	Agency for the Real Estate Cadastre of the Republic of North Macedonia
ASIG	State Geospatial Information Authority in Albania
AU	Administrative units
BESTSDI	Western Balkans Academic Education Evolution and Professional's Sustainable Training for Spatial Data Infrastructures project
BO	Beneficiary Organizations
BY	Attribution (Licensing schema)
CA	Coordinating Adviser
CC	Creative Commons (Licensing schema)
DEM	Elevation data
DG	Director General
DG-JRC	Directorate-General - Joint Research Centre, the European Union's scientific and technical research laboratory and an integral part of the European Commission
DIA	Diagram Editor
EC	European Commission
EL	Elevation data
ETRS89	The European Terrestrial Reference System 1989 (ETRS89) is an ECEF (Earth-Centered, Earth-Fixed) geodetic Cartesian reference frame
EU	European Union
FGA	Federal Administration for Geodetic and Real Property Affairs of FBiH
FTP	File Transfer Protocol
GARS	Republic Authority for Geodetic and Property Affairs of the Republic of Srpska
GIS	Geographic Information System
GML	Geography Markup Language,
GN	Geographical names
GO	Geology data
HTTP	Hyper Text Transfer Protocol
HY	Hydrography data
INSPIRE	Infrastructure for Spatial Information in the European Community
IPA-DRAM	The Disaster Risk Assessment and Mapping in Western Balkans and Turkey programme
IPRO	Immovable Property Central Registration Office of the Republic of Albania
IR	Implementing Rules
ISO	International Standardisation Organisation

JRC	Joint Research Centre, the European Union's scientific and technical research laboratory and an integral part of the European Commission
KCA	Kosovo Cadastral Agency
Lantmäteriet	The Swedish mapping, cadastral and land registration authority
LINKVIT	The LINKVIT training project is focused on harmonization and adaptation of training material to answer the needs and demands of the professionals of geo-information (GI) about the new EU legal framework defined principally by INSPIRE and by other Directives for regulation of GI and environment.
LM	Lantmäteriet
MOU	Memorandum of Understanding
NC	National Coordinator
NC	Non-commercial (Licensing schema)
ND	No Derivative works (Licensing schema)
OGC	Open Geospatial Consortium, an international, non-profit organization engaged in development of standards for geospatial and location-based services
OI	Orthophoto imagery
PD	Project Director
PM	Project Manager
QGIS	QGIS is an open-source cross-platform desktop geographic information system (GIS) application that supports viewing, editing, and analysis of geospatial data
REA	Real Estate Administration of Montenegro
RGA	Republic Geodetic Authority of the Republic of Serbia
SA	Share Alike (Licensing schema)
SAC	State Agency of Cadastre, Albania (former IPRO)
SDI	Spatial Data Infrastructure; NSDI = National Spatial Data Infrastructure
SGA	The State Geodetic Administration of the Republic of Croatia
TM	Transverse Mercator projection
TR	Transport data
UTM	The Universal Transverse Mercator (UTM) is a system for assigning coordinates to locations on the surface of the Earth
WCS	Web Coverage Service
WFS	Web Feature Services
WMS	Web Map Service
WP	Work Package
WS	Workshop
XML	Extensible Markup Language